AIR QUALITY CONFORMITY DETERMINATION
FOR THE

2010 -2013 ANCHORAGE
TRANSPORTATION IMPROVEMENT PROGRAM

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EXECUTIVE SUMMARY

Because Anchorage is a maintenance area for carbon monoxide (CO) federal regulations require AMATS[*] as the metropolitan planning organization to determine whether transportation plans and program are in conformance with the air quality goals in the Alaska State Implementation Plan (SIP). Specifically, AMATS must determine whether transportation plans and programs are consistent with the Anchorage CO Maintenance Plan which is contained within the SIP. The CO Maintenance Plan establishes a CO emission budget for mobile sources in the Anchorage CO Maintenance Area. To meet conformity requirements, the emissions projected to result from the transportation plan or program in the maintenance area must be below the established budget. Remaining below the budget provides some assurance that the national ambient air quality standard for CO will not be violated in the future.

The transportation network envisioned in the 2010-2013 Transportation Improvement Program (TIP) is identical to the one laid out in the 2007 – 2027 Long Range Transportation Plan (LRTP) adopted in 2007. Because the transportation networks considered in the 2007-2027 LRTP and the 2010-2013 TIP are identical and planning assumptions regarding the growth in vehicle travel have not changed, the conformity analyses for the 2007-2027 LRTP and the 2010-2013 TIP are also identical.[†] The conformity analysis performed for the 2007-2027 LRTP showed that CO emissions were well below the allowable budget in the SIP and AMATS therefore determined that the LRTP met air quality conformity requirements. For this same reason, the 2010-2013 TIP is also in conformance.

INTRODUCTION AND BACKGROUND

This document provides analysis and conclusions regarding the air quality conformity determination for the 2010-2013 Anchorage Transportation Improvement Program (TIP) pursuant to 40 CFR Part 93. This analysis must demonstrate that the CO emissions projected from the transportation network envisioned in the 2010-2013 TIP are under the allowable emission budget outlined in the Alaska State Implementation Plan for air quality. Anchorage is currently only required to conduct air quality conformity determinations for carbon monoxide (CO).

The transportation network envisioned in the 2010 – 2013 TIP is identical to that considered in the 2007-2027 Anchorage LRTP adopted in 2007. Moreover, planning assumptions regarding the growth in transportation activity (e.g. vehicle miles travelled, number of vehicle trips) have not changed since 2007. For this reason, the conformity analysis for the 2010-2013 TIP will be identical to that performed for the 2007-2027 LRTP.

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[*] AMATS stands for Anchorage Metropolitan Area Transportation Solutions.

[†] Because the analyses are identical much of the narrative in this document is taken verbatim from the conformity analysis document prepared in April 2007 for the Long Range Transportation Plan.

