



Tahoe Transportation
DISTRICT

North-South Transit Connection Alternatives Analysis FINAL

May 2012

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1.0 PURPOSE AND NEED

1.1 Introduction

The Tahoe Basin is a unique area in terms of its geography, environment, and legislation. The Tahoe Basin is protected by both the Tahoe Regional Planning (TRP) Compact (PL 96-551) and Executive Order 13057 that prescribe planning goals and priorities. The Compact created two bi-state agencies to protect and restore Lake Tahoe's environment while providing for controlled and orderly growth. One of these agencies is the Tahoe Regional Planning Agency (TRPA) responsible for establishing Environmental Carrying Capacity Thresholds for the Basin and for regional land-use regulation and planning. The other is the Tahoe Transportation District (TTD) responsible for planning and implementing transportation system improvements. The Compact also established in statute a requirement of providing alternatives to the automobile without expanding the road network as a way of protecting the Lake. The Executive Order established a Federal Partnership in 1997 to assist local, regional, and state government, and the private sector in the protection and restoration of the Lake Tahoe region. The Executive Order and the creation of the subsequent Lake Tahoe Restoration Act (PL 106-506) are but the latest expressions of administrative and legislative federal interest in Lake Tahoe.

These environmental restoration efforts, coordinated and implemented by TRPA, TTD, and the Tahoe Metropolitan Planning Organization (TMPO) as well as other federal, state, and local jurisdictions, generally reflect the need to preserve or improve the water and air quality around Lake Tahoe through the achievement of environmental threshold carrying capacities. However, auto congestion created by the Tahoe Basin's unique geography, proximity to major urban areas, limited road network, and relatively few access points threatens to stymie these efforts. In order to improve access to and circulation within the Tahoe Basin, achieve the regional air, water quality, and green house gas goals, and comply with the Compact, a North-South Transit Connection is proposed. The North-South Transit Connection will be an efficient and coordinated approach to reducing dependency on the private automobile in the Tahoe Basin as directed by the Compact. The following describes the purpose and need for North-South Transit Connection.

1.1.1 Description of Study Area

Lake Tahoe is approximately 72 miles in circumference (22 miles long and 18 miles across) which at 191 square miles in surface area is the nation's largest alpine lake straddling the states of California and Nevada. Figure 1 shows the location of Lake Tahoe relative to major population centers while Figure 2 shows the Tahoe Basin and its entry points. Lake Tahoe is bound on all sides by mountains; the Sierra Nevada range to the west and south and the Carson Range to the north and east and can be characterized as a high mountain valley (6,223 foot elevation). Much of the eastern and western shores of Lake Tahoe consist of scenic rugged mountain terrain which makes travel difficult to those unaccustomed driving in mountainous environments. This is especially true during winter months when the Sierra Nevada Mountains can receive 500 inches of snowfall during an average winter.

Figure 1: Lake Tahoe Regional Map

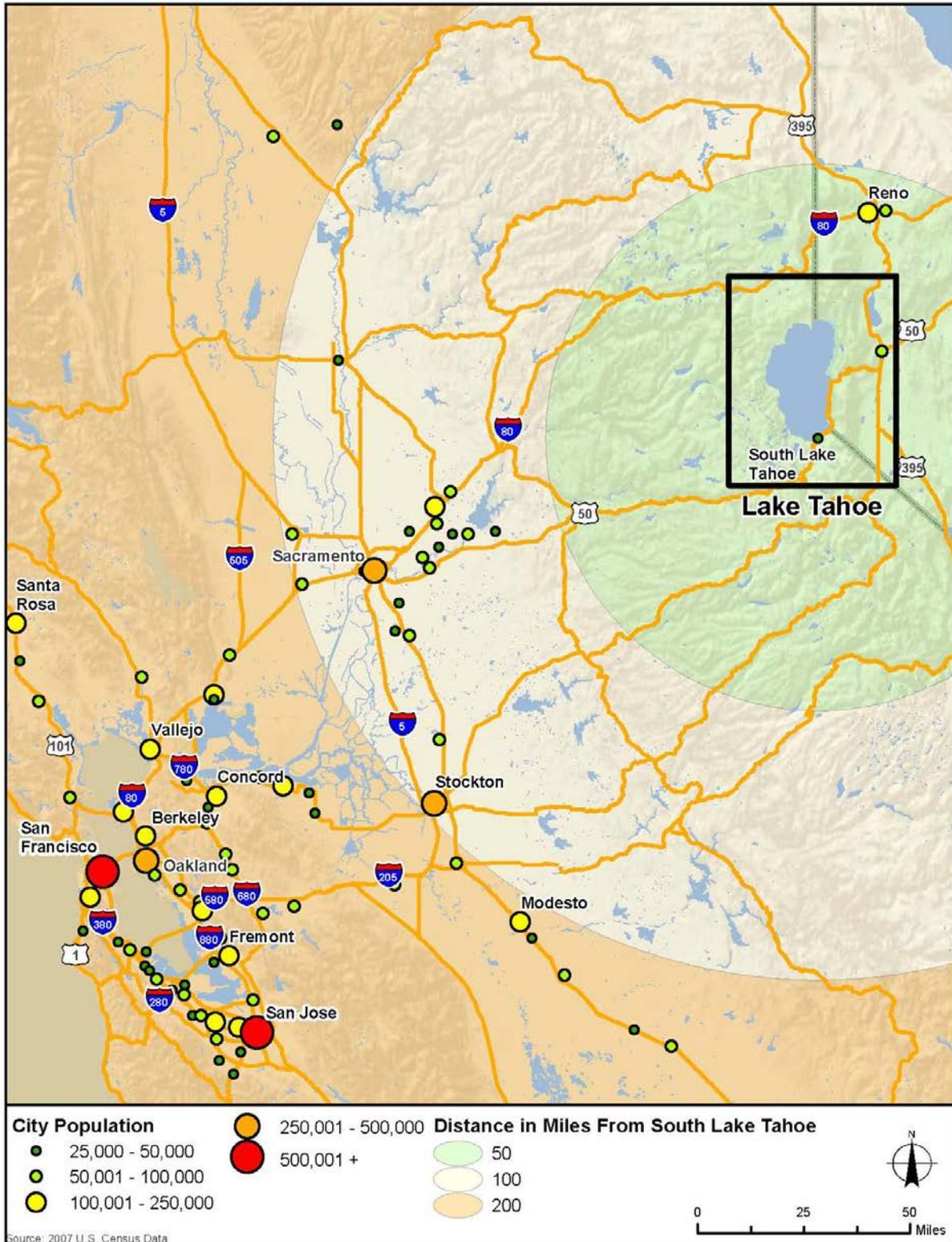
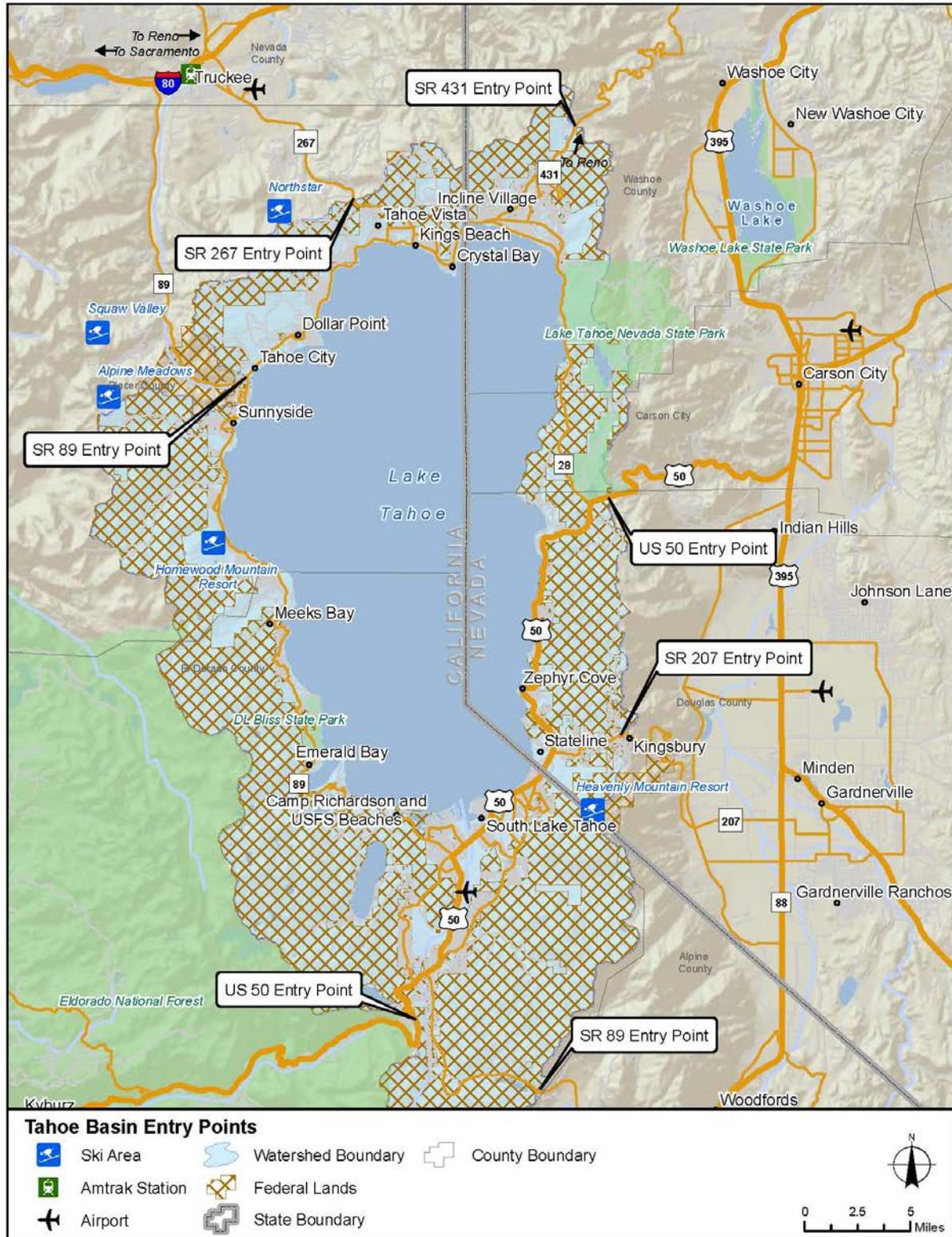


Figure 2: Tahoe Basin Entry Points



The Tahoe Basin lies approximately 160 miles northeast of San Francisco, 90 miles northeast of Sacramento, and 30 miles southwest of Reno. There are seven points of entry into the Tahoe Basin; all classified as a state or federal highway. Within the Tahoe Basin, Lake Tahoe is ringed by US 50 on the south shore and the southern portion of the east shore, SR 28 on the north shore and northern portion of the east shore, and SR 89 on the west shore. Both SR 28 and SR 89 are windy two-lane mountain roads with several steep grades.

During summer and winter months, these roadways experience severe congestion at various locations resulting in levels of service F. Significant attractions in the Tahoe Basin lie on the north, west, east, and south shores and include ski resorts, casinos, access to National Forest System lands and trails, beaches, resort accommodations, and marinas. According to TRPA, there are over 3 million annual visitors to the Tahoe Basin.

In addition, the portion of SR 89 around Emerald Bay often closes in winter due to avalanche danger and even when open during winter, hazardous conditions exist which require utilization of tire chains and/or four wheel drive vehicles. According to Catltrans, SR 89 was closed fifty (50) times during the winter 2010-2011. These travel restrictions and impediments tend to deter regional travel and access on a frequent basis.

The following photos illustrate the windy and steep grades associated with SR 89 on the west shore.



Northbound SR 89 south of Emerald Bay. Steep grades and switchbacks with tight turn radii constrain roadway and large vehicle operations. Extended winter road closures are common due to hazardous road conditions and avalanche.



Southbound SR 89 south of Emerald Bay consists of narrow lanes, steep grades, and limited to non-existing shoulders. Extended winter road closures are common due to hazardous road conditions and avalanche.



Southbound SR 89 south of Emerald Bay is constructed on a narrow ridge with sheer vertical drops on both sides of roadway.



Southbound SR 89 south of Emerald Bay continued. Extended winter road closures are common due to hazardous road conditions and avalanche.



Northbound SR 89 at Emerald Bay at high avalanche hazard location



Southbound SR 89 at Emerald Bay at high avalanche hazard location.



Northbound SR 89 north of Emerald Bay at high avalanche hazard and rock slide location. This section also consists of steep grades.



During winter 2011, an avalanche engulfed a motorist on SR 89.

North and West Shore

The north and west shore of Lake Tahoe is more decentralized than the south shore and includes the unincorporated communities of Tahoma, Homewood, Sunnyside, Tahoe City, Carnelian Bay, Tahoe Vista, Kings Beach, Crystal Bay, and Incline Village. The Town of Truckee is located to the north of Lake Tahoe and also serves as a major origin and destination. Highways 89, 28, and 267 combine to form the “resort triangle”, which is the location of one of the highest concentration of ski resorts in the world, including Alpine Meadows, Sugar Bowl, Squaw Valley, and Northstar-at-Tahoe.

South Shore

The south shore of Lake Tahoe is denser than the north shore and includes the incorporated City of South Lake Tahoe and the unincorporated communities of Meyers, California and Stateline, Nevada. The area with the largest concentration of population, employment and overnight accommodations in Lake Tahoe is on the south shore between the intersection of Highway 89 and US 50 (otherwise known as the South Y) and Stateline. Multiple casinos are located in Stateline, as is access to the Heavenly Ski Resort gondola which straddles the states of California and Nevada. Additional ski resorts such as Sierra at Tahoe and Kirkwood are short drives from the south shore.

1.1.2 Transportation Monitoring Program

According to the TRPA/TMPO Transportation Monitoring Program Report (December 2010), TMPO estimates indicate that the Tahoe Region’s year-round population, school enrollment, and overnight room occupancy has steadily decreased since 2000, and has continued a downward trend in recent years because of the economy and the transition to a second home community. However, peak seasonal demand of the road network does result in severe congestion and intersection breakdown. On the north shore, traffic counts have decreased by 9 percent while transit ridership has increased by 75 percent over the last 10 years because of service expansion. On the south shore, both traffic and transit ridership have shown parallel declines, which is a result of overall population and visitor declines as well as a contraction in available transit service. One area that is showing steady increases is traffic counts at entry points to the Tahoe Basin, as average annual daily traffic volumes have increased to 70,000 per day during peak season. This suggests that mode share in the Tahoe Basin continues to be dominated by private vehicles, in part because there is no viable transit connection to and from the Tahoe Basin from major urban areas or between the communities of the north and south shore.

1.1.3 Legislative Environment

The Regional Plan Update was initiated in 2002 to bring together public agencies and the community to develop a coordinated 20-year resource and land-use management plan for the Tahoe Basin. As with past Tahoe plans this planning process seeks to bring forth an updated regional plan that integrates land-use, resource protection and restoration, and transportation actions. The Regional Transportation Plan (RTP) is part of that package that identifies projects and outlines transportation initiatives consistent with conditions that meet environmental carrying capacities established by the Compact. This Compact was established to preserve the air, water, fisheries, vegetation, soil conservation, noise, recreation, scenic, and wildlife environmental quality of the Tahoe Basin, which is considered a unique ecological treasure. In conjunction with communities around Lake Tahoe, participating agencies include the TRPA, the United States Forest Service (USFS), the Lahontan Regional Water Quality Control Board, and the Nevada Division of Environmental Protection. Due to the Compact, it is incumbent upon member agencies and the federal government to move forward with planning efforts in a coordinated manner within the Tahoe Basin. Specifically, the Compact states the following points:

- The Compact establishes that the “maintenance of the social and economic health of the region depends on maintaining the significant scenic, recreational, educational, scientific, natural and public health values provided by the Lake Tahoe Basin.”
- The Compact also states that “the Federal government has an interest in the acquisition of recreational property and the management of resources in the region to preserve environmental and recreational values, and the Federal government should assist the States in fulfilling their responsibilities.”
- Specific to transportation planning, the Compact states “To reduce dependency on the automobile by making more effective use of existing transportation modes and of public transit to move people and goods within the region; and
 - Where increases in capacity are required, the agency shall give preference to providing such capacity through public transportation and public programs and projects related to transportation.

Additional executive administrative support for planning and environmental preservation in the Tahoe Basin is provided by former President Clinton’s Executive Order 13057: Federal Actions in the Lake Tahoe Region. This Order directed federal agencies to establish an interagency partnership to ensure the following:

- “Federal agency actions are coordinated and operate to protect the extraordinary natural, recreational, and ecological resources in the Lake Tahoe Region and the economies that depend on them.”

- Regarding transportation, the Executive Order directs Federal agencies to “support and participate in programs and studies necessary to achieve transportation and air quality goals for the Lake Tahoe Region.”

In addition to legislative support, the Federal Government manages approximately 80 percent of all land in the Tahoe Basin and is therefore a necessary and integral partner in any planning efforts.

As noted above, access into and travel throughout the Tahoe Basin is constrained by both geography and legislation that prohibits the addition of roadway capacity. During peak visitor seasons in the winter and summer, congestion exists throughout the Tahoe Basin and threatens the environmental, economic, and social well-being of Lake Tahoe. Capacity constraints must be addressed through the use of public transportation, and maximizing the efficiency of existing roadways. The proposed North-South Transit Connection will address critical elements in improving air quality, enhancing economic opportunities, enhancing safety and emergency access, and providing for expansion of employment opportunities while providing the ability to add substantial travel capacity through a transit alternative in the Tahoe Basin.

1.2 Existing Conditions

1.2.1 Transit

Existing transit services in the Tahoe Basin include providers which are primarily focused on serving destinations on either the north or south shore. Existing transit service is highly influenced by seasonal demand and often serves specific visitor markets in addition to the local population needs. Currently, there is no consistent transit service between the largest destinations on the north and south shore. There is no year-round service between the north and south shore, and the service that does exist (in the summer only) is characterized by poor headways, span of service, and the fact that transit vehicles have no alternative but to utilize the same travel corridors that experience heavy congestion and associated delays. The lack of a consistent transit service between the north and south shore is primarily due to the physical characteristics of and traffic congestion on Highway 89. Existing transit service coverage, including the gap in year-round service between the north and south shore, is illustrated in Figure 3. Figure 4 provides a background map related to existing transit service. Table 1 provides a summary of existing transit services in the Tahoe Basin.

Table 1: Existing Transit Service Coverage

	Seasonal		Year Round
	Winter	Summer	
NORTH AND WEST SHORE			
Tahoe Area Regional Transit (TART)			
Mainline			•
Highway 89			•
Highway 267	•		
Summer Trolley		•	
Emerald Bay Connection		•	
Tahoe Transportation District (TTD)			
North Shore to Reno/Tahoe International Airport			•
Night Rider			•
Truckee Transit			
Ski Shuttle (between resorts)	•		
Truckee Airport to Donner Lake shuttle		•	
Private Shuttle Services			
Ski Shuttle (between resorts)	•		
SOUTH AND EAST SHORE			
BlueGO Transit Services, Inc. (BlueGO)			
Fixed route local bus service			•
Express regional bus service			•
Heavenly Ski Shuttle	•		
Nifty 50 Trolley		•	

Source: TART and BlueGO, 2011.