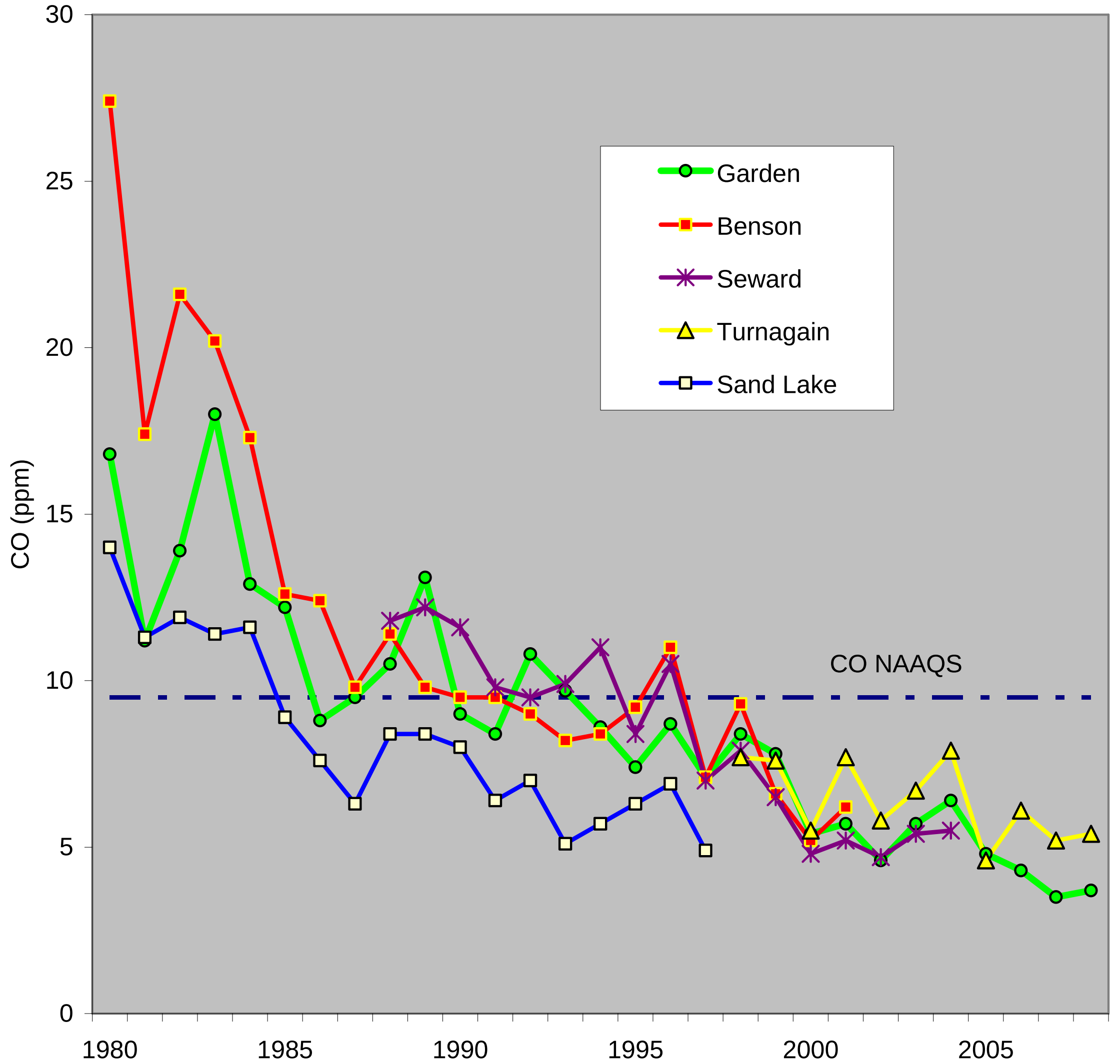
It should be noted that AMATS has recently considered a number of amendments to the LRTP with respect to the construction of the Knik Arm Crossing (KAC). AMATS considered removing the KAC from the LRTP and later decided to amend the LRTP by moving the KAC to the list of long term projects in the Plan not to be constructed until 2018 or later. However, as this TIP conformity document is being prepared, we understand that the AMATS Policy Committee, in response to a lawsuit, has agreed to rescind its decision to delay the KAC. Because the delay of the KAC was the only change to the transportation network being considered, we are assuming the AMATS Policy Committee take action to make the original 2007-2027 LRTP the "LRTP of record" and retain the KAC as a short term project as originally envisioned. Thus the planning assumptions and analysis used to prepare the conformity analysis for the 2010-2013 are identical to those in the original 2007-2027 LRTP.

Anchorage CO Attainment Status

Carbon monoxide (CO) is a colorless, odorless and poisonous gas produced by incomplete burning of carbon in fuel. The health threat from CO is most serious for those who suffer from cardiovascular disease, particularly those with angina and peripheral vascular disease. Due to the health effects of carbon monoxide, the Environmental Protection Agency (EPA) established National Ambient Air Quality Standards (NAAQS) for CO. Although the Municipality of Anchorage has a history of NAAQS violations, there has been a dramatic decline in CO concentrations from the peak levels experienced in Anchorage in the early and mid-1980s (see chart below).

Anchorage was first identified as experiencing high levels of ambient CO concentrations in the early 1970s. Since that time, extensive monitoring programs demonstrated elevated levels of CO throughout the community. Anchorage violated the national ambient air quality standard (NAAQS) for CO every year from 1972 through 1994 and again in 1996. In 1998 the EPA declared Anchorage as a serious nonattainment area for CO. Between 1997 and 2008, however, Anchorage compiled 12 consecutive years of compliance with the NAAQS. In February 2004, on behalf of the Municipality of Anchorage, the State of Alaska requested that the EPA redesignate Anchorage from a nonattainment area to an area that has attained the standard. This request was accompanied by a maintenance plan that showed that Anchorage should continue to maintain compliance with the NAAQS through 2023. The EPA approved this plan on June 23, 2004. Anchorage is now considered a CO maintenance area; an area that has attained compliance with the NAAQS.

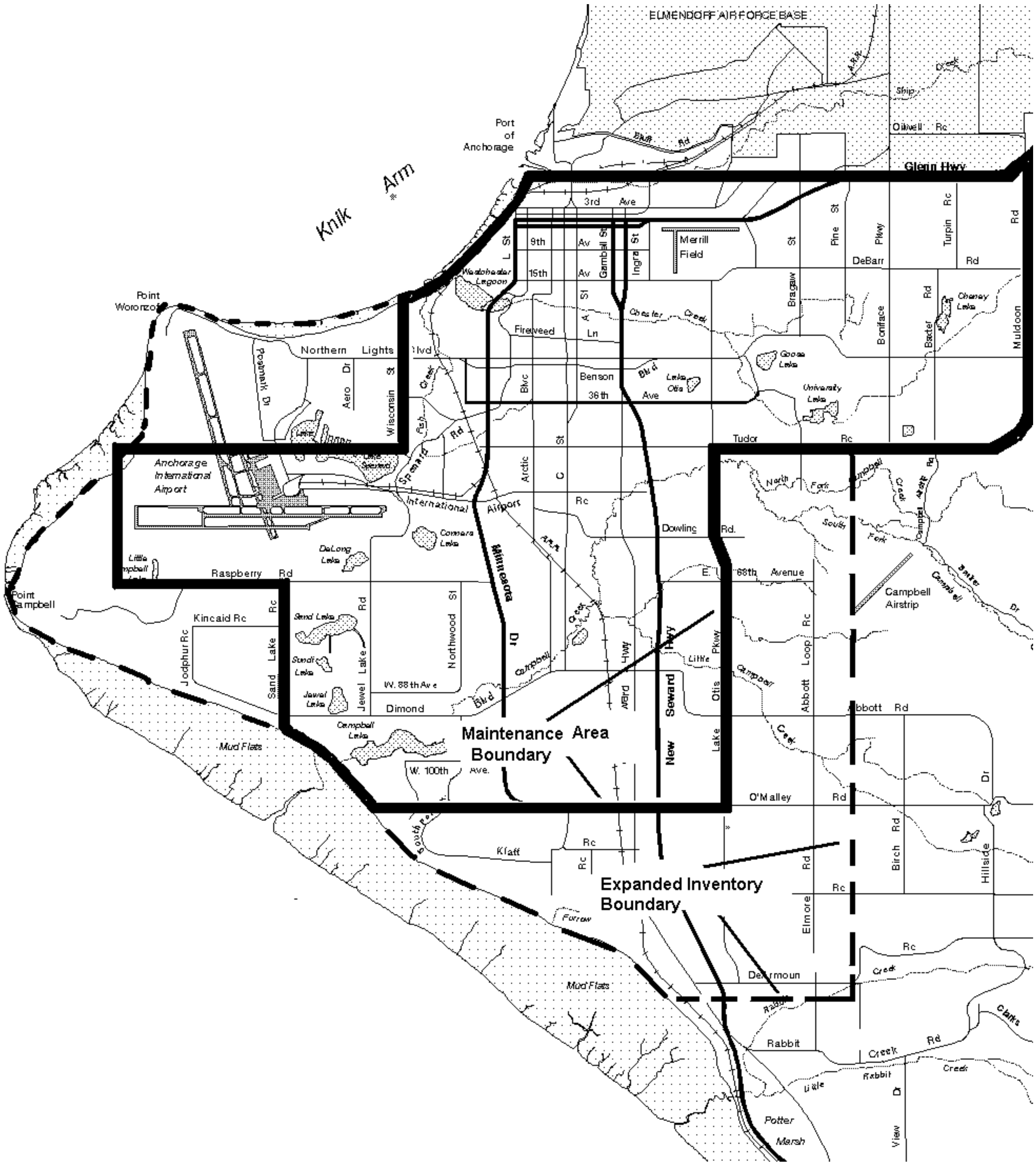
Figure 1
Trend in 2nd Maximum CO Concentration 1980 - 2008