Figure 3: Existing Transit Service Coverage

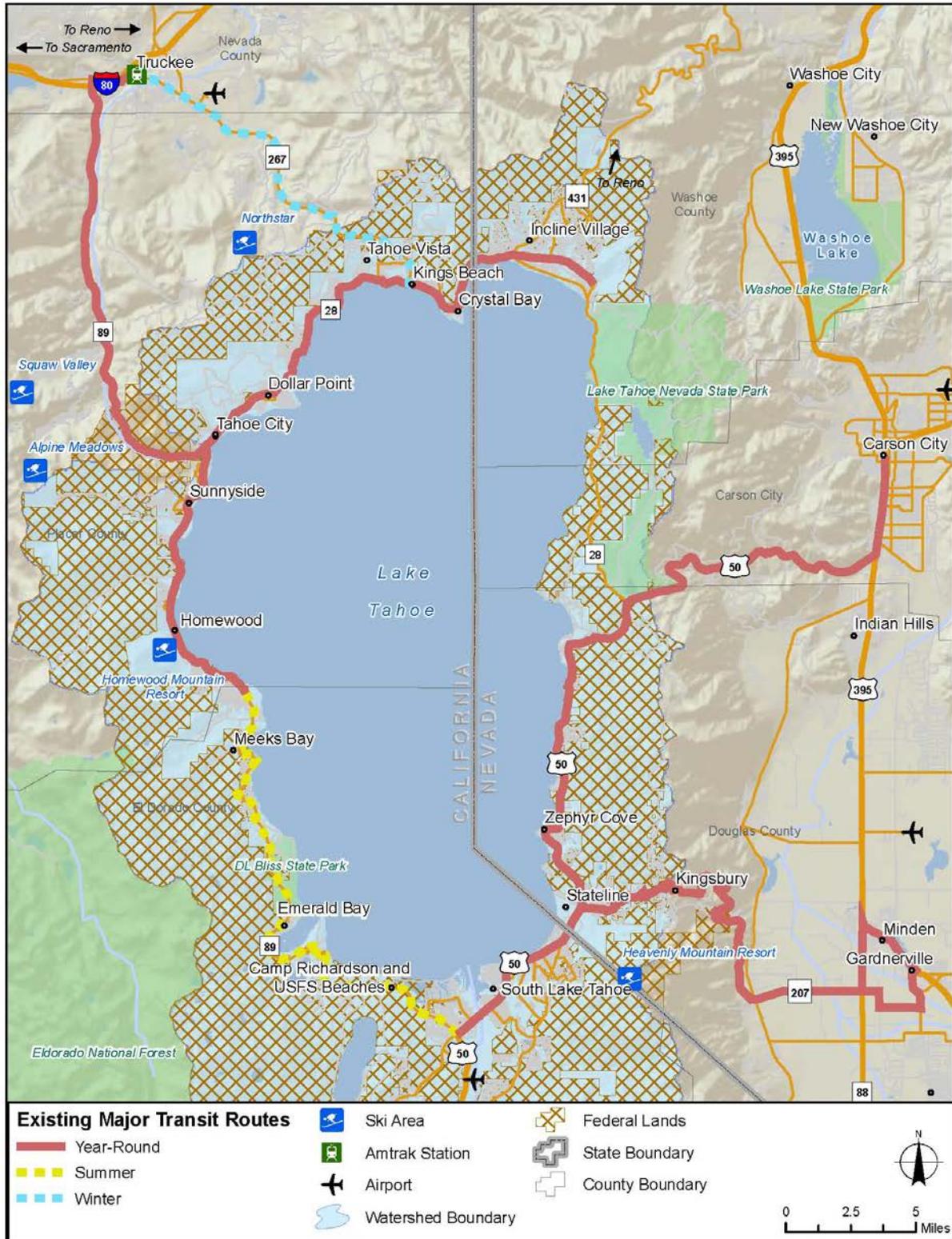
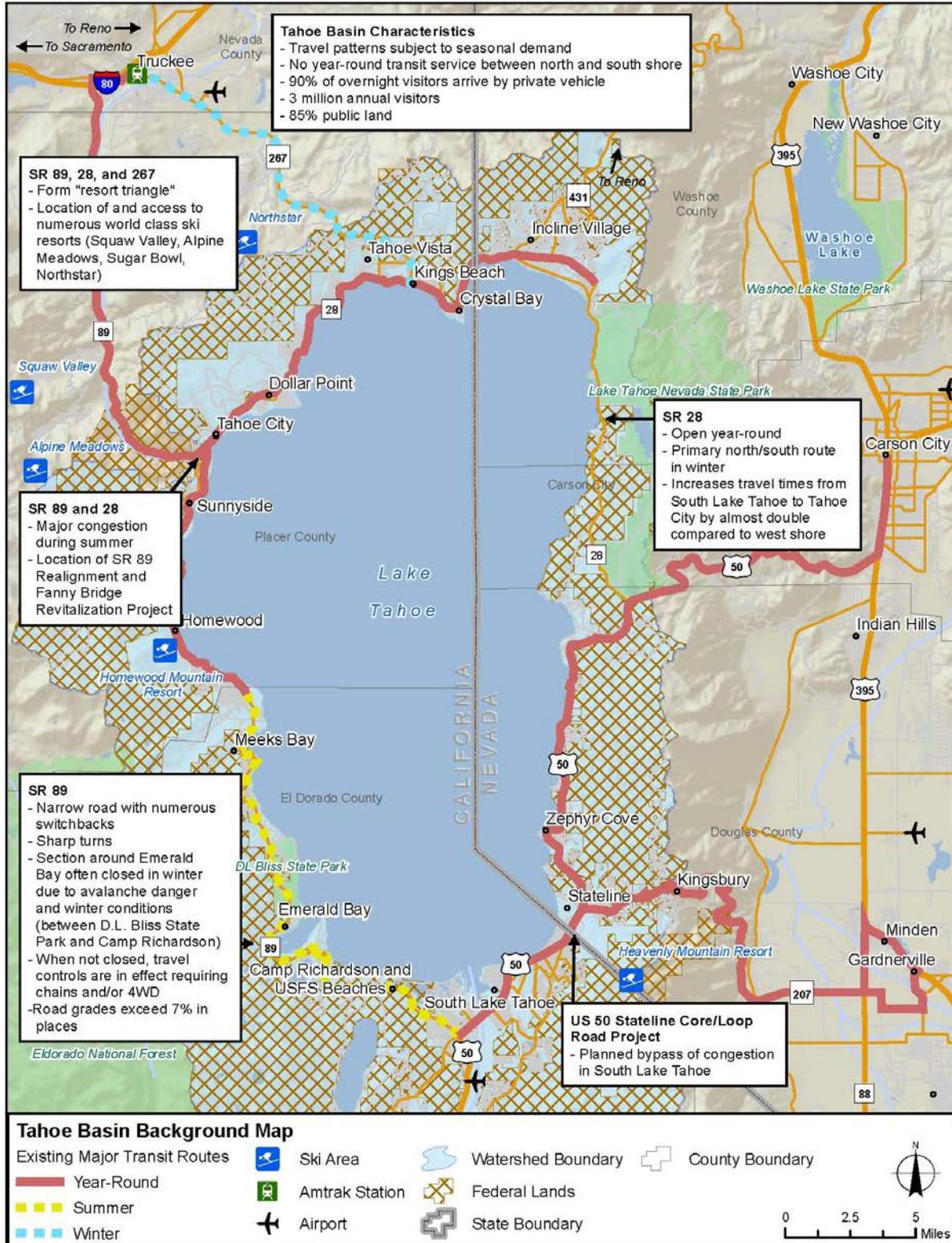


Figure 4: Tahoe Background Map



North and West Shore

Transit service on the north and west shore is provided by Tahoe Area Regional Transit (TART) through the Placer County Department of Public Works. TART operates two year-round bus routes serving Highway 28 and Highway 89. TART’s Mainline Route provides service along the west and north shores connecting Tahoma, Homewood, Tahoe City, Kings Beach, and Incline Village. The Highway 89 Route provides service between Tahoe City and Truckee.

TART operates a seasonal route on Highway 267 Route that provides winter-only service between Truckee and Crystal Bay. TART also provides a free summer night trolley that operates between Squaw Valley and Crystal Bay along SR 89 and SR 28.

TTD, with assistance from Truckee/North Tahoe Transportation Management Association and Placer County, provides additional transit service on the north shore with the North Lake Tahoe Express (to Reno/Tahoe International Airport) and Night Rider (supplemental night service to TART). In addition, Truckee Transit provides seasonal service with winter ski shuttle service from Truckee and summer bus service between Truckee-Tahoe Airport and Donner Lake. During the winter season, there are a variety of private ski shuttles serving Alpine Meadows, Diamond Peak, Northstar-at-Tahoe, Squaw Valley USA, and Sugar Bowl, Donner Ski Ranch, Soda Springs, and Boreal. Most of these shuttles have direct connections with TART.

Seasonal transit service on the west shore is provided by the Emerald Bay Connection, which is a summer bus service connection between TART and BlueGO. The TART Mainline Route connects with the BlueGO Nifty Fifty Trolley in Tahoma. This service connection is not available in the winter due to ridership demand and operating constraints.

TART Service Characteristics

Table 2 provides a summary of TART hours of operation and frequency by route (for service that operates year-round only). TART has major seasonal variations in hours of operation and frequency.

Table 2: TART Service Characteristics

Route	Hours of Operation		Frequency
Mainline	Tahoma to Incline West Shore 7:08am-6:24pm North Shore 6:00am-6:54pm Nevada 6:30am-7:12pm	Incline to Tahoma West Shore 6:30am-5:50pm North Shore 6:00am-6:48pm Nevada 6:42pm-7:25pm	30-60 minutes
Hwy 89	Tahoe City to Truckee 6:30am-5:30pm	Truckee to Tahoe City 7:30am-6:28pm	60 minutes

Source: TART, 2011.

TART Ridership

Table 3 lists TART monthly boarding by route between July 2010 and March 2011. TART has major seasonal variations in ridership, with the winter ski season being the highest ridership period. TART's highest ridership route is the TART Mainline, which serves the North Shore. TART has seen strong ridership growth in recent years, especially during the winter season. According to TART, ridership for the winter season increased by 18 percent between 2009-2010 and 2010-2011, with total boardings increasing from 139,917 to 165,039.

Table 3: TART Monthly Ridership by Route

Route	2010						2011		
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Mainline									
West Shore	3,362	3,129	2,046	1,635	1,690	3,017	3,919	3,718	4,115
North Shore	14,652	14,118	10,614	9,056	7,947	14,337	18,528	15,580	14,920
Nevada	4,613	4,585	3,582	3,007	2,371	3,210	3,843	3,168	3,652
Hwy 89	7,122	7,004	5,077	4,390	4,277	11,385	14,038	10,663	10,290
Hwy 267	1,224	1,226	232	-	-	7,122	12,536	10,596	9,336
CA Trolley	4,115	2,970	448	-	-	-	-	-	-
NV Trolley	1,152	951	125	-	-	-	-	-	-
Total	36,240	33,983	22,124	18,088	16,285	39,071	52,864	43,725	42,313

Source: TART, 2011.

South Shore

Transit service on the south shore is provided by the Tahoe Transportation District under an operating contact with Tectrans, Inc. The service, known as BlueGO, operates local and express bus routes, and seasonal shuttle and trolley service. BlueGO orients its service around several key destinations in and around the South Shore of Lake Tahoe, including South Lake Tahoe, Stateline, Round Hill/Zephyr Cove, and Carson City. The majority of BlueGO's bus routes begin and end in South Lake Tahoe. Major transit facilities include the Stateline Transit Center, Kingsbury Transit Center, and South Y Transit Center. BlueGO's express bus routes provide service to South Lake Tahoe from areas such as Gardnerville and Carson City which are located in the Carson Valley outside of the Tahoe Basin. These services connect with regular BlueGO bus routes in South Lake Tahoe.

BlueGO provides seasonal service with the Heavenly ski shuttle in the winter (which consists of 7 coordinated shuttle routes), and the Nifty Fifty Trolley in the summer (which operates between the South Y and Tahoma, where it meets TART as part of the Emerald Bay Connection).

BlueGO Service Characteristics

Table 4 provides a summary of BlueGO hours of operation and frequency by route (for service that operates year-round). Similar to TART, BlueGO has major seasonal variations in hours of operation and frequency.

Table 4: BlueGO Service Characteristics

Route	Hours of Operation		Frequency
20X	Daily Eastbound 8:45am- 9:50am 3:40pm- 7:45pm	Daily Westbound 5:35am-8:38am 2:25pm-3:35pm	30-60 minutes
21X	Mon-Fri Eastbound 5:30am-9:28am 2:30pm-6:28pm Sat-Sun Eastbound 6:30am-9:28am 2:30pm-6:28pm	Mon-Fri Westbound 6:30am-10:28am 3:30pm-7:28pm Sat-Sun Westbound 7:30am-10:28am 3:30pm-7:28pm	60 minutes
22	Sun-Thurs Eastbound 7:30am-12:30am Fri-Sat Eastbound 7:30am-1:25am	Sun-Thurs Westbound 8:00am-12:30am Fri-Sat Westbound 8:00am-1:25am	60 minutes
24X	Mon-Fri Eastbound 7:42am-8:30am	Mon-Fri Westbound 12:50pm-3:55pm	1-2 trips
50	Daily Eastbound 5:15am-10:49pm	Daily Westbound 5:49am-11:15pm	60 minutes
53	Daily Eastbound 6:45am-12:15am	Daily Westbound 7:20am-12:45am	60 minutes

Source: TTD, 2011.

BlueGO Ridership

Table 5 lists BlueGO monthly boardings by route between July 2010 and February 2011. Similar to TART, BlueGO has major seasonal variations in ridership, with the winter ski season being the highest ridership period. BlueGO has also undergone major service revisions during the past year because transit funding cuts in the State of California.

Table 5: BlueGO Monthly Ridership by Route

Route	2010						2011	
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
10	-	-	-	-	1,123	5,920	4,247	5,076
11	-	-	-	-	5,486	31,523	29,260	43,481
12	-	-	-	-	492	5,501	4,199	6,420
13	-	-	-	-	691	5,483	5,877	6,449
14	-	-	-	-	-	10,900	9,935	11,178
15	-	-	-	-	-	13,237	12,438	15,472
16	-	-	-	-	-	1,448	1,641	3,870
17	-	-	-	-	110	307	1,453	1,374
20X	2,111	1,975	1,659	1,634	1,695	2,214	2,096	1,836
21X	1,750	1,567	1,646	1,515	1,362	1,932	1,989	2,013
22	181	-	-	-	-	8,801	6,505	6,958
23	8,148	6,344	5,154	4,650	6,883	-	-	-
24X	-	338	593	614	562	253	612	454
30	4,712	4,560	1,389	168	-	-	-	-
40	363	-	-	-	-	-	-	-
50	18,479	19,983	19,195	12,688	12,275	17,969	17,995	15,481
52	1,174	1,168	1,194	39	-	-	-	-
53	1,205	1,080	969	7,732	8,289	11,140	13,045	11,958
54	3,533	3,072	2,793	173	-	-	-	-
55	1,417	1,498	1,643	103	-	-	-	-
On Call	2,622	2,837	2,834	2,860	2,445	2,707	2,758	2,328
Total	45,695	44,422	39,069	32,176	41,413	119,635	114,050	134,348

Source: TTD, 2011.

1.2.2 Travel Mode Survey

TRPA regularly conducts a Travel Mode Survey to gather accurate and reliable travel mode data of full time residents, seasonal residents, and visitors to commercial and recreational sites within the Tahoe Basin. The most recent survey conducted by NuStats in October 2010 will be used as a basis for ridership estimates for the North-South Transit Connection. In order to do this, the survey must be expanded to draw meaningful conclusions from the data set.

An analysis of the travel mode survey indicates there are currently at least 123,000 daily trips being made in the study area during peak season. The survey database consists of about 1,400 records. Each record contains information regarding the traveler's origin, destination, mode of transportation, party size, trip purpose, residential status, and length of stay, along with additional information. The survey was conducted at 19 commercial sites and 32 recreational sites. The survey is a sample and as such does not represent the entire population or activity in the study area.

Out of the 1,400 records, 1,250 records were geocoded with an origin and destination pair. The 1,250 survey records can be categorized into three groups based on full time, seasonal, and visitor status. In order to aid the analysis of trip making pattern in the study area, several analysis districts were developed based on the location of the survey sites and origins of each survey record. Once the analysis districts were established, each survey record was assigned an origin and destination analysis districts based on location within the Tahoe Basin. Expansion factors were then applied to identify trip patterns in the study area in more detail.

Table 6 describes the results of the Expanded Travel Mode Survey. According to the results, approximately 122,750 daily trips are made in the study area. Of this amount, approximately 99,100 daily trips (81%) are made by full time residents, with the remaining 23,650 daily trips (19%) made by visitors. Approximately 20,500 (17%) of all daily trips are made between north and south districts.

Table 6: Total Daily Trips from Expanded Travel Mode Survey

Trip type	Daily trips
Trips made by Full time residents	99,100 (81%)
Trips made by Visitors	23,650 (19%)
Trips made by all population	122,750 (100 %)
Trips made between the north and south districts	20,500 (17%)
Trips made between adjacent districts	102,250 (83%)
Top five trip purposes	
Outdoor recreation	55,930 (46 %)
Minor Shopping	20,100 (16 %)
Work	13,800 (11 %)
Restaurant	12,400 (11 %)
Other	5,400 (5 %)
Top travel modes	
Car/Truck/Van	97,100 (79 %)
Walk	10,600 (9 %)
Bicycle	10,000 (8 %)
Motor Cycle/Moped	2,050 (1.7 %)
Ferry/Boat	1,450 (1.2 %)
Public transport	750 (0.6 %)

Source: HDR, 2011

1.2.3 Demographics

This section describes 2010 Census population and housing data for each of the five counties that make up the Tahoe Basin. This 2010 census data is summarized in Table 7.

Table 7: Demographics

	California				Nevada					
	El Dorado		Placer		Carson City		Douglas		Washoe	
Total population	181,058		348,432		55,274		46,997		421,407	
Age Profile (years)										
0 - 14	33,145	18%	69,441	20%	9,712	18%	7,639	16%	82,696	20%
15 - 24	21,480	12%	42,234	12%	6,778	12%	4,830	10%	61,369	15%
25 - 34	17,244	10%	39,173	11%	6,627	12%	4,242	9%	56,469	13%
35 - 44	22,203	12%	46,565	13%	6,991	13%	5,093	11%	55,353	13%
45 - 54	32,346	18%	53,339	15%	8,428	15%	7,715	16%	61,322	15%
55 - 64	28,116	16%	44,118	13%	7,605	14%	7,999	17%	53,319	13%
65+	26,524	15%	53,562	15%	9,133	17%	9,479	20%	50,879	12%
Household (housing units)	88,159		152,648		23,534		23,671		184,841	
Occupied	70,223	80%	132,627	87%	21,427	91%	19,638	83%	163,445	88%
Owner occupied	51,391	73%	94,223	71%	12,728	59%	14,105	72%	95,678	59%
Renter occupied	18,832	27%	38,404	29%	8,699	41%	5,533	28%	67,767	41%
Vacant	17,936	20%	20,021	13%	2,107	9%	4,033	17%	21,396	12%
Seasonal	12,677	71%	12,020	60%	145	7%	2,303	57%	5,025	23%
65 years and over	16,640	24%	33,696	25%	5,969	28%	3,097	16%	33,112	20%

Source: 2010 Census

A few interesting observations may be made from these data. The counties with the largest land area in the Tahoe Basin and its surrounding communities have:

- A larger share of households identified as seasonal.
- A greater percentage of people over 65 years of age occupying homes.
- A higher percentage of owner occupied housing.
- Slightly higher percentages of people over 45.

1.2.4 Other Data Availability

TTD is the recipient of a number of data collection efforts that take place throughout the Tahoe Basin. However, such efforts often reflect only portions of the total travel market. Thus, the TTD is now establishing more specific data collection plans. In the meantime, however, the following efforts are ongoing and provide some useful information for travel markets on both the north and south shore:

- Bike Trail User Survey – performed every 10 years by the Tahoe Coalition of Recreation Providers (1997, 2007)
- Summer Visitors Travel Survey – performed every two years by the Tahoe Regional Planning Agency (2004, 2006, etc)
- Winter Visitors Travel Survey – performed every two years by the Tahoe Regional Planning Agency (2004, 2006, etc)
- Tahoe Regional Household Travel Survey – performed infrequently by the Tahoe Regional Planning Agency

Currently, TRPA maintains a regional travel model that is calibrated to the summer travel markets. This model does not reflect average daily travel patterns, but it designed to be used to understand a peak summer travel day.

The recently completed *South Lake Tahoe Short Range Transit Plan* (December, 2010) contains a wealth of transit and demographic data that resulted in recommended system improvements that would provide efficiencies and increase ridership. The *South Lake Tahoe SRTP* is the last component of a comprehensive regional transit strategy when coupled with the *Tahoe Interregional-Intraregional Transit Study* in 2005 and the *Tahoe Area Regional Transit Systems Plan* in 2005. An update to the *Tahoe Area Regional Transit Systems Plan* is underway with completion expected in 2012.

1.3 Travel Markets

Travel markets in the Tahoe Basin center around seasonal travel patterns, a few predominant destinations, and the existence of a large transit dependent population. While these fluctuating markets create a challenge for providing comprehensive and coordinated transit services over such a large region, there are various opportunities to provide direct connection between points/destination and communities that are otherwise not connected through transit or other alternatives to the automobile. As described earlier, approximately 122,750 daily trips are made in the study area. Of this amount, approximately 99,100 daily trips (81%) are made by full time residents, with the remaining 23,650 daily trips (19%) made by visitors. Approximately 20,500 (17%) of all daily trips are made between the north and south shore.

1.3.1 Seasonal Travel Markets

Tourism is the predominant economic activity in the Tahoe Basin, as it provides 74 percent of jobs in the Basin. Because of this large and seasonal industry, there are fluctuations in the year-round travel markets. The existing transit service demonstrates this, as seasonal ski shuttle service is provided in the winter and trolley service in the summer.