Maintenance Area Boundary

The boundaries of the Anchorage nonattainment area were established in 1978. When Anchorage was redesignated as a maintenance area in 2004, these same boundaries were used to describe the maintenance area. The emission inventory boundary contains this maintenance area plus areas to the south and west not included in the maintenance area. The boundary was expanded slightly because significant residential and commercial growth has occurred in south and west Anchorage in the past two decades. The boundaries of the maintenance area are compared with the expanded emission inventory area in Figure 2. The inventory area encompasses approximately 200 square kilometers of the Anchorage Bowl.

Figure 2
Anchorage Maintenance Area Boundary Compared with Expanded Inventory Area



<u>Conformity Criteria Used in This Analysis</u>

On August 15, 1997 the EPA published a clarified and more flexible transportation conformity rule. The rule was amended on January 24, 2008 to reflect changes in the new surface transportation legislation known as SAFETEA-LU. The specific conformity criteria used in this review include the following sections contained in 40 CFR Part 93 of the Federal Register:

Section	Criteria
93.110	The conformity determination must be based on the latest planning assumptions.
93.111	The conformity determination must be based on the latest emission estimation model available.
93.112	Conformity must be determined according to the consultation procedures in this subpart and in the applicable implementation plan, and according to the public involvement procedures established in compliance with 23 CFR part 450.
93.113(b)	The LRTP and TIP must provide for the timely implementation of TCMs from the applicable implementation plan.
93.118	The LRTP and TIP must be demonstrate that emissions of the pollutants are less than or equal to the motor vehicle emissions budget established in the applicable implementation plan..

<u>Analysis Years</u>

The analysis years correspond to the requirements contained in 40 CFR 93.118(B) which states that the analysis years shall be no more than ten years apart with the first analysis year no more than five years beyond the year in which the conformity determination is being made. The conformity analysis performed for the 2007 -2027 LRTP covered the period 2007 through 2027. The conformity analysis for the 2010-2013 TIP will also examine analysis years 2007, 2017 and 2027. Appendix A contains a list of the roadway improvement projects by analysis year based on recommended short and long-term priorities. The priorities in the 2010-2013 TIP are consistent with 2007-2027 LRTP adopted in 2007 including assumptions regarding the construction of the KAC.

METHODOLOGY AND PROJECTED CO EMISSIONS

Overview

Local studies suggest that warm-up idling is a very important source of CO emissions and the use of engine block heaters is an effective way to reduce emissions. MOBILE6 would ordinarily be used to quantify emissions. However, a conventional MOBILE6 approach to computing vehicle emission rates does not adequately address the emissions impact of warm-up idling at the beginning of a trip. Moreover, MOBILE6 does not provide a mechanism to estimate the air quality benefits of engine block heater use.

To address these limitations Anchorage prepared a grid-based inventory of carbon monoxide (CO) emissions to more accurately characterize the time and location of mobile, area, and point-source emissions. Particular emphasis was devoted to accurately estimate CO emissions from vehicle cold starts and warm up idling and to accurately reflect the thermal state of vehicles traveling within Anchorage.