The winter travel market is more organized in its arrangement, as much of the tourism activity is focused around the ski areas themselves as this is the predominant attraction to Lake Tahoe during the winter months. The existence of a number of public and private ski shuttles during the winter is a result of this arrangement. The summer travel market is more decentralized as the visitor destinations are more varied as are the activities. As a result, there are fewer seasonal transit services in the summer and the traffic congestion is more substantial and frequent.

1.3.2 Predominant Destinations

The largest areas of population, employment, and activity in the Tahoe Basin are the north and south shores. These areas are connected via Highways 28 on the east shore and Highway 89 on the west shore. Opportunities to connect these destinations via transit from other points in the Tahoe Basin currently vary from limited to non-existent. The link between them is important, because both the north and south shores serve as gateways to other destinations in the Tahoe Basin. Integrating these communities through transit could provide numerous benefits to the region through the expansion of job and housing markets as well as expenditures from visitors who may find cross-lake travel more efficient.

There are four primary travel markets in the Tahoe Basin:

- Internal North Shore: This includes the TART service area and the unincorporated communities of Tahoma, Homewood, Tahoe City, Kings Beach, Crystal Bay, and Incline Village, among others. The Town of Truckee is located to the north and is a major origin and destination.
- Internal South Shore: This includes the BlueGO service area and the incorporated City of South Lake Tahoe and the unincorporated communities of Stateline, Nevada, and Meyers, CA.
- North Shore to South Shore: This includes connections via Highways 28 and 89 or waterborne transit. The only transit connection between the north and south shore is seasonal transit service on the west shore provided by the Emerald Bay Connection, which is a summer bus service connection between TART and BlueGO, and for which current funding will expire in two years.
- To/from Tahoe Basin: This includes connections to/from points outside the Tahoe Basin, including Reno, Carson City, Sacramento, and the Bay Area. These population centers are the major metropolitan area in which people travel from to visit Lake Tahoe.

While the connection between the north and south shore will be the focus of the study, geographic and demographic constraints exist within each of the four travel markets described above. Therefore, providing comprehensive transit services that connect population with the proposed project is an important and ongoing concern for TTD.

1.3.3 Transit Dependents

There is a large transit dependent population in the Tahoe Basin. As noted above, tourism is the predominant economic activity and much of the service industry that supports tourism is transit dependent. This transit dependent population also includes residents who do not have a private vehicle or choose not to use one because of the high cost of living in the Tahoe Basin, as well as visitors who access the Basin without a private vehicle (over 90 percent of overnight visitors access the Basin via a private or rented automobile).

The need for transit by employees is such that in locations where transit services do not exist, employers often operate their own private shuttle services based on seasonal demand. Generally, residents work in or near their county of residence. This would indicate the importance of providing a consistent and quality level of transit service within both the north and south shore communities. Additionally, the proposed North-South Transit Connection may increase employment opportunities for both north and south shore residents by providing an efficient connection both across the Lake and to services on both the north and south shores.

1.4 Purpose for the Transit Investment

1.4.1 Project Description

The proposed North-South Transit Connection will provide a direct transit service between the north and south shore of Lake Tahoe. The alternatives will include both bus and ferry alternatives between the north and south shore. The service is proposed to operate year-round at headways and a span of service in line with current levels of service. Additionally, the service will coordinate with local transit services on both the north and south shore. The project will assist in achieving local, state, regional, and federal environmental and transportation goals by reducing dependency on the private automobile and environmental impacts associated with auto use.

1.4.2 Goals

The project goals and measures for meeting these goals are described in Table 8.

Table 8: Goals and Evaluation of Alternatives

#	Goal	Measures
1	Support regional goals and planning mandates	
	Provide multi-modal transportation alternatives	Number and length of alternative mode facilities
	Promote smart growth measures	Number of developments located adjacent to transit
2	Enhance transportation and mobility	
	Travel time savings	Output of travel model or survey data
	Consolidate transit services	Number of revenue miles operated per agency
	Improve non-motorized connections	Number and length of connecting bike and pedestrian paths to transit facilities
	Provide year-round transit service	Service consistency on both north and south shore
	Improve safety and reliability	Reduction in accidents near proposed services
	Serve transit dependent populations	Maintain or improve services near transit dependent populations
3	Meet and exceed environmental goals	
	Improve and maintain air quality	Reduce VMT and improve air quality per TRPA Thresholds and CAA
	Improve and maintain water quality	Reduce sediment loads from stormwater and air deposition consistent with TMDL load allocations and CWA
4	Promote livability principles Basin-wide	
	Consolidate development around transit nodes	Number of developments located adjacent to transit services
	Direct connection to varied housing choices	Number of affordable housing units developed within ½ mile of transit service

1.5 Need for the Transit Investment

1.5.1 Support Regional Planning Efforts and Mandates

The proposed North-South Transit Connection supports regional planning efforts by providing a multi-modal transportation alternative and supporting smart growth in the Tahoe Basin. The legislative environment for the Tahoe Basin is described in Section 1.1.3.

Provide Multi-Modal Transportation Alternatives

The North-South Transit Connection supports regional planning efforts to provide multi-modal transportation alternatives to private vehicle trips. According to visitor statistics, the dominant mode of travel into the Tahoe Basin is the automobile. Over 90 percent of overnight visitors access the Tahoe Basin through the use of a private or rented automobile. Roughly the same pattern holds for those making day trips to the Tahoe Basin. A North-South Transit connection would provide the basis to create a distribution system for auto trips entering the Tahoe Basin. As discussed in greater detail below, travel time savings on a transit alternative may be up to 40 minutes over a vehicle trip between the North and South Shore. Travel time and associated cost savings as well as environmental benefits offered by a North-South Transit Connection indicate a transit alternative to vehicle trips would meet several regional goals.

Smart Growth Principles

The North-South Transit Connection supports smart growth planning principals in the Tahoe Basin by focusing transportation improvements between the north and south shore by providing alternatives to the automobile and increasing transportation capacity. These improvements will allow for transportation and land use decisions at either end of the lake to be made in context of the entire Tahoe Basin and its rural, but pristine setting. The North-South Transit Connection maximizes the connectivity of the transportation system to proposed developments while minimizing the impacts to surrounding communities and natural resources.

1.5.2 Transportation

The North-South Transit Connection provides improved transportation connectivity through travel time savings, the consolidation of transit services, and the improvement of multi-modal connections, including non-motorized transportation.

Travel Time Savings

The North-South Transit Connection has the benefit of providing travel time savings over existing seasonal transit service between the north and south shore and more importantly, over the existing travel time of private vehicles using highways on either side of the lake. According to the Lake Tahoe North/South Connection Project Initiation Package, a proposed ferry service could be 18 miles in length and take 40 minutes. This is a substantial travel time savings over private vehicles trips, which are 32 to 39 miles in length, depending on the route, and take 1 hour to 1 hour 20 minutes, depending on the season and time of day. Overall, the advantage of the North-South Transit Connection is that it provides both a travel time savings and a more reliable trip time.

Consolidate Transit Service

The North-South Transit Connection would create a year-round transit connection between the north and south shore and consolidate transit service into a priority corridor. The North-South Transit Connection does this by connecting the two largest population, employment, and activity centers in the Tahoe Basin and by providing all-day, two-way transit service. This structure allows transit services on either end to be restructured so that their service focuses on trip distribution and operate as an integrated transit system.

Improve Non-Motorized Connections

The North-South Transit Connection provides an opportunity for improved non-motorized connections as well. Many of the non-motorized trips in the north or south shore are constrained to those areas only because a vehicle trip is required to access the other end of the lake. The North-South Transit Connection opens up either side of the lake to these non-motorized trips, and allows public as well as private shuttle companies to support these trips as necessary based on demand and the destination wishes of the traveler.

1.5.3 Mobility

The North-South Transit Connection provides improved transportation mobility by providing a year-round transit connection between the north and south shore and serve transit dependent populations.

Year-Round Transit Connection

The North-South Transit Connection would address year-round transit demand in the Tahoe Basin. The largest areas of population, employment, and activity in the Tahoe Basin are the north and south shores. These areas are connected via Highways 28 and 89, but opportunities to connect between them via transit from other points in the Tahoe Basin vary from limited to non-existent. The link between them is important, because both the north and south shores serve as gateways to other destinations both from

and within the Tahoe Basin. Currently, the only transit connection between the north and south shore is seasonal transit service on the west shore provided by the Emerald Bay Connection, which is a summer bus service. The North-South Transit Connection would respond to a shift in regional travel patterns from seasonal to year-round service.

Safety and Reliability

The North-South Transit Connection seeks to provide a safe and reliable transit connection between the north and south shore. Currently, there are safety and reliability issues associated with the highways on either side of Lake Tahoe, particularly Highway 89 on the west shore. For example, travel between the north and south shore can be severely impacted by weather during the winter months because of the narrow roadways and the combination of snow, ice, and poor visibility. During the summer, peak traffic volumes lead to substantial travel time delays. Together, these seasonal travel issues have a detrimental impact on the travel of people, goods, and services between the north and south shore. One measure of the proposed North-South Transit Connection would be to understand safety and travel time reliability issues associated with Highways 28 and 89.

Serve Transit Dependent Populations

The North-South Transit Connection improves transit options for the large transit dependent population in the Tahoe Basin. Many of the transit dependent trips in the north or south shore are constrained to those areas only since most of the time a vehicle trip is required to access the other end of the lake. The North-South Transit Connection opens up either side of the lake to those that are transit dependent, and allows both public and private transit companies to support these trips as necessary.

Facilitate Non-Auto Trips

The North-South Transit Connection vastly improves the ability of the visitor to arrive at Lake Tahoe without bringing an auto. With a complete regional transit system visitors can arrive at their destination and be able to move around the lake without being dependent on an auto. As part of the complete system of bike/pedestrian trails, transit, and road system improvements, the true destination resort goal is achieved which thereby improves the community, economy, and environment of Lake Tahoe.

1.5.4 Environmental

The Tahoe Basin is a national and international natural treasure and is designated an Outstanding Natural Resource Water by the U.S. Environmental Protection Agency. Lake Tahoe and the surrounding mountains create a unique ecosystem that both Federal and state governments have mandated be preserved. Given the national interest and incredibly significant resources in this region, local planners and stakeholders have additional considerations not present in other regions. The largest impact on the Tahoe Basin is a large amount of visitor and auto traffic. Thus, a transportation solution that can

consolidate a portion of these trips or provide a direct transit connection between attractions on the North and South Shore can reduce auto traffic thereby help to preserve air and water quality and improve quality of life for both residents and visitors. In addition the ability to provide that connection without widening highways or the impact of building other physical transit corridors maintains the goal of protecting Tahoe's resources and further facilitates their restoration.

Air and Water Quality

The Pathway process, a coordinated Basin-wide planning effort to update the Regional Plan have identified the following important topics related to maintaining or improving air and water quality: 1) Visibility or Clarity 2) Impact on human health 3) Impact on eco-system health 4) Reduction of emissions and 5) Restore and then maintain water quality. Each of these goals has one important item in common: to reduce pollutants within the Tahoe Basin. Increasing use of public transit was identified as one important way to achieve this goal. Pollutants from cars and the roadway contribute particles directly into Lake Tahoe via road dust as well as damaging the leaves and needles of trees in the surrounding Forest Service lands. Because the peak summer season auto congestion levels correspond to the growing season of trees, it can be especially damaging to the forests in and around the Tahoe Basin. With the implementation of a proposed cross-lake transit service, a reduction in auto trips is feasible.

More recently the State of California has assigned green house gas reduction goals for the Tahoe Basin. Mobile sources are an important target for their reduction. A regional transit system is expected to help reduce vehicle trips and therefore contribute to this goal.

Other TRPA Environmental Threshold Goals

Additional resource goals for the connection will be to minimize the impacts to scenic quality, plant communities such as forests, noise, soil disturbance and erosion, fisheries, and wildlife. The constraints that these resource goals along with geographical and topographical challenges the Basin's mountainous environment provide will be a major factor in determining the best connection solution.

1.5.5 Livability

While a connection between the north and south will be regionally significant, an equally important set of connections will be made at either end of a proposed project. Transit service providers on both the north and south shore recognize the need to provide connection to the proposed project as well as provide both motorized and non-motorized options throughout their respective communities. Regionally, the proposed project will help these communities coalesce development and services around a significant transit node, as well as create an opportunity to plan affordable housing options within the reach of regional transit as well as access both the numerous private and public recreation facilities within the Tahoe Basin.

Consolidate Development Around Transit Nodes

The integration of transportation and land use is a critical element of regional growth and circulation goals. The Regional Transportation Plan promotes a Pedestrian and Transit Oriented Development concept in developed areas within the Tahoe Basin. These focal points will contain mixed use development that is easily walk or bike-able, and also close to transit stops. While this pattern of dense development will help communities focus future development, travel patterns suggest visitors will not stay in one place. Thus, the proposed North-South Transit Connection will allow visitors to travel amongst communities on the north and south shore without needing an automobile.

Direct Connection to Varied Housing Choices

While visitors traveling into and throughout the Tahoe Basin make up the majority of trips annually, those who work for a business in the Basin create another significant travel market. The portion of this market that uses transit is likely transit dependent and does not live within the Tahoe Basin. A regional priority is to identify, within the proposed redevelopment areas, portions of development that contain a mix of housing choices. Residents of these communities would benefit both from easier pedestrian and bicycle access to amenities and also the accessibility that the proposed project provides to regional destinations.

2.0 EVALUATION METHODOLOGY

This section describes the methodologies that are used to evaluate alternatives for the North-South Transit Connection Alternatives Analysis (AA).

2.1 Methodology

The AA will develop project information in sufficient detail so that citizens, stakeholder groups, local and federal agencies, elected officials, and other study participants can make informed decisions on alternatives between the north and south shore of Lake Tahoe. The AA is being advanced in accordance with the project development process outlined by the Federal Transit Administration (FTA) for major transit capital investments.

The AA presents an evaluation of alternatives under consideration for the North-South Transit Connection. The alternatives will be screened based on defined criteria to identify a Locally Preferred Alternative (LPA). The AA will provide decision-makers the information needed to advance the project, including environmental documentation in compliance with the California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA), design, and construction.

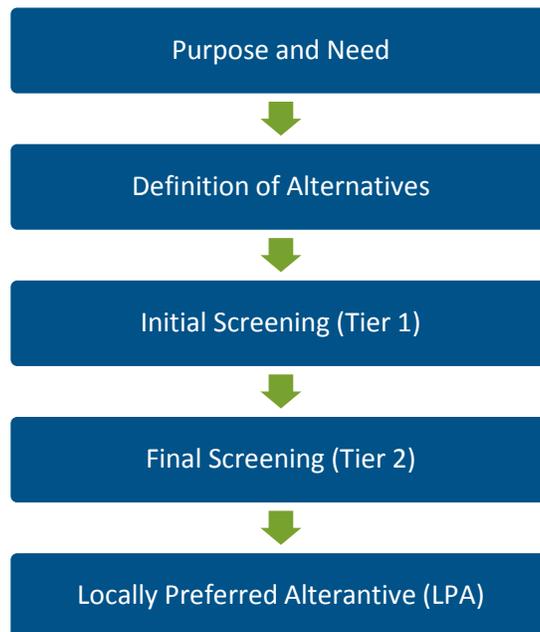
2.2 Evaluation Process

The evaluation process (Figure 5) includes two phases: Initial Screening (Tier 1) and Final Screening (Tier 2). Initial screening includes a conceptual level evaluation that analyzes the advantages and disadvantages of the alternatives. The purpose of the initial screening evaluation is to determine which of the alternatives would be the most feasible, and thereby narrow the range of alternatives to be considered for more detailed analysis in final screening. The initial screening evaluation criteria are qualitative in nature and seek to eliminate alternatives that have fatal flaws, do not meet project goals, or do not have public support.

The final screening includes the shorter list of alternatives that advanced from the initial screening. The final screening evaluation criteria are more quantitative than initial screening and address ridership potential, operational characteristics, cost, system configuration, design issues, environmental issues, land use and economic development opportunities, and community support. The results of the final screening will identify a LPA.

It should be noted that public involvement is an essential component throughout the evaluation process, as it is necessary to gain an understanding of the public's perception of need, value, priority, and location of the transit investment. The major groups to be targeted include the general public, business leaders, agency staff, and elected officials.

Figure 5: Evaluation Process



2.3 Initial Screening Evaluation

The initial screening evaluation analyzes the initial list of alternatives being considered using a set of qualitative evaluation criteria. Its purpose is to eliminate alternatives that have fatal flaws, do not meet project goals, or do not have public support.

Table 9 illustrates the criteria to be used in the initial screening analysis to evaluate potential alternatives. The alternatives will be rated High, Medium, or Low for each criterion, with High meaning optimal performance and Low indicating sub-standard performance. All of the criteria are weighted equally for the initial screening.

Table 9: Initial Screening Evaluation Criteria

Criteria	Measurement
Mobility	What is the relative potential of the alternative to improve mobility?
Travel time	What is the relative travel time of the alternative?
Ridership potential	What is the relative potential of the alternative to attract riders?
Capital costs	What is the relative capital cost of the alternative?
Operation and maintenance costs	What is the relative operating and maintenance cost of the alternative?
Capacity	What is the relative passenger carrying capacity of the alternative?
Missed destinations	Does the alternative miss any major destinations?
Fatal flaw	Does the alternative have a fatal flaw that prevents implementation?
Transit system integration	Does the alternative have the ability to be integrated with existing transit systems on north and south shore?
Expandability	Does the alternative have the ability to be expanded?
Traffic delay	Does the alternative use a route that experiences substantial traffic delay?
Economic development	Does the alternative serve areas with potential for economic development?
Plans and guidelines	Is the alternative consistent with adopted local/regional plans and Federal guidelines?
Community support	Is there community support for the alternative?

2.4 Final Screening Evaluation

The alternatives advancing from initial screening will be evaluated in more detail in final screening. The final screening evaluation criteria are more quantitative than the initial screening evaluation criteria and are intended to identify a Locally Preferred Alternative (LPA). The final screening evaluation criteria are based on the following categories:

- Ridership
- Capital costs
- Operation and maintenance costs
- Cost/benefit
- Travel time
- Destinations
- Circulation
- Design
- Environmental
- Economic development

Table 10 illustrates the criteria to be used in the final screening analysis to evaluate potential alternatives.

Table 10: Final Screening Evaluation Criteria

Criteria	Measure
Ridership	What is the ridership for each alternative?
Capital Costs	What is the capital cost of each alternative?
O&M Costs	What is the operating and maintenance (O&M) cost of each alternative?
Cost/Benefit	What is the cost/benefit of each alternative?
Travel time	What is the travel time for each alternative?
Destinations	Does the alternative miss any major destinations?
Circulation	
Transit	What are the transit issues associated with each alternative?
Traffic	What are the traffic operation issues associated with each alternative?
Bicycle/pedestrian	What are the bicycle/pedestrian issues associated with each alternative?
Design	
Physical constraints	What are the physical constraints of each alternative?
Operational constraints	What are the operational constraints associated with each alternative?
Environmental	
Property impacts	Does the alternative require additional right-of-way?
Land Use	What are the existing and future land use implications of each alternative?
Communities and neighborhoods	Does the alternative have community and neighborhood issues?
Visual and aesthetics	Does the alternative have visual and aesthetic issues?
Historic and cultural resources	Does the alternative affect historic and cultural resources?
Parklands	Does the alternative affect parklands?
Noise and vibration	Does the alternative affect sensitive noise receptors?
Energy	Does the alternative positively or negatively affect overall energy consumption?
Hazardous materials	Does the alternative have hazardous material issues?
Public safety and security	Does the alternative have public safety and security issues?
Soils, geology and seismic	Does the alternative have soil, geology, and seismic issues?
Ecosystem and natural environment	Does the alternative affect the ecosystem and natural environment?
Water quality and hydrology	Does the alternative affect water quality and hydrology?
Air quality	Does the alternative have air quality issues?
Construction	Does the alternative have construction issues?
Economic Development	What are the opportunities for economic development for each alternative?

3.0 INITIAL SCREENING OF ALTERNATIVES

This section describes the initial screening of alternatives for the North-South Transit Connection Alternatives Analysis (AA).

3.1 Initial Screening Alternatives

The Build alternatives evaluated during initial screening include a combination of ferry, bus, and bus/ferry alternatives. These alternatives are described in Table 11 and shown in Figures 6 through 10.