The methodology used to prepare estimates of mobile source emissions used in this conformity analysis were similar to that used in the preparation of the latest Anchorage CO maintenance SIP revisions approved by EPA effective July 2004. The methodology involves a three step modeling process, utilizing the regional transportation model, an air quality post processor and the EPA approved emissions model (MOBILE6). The air quality post-processor was developed that is designed to be used within the travel demand model software. The post-processor provides estimates of vehicle miles of travel (VMT), travel speed, trip starts, and demographic characteristics using a one-kilometer grid overlay on the Anchorage Travel Demand Model. This post processor operates in a seamless fashion with the Anchorage Travel Demand Model that is used to forecast future travel volumes on Anchorage roadways. This integration allows estimation of travel activity by time of day, and further allows the tracking of VMT by operating mode along the roadway system, thus providing the opportunity to develop a more thorough characterization of the thermal state of a vehicle’s engine. Speed estimates are disaggregated by roadway functional class, while VMT and trip start estimates are disaggregated by trip purpose.

The output of this post processor is a linked set of database files with detailed vehicle activity and socioeconomic data for each grid. The linked files can be processed with estimates of vehicle emissions rates for air quality models (Mobile6) to develop the final forecast of CO emissions by location and time of day.

Travel Demand Model

In April 2005, AMATS adopted a new Transportation Demand Model. The updated model was a significant improvement over the previous model which was developed in 1998 (the basis for the previous air quality conformity determinations). Some of the major improvements and updates included:

1) Re-estimation of household and employment characteristics and totals for traffic analysis zones based on 2000 US Census and Alaska Department of Labor information,

2) Restructuring and refinement of the highway network representation;

3) Restructuring and refinement of the transit network representation including development of ridership catchment areas for the traffic analysis zones;

4) Re-estimation and extension of all household disaggregation models based on 2000 US Census data;

5) Re-estimation and re-categorization of all trip generation and attraction models including expanding the number of individual trip purposes;

6) Re-estimation of trip distribution models based on the new trip purposes using information about trip lengths obtained from the 2002 Household Survey as a basis;

7) Revised time of day model. Old model generated total link loads and estimated trip purpose percent based on an external methodology. New model uses simultaneous assignment of all trip purposes separately to generate link loads stratified by trip purpose.

8) Re-estimation of mode choice models based on household survey data including addition of separate out of pocket cost parameter including parking costs. General improvements in parameter estimation utilizing GIS capabilities;

9) Re-estimation of household and employment forecast based on updated existing land use data and regional projections.

The 2005 model update did not include the KAC as a part of its network. With the addition of a second connection to the Mat-Su Valley, it was necessary to change the structure of the Anchorage Transportation Demand Model to not only forecast the traffic that would be expected to use the Glenn Highway corridor but also forecast the traffic that would use the new KAC. This required the development of a regional model that expanded coverage to include all of the major Mat-Su Borough roads.

One of the major issues that arose with respect to the development of the regional model involved how to incorporate toll revenues. Wilber Smith, another consultant to KABATA, recommended using toll dampening factors on the trips that use the bridge. The trip dampening factors vary depending on the trip purpose with Non Home-Based Work trips, the least sensitive to price, dampened by 6%, Home-Based Work trips dampened by 6.5%, and Home-Based Other trips dampened by 8.25%. The above factors were based on the Stated Preference Survey conducted for the Tacoma Narrows Bridge in Washington State. In the survey, information was gathered from motorist relating to limiting the number of trips over the toll bridge based upon a certain toll rate. According to the Wilber Smith Report this takes into account trip reductions due to telecommuting, trip chaining, etc.