Table 11: Initial Screening Alternatives

Alt	Name	Description
Ferry Alternatives		
1	South Lake Tahoe/Tahoe City	Direct ferry service between South Lake Tahoe and Tahoe City
2	South Lake Tahoe/Tahoe City/Kings Beach	Triangular ferry service between South Lake Tahoe, Tahoe City, and Kings Beach
3	West Shore/North Shore	Circulator ferry service between South Lake Tahoe, Homewood, Tahoe City, and Kings Beach
4	Round-the-Lake	Circulator ferry service between South Lake Tahoe, Homewood, Tahoe City, Kings Beach, and Zephyr Cove
Bus Alternatives		
5	South Lake Tahoe/Tahoe City via West Shore	Bus service between South Lake Tahoe and Tahoe City via west shore
6	South Lake Tahoe/Kings Beach via East Shore	Bus service between South Lake Tahoe and Kings Beach via east shore
Bus/Ferry Alternatives		
7	South Lake Tahoe/Homewood (Bus) and Homewood/Tahoe City (Ferry)	Bus service between South Lake Tahoe and Homewood and ferry service between Homewood and Tahoe City
8	South Lake Tahoe/Homewood (Ferry) and Homewood/Tahoe City (Bus)	Ferry service between South Lake Tahoe and Homewood and bus service between Homewood and Tahoe City
9	South Lake Tahoe/Kings Beach (Bus) And Kings Beach/South Lake Tahoe (Ferry)	Bus service between South Lake Tahoe and Kings Beach and ferry service between Kings Beach and South Lake Tahoe
10	South Lake Tahoe/Kings Beach (Bus) and Kings Beach/Tahoe City/South Lake Tahoe (Ferry)	Bus service between South Lake Tahoe and Kings Beach and ferry service between Kings Beach, Tahoe City, and South Lake Tahoe

Note: South Lake Tahoe destinations to be determined during final screening. Destinations could include Camp Richardson, Timber Cove Marina, Lakeside Marina, Ski Run Marina, Tahoe Keys, and/or Zephyr Cove.

Figure 6: Ferry Alternatives 1 and 2

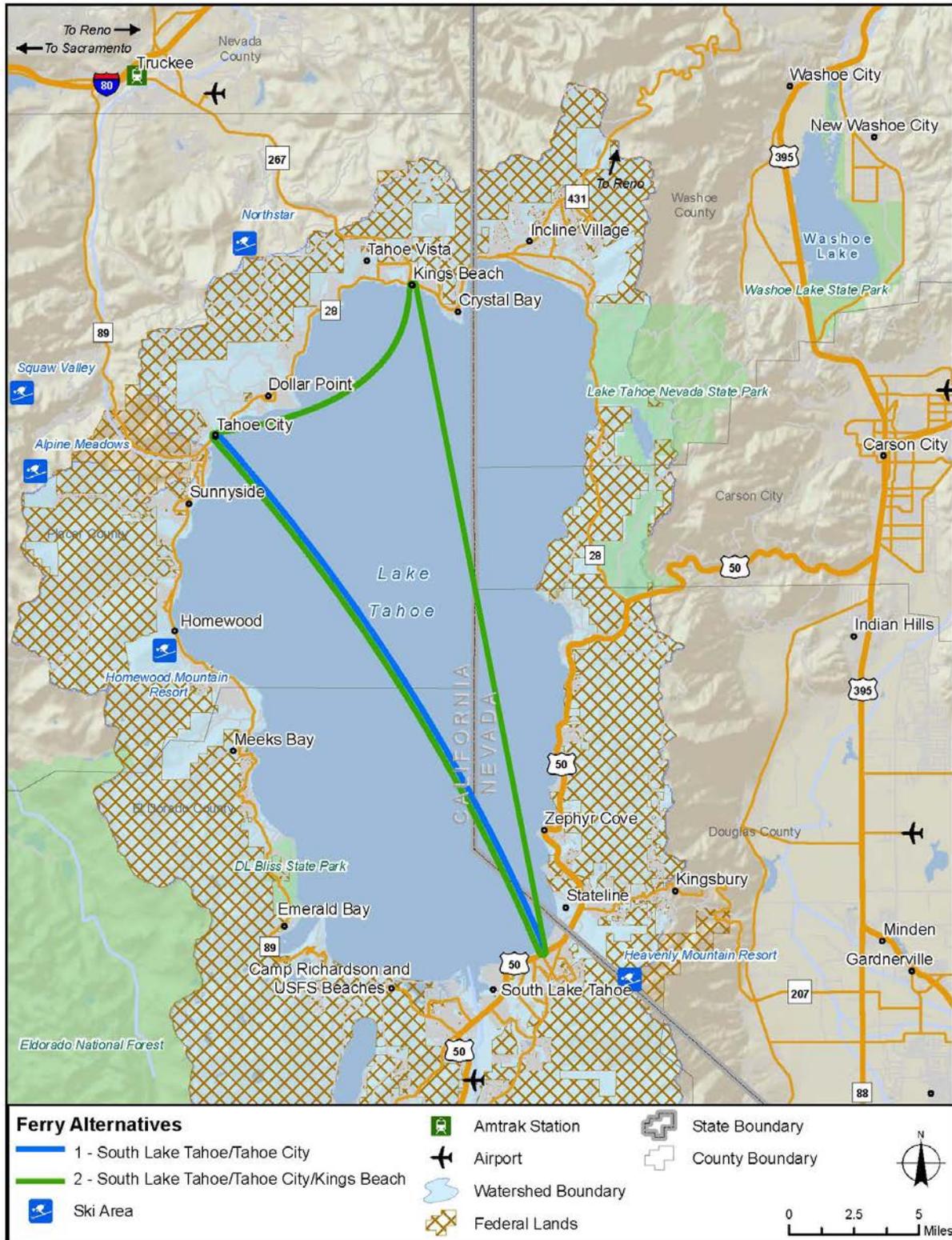


Figure 7: Ferry Alternatives 3 and 4

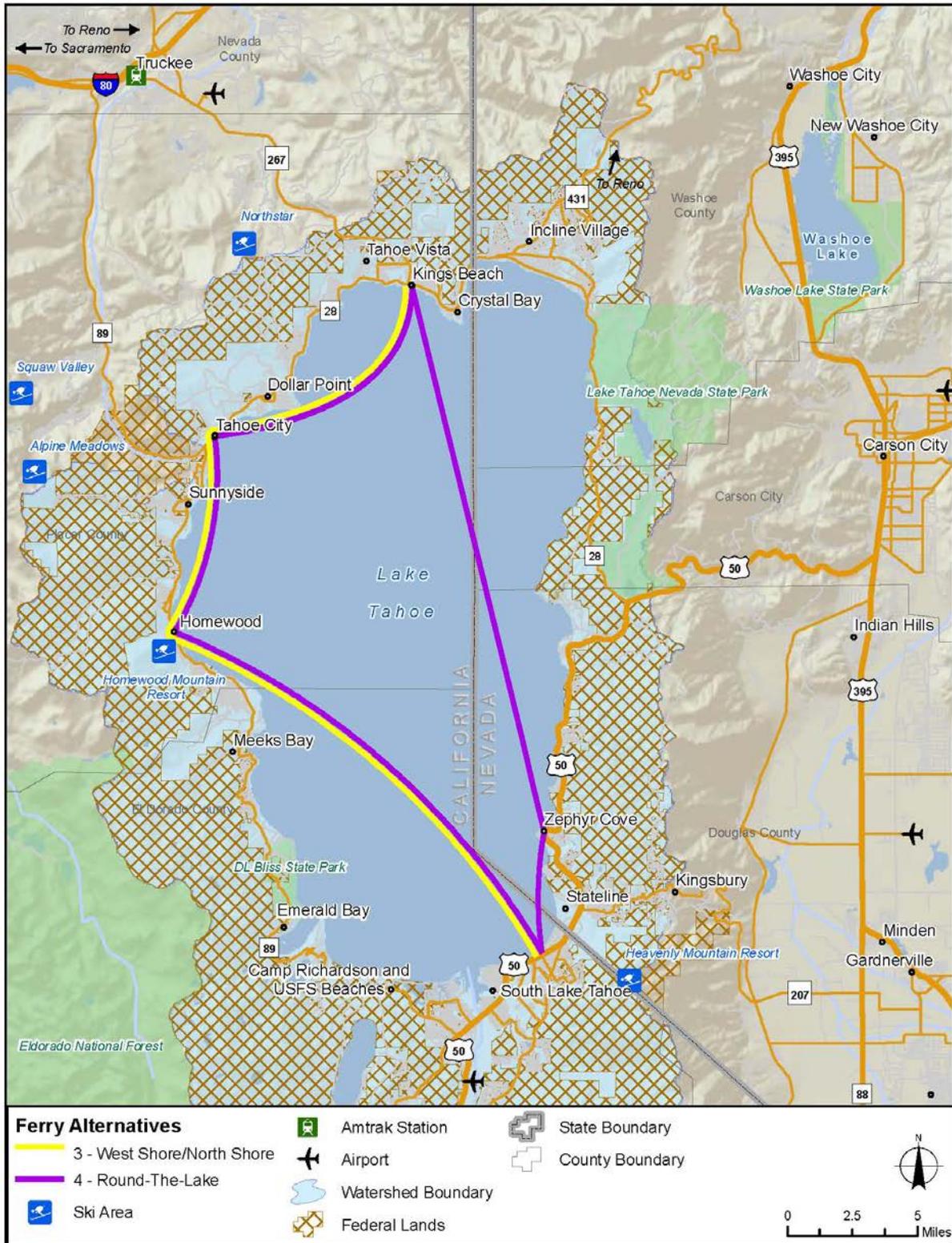


Figure 8: Bus Alternatives 5 and 6

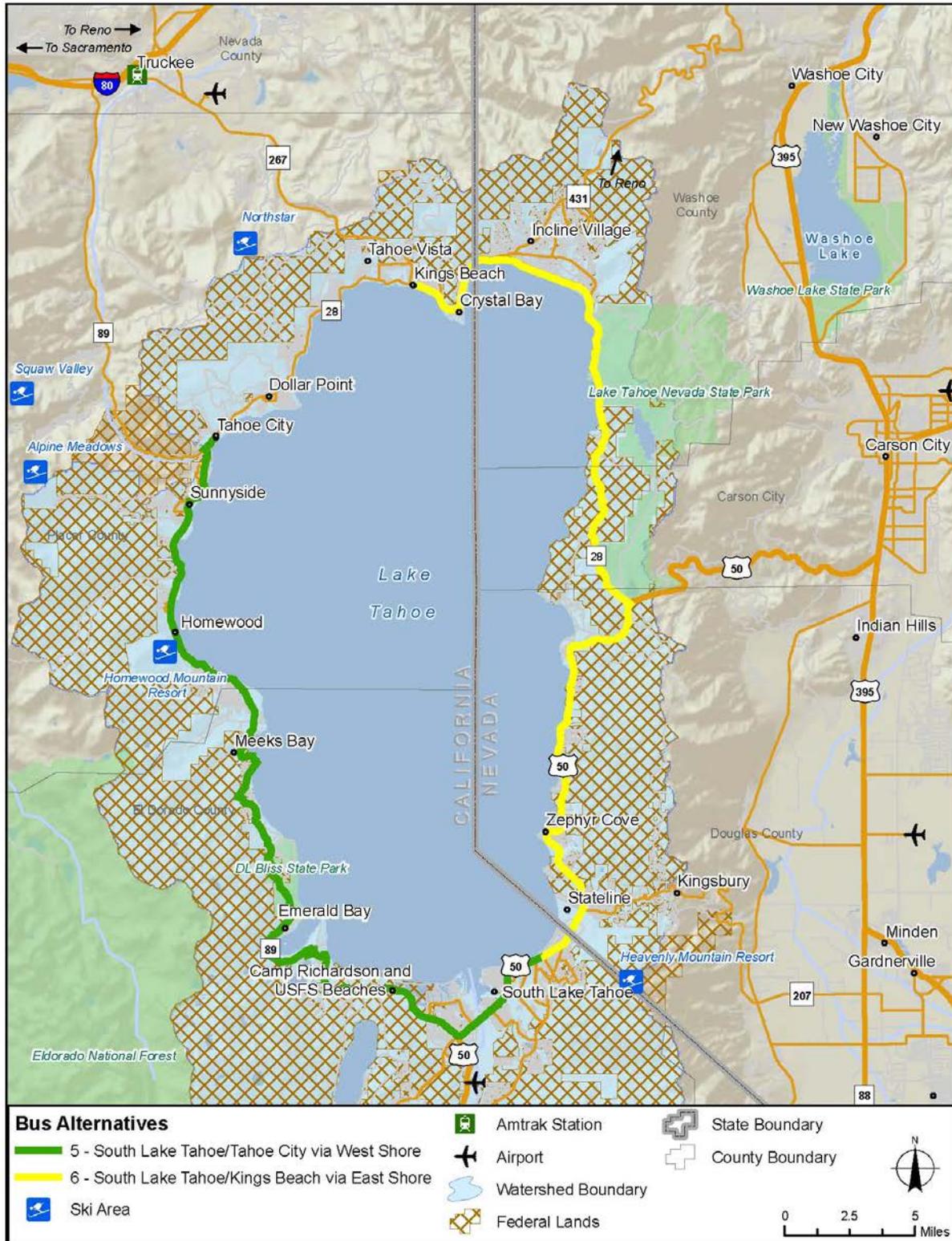


Figure 9: Bus/Ferry Alternatives 7 and 8

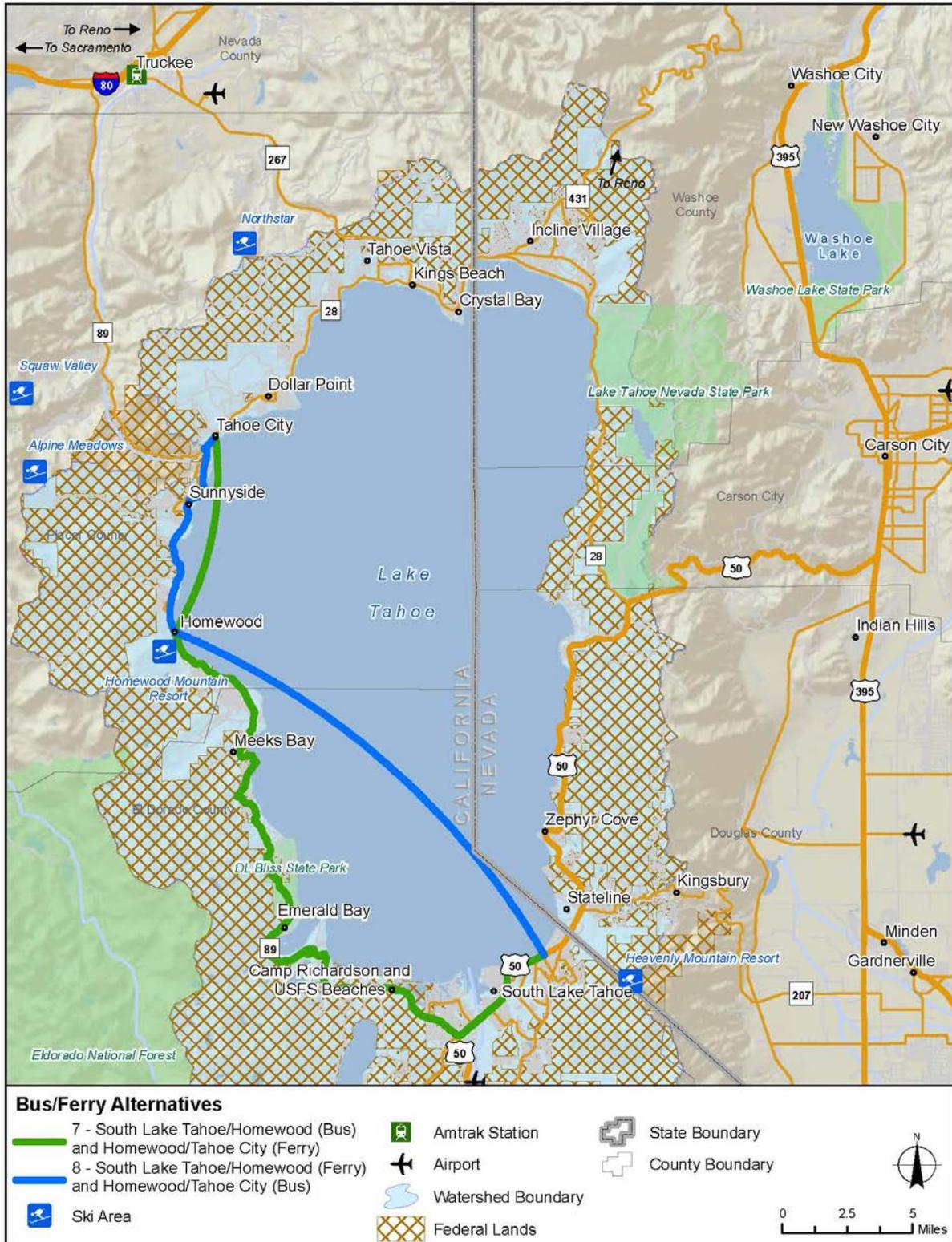
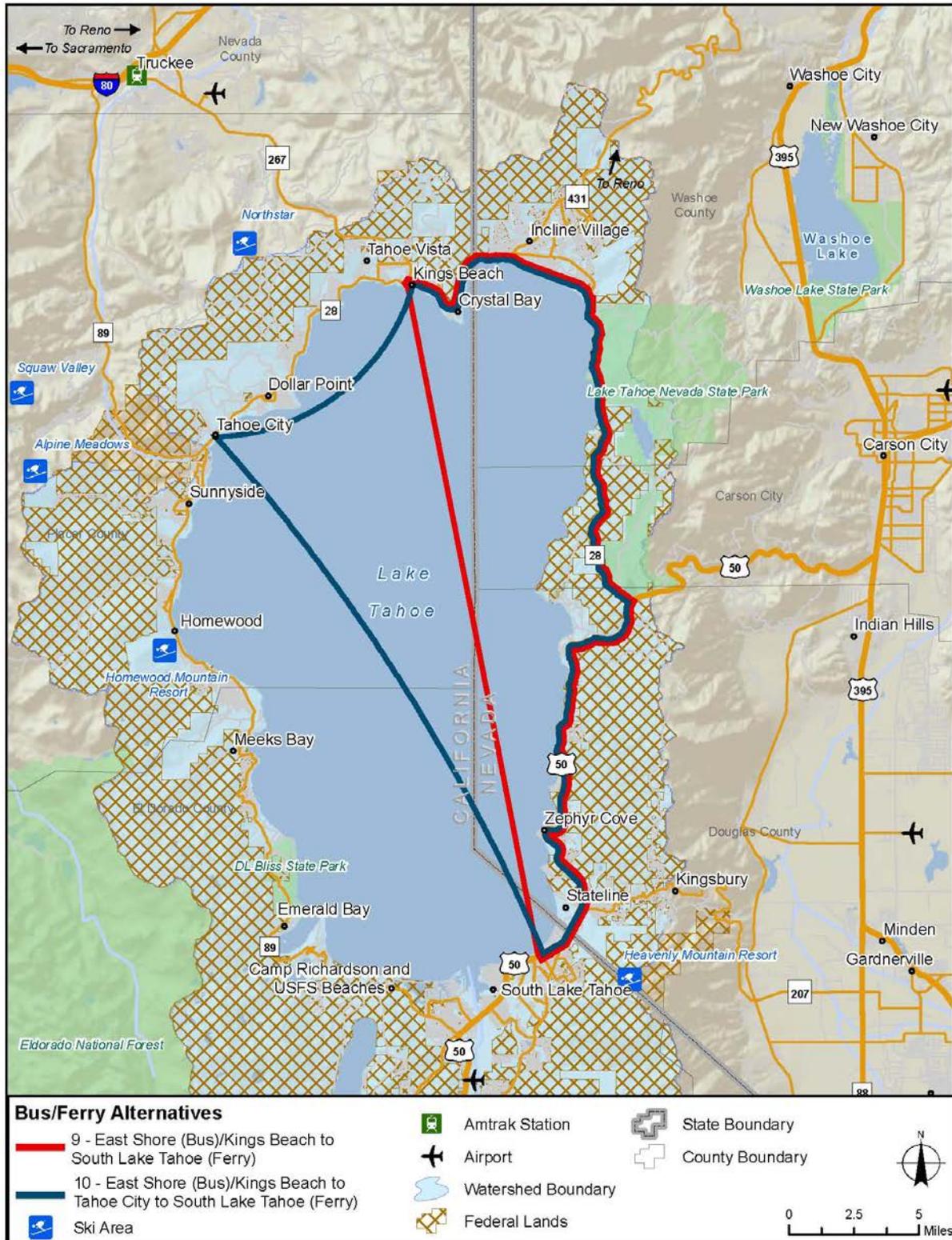


Figure 10: Bus/Ferry Alternatives 9 and 10



3.2 Initial Screening Evaluation

This section includes the initial screening evaluation and begins with a summary of the advantages and disadvantages of each alternative, and is followed by the initial screening of the alternatives based on evaluation criteria. Table 12 provides a general description of the advantages and disadvantages of each alternative.

Table 12: Advantages/Disadvantages of Initial Screening Alternatives

Alt	Advantage	Disadvantage
Ferry Alternatives		
1	<ul style="list-style-type: none"> – Direct ferry service between Tahoe City and South Lake Tahoe – Shortest and most direct ferry alternative – Fastest travel time of ferry alternatives – Requires fewest number of vessels – Lowest capital and O&M cost of ferry alternatives because of number of vessels and support facilities required 	<ul style="list-style-type: none"> – Requires additional passenger distribution on north shore – Does not serve Kings Beach – Does not serve intra north shore trips
2	<ul style="list-style-type: none"> – Serves Kings Beach in addition to Tahoe City and South Lake Tahoe – Second fastest travel time of ferry alternatives – Serves intra north shore trips – Second lowest capital and O&M cost of ferry alternatives because of number of vessels and support facilities required 	<ul style="list-style-type: none"> – Triangular service requires some passengers to travel out of direction – May require additional vessels to maintain same frequency as Alternative 1
3	<ul style="list-style-type: none"> – Serves Kings Beach and Homewood in addition to Tahoe City and South Lake Tahoe – Serves intra north and west shore trips 	<ul style="list-style-type: none"> – Circulator service requires some passengers to travel out of direction – Second longest travel time of ferry alternatives – Requires additional vessels to maintain same frequency as Alternatives 1 and 2 – Second highest capital and O&M cost of ferry alternatives because of number of vessels and support facilities required
4	<ul style="list-style-type: none"> – Serves Kings Beach, Homewood, and Zephyr Cove in addition to Tahoe City and South Lake Tahoe – Serves intra north, west, and east shore trips – Provides most service coverage of ferry alternatives 	<ul style="list-style-type: none"> – Circulator service requires many passengers to travel out of direction – Longest travel time of ferry alternatives – Requires additional vessels to maintain same frequency as Alternatives 1 and 2 – Highest capital and O&M cost of ferry alternatives because of number of vessels and support facilities required

Table 12 (Continued): Advantages/Disadvantages of Initial Screening Alternatives

Alt	Advantage	Disadvantage
Bus Alternatives		
5	<ul style="list-style-type: none"> – Direct bus service between Tahoe City and South Lake Tahoe via west shore – Shortest and most direct bus alternative – Fastest travel time of bus alternatives – Requires fewest number of buses – Lowest capital and O&M cost of bus alternatives because of number of buses and support facilities required 	<ul style="list-style-type: none"> – Uses SR 89 on west shore which is a narrow, windy road and subject to frequent winter closures and major traffic congestion during peak travel seasons – Cannot provide reliable bus service – Requires additional passenger distribution on north shore – Does not serve Kings Beach – Does not serve intra north shore trips
6	<ul style="list-style-type: none"> – Direct bus service between Kings Beach and South Lake Tahoe via East Shore – Provides reliable bus service because US 50/SR 28, which are open year round – Avoids winter closures and traffic congestion on SR 89 on west shore 	<ul style="list-style-type: none"> – Requires additional passenger distribution on north shore – Does not serve Tahoe City – Does not serve intra north shore trips – Slowest travel time of bus alternatives – Requires additional buses to maintain same frequency as Alternative 5 – Highest capital and O&M cost of bus alternatives because of number of buses and support facilities required
Bus/Ferry Alternatives		
7	<ul style="list-style-type: none"> – Avoids traffic congestion on SR 89 between Tahoe City and Homewood – Serves intra west shore trips 	<ul style="list-style-type: none"> – Requires additional passenger distribution on north shore – Does not serve Kings Beach – Does not serve intra north shore trips – Requires a transfer between bus and ferry – Requires fleet for both bus and ferry – Tied with Alternatives 8, 9, and 10 for highest capital cost for all alternatives because of number of buses/vessels and support facilities required
8	<ul style="list-style-type: none"> – Avoids winter closures on SR 89 between Homewood and South Lake Tahoe – Serves intra west shore trips 	<ul style="list-style-type: none"> – Requires additional passenger distribution on north shore – Does not serve Kings Beach – Does not serve intra north shore trips – Requires a transfer between bus and ferry – Requires fleet for both bus and ferry – Tied with Alternatives 7, 9, and 10 for highest capital cost for all alternatives because of number of buses/vessels and support facilities required

Table 12 (Continued): Advantages/Disadvantages of Initial Screening Alternatives

Alt	Advantage	Disadvantage
9	<ul style="list-style-type: none"> – Direct bus service between Kings Beach and South Lake Tahoe via East Shore – Provides reliable bus service because US 50/SR 28, which are open year round – Avoids winter closures and traffic congestion on SR 89 on west shore 	<ul style="list-style-type: none"> – Requires additional passenger distribution on north shore – Does not serve Tahoe City – Does not serve intra north shore trips – Requires a transfer between bus and ferry – Requires fleet for both bus and ferry – Tied with Alternatives 7, 8, and 10 for highest capital cost for all alternatives because of number of buses/vessels and support facilities required
10	<ul style="list-style-type: none"> – Direct bus service between Kings Beach and South Lake Tahoe via East Shore – Provides reliable bus service because US 50/SR 28, which are open year round – Avoids winter closures and traffic congestion on SR 89 on west shore 	<ul style="list-style-type: none"> – Triangular service requires some passengers to travel out of direction – Requires a transfer between bus and ferry – Requires fleet for both bus and ferry – Tied with Alternatives 7, 8, and 9 for highest capital cost for all alternatives because of number of buses/vessels and support facilities required

The initial screening evaluates each of the alternatives according to a set of evaluation criteria. The alternatives are rated High (3), Medium (2), or Low (1) for each criteria, with High (3) meaning optimal performance and Low (1) indicating sub-standard performance. All of the criteria are weighted equally for the initial screening. Overall, the higher the score equals the higher the performance of the alternative. Table 13 shows the results of the initial screening.

Table 13: Initial Screening of Alternatives

Criteria	Alternatives										Details
	1	2	3	4	5	6	7	8	9	10	
Mobility	3	3	3	3	2	3	1	1	1	1	– All alternatives provide a high level of mobility except Alternative 5 (bus) and Alternatives 7 and 8 (bus/ferry) because they use SR 89 on the west shore which is subject to winter closures and/or major traffic congestion; Alternatives 7, 8, 9, and 10 (bus/ferry) also require a transfer between modes
Travel time	3	3	1	1	2	2	1	1	1	1	– Alternatives 1 and 2 provide the most direct service and fastest travel time
Ridership potential	3	3	3	3	2	3	1	1	1	1	– Alternatives 1, 2, 3, and 4 have the highest ridership potential because they are ferry alternatives and serve both local and visitor travel markets
Capital costs	3	3	2	2	3	3	1	1	1	1	– Alternatives 1 and 2 (ferry) and Alternatives 5 and 6 (bus) have the lowest capital cost because they minimize fleet acquisition and terminal facilities
O&M costs	3	3	2	2	3	3	1	1	1	1	– Alternatives 1 and 2 (ferry) and Alternatives 5 and 6 (bus) have the lowest O&M cost because they minimize fleet acquisition and are the shortest, most direct routes
Capacity	3	3	3	3	2	2	2	2	2	2	– Alternatives 1, 2, 3, and 4 have the most capacity because ferry vessels have a much larger passenger capacity than buses; in addition ferry vessels can accommodate more skis/snowboards and bicycles
Missed destinations	2	3	3	3	2	2	1	1	2	3	– Alternatives 2, 3, 4, and 10 serve all major destinations, while the remainder of alternatives miss either Kings Beach or Tahoe City

High (3) = Optimal Performance, Medium (2) = Moderate Performance, and Low (1) = Substandard Performance.

Table 13 (Continued): Initial Screening of Alternatives

Criteria	Alternatives										Details
	1	2	3	4	5	6	7	8	9	10	
Fatal flaw	3	3	3	3	1	3	1	1	3	3	– Alternative 5 (bus) and Alternatives 7 and 8 (bus/ferry) have fatal flaws because they use SR 89 on the west shore, which is subject to winter closures and/or major traffic congestion
Transit system integration	3	3	3	3	3	3	2	2	2	2	– All alternatives provide good transit system integration and connect to TART and BlueGO on the north and south shore; Alternatives 7, 8, 9, and 10 (bus/ferry) rate lower because they require an additional transfer between modes
Expandability	3	3	3	3	1	3	1	1	3	3	– All alternatives have good expandability except Alternative 5 (bus) and Alternatives 7 and 8 (bus/ferry) because they use SR 89 on the west shore which is subject to winter closures and/or major traffic congestion
Traffic delay	3	3	3	3	1	3	1	1	3	3	– All alternatives minimize traffic delay except Alternative 5 (bus) and Alternatives 7 and 8 (bus/ferry) because they use SR 89 on the west shore which is subject to winter closures and/or major traffic congestion
Economic development	3	3	3	3	2	2	2	2	2	2	– Alternatives 1, 2, 3, 4 (ferry) and Alternatives 7, 8, 9, and 10 (bus/ferry) rate higher than Alternatives 5 and 6 (bus) because of the economic development potential around multi-modal ferry terminals as well as a ferry’s ability to serve local and visitor travel markets
Plans and guidelines	3	3	3	3	2	3	1	1	2	2	– Alternatives 1, 2, 3, and 4 (ferry) and Alternative 6 (bus) have all been identified as viable alternatives between the north and south shore in previous planning efforts

High (3) = Optimal Performance, Medium (2) = Moderate Performance, and Low (1) = Substandard Performance.

Table 13 (Continued): Initial Screening of Alternatives

Criteria	Alternatives										Details
	1	2	3	4	5	6	7	8	9	10	
Community support	3	3	2	1	2	3	1	1	1	1	– Alternatives 1 and 2 (ferry) have received the most community support to date because they provide the most direct service and fastest travel time; Alternative 6 (bus) has also received community support because of its ability to provide year round service using US 50/SR 28 on the east shore
Total	41	42	37	36	28	38	17	17	25	26	– Alternatives 1, 2, and 6 have the highest scores among all alternatives

High (3) = Optimal Performance, Medium (2) = Moderate Performance, and Low (1) = Substandard Performance.

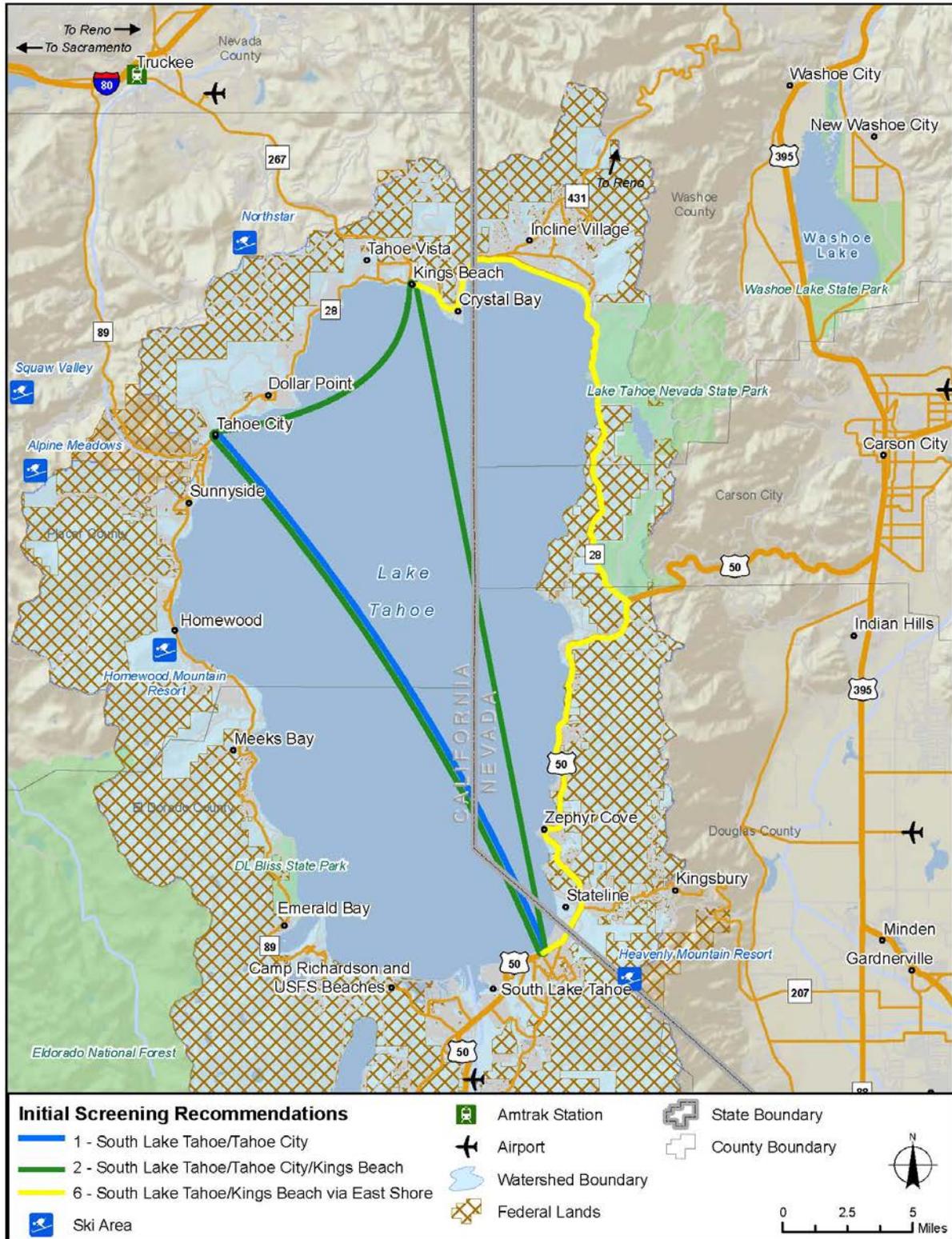
3.3 Initial Screening Recommendations

Based on the results of the initial screening evaluation, the following recommendations will be made for alternatives that will be advanced into final screening. It is recommended that Alternatives 1 and 2 (ferry) and Alternative 6 (bus) be advanced into final screening. Table 14 summarizes the results of the initial screening. Figure 11 shows the alternatives that will be advanced into final screening.

Table 14: Initial Screening Recommendations

Alt	Recommendation	Details
Ferry Alternatives		
1	Advance	<ul style="list-style-type: none"> – Most direct service and fastest travel time – Lowest capital and O&M cost of ferry alternatives
2	Advance	<ul style="list-style-type: none"> – Provides additional service coverage by serving intra north shore trips – Can be designed to provide triangular or point to point service
3	Eliminate	<ul style="list-style-type: none"> – Second longest travel time and circulator service requires some passengers to travel out of direction – Second highest capital and O&M cost of ferry alternatives
4	Eliminate	<ul style="list-style-type: none"> – Longest travel time and circulator service requires many passengers to travel out of direction – Highest capital and O&M cost of ferry alternatives
Bus Alternatives		
5	Eliminate	<ul style="list-style-type: none"> – Uses SR 89 on west shore which is a narrow, windy road and subject to frequent winter closures and major traffic congestion during peak travel seasons – Cannot provide reliable bus service on west shore
6	Advance	<ul style="list-style-type: none"> – Provides reliable bus service because US 50/SR 28 on the east shore are open year round – Only viable bus alternative
Bus/Ferry Alternatives		
7	Eliminate	<ul style="list-style-type: none"> – Requires bus/ferry transfer – Tied for highest capital cost for all alternatives
8	Eliminate	<ul style="list-style-type: none"> – Requires bus/ferry transfer – Tied for highest capital cost for all alternatives
9	Eliminate	<ul style="list-style-type: none"> – Requires bus/ferry transfer – Tied for highest capital cost for all alternatives
10	Eliminate	<ul style="list-style-type: none"> – Requires bus/ferry transfer – Tied for highest capital cost for all alternatives

Figure 11: Initial Screening Recommendations



4.0 FINAL SCREENING OF ALTERNATIVES

This section describes the final screening of alternatives for the North-South Transit Connection Alternatives Analysis (AA).

4.1 Final Screening Alternatives

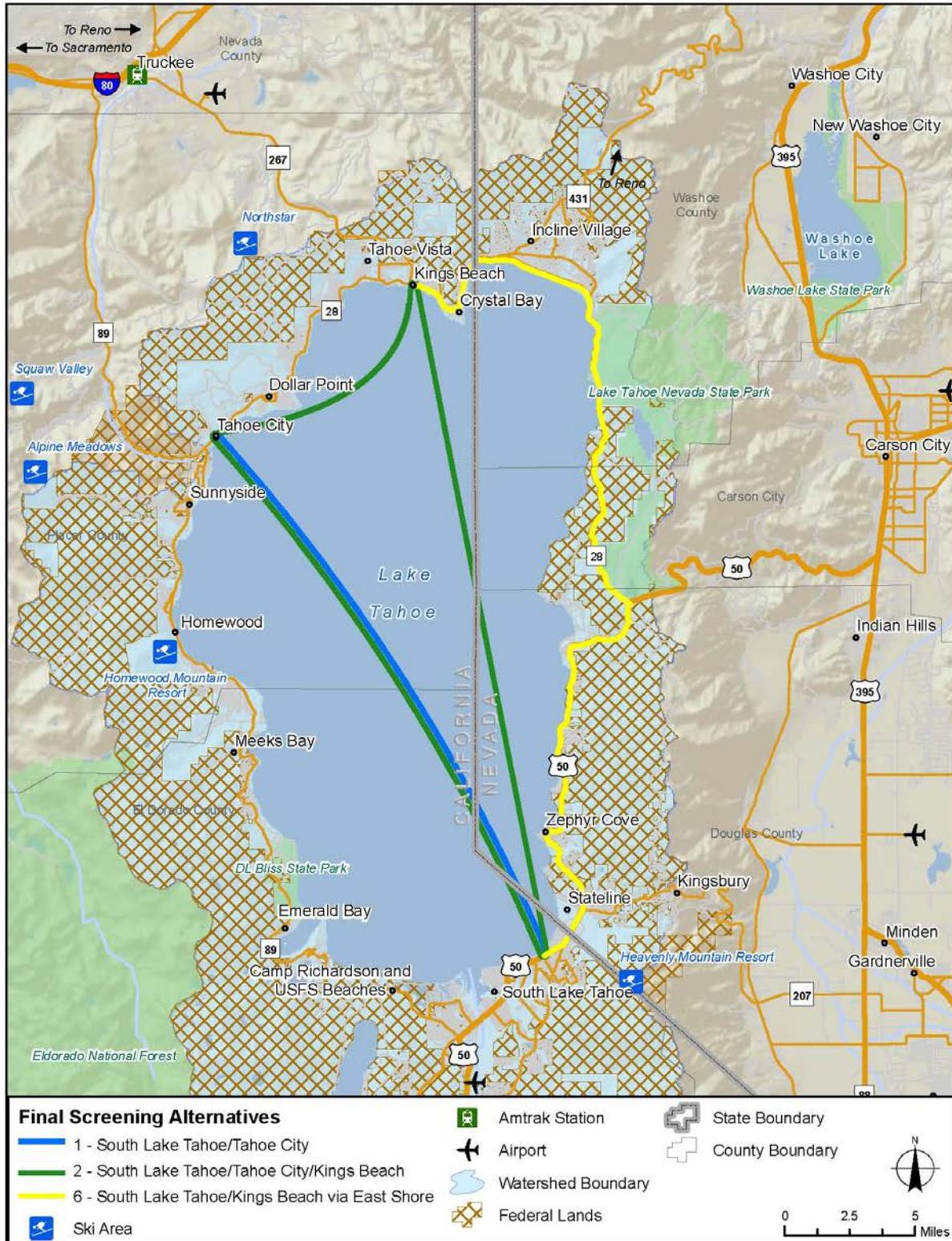
The Build alternatives evaluated during initial screening include a combination of ferry, bus, and bus/ferry alternatives. Based on the results of the initial screening evaluation, it is recommended that Alternatives 1 and 2 (ferry) and Alternative 6 (bus) be advanced into final screening. Table 15 describes the alternatives that will be advanced into final screening. Figure 12 shows the alternatives that will be advanced into final screening.