Foregoing a trip due to a toll is different from the question of whether or not an alternative route would be taken, however. In the case of Mat-Su Borough residents, the alternative route would be the Glenn Highway. Depending on the origin of the trip, it may be more cost effective to take the Glenn Highway in order to avoid the toll, even though it may be a little longer. Neither the regional model nor the Anchorage Transportation Demand Model is currently capable of incorporating toll costs directly in the model chain. According to Section 93.110 (d) of the Air Quality Conformity Regulations, it appears that tolls should be reflected in the air quality conformity analysis. However, when asked to clarify this requirement, FHWA stated that "the conformity rule is not specific whether these are required to be included in the model. So if your existing model was not set up to incorporate tolls, you are not required to update the model just for that. You can use other reasonable methods to satisfy 93.110." (Source: Email from Cecilia Ho dated October 11, 2006.) As a result, it was decided not to incorporate tolls in the regional model.

One of the drawbacks of the regional model is that it is a daily model and is therefore not capable of providing the time of day output (AM Peak, Off-Peak, and PM Peak) that the air quality postprocessor requires. As a result, it was necessary to convert the productions and attraction tables from the regional model into two separate external stations which could then be run in conjunction with the standard Anchorage Transportation Demand Model and air quality post-processor. The output based on this procedure was used as input to the Mobile 6 air quality model.

In summary, the transportation demand models used in this analysis meets all of the requirements for determining regional transportation-related emissions for serious CO non-attainment areas contained in 23 CFR 93.122(b)(1):

- Both the Anchorage Transportation Planning Model and the Regional Model was validated against observed 2002 daily counts and was found to meet the validation criteria established by FHWA (23 CFR 93.122(b)(1)(i)).

- Population and employment projections were based on the 2005 Institute of Social and Economic Institute Population and Employment projections, the most recent available. (23 CFR 93.122(b)(1)(ii)).

- Land use assignment scenarios used as input into the model utilize an accessibility index to distribute land use based in part on future improvements to the transportation system (23 CFR 93.122(b)(1)(iii)).

- The model uses a TransCAD capacity sensitive assignment procedure (User Equilibrium) which incorporates link capacity restraint effects and flow-dependent travel times. Emissions estimates were based on a methodology that differentiates between peak and off-peak volumes and speeds and uses speeds based on final assigned volumes. (23 CFR 93.122(b)(1)(iv)).

- Zone to zone impedances used to distribute trips between origins and destination pairs are in reasonable agreement with travel times that are estimated in the final assigned traffic volumes (23 CFR 93.122(b)(1)(v)).

- The model uses multinomial mode choice models to provide estimates of travel for the following modes: drive alone, high-occupancy vehicle with two occupants, high-occupancy vehicle with three occupants, bus transit, and non-motorized modes (walk and bicycle). Variables utilized in the model included travel times and costs, and socioeconomic characteristics of the trip-maker such as household size and income, auto ownership, number of workers in the household, and presence or absence of children (23 CFR 93.122(b)(1)(vi)).

The "Anchorage Travel Model Calibration and Validation Report" dated February 2005 provides a comprehensive description of the entire set of travel demand models used in this air quality conformity determination, is available from the Municipality of Anchorage, Traffic Department. This report is supplemented by the Regional Model Documentation Report prepared by HDR, Inc. which is also available at the MOA Traffic Department.

Land Use Assumptions

One of the most important assumptions used as input in the Anchorage Transportation Demand Model involves population and employment projections. It is the policy of AMATS to use the population and employment estimates provided by the Institute of Social and Economic Research (ISER). In September 2005, ISER developed a new population and employment projection specifically for the Knik Arm Crossing project. For the purpose of these projections ISER assumed that the KAC would become operational in 2012. In this report, separate forecast were prepared with and without the bridge. The KAC is expected to have little effect on the overall regional growth in terms of population and employment. However, by providing access to a large supply of vacant land in the Mat-Su borough, the KAC will have an impact on the relative share of population, households, and jobs growth between the Municipality of Anchorage and the Mat-Su Borough. The impact of the bridge (on population and employment) will be slow at first but will accelerate as the supporting infrastructure (roads, schools, and utilities) is developed. Due to the opening of the bridge, Anchorage is projected to lose 4,900 households (or 12,900 people) and 5,800 jobs to the Mat-Su Borough that it would otherwise be expected to capture (by 2027). Tables 3, 4, and 5 show the difference in the regional distribution of population, households, and employment with and without the bridge.