Table 15: Final Screening Alternatives

Alt	Name	Description
Ferry Alternatives		
1	South Lake Tahoe/Tahoe City	Direct ferry service between South Lake Tahoe and Tahoe City
2	South Lake Tahoe/Tahoe City/Kings Beach	Triangular ferry service between South Lake Tahoe, Tahoe City, and Kings Beach
Bus Alternatives		
6	South Lake Tahoe/Kings Beach via East Shore	Bus service between South Lake Tahoe and Kings Beach via east shore

Note: South Lake Tahoe destinations to be determined during final screening. Destinations could include Camp Richardson, Timber Cove Marina, Lakeside Marina, Ski Run Marina, Tahoe Keys, and/or Zephyr Cove.

Figure 12: Final Screening Alternatives



4.2 Final Screening Evaluation

4.2.1 Ridership

This section describes the potential ridership for each alternative. The daily ridership forecasts were developed by applying a transit mode share to the total person trips estimated in the expanded travel mode survey described in the Purpose and Need. The ridership estimate also considers the alternatives peak and off-peak headway, travel time, fare, and fleet requirements.

The daily ridership estimate for each alternative is shown in Table 16.

Table 16: Ridership

Attributes	Alternative		
	1	2	6
	Ferry	Ferry	Bus
Peak Headway	45 minutes	45 minutes	45 minutes
Off-Peak Headway	60 minutes	60 minutes	60 minutes
One-Way Travel Time	20-25 minutes	35-40 minutes	70 minutes
Fare	\$7	\$9	\$5
Number of Vessels/Buses	3 vessels	4 vessels	5 buses
Total Trips in Travel Market During Peak	64,000	90,000	50,000
Mode Share	2.5%	2.5%	1%
Daily Ridership	1,600 - 1,800	2,300 - 2,600	400 - 500

Overall, the daily ridership estimate for Alternatives 1 and 2 (ferry) are substantially higher than Alternative 6 (bus). Alternative 2 (2,600 riders) has a higher ridership estimate than Alternative 1 (1,800 riders) because it serves Kings Beach as an additional destination. Alternative 6 (500 riders) has the lowest ridership estimate for all alternatives, primarily because it does not serve Tahoe City and has a slower travel time between the north and south shore.

4.2.2 Capital Costs

Capital costs were generated for each of the alternatives using the FTA Standard Cost Category (SCC) workbooks. The SCC workbook methodology includes the following categories that are applicable to ferry and bus alternatives:

- Stops: Stops, shelters, platforms, and passenger amenities
- Support facilities: Maintenance and storage facility, shops, and administration buildings
- Sitework and special conditions: Demolition, clearing, earthwork, utilities, civil improvements, roadway improvements, curb, gutter, sidewalk, and paving
- Systems: Traffic signals, communications, and fare collection
- Right-of-way: Purchase or lease of land
- Vehicles: Vehicles and spare parts
- Professional services: Preliminary engineering, final design, program management, construction management, insurance, permits, and inspections
- Project reserve: Unallocated contingency

The capital costs for each alternative are summarized in Table 17.

Table 17: Capital Costs

SCC	Item	Alternative		
		1	2	6
		Ferry	Ferry	Bus
10	Guideway and Track Elements	\$0	\$0	\$0
20	Stops	\$1,675,000	\$2,182,000	\$600,000
30	Support Facilities	\$1,300,000	\$1,300,000	\$390,000
40	Sitework and Special Conditions	\$3,315,000	\$3,413,000	\$845,000
50	Systems	\$325,000	\$455,000	\$195,000
	Construction Subtotal	\$6,615,000	\$7,349,000	\$2,030,000
60	Right-of-Way	\$1,000,000	\$1,500,000	\$0
70	Vehicles	\$21,000,000	\$31,500,000	\$11,400,000
80	Professional Services	\$1,985,000	\$2,205,000	\$609,000
	Subtotal	\$30,600,000	\$42,554,000	\$14,039,000
	Project Reserve (10%)	\$3,060,000	\$4,255,000	\$1,404,000
	Total	\$33,660,000	\$46,809,000	\$15,443,000

Overall, Alternative 6 (bus) has the lowest capital cost (\$15,443,000). This is because the fleet cost for a bus is substantially lower than a ferry and there are no major capital facilities required. Alternative 1 (ferry) has the lowest capital cost (\$33,660,000) of the ferry alternatives, primarily because it only requires two ferry vessels and does not serve Kings Beach. Alternative 2 (ferry) has the highest capital cost (\$46,809,000) because it requires three ferry vessels and serves Kings Beach in addition to South Lake Tahoe and Tahoe City.

4.2.3 Operation and Maintenance Costs

This section describes the operation and maintenance (O&M) cost for each alternative. The following operating assumptions apply to Alternatives 1, 2, and 6 (bus and ferry):

- Number of trips: 24 one-way (12 roundtrips)
- Frequency: 45 minutes (peak) and 60 minutes (off-peak)
- Annual multiplier: 301 days

Alternatives 1 and 2 (Ferry)

The O&M costs for Alternatives 1 and 2 (ferry) are estimated on a cost per revenue hour basis using information from peer ferry systems, specifically the Massachusetts Bay Transportation Authority (MBTA) and Golden Gate Ferry. Table 18 shows the cost per revenue hour for these ferry systems according to the National Transit Database (2010). The average cost per revenue hour between these peer ferry systems is \$963.83.

Table 18: Peer Ferry System O&M Costs

Peer Systems	Cost per Revenue Hour
Ferry	
MBTA (Boston)	\$455.38
Golden Gate (Bay Area)	\$1472.28
Average	\$963.83

Source: National Transit Database (NTD), 2010

The O&M costs for Alternatives 1 and 2 are estimated by multiplying the number of trips by the weekday revenue hours, which are multiplied by an annual multiplier (301 days) to determine the annual revenue hours. The annual revenue hours are multiplied by the cost per revenue hour (\$963.83). Using this formula, the total annual O&M cost for Alternative 1 is \$3,342,100 and for Alternative 2 is \$9,399,656. The O&M cost for Alternatives 1 and 2 are summarized in Table 19.

Table 19: O&M Costs (Alternatives 1 and 2)

Alt	Number of Trips	Revenue Hours per Trip	Weekday Revenue Hours	Annual Multiplier	Annual Revenue Hours	Cost per Revenue Hour	Annual O&M Cost
Ferry							
1	24	0.48	11.52	301	3,468	\$963.83	\$3,342,100
2	24	1.35	32.40	301	9,752	\$963.83	\$9,399,656

Alternative 6 (Bus)

The O&M cost for Alternative 6 (bus) is estimated using the same methodology that TTD uses for its BlueGo bus service. This service is contracted on a cost per revenue hour basis. A revenue hour is defined as the time a vehicle is scheduled to be in revenue service and does not include deadhead, pre, or post trip time. TTD provides the fuel and other costs which are accounted for on a cost per mile basis and includes all vehicle miles (not just revenue miles).

The O&M cost for Alternative 6 is estimated by adding the contract service costs (using cost per revenue hour) and the TTD overhead costs (using cost per mile). These are estimated by multiplying the number of trips by the weekday revenue hours/miles, which is multiplied by an annual multiplier (301 days) to determine the annual revenue hours/miles. The annual revenue hours/miles are multiplied by the cost per revenue hour/mile (\$53.75/\$0.76). Using this formula, the total annual O&M cost for Alternative 6 is \$647,556.

The O&M cost for Alternative 6 is summarized in Table 20.

Table 20: O&M Costs (Alternative 6)

Alt	Trips	Rev Hours per Trip	Miles per Trip	Week-day Rev Hours	Week-day Miles	Annual Multiplier	Annual Rev Hours	Annual Miles	Cost per Rev Hour	Cost per Mile	Annual O&M Cost
Bus											
6	24	1.17	-	27.84	-	301	8,452	-	\$53.75	-	\$454,299
	24	-	32	-	845	301	-	254,285	-	\$0.76	\$193,256
											\$647,556

Source: TTD, 2012

Summary

The annual O&M cost for Alternative 6 (bus) is substantially lower than Alternatives 1 and 2 (ferry). Alternative 1 (\$637,556) has the lowest O&M cost because it is less expensive to operate bus than a ferry. This is because a bus only requires a single operator where as a ferry requires an operator plus additional crew members. For the ferry alternatives, Alternative 1 (\$3,342,100) has a much lower O&M cost than Alternative 2 (\$9,399,656) because it has a shorter travel time and does not serve Kings Beach as an additional destination.

4.2.4 Cost per User

This section describes the cost per user for each alternative. Cost per user provides a comparison of the cost-benefit for each alternative. This is useful because in many cases the performance of the alternative is otherwise a function of the route length, travel time, and number of stops. The cost per user assigns a dollar value to each alternative based on the ridership, capital cost, and O&M cost. The formula that is used to calculate cost per user is described below:

$$\text{Cost per User} = (\text{Annualized Capital Cost} + \text{Annualized O\&M Cost}) / \text{Daily Ridership}$$

The cost per user for each alternative is shown in Table 21.

Table 21: Cost per User

Alternative	Annualized Capital Cost	Annual O&M Cost	Annualized Capital + O&M Cost	Daily Ridership	Cost per User
Ferry					
1	\$33,660,000	\$3,342,100	\$5,186,000	1,600	\$3.05
2	\$46,809,000	\$9,399,656	\$11,964,000	2,500	\$4.88
Bus					
6	\$15,443,000	\$647,556	\$1,494,000	500	\$3.32

Overall, Alternative 1 (ferry) has the lowest cost per user (\$3.05). This indicates Alternative 1 is the best value in terms of ridership and cost. While Alternative 2 (ferry) has the highest ridership, it also has the highest capital and O&M cost, which results in the highest cost per user (\$4.88). Alternative 6 (bus) has second lowest cost per user (\$3.32), but it also has the lowest ridership.

4.2.5 Travel Time

This section compares the travel time between the final screening alternatives. The travel time for the ferry alternatives depends on the speed of the ferry vessel. For this analysis, it is assumed the speed of the ferry vessel is 28 knots. The travel time of the bus alternative is based on posted speed limit on Highways 50 and 28 on the east shore. The travel time for each alternative is shown in Table 22.

Table 22: Travel Time

Alternative	Travel Time
Ferry	
1	20-25 minutes
2	60-65 minutes (assumes 10 minute layover in Tahoe City)
Bus	
6	70 minutes

Alternatives 1 and 2 (ferry) provide a much faster travel time than Alternative 6 (bus). This is because the ferry alternatives serve the north and south shore with direct point to point service while the bus alternative needs to follow Highways 50 and 28 on the east shore.

4.2.6 Destinations

This section describes the major destinations served by each alternative. South Lake Tahoe, Tahoe City, and Kings Beach are identified as the major destinations in the corridor between the north and south shore. The destinations served by each alternative are shown in Table 23.

Table 23: Destinations

Alternative	Destinations		
	South Lake Tahoe	Tahoe City	Kings Beach
Ferry			
1	•	•	
2	•	•	•
Bus			
6	•		•

Alternative 2 (ferry) is the only alternative that serves all three destinations. Alternative 1 (ferry) does not serve Kings Beach while Alternative 6 (bus) does not serve Tahoe City.

4.2.7 Transit Service Characteristics

This section describes the transit service characteristics for each alternative. Service characteristics include both transit operation and fleet issues. A comparison of service characteristics is provided in Table 24.

Table 24: Transit Service Characteristics

Service Characteristics	Alternative		
	1	2	6
	Ferry	Ferry	Bus
Transit integration	<ul style="list-style-type: none"> – Direct service (point to point) – Transfers to TART and BlueGo service on north and south shore 	<ul style="list-style-type: none"> – Direct service (point to point) – Transfers to TART and BlueGo service on north and south shore 	<ul style="list-style-type: none"> – Less direct service (out of direction) – Transfers to TART and BlueGo service on north and south shore
Vehicle/vessel delay	<ul style="list-style-type: none"> – Potential delay from inclement weather (wind/wave conditions) on Lake Tahoe 	<ul style="list-style-type: none"> – Potential delay from inclement weather (wind/wave conditions) on Lake Tahoe 	<ul style="list-style-type: none"> – Potential delay from traffic congestion or weather on Highways 50 and 28 – No alternative route
Physical constraints	<ul style="list-style-type: none"> – No physical constraints 	<ul style="list-style-type: none"> – No physical constraints 	<ul style="list-style-type: none"> – Narrow roadway and steep mountain grades on Highways 50 and 28
Expansion	<ul style="list-style-type: none"> – Additional destinations can be added with minimal investment – Multiple route combinations 	<ul style="list-style-type: none"> – Additional destinations can be added with minimal investment – Multiple route combinations 	<ul style="list-style-type: none"> – Destinations constrained by routing of Highways 50 and 28 – No additional route combinations
Number of vehicles/vessels	<ul style="list-style-type: none"> – 3 ferry vessels 	<ul style="list-style-type: none"> – 3 ferry vessels 	<ul style="list-style-type: none"> – 6 buses (12 buses over 25 year)
Vehicle/vessel lifespan	<ul style="list-style-type: none"> – 25 years 	<ul style="list-style-type: none"> – 25 years 	<ul style="list-style-type: none"> – 12 years
Passenger capacity	<ul style="list-style-type: none"> – 120 to 200 passengers 	<ul style="list-style-type: none"> – 120 to 200 passengers 	<ul style="list-style-type: none"> – 80 to 100 passengers
Bicycle capacity	<ul style="list-style-type: none"> – Minimum of 10 bikes 	<ul style="list-style-type: none"> – Minimum of 10 bikes 	<ul style="list-style-type: none"> – Max of 3 bikes per bus

Overall, Alternatives 1 and 2 (ferry) provide better transit service characteristics than Alternative 6 (bus). Alternatives 1 and 2 provide direct point to point service between the north and south shore while Alternative 6 must travel out of direction via Highways 50 and 28 on the east shore. All alternatives are subject to inclement weather, although Alternative 6 is subject to additional physical constraints (narrow roadways and steep mountain grades). These physical constraints also restrict future expansion opportunities. In addition, Alternatives 1 and 2 (ferry) have a larger passenger capacity and can accommodate more bikes than Alternative 6 (bus).

4.2.8 Environmental Issues

This section identifies potential environmental issues for each alternative. Potential environmental issues were identified for each alternative relative to the environmental impact categories:

- Property Impacts
- Land Use
- Communities and Neighborhoods
- Visual and Aesthetics
- Historic and Cultural Resources
- Parklands
- Noise and Vibration
- Energy
- Hazardous Materials
- Public Safety and Security
- Soils, Geology, and Seismic
- Ecosystem and Natural Environment
- Water Quality and Hydrology
- Air Quality
- Construction

A summary of potential environmental issues for each alternative are shown in Table 25. This table identifies the differences between the alternatives relative to the environmental impact categories. Detailed environmental analysis will take place during the subsequent environmental documentation phase to comply with the National Environmental Policy Act (NEPA) and the California Environmental Policy Act (CEQA). The environmental documentation phase will begin after adoption of the LPA.

Table 25: Environmental Issues

Environmental Issues	Alternative		
	1	2	6
	Ferry	Ferry	Bus
Property impacts	– Property acquisition may be required for ferry dock facilities, including a location for maintenance and storage (ferry dock facilities to be located at South Lake Tahoe and Tahoe City)	– Property acquisition may be required for ferry dock facilities, including a location for maintenance and storage (ferry dock facilities to be located at South Lake Tahoe, Tahoe City, and Kings Beach)	– No issues identified
Land Use	– No issues identified – All alternatives are compatible with existing and future land use		
Communities and neighborhoods	– No issues identified		
Visual and aesthetics	– No issues identified		
Historic and cultural resources	– No issues identified		

Table 25 (Continued): Environmental Issues

Issue	Alternative		
	1	2	6
	Ferry	Ferry	Bus
Parklands	– No issues identified	– Potential ferry dock at Kings Beach State Park (may be adjacent to or part of park)	– No issues identified
Noise and vibration	– No issues identified		
Energy	– No issues identified		
Hazardous materials	– Ferry dock facilities will require hazardous materials analysis (ferry dock facilities to be located at South Lake Tahoe and Tahoe City)	– Ferry dock facilities will require hazardous materials analysis (ferry dock facilities to be located at South Lake Tahoe, Tahoe City, and Kings Beach)	– No issues identified
Public safety and security	– No issues identified		
Soils, geology, and seismic	– No issues identified		
Ecosystem and natural environment	– No issues identified		
Water quality and hydrology	– Potential water quality issues from ferry vessel emissions	– Potential water quality issues from ferry vessel emissions	– Potential water quality issues from bus emissions
Air quality	– No issues identified		
Construction	– Potential disruption from transport and assembly of ferry vessels – Potential disruption from construction of ferry dock facilities, including a location for maintenance and storage (ferry dock facilities to be located at South Lake Tahoe and Tahoe City)	– Potential disruption from transport and assembly of ferry vessels – Potential disruption from construction of ferry dock facilities, including a location for maintenance and storage (ferry dock facilities to be located at South Lake Tahoe, Tahoe City, and Kings Beach)	– No issues identified

4.2.9 Economic Development Potential

This section describes the economic development potential for each alternative. The economic development potential is assessed based on the major destinations served (South Lake Tahoe, Tahoe City, and Kings Beach) and the transit service characteristics (ferry or bus). The economic development potential for each alternative is shown in Table 26.

Table 26: Economic Development Potential

Alt	Economic Development Potential		
	South Lake Tahoe	Tahoe City	Kings Beach
Ferry			
1	<ul style="list-style-type: none"> – High economic development potential in South Lake Tahoe associated with ferry alternative – Potential for increased development at Ski Run marina or Stateline – Adjacent property uses support future economic development 	<ul style="list-style-type: none"> – High economic development potential in Tahoe City associated with ferry alternative – Potential for increased development at Tahoe City marina site – Adjacent property uses support future economic development 	<ul style="list-style-type: none"> – Does not serve Kings Beach
2	<ul style="list-style-type: none"> – High economic development potential in South Lake Tahoe associated with ferry alternative – Potential for increased development at Ski Run marina or Stateline – Adjacent property uses support future economic development 	<ul style="list-style-type: none"> – High economic development potential in Tahoe City associated with ferry alternative – Potential for increased development at Tahoe City marina site – Adjacent property uses support future economic development 	<ul style="list-style-type: none"> – Medium economic development potential in Kings Beach associated with ferry alternative – Site is constrained by existing parkland – Adjacent property restrict future economic development
Bus			
6	<ul style="list-style-type: none"> – Low economic development potential in South Lake Tahoe associated with bus alternative – Bus terminus likely to be an on-street facility with minimal opportunity for economic development 	<ul style="list-style-type: none"> – Does not serve Tahoe City 	<ul style="list-style-type: none"> – Low economic development potential in Kings Beach associated with bus alternative – Bus terminus likely to be an on-street facility with minimal opportunity for economic development

4.2.10 Final Screening Results

A summary of final screening is shown in Table 27.

Table 27: Summary of Final Screening

	Alternative 1	Alternative 2	Alternative 6
	Ferry	Ferry	Bus
Ridership	1,600 - 1,800 daily riders	2,300 - 2,600 daily riders	400 – 500 daily riders
Annual O&M Cost	\$3,342,100	\$9,399,656	\$647,556
Capital Cost	\$33,660,000	\$46,809,000	\$15,443,000
Cost per User	\$3.05	\$4.88	\$3.32
Travel Time	20-25 minutes	60-65 minutes	70 minutes
Destinations	South Lake Tahoe (Yes) Tahoe City (Yes) Kings Beach (No)	South Lake Tahoe (Yes) Tahoe City (Yes) Kings Beach (Yes)	South Lake Tahoe (Yes) Tahoe City (No) Kings Beach (Yes)
Service Characteristics			
Transit integration	– Direct service (point to point)	– Direct service (point to point)	– Less direct service (out of direction)
Vehicle/vessel delay	– Potential delay from inclement weather (wind/wave conditions)	– Potential delay from inclement weather (wind/wave conditions)	– Potential delay from traffic congestion or weather on Highways 50 and 28
Physical constraints	– No issues identified	– No issues identified	– Narrow roadway and steep mountain grades on Highways 50 and 28
Expansion	– Additional destinations can be added with minimal investment – Multiple route combinations	– Additional destinations can be added with minimal investment – Multiple route combinations	– Destinations constrained by routing of Highways 50 and 28 – No additional route combinations
Fleet	– 2 ferry vessels	– 3 ferry vessels	– 6 buses (12 buses over 25 years)
Fleet lifespan	– 25 years	– 25 years	– 12 years
Passenger capacity	– 120 to 200 passengers	– 120 to 200 passengers	– 80 to 100 passengers
Bicycle capacity	– Minimum of 10 bikes	– Minimum of 10 bikes	– Limited to 3 bikes per bus
Environmental Issues			
Property impacts	– Property acquisition may be required for ferry dock facilities, including a location for maintenance and storage	– Property acquisition may be required for ferry dock facilities, including a location for maintenance and storage	– No issues identified

Table 27 (Continued): Summary of Final Screening

	Alternative 1	Alternative 2	Alternative 6
	Ferry	Ferry	Bus
Parklands	– No issues identified	– Potential ferry dock at Kings Beach State Park (may be adjacent to or part of park)	– No issues identified
Hazardous materials	– Ferry dock facilities will require hazardous materials analysis (ferry dock facilities to be located at South Lake Tahoe and Tahoe City)	– Ferry dock facilities will require hazardous materials analysis (ferry dock facilities to be located at South Lake Tahoe, Tahoe City, and Kings Beach)	– No issues identified
Water quality/ hydrology	– Potential water quality issues from ferry vessel emissions	– Potential water quality issues from ferry vessel emissions	– Potential water quality issues from bus emissions
Construction	– Potential disruption from transport and assembly of ferry vessels – Potential disruption from construction of ferry dock facilities	– Potential disruption from transport and assembly of ferry vessels – Potential disruption from construction of ferry dock facilities	– No issues identified
Economic Development			
South Lake Tahoe	– Potential for increased development at Ski Run marina or Stateline	– Potential for increased development at Ski Run marina or Stateline	– Bus terminus likely to be an on-street facility with minimal opportunity for economic development
Tahoe City	– Potential for increased development at Tahoe City marina site	– Potential for increased development at Tahoe City marina site	– Does not serve Tahoe City
Kings Beach	– Does not serve Kings Beach	– Site is constrained by existing parkland	– Bus terminus likely to be an on-street facility with minimal opportunity for economic development

Based on the summary of final screening results, the alternatives were rated High (3), Medium (2), or Low (1) for each criteria, with High (3) meaning optimal performance and Low (1) indicating sub-standard performance. All of the criteria are weighted equally for final screening. Overall, the higher the score equals the higher the performance of the alternative. The results of the final screening are shown in Table 28.

Table 28: Final Screening Results

Criteria	Alternative		
	1	2	6
	Ferry	Ferry	Bus
Ridership	3	3	1
Capital costs	2	1	3
O&M costs	2	1	3
Cost per user	3	2	1
Travel time	3	2	1
Destinations	2	3	2
Service characteristics	3	2	1
Environmental issues	3	3	2
Economic development	3	3	1
Total	24	20	15

4.3 Final Screening Recommendations

Based on the results of the final screening evaluation, it is recommended that Alternative 1 (ferry) be identified as the Locally Preferred Alternative (LPA). Alternative 1 is recommended as the LPA because:

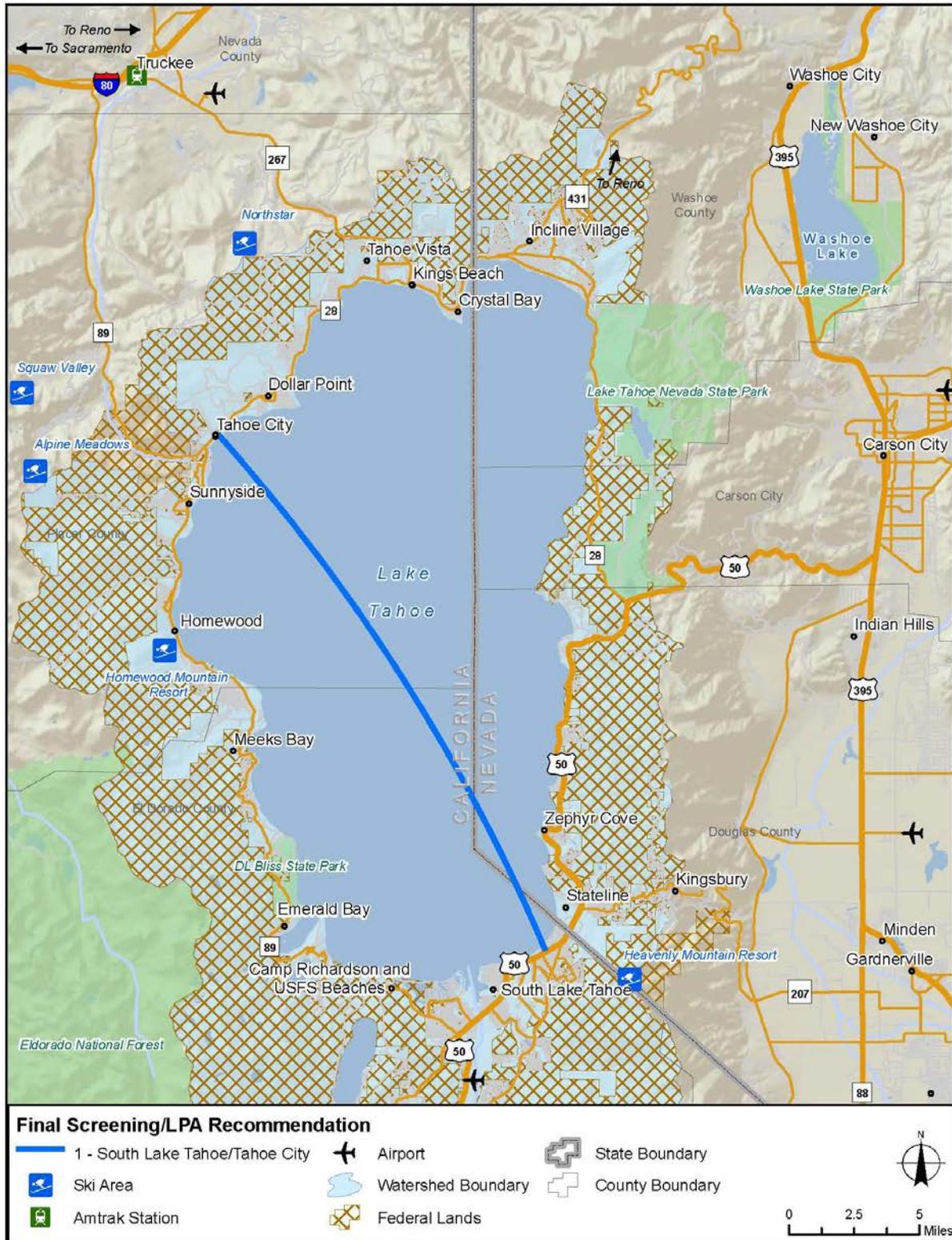
- It provides the most direct service between the north and south shore
- It provides the fastest travel time between the north and south shore
- It has the lowest capital and O&M cost of the ferry alternatives
- It has the lowest cost per user of all alternatives
- It provides optimal service characteristics in terms of transit operations
- It provides the highest passenger and bicycle capacity
- It has the fewest environmental issues for all alternatives
- It received the most community support
- It can be expanded to serve destinations such as Kings Beach in the future

Table 29 summarizes the results of the final screening. Figure 13 shows the Final Screening/LPA recommendation.

Table 29: Final Screening/LPA Recommendation

Alt	Recommendation	Details
Ferry Alternatives		
1	Advance	<ul style="list-style-type: none"> – Most direct service – Fastest travel time – Lowest capital and O&M cost of ferry alternatives – Lowest cost per user of all alternatives – Optimal service characteristics – Highest passenger and bicycle capacity – Fewest environmental issues – Received the most community support – Can be expanded to serve Kings Beach in the future
2	Eliminate	<ul style="list-style-type: none"> – Higher capital and O&M cost than Alternative 1 – Segment between Tahoe City and Kings Beach is already served by TART – Requires additional fleet to maintain the same frequency as Alternative 1
Bus Alternatives		
6	Eliminate	<ul style="list-style-type: none"> – Slowest travel time between north and south shore – Received the least community support

Figure 13: Final Screening/LPA Recommendation



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Appendix A

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To: Alfred Knotts, Tahoe Transportation District
Via: Mark McLaren, HDR
From: Vijay Mahal and Nick Karcz, HDR
Date: April 11, 2012
Subject: Ridership Estimates for Lake Tahoe Ferry Service

Introduction/Summary

The purpose of this memorandum is to describe the process used in expanding the results of the **Travel Mode Share Survey** that was conducted for the Tahoe Regional Planning Agency (TRPA) and to document the methodology used to estimate the ridership potential for four transit alternatives being considered for the Tahoe Basin. The four alternatives include three ferry service alternatives and one bus alternative. Two of the proposed ferry service alternatives would serve key destinations around the lake. The ferry alternatives would provide a good, environmentally friendly, reliable transit option for those traveling between the north and south shore areas of the lake, as well as for those who would be making shorter trips to the east and west shores.

Our analysis of the travel survey indicates there are currently at least 234,000 daily trips being made in the study area on a peak summer day. Of these about 100,000 are made by the study area residents and 134,000 are made by visitors. The estimated ridership for the four transit alternatives is shown below:

Full service Ferry alternative: Connects north and south shores via two intermediate stops on east and west shores.

Projected ridership: 3,000 to 3,500 daily boardings

Alternative 1: Direct ferry service connecting South Lake Tahoe to Tahoe City.

Projected ridership: 1,600 to 1,800 daily boardings

Alternative 2: Ferry service connecting South Lake Tahoe and Kings Beach via an intermediate stop at Tahoe City.

Projected ridership: 2,300 to 2,600 daily boardings

Alternative 3: Bus service from South Lake Tahoe to Kings Beach via eastern shore.

Projected ridership: 400 to 500 daily boardings.

Data used in the analysis

The primary source of data used in this analysis is the travel survey conducted by **NuStats** for TRPA. This is the most recent observed travel behavior data currently available for the study area. The data was

supplemented by information from the 2010 Census as well as the trip table data from TRPA's regional travel model.

Geo-coding Survey Records

The travel survey was conducted by **NuStats** in August 2010. Generally, the first two weeks of August are considered the peak summer weeks of the year, in terms of tourist activity. Therefore, the survey data can be regarded as a reasonable representation of travel activity on a typical peak summer day. The survey database consists of about 1,400 records. Each record contains information regarding the traveler's origin, destination, mode of transportation, party size, trip purpose, residential status, and length of stay, along with additional information. The survey was conducted at 19 commercial sites and 32 recreational sites. At low activity sites, every person was intercepted and surveyed and at high activity sites, every third travel party was surveyed. The survey is just a sample and as such does not represent the entire population or activity in the study area. *In order to draw meaningful conclusions from this data set, the first step is to expand it to represent the study area population and activity.* Out of the 1,400 records, 1,250 records were geocoded with an origin and destination pair. Geocoding is a process that associates a record with a map location using an address or zip code. The 1,250 survey records can be categorized into three groups based on full time, seasonal, and visitor status, as summarized in **Table 1**.

Table 1: Geocoded Survey Records

Status	No. of Records	Percent of Total
Full Time	118	37%
Seasonal	464	9%
Visitor	668	54%
Total	1,250	100%

Development and Assignment of Analysis Districts

In order to aid the analysis of trip making patterns in the study area, several analysis districts were developed based on the location of the survey sites and origins of each survey record. Based on this information, a total of 15 analysis districts were created as shown in **Figure 1**. The analysis districts are further classified as north, south, east and west shore based on information provided from the survey. The analysis districts and their associated shore are identified in **Table 2**.

Figure 1: Lake Tahoe Region Analysis Districts

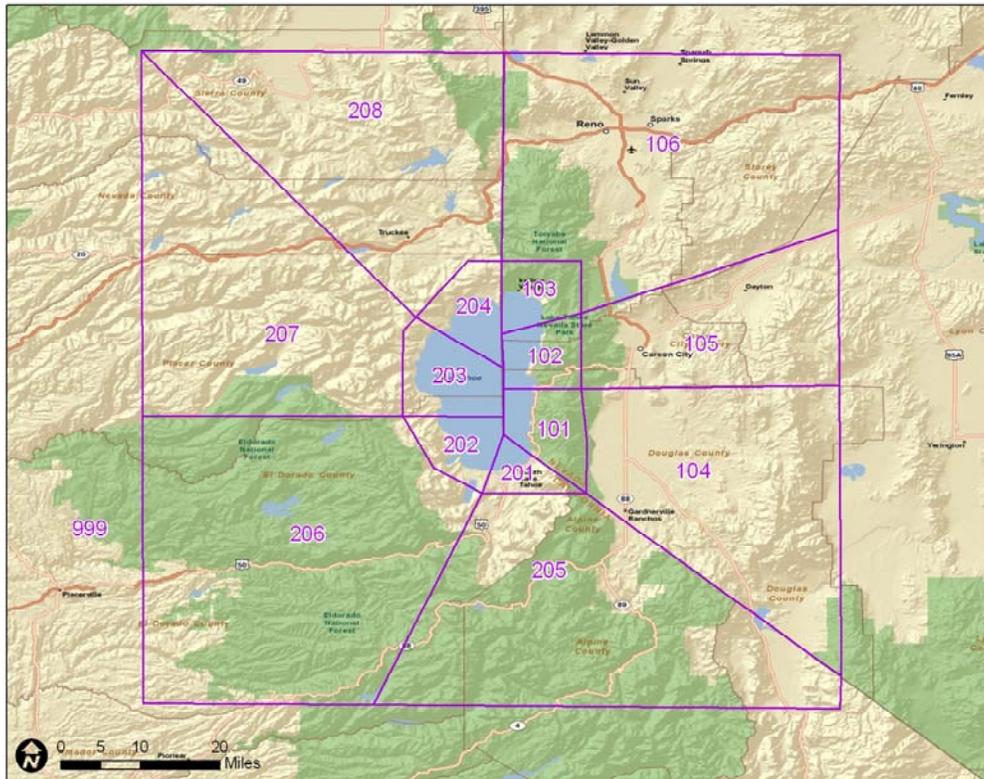


Table 2: Analysis Districts

Classification	Analysis Districts
Inner area- North	103,204
Inner area- South	101,201,202
Inner area -East	102
Inner area -West	203
Outer area	205,206,207,208,106,105,104

Once the analysis districts were established, each survey record was assigned an origin and destination analysis districts based on location within the Lake Tahoe Region.

Reclassification of Seasonal Residents

Of the 1,250 records collected, 118 of those records were identified as seasonal residents (9% of total records). The length of stay for seasonal residents varied significantly (1 to 180 days), so it was determined that these records would be reclassified into either full time residents or visitors based on the length of stay. If the seasonal resident stayed in the Lake Tahoe Region for more than 30 days, the seasonal resident was reclassified as a full time resident. If the seasonal resident stayed in the Lake Tahoe Region for 30 days or less (or the length of stay was unknown), the seasonal resident was

reclassified as a visitor. **Table 3** shows the reclassification of the seasonal resident records into either the full time resident or visitor category.

Table 3: Seasonal Resident Reclassification

Status	Old Classification	New Classification	Percent
Full Time	0	17	14%
Seasonal	118	0	0%
Visitor	0	101	86%
Total	118	118	100%

Expansion of Full Time Resident Survey Records

For full time residents, the survey records were expanded using the following steps:

- A site factor was first applied to each survey record based on the survey site, which was the destination of the person surveyed. If the survey record was at a site that was identified as “Census”, a factor of 1 was applied. If the survey record was at a site that was identified as “Every 3rd Travel Party”, then a factor of 3 was applied. *A list of the site by site sampling methodology can be found on pages 11 and 12 of the Travel Mode Share Survey submitted to TRPA by NuStats.*
- Each survey record also had a field that identified how many people were in the surveyed party, which was identified in the TRPPY field of the database. The site factor was multiplied by the number of people in the surveyed party to get the expanded survey record.
- An expansion factor was then developed for the full time resident survey records that originated in the analysis districts adjacent to Lake Tahoe. Population data was first collected from the 2010 US Census for census tracts adjacent to Lake Tahoe and each census tract was then assigned to one of seven analysis districts. Based on the proximity of the origin locations for District 205, it was determined that the records for this district would be combined with records from District 201, given that these two districts share the same census tract, and that all origin locations for the records in District 205 are within that census tract. The 2010 population was then divided by the expanded survey records for records that originated within the respective analysis district to get the expansion factor for that analysis district. **Table 4** identifies the expansion factors developed for five analysis districts. Due to the limited number of expanded survey records in Districts 102 and 202, the estimated expansion factor for those districts turned out to be greater than 100 which is considered excessively large. So, a decision was made to apply the adjacent district’s expansion factor to District 102 and 202. The expansion factors developed in this study apply to only full time resident survey records originating in Districts 101, 102, 103, 201,202, 203, 204 and 205.

Table 4: Expansion Factors for Full time Residents

Analysis District	2010 Population	Expanded Survey Record	Expansion Factor
101	5,344	152	35
103/102	9,087	118	77
201/205	24,540	569	43
203/202	3,867	105	37
204	6,581	205	32

The following calculations were used for expanding the full time resident records:

For full time residents originating in Districts 101, 103, 201/205, 203, and 204.

Expanded Full Time Residents

$$= \text{Site Factor} \times \text{No. in Surveyed Party} \times \text{Expansion Factor in Origin District}$$

For full time residents originating in Districts 102, 104, 105, 106, 206, 207, 208, 999, no expansion factor was applied as the number of survey records in these districts were too small to make any statistical inference.

$$\text{Expanded Full Time Residents} = \text{Site Factor} \times \text{No. in Surveyed Party}$$

After applying the expansion factors to the full-time resident trips, we estimated about 99,600 daily trips (both directions included) in the study area. Of these, about 20 percent were between the north and south shore districts. **Table 5** summarizes this data.

Table 5: Fully Expanded Trips for Full-Time Residents

Trips made by full-time residents	Daily Trips ¹
Total number of trips made by residents within the inner districts.	79,650
Trips from Inner area North to South districts	19,950
Total trips	99,600

Expansion of Visitor Survey Records

For visitors, the survey records were expanded using the following steps:

- A site factor was first applied to each survey record based on the survey site which was the destination of the person surveyed. If the survey record was at a site that was identified as “Census”, a factor of 1 was applied. If the survey record was at a site that was identified as

¹ Trips do not include school and personal business trips.

“Every 3rd Travel Party”, then a factor of 3 was applied. *A list of the site by site sampling methodology can be found on pages 11 and 12 of the Travel Mode Share Survey submitted to TRPA by NuStats.*

- Each survey record also had a field that identified how many people were in the surveyed party, which was identified in the TRPPY field of the database. The site factor was multiplied by the number of people in the surveyed party to get the expanded survey record.
- An expansion factor was then developed for survey records that indicated the visitor stayed at a motel or hotel. First, the total number of expanded visitor records (survey record * site factor) that indicated a hotel or motel stay was summed. This number was then multiplied by a factor of 1.25, to account for large groups that were surveyed that occupied more than one hotel room. The next step was to determine the total number of occupied rooms in hotels/condo/bed and breakfast facilities located within the study area on a peak summer day so that an expansion factor for the visitor trips can be estimated.
- The hotel occupancy data provided by Tahoe Transportation district indicate the average yearly occupancy in 2009/2010 was about 78 percent for hotels located in the study area. In peak summer however, the occupancy is close to 95 percent. Therefore, it is reasonable to assume that the total occupied rooms in peak summer day would be almost equal to the total hotel capacity in the study area. The total hotel/condo and bed and breakfast capacity in the study area was estimated by visiting Expedia.com and tallying up all the hotels within five miles from the lake. Since the hotel accommodation is less expensive in facilities located outside of the inner districts, many tourists stay in hotels as far as Reno, Truckee, and Carson City and drive to Lake Tahoe for recreation. Therefore, in order to estimate the total occupied rooms attributable to Lake Tahoe visitors, we considered 95 percent capacity of the hotels located within the inner districts as well as 25 percent of the capacity of hotels located in Reno, Carson City and Truckee. This calculation yielded about 15,000 occupied rooms for a peak summer day. The expansion factor for overnight visitors was calculated by dividing the total occupied rooms by the expanded visitor hotel rooms (700 rooms) which yielded an expansion factor of 22. For those who are day visitors and campers, we applied half the expansion factor of overnight visitors. This decision was made based on the data provided by TRPA’s travel model according to which, about 30 percent of all visitors are day visitors. To estimate the total visitor trips activity in the study area, the expansion factors were applied to each expanded survey record that indicated the visitor stayed in a motel/hotel or campground.

The following calculations were used for expanding the visitor records:

- For visitors staying in a motel/hotel, campers and day visitors:

$$\text{Expanded Visitors} = \text{Site Factor} \times \text{No. in Surveyed Party} \times \text{ExpansionFactor}$$

The results of our calculations indicate there are approximately 134,000 visitor trips (both direction counted individually) generated by visitors on a peak summer day. **Table 6** shows a summary of trip movement from expanded data.

Table 6: Fully expanded Visitor Trips

Trips made by Visitors	Daily Trips
Total number of trips made by visitors within the inner districts.	106,000
Trips from Inner area North to South districts	28,000
Total trips	134,000

When full-time resident trips and visitor trips are combined, there are approximately 233,600 daily person trips in the study area. **Table 7** presents some additional statistics from the expanded survey data analysis.

Table 7: Total Daily Trips from Expanded Survey

Trip type	Number of daily trips
Trips made by Full time residents	99,600 (41%)
Trips made by Visitors	134,000 (59%)
Trips made by all population	233,600 (100%)
Trips from Inner area North to South districts	49,950 (21%)
Trips made between adjacent inner districts	183,650 (79%)
Top five trip purposes	
Outdoor recreation	114,500 (49%)
Minor Shopping	37,000 (16%)
Work	28,000 (12%)
Restaurant	26,000 (11%)
All Other categories	28,100 (12%)

Testing the Reasonableness of trip estimation

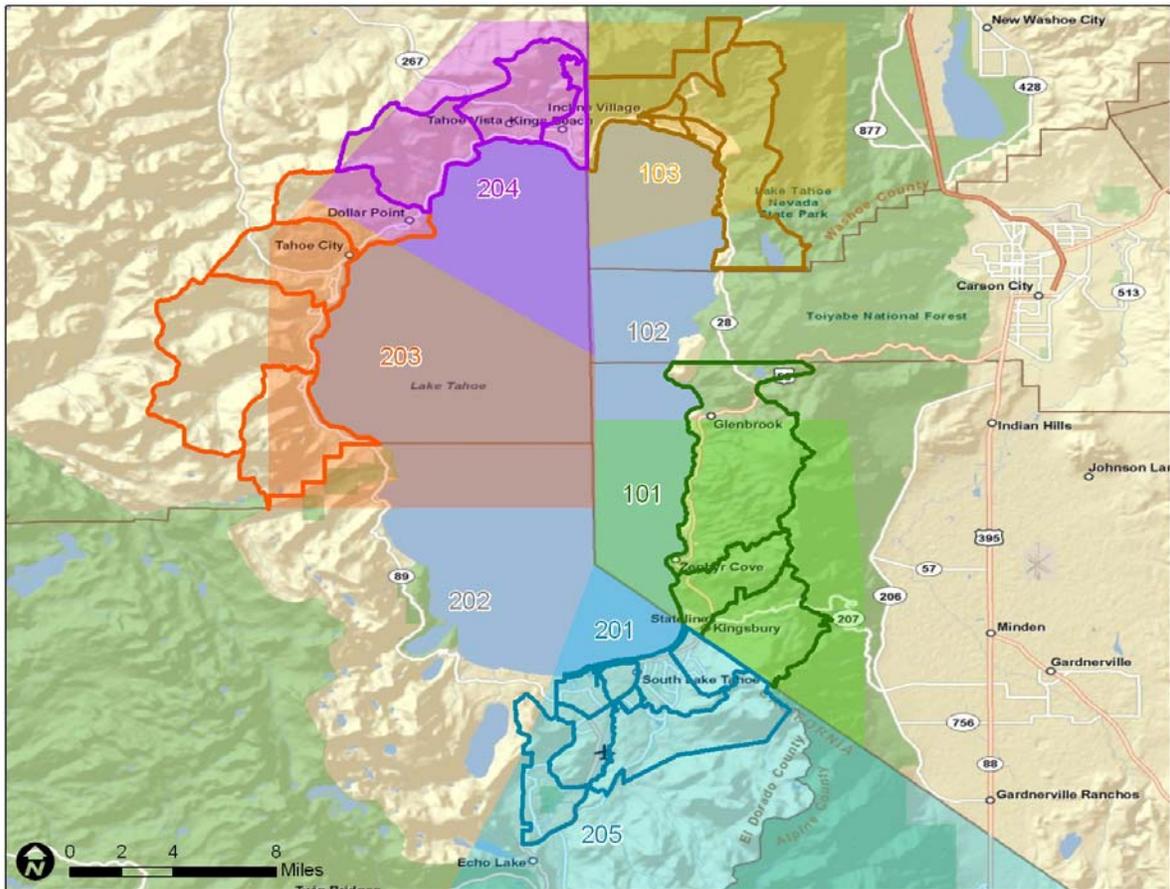
Full-time resident trips: According to 2010 Census, the population in the study area around Lake Tahoe that was used in the analysis is approximately 49,500². **Figure 2** shows the census tracts (highlighted in dark lines) that were used in estimating the population. We did not count the population in districts 102 and 202 because the survey contained very few trips originating from those two districts. The average household size in South Lake Tahoe is 2.5³. The approximate number of households in the study area can be obtained by dividing the population by the average household size. In our case, this calculation yields about 19,800 households. The average trips generated by a typical household in the United States ranges between 7.3 and 9.7⁴.

² The total resident population in Lake Tahoe, however, is about 66,000 according to the website: http://www.tahoefacts.com/html/tahoe_faqs.html

³ <http://www.city-data.com/neighborhood/Fallen-Leaf-Lodge-South-Lake-Tahoe-CA.html>

⁴ <http://tmip.fhwa.dot.gov/resources/clearinghouse/docs/mvr/cm/ch3.htm>

Figure 2: Census Tracts used in Estimating Study Area Population



Using the lower trip rate of 7.3 (a more conservative assumption), the 19,800 households can potentially generate 144,500 daily trips. According to TRPA’s regional travel model, 85 percent of the resident trips in Lake Tahoe are internal to the study area (around the lake). Eight five percent of 144,500 would be about 123,000 resident trips and our estimate of 99,100 resident trips is well below 123,000. It is also well below the estimate produced by RPTA’s travel model which shows there are approximately 132,000 trips made by residents in the study area. Therefore, we can conclude that the expansion factor we developed to estimate the total resident trip activity is on the conservative side.

Visitor trips: According to the Reno-Sparks Convention & Visitor Authority, TRPA’s website and Lake Tahoe Facts website⁵, more than 3 million tourists visit Lake Tahoe per year. Data on the numbers of visitors by summer and winter seasons is not available. Therefore, it is difficult to estimate the actual number of people visiting the Lake Tahoe area on a peak summer day. However, based on the hotel capacity and occupancy data, we can hypothesize there are roughly 25,000 to 35,000 people visiting the region on a peak summer day. Assuming each visitor makes 4 trips per day, this implies there are about 100,000 to 140,000 trips made in the study area by visitors on a peak summer day. Our estimate of 134,000 visitor trips is reasonable in comparison to the above numbers. According to the base year

⁵ http://www.tahoefacts.com/html/tahoe_faqs.html

results of TRPA's travel model, the total number of daily visitor trips is around 109,000 (overnight and day visitors combined).

Development of Ridership forecasts for the proposed ferry alternatives

The ridership forecasts for the proposed ferry alternatives were developed by applying a transit mode share to all the trips for which the proposed service is a viable alternative. Trips that begin and end within the same inner district will not be able to use the ferry service and therefore, they were discounted from the analysis. The expanded survey results indicate about 40 percent of the trips in the inner districts begin and end within the same district. Therefore, the remaining 60 percent are likely candidates for the ferry service. **Table 8** summarizes this information.

Table 8: Candidate Trips for Ferry Service

Trip category	Number of trips
Total trips in the inner districts	233,600
Trips that begin and end in the same district (ferry is not an option for these trips)	93,600
Trips for which Ferry service is a viable alternative	140,000

In order to determine a conservative range for transit mode share, we analyzed the ridership on comparable ferry services in Boston, Massachusetts and San Francisco. In Boston, currently, the MBTA runs three ferry services between downtown Boston and Hingham, Hull and Quincy. The service that runs from Hingham carries commuters as well as tourist trips. The average headway on this service during peak period is about 30 minutes. This service carried about 3,500 trips a day prior to the opening of the Greenbush commuter rail line which runs parallel to the ferry service. Based on the traffic volumes in the corridor (serving the south shore and Boston) and the ridership on the ferry service, we estimated the mode share on Boston's Hingham ferry service was around 6 to 7 percent.

In San Francisco, six ferry routes are operated by four different operators. Among them, the Golden Gate ferries are probably the most comparable ones to the proposed service in Lake Tahoe. The Golden Gate ferries carry a sizable tourist population and the fares range from \$4.00 to \$ 8.25. During peak periods, the service operates approximately every half hour. In 2002, the Golden Gate ferries carried about 6,950 riders on a weekday which translates to a mode share of about 4.3 percent⁶. Similarly, the ferry mode split in the Bay Bridge corridor is about 0.4 percent. On the average, the mode share of ferry service across the Golden Gate and Bay Bridge screen lines is in the order of 2.5 percent. The ferries in this corridor carry a significant portion of tourist trips.

Since most of the trips in Lake Tahoe region would be recreational trips, we decided that a 2.5 percent mode share would be more applicable to our study rather than the mode shares of Boston's ferry service which carries a significant commute trips.

⁶ Ridership Model Calibration and Validation, Prepared by Cambridge Systematics for the Water Transportation Authority, May 15, 2002

Development of Ridership forecasts for the proposed bus alternative

The ridership forecast for the proposed bus alternative was developed by applying a transit mode share to all the trips for which the proposed service is a viable alternative. Based on the current transit ridership in the region, the transit mode share amounts to approximately 1 percent. In this study, we used one percent bus mode share to determine the ridership on the proposed bus alternative.

Operating assumptions of the proposed ferry and bus alternatives

The proposed ferry services would be a premium quality service comparable to the Hingham commuter ferry service in Boston. It would provide a highly reliable service, a comfortable and scenic ride and would have dedicated space for transporting skis, surf boards and other sporting equipment. Sufficient parking would be provided at key points to enable park and ride access. Intermodal connections to the proposed ferry service would be provided from the BlueGO and TART services as well as private shuttle buses. The level of service on both BlueGO and TART routes would be adjusted to reduce redundancy. Ridership estimates were developed for four alternatives which are listed below.

Full Service Alternative: Ferry service connecting South Lake Tahoe and Kings Beach via two intermediate stops on the west shore and two intermediate stops on the east shore. Service to east and west shore will be provided by alternate ferries.

Alternative 1: Direct ferry service connecting South Lake Tahoe to Tahoe City.

Alternative 2: Ferry service connecting South Lake Tahoe and Kings Beach via an intermediate stop at Tahoe City.

Alternative 3: Bus service from South Lake Tahoe to Kings Beach via eastern shore.

The first step in the calculation of ridership was to estimate the total trips in the travel market that the ferry/bus alternative would serve. This was done by analyzing and aggregating the trips that are in the districts served by the alternative. The second step was to apply 2.5 percent mode share for ferry alternatives and 1 percent mode share for bus alternative on those trips to estimate the ferry and bus ridership.

Table 9 summarizes the level of service assumptions and the projected ridership on all the alternatives. Though there will be some diversion of ridership from the existing TART and BlueGO services to the proposed ferry service, it is expected that a major portion of the ridership would be shifting from the automobile mode. As seen from table, the Full service alternative is projected to generate the highest ridership, in the order of 3,000 to 3,500 daily boardings. This alternative would serve several travel markets both on the east and west shore as well as the north and south shores. Alternative 1 which provides a direct service to Tahoe City from South Lake Tahoe would most likely produce a ridership of 1,600 to 1,800 boardings. Alternative 2 which serves both Tahoe City as well as Kings Beach is projected to generate 2,300 to 2,600 daily boardings. Finally, the bus alternative because of its long travel times and lack of premium quality service, is expected to produce a daily ridership of only about 400 to 500 boardings. **Table 9** also provides data on fleet size and approximate revenues for each alternative.

Table 9: Projected Ridership on the Proposed Ferry and Bus Alternatives

Service Attributes and Ridership	Full Service Alternative	Alternative 1	Alternative 2	Alternative 3
	South Lake Tahoe to Kings Beach Via two intermediate stops on the west shore and two intermediate stops on the east shore	South Lake Tahoe to Tahoe City	South Lake Tahoe to Kings Beach Via Tahoe City	South Lake Tahoe to Kings Beach via Eastern shore
Mode	Ferry	Ferry	Ferry	Bus
Peak Headways	45 minutes	45 minutes	45 minutes	45 minutes
Off-peak headways	60 minutes	60 minutes	60 minutes	60 minutes
One-way Travel time	40-45 minutes	20-25 minutes	35 to 40 minutes	70 minutes
Fare	\$8	\$7	South Lake Tahoe to Tahoe City: \$7 Tahoe City to Kings Beach: \$2 South Lake Tahoe to Kings Beach: \$9	\$5
Intermediate stop	2	0	1	0
Connecting services	BlueGo/TART/Shuttles	BlueGo/TART/Shuttles	BlueGo/TART/Shuttles	BlueGo/TART/Shuttles
Park and Ride Access	Yes	yes	yes	yes
Total trips in the travel market during peak summer day	140,000	64,000	90,000	50,000
Assumed mode share	2.50%	2.50%	2.50%	1.00%
Projected daily ridership	3,000 to 3,500	1,600 to 1,800	2,300 to 2,600	400 to 500
Estimated daily fare revenue	\$26,000	\$12,000	\$19,500	\$2,250
Number of vessels */buses needed	5	3	4	5
* Vessel capacity 120				

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Appendix B

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Tahoe North-South Transit Connection Alternatives Analysis (AA)
Capital Cost Estimate (All Costs Shown in Thousands)

SCC	Item	Unit Cost (2012)	Unit	Alloc Conting	Escalation to Const Year	Alternative 1		Alternative 2		Alternative 6	
						Quantity	Amount	Quantity	Amount	Quantity	Amount
10	GUIDEWAY & TRACK ELEMENTS						\$ -		\$ -		\$ -
20	STATIONS, STOPS, TERMINALS, INTERMODAL						\$ 1,675		\$ 2,182		\$ 600
20.01	At-grade station, stop, shelter, mall, terminal, platform (South Lake Tahoe and Kings Beach)	\$ 250	Per Bus Stop	20%	0%	0	\$ -	0	\$ -	2	\$ 600
20.04	Other stations, landings, terminals: ferry (South Lake Tahoe)	\$ 974	Lump Sum	20%	0%	1	\$ 1,169	1	\$ 1,169	0	\$ -
20.04	Other stations, landings, terminals: ferry (Tahoe City)	\$ 422	Lump Sum	20%	0%	1	\$ 506	1	\$ 506	0	\$ -
20.04	Other stations, landings, terminals: ferry (Kings Beach)	\$ 422	Lump Sum	20%	0%	0	\$ -	1	\$ 506	0	\$ -
30	SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS						\$ 1,300		\$ 1,300		\$ 390
30.01	Administration building	\$ 500	Lump Sum	30%	0%	1	\$ 650	1	\$ 650	0	\$ -
30.02	Light maintenance facility	\$ 1,000	Lump Sum	30%	0%	1	\$ 1,300	1	\$ 1,300	0	\$ -
30.02	Share of existing maintenance facility	\$ 300	Lump Sum	30%	0%	0	\$ -	0	\$ -	1	\$ 390
40	SITWORK & SPECIAL CONDITIONS						\$ 3,315		\$ 3,413		\$ 845
40.01	Demolition, clearing, earthwork	\$ 75	Lump Sum	30%	0%	2	\$ 195	3	\$ 293	2	\$ 195
40.03	Hazardous materials, contaminated soil removal/mitigation, ground water treatments	\$ 50	Lump Sum	30%	0%	2	\$ 130	3	\$ 195	0	\$ -
40.04	Environmental mitigation	\$ 150	Lump Sum	30%	0%	2	\$ 390	3	\$ -	0	\$ -
40.06	Pedestrian/bike access and accommodation, landscaping	\$ 250	Lump Sum	30%	0%	2	\$ 650	3	\$ -	2	\$ 650
40.07	Automobile, bus, van accessways including roads, parking lots	\$ 750	Lump Sum	30%	0%	2	\$ 1,950	3	\$ 2,925	0	\$ -
50	SYSTEMS						\$ 325		\$ 455		\$ 195
50.05	Communications	\$ 50	Lump Sum	30%	0%	1	\$ 65	1	\$ 65	1	\$ 65
50.06	Fare collection system and equipment	\$ 50	Per Ticket Vending	30%	0%	4	\$ 260	6	\$ 390	2	\$ 130
	CONSTRUCTION SUBTOTAL (10-50)						\$ 6,615		\$ 7,349		\$ 2,030
60	RIGHT-OF-WAY, LAND, EXISTING IMPROVEMENTS						\$ 1,000		\$ 1,500		\$ -
60.01	Purchase or lease of real estate	\$ 500	Lump Sum	0%	0%	2	\$ 1,000	3	\$ 1,500	0	\$ -
70	VEHICLES						\$ 21,000		\$ 31,500		\$ 11,400
70.04	Bus (Articulated)	\$ 950	Per Bus	0%	0%	0	\$ -	0	\$ -	12	\$ 11,400
70.05	Ferry (Catamaran)	\$ 10,500	Per Ferry	0%	0%	2	\$ 21,000	3	\$ 31,500	0	\$ -
80	PROFESSIONAL SERVICES	30%					\$ 1,985		\$ 2,205		\$ 609
80.01	Preliminary engineering	3%	Lump sum				\$ 198		\$ 220		\$ 61
80.02	Final design	8%	Lump sum				\$ 529		\$ 588		\$ 162
80.03	Program management for design and construction	6%	Lump sum				\$ 397		\$ 441		\$ 122
80.04	Construction administration and management	6%	Lump sum				\$ 397		\$ 441		\$ 122
80.05	Professional liability	3%	Lump sum				\$ 198		\$ 220		\$ 61
80.06	Legal, permits, review fees	1%	Lump sum				\$ 66		\$ 73		\$ 20
80.07	Survey, testing, investigation, inspection	1%	Lump sum				\$ 66		\$ 73		\$ 20
80.08	Start up	2%	Lump sum				\$ 132		\$ 147		\$ 41
	SUBTOTAL (10-80)						\$ 30,600		\$ 42,554		\$ 14,039
90	PROJECT RESERVE (UNALLOCATED CONTINGENCY)	10%					\$ 3,060		\$ 4,255		\$ 1,404
	SUBTOTAL (10-90)						\$ 33,660		\$ 46,809		\$ 15,443
100	FINANCE CHARGES										
	TOTAL (10-100)						\$ 33,660		\$ 46,809		\$ 15,443

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Appendix C

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Tahoe North-South Transit Connection Alternatives Analysis (AA)
Operation and Maintenance (O&M) Cost Estimate

Alternatives 1 and 2 (Ferry)

Alternative	Number of Trips	Revenue Hours per Trip	Weekday Revenue Hours	Annual Multiplier	Annual Revenue Hours	Cost per Hour	Annual O&M Cost
Alt 1	24	0.48	11.52	301	3,468	\$963.83	\$3,342,100
Alt 2	24	1.35	32.4	301	9,752	\$963.83	\$9,399,656

Alt 1			
South Lake Tahoe - Tahoe City	29	60	0.48
Total			0.48

Alt 2			
South Lake Tahoe - Tahoe City	29	60	0.48
Tahoe City - Kings Beach	17	60	0.28
Kings Beach - South Lake Tahoe	35	60	0.58
Total			1.35

Tahoe North-South Transit Connection Alternatives Analysis (AA)
 Operation and Maintenance (O&M) Cost Estimate

Alternative 6 (Bus)

Alternative	Number of Trips	Revenue Hours per Trip	Weekday Revenue Hours	N/A	N/A	Annual Multiplier	Annual Revenue Hours	Cost per Hour	Subtotal Annual O&M Cost
Alt 6	24	1.17	28.08			301	8,452	\$53.75	\$454,299

Alternative	Number of Trips	Revenue Miles per Trip	Weekday Revenue Miles	Weekday Non-Revenue Miles	Weekday Miles	Annual Multiplier	Annual Miles	Cost per Mile	Subtotal Annual O&M Cost
Alt 6	24	32	768	76.8	845	301	254,285	\$0.76	\$193,256

Total Annual O&M Cost
\$647,556

Alt 6			
South Lake Tahoe - Kings Beach	10	60	0.17
Total			0.17

Appendix D

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Tahoe North-South Transit Connection Alternatives Analysis (AA)

Cost per User

Alternative	Capital Cost	Annualized Capital Cost	Annual O&M Cost	Annualized Capital + O&M Cost	Daily Boardings	Cost per User
Alt 1	\$33,660	\$1,844	\$3,342	\$5,186	1,700	\$3.05
Alt 2	\$46,809	\$2,564	\$9,400	\$11,964	2,450	\$4.88
Alt 6	\$15,443	\$846	\$648	\$1,494	450	\$3.32

All costs shown in thousands

The annualized capital cost is based on a 50-year amortization of costs at a 5% interest rate.

n	50
i	0.05