Table 3
Knik Arm Crossing Impact on Regional Population Distribution

	2027 With Crossing	2027 Without Crossing	Numeric Change
Anchorage	339,100	352,000	-12,900
Mat-Su Valley	185,500	171,600	13,900
Total	524,600	523,600	-1,000

Table 4
Knik Arm Crossing Impact on Regional Household Distribution

	2027 With Crossing	2027 Without Crossing	Numeric Change
Anchorage	129,500	134,400	-4,900
Mat-Su Valley	67,600	62,500	5,100
Total	197,100	196,900	200

Table 5
Knik Arm Crossing Impact on Regional Employment Distribution

	2027 With Crossing	2027 Without Crossing	Numeric Change
Anchorage	170,200	176,000	-5,800
Mat-Su Valley	50,200	45,000	5,200
Total	220,400	221,000	-600

In its “Memorandum on the Economic and Demographic Impacts of a Knik Arm Bridge:” (September 2005), ISER listed the following assumptions regarding the economic effects of the bridge that might have an effect on transportation patterns in the region:

- A bridge results in a modest shift in basic sector activity from Anchorage to Point Mackenzie region of the Mat-Su Borough. This is most likely to be warehousing and other businesses that require large amounts of land. The accompanying shift would initially be modest and some workers at these jobs might commute from Anchorage.

- Over the longer term there will be a modest shift in some other basic sector jobs to the Mat-Su Borough that would other wise locate in anchorage, for example, tourism and recreation.

- Growth in the other basic industries in the Mat-Su Borough, including mining and timber, is not significantly impacted by the bridge.

- The bridge increased the attractiveness of commuting by workers living in the Mat-Su Borough but working in Anchorage. However, the increase is limited by the number of Anchorage jobs that pay enough to support the cost of a commute.

- Most Anchorage workers in jobs with a wage high enough to consider commuting will continue to choose not to commute. The largest source of new commuters will be the result of job separations. In other words, newly hired workers that are new to the region are the most likely to choose to commute. Currently employed workers are less likely to consider a move.

- The growth of support jobs in the Mat-Su Borough does not significantly increase their draw from the Anchorage market. (Only a limited number of Anchorage residents make shopping trips to the Mat-Su Borough.)

- Population growth in the Mat-Su Borough is constrained by the number of jobs in the Borough and the number of residents who commute to jobs outside the Borough (primarily Anchorage).

- Increased access to developable land in the Mat-Su Borough will not result in an absolute reduction in population in Anchorage. Some of the projected increase in population in the Greater Anchorage-Mat-Su Borough region will choose to live in Anchorage.

Table 6, 7, and 8 show the population, household and employment projections used in the Anchorage Transportation Planning Model. They show that the Mat-Su Valley will experience the most dramatic population growth (182%), followed by Chugiak-Eagle River (73%), and the Anchorage Bowl (20%). This is in line with recent trends, which show the Mat-Su Valley increasing its share of the regional population from 9.3% in 1980 to 17.7% in 1999. Mat-Su Valley's share of regional employment also grew from 4.0% in 1980 to 8.4% in 1999.

Table 6
Regional Population and Projections

	2002	2027 Forecast	Numeric Change	Percent Change
Anchorage	237,160	284,459	47,299	20
Chugiak-Eagle River	31,540	54,641	23,101	73
Mat-Su Valley	65,800	185,500	119,700	182
Total	334,500	524,600	190,100	57

Table 7
Regional Households and Projections

	2002	2027 Forecast	Numeric Change	Percent Change
Anchorage	84,620	111,158	26,538	31
Chugiak-Eagle River	10,580	18,342	7,762	73
Mat-Su Valley	22,800	67,600	44,800	196
Total	118,000	197,100	79,100	67

Table 8
Regional Employment and Projections

	2002	2027 Forecast	Numeric Change	Percent Change
Anchorage	137,900	162,701	24,801	18
Chugiak-Eagle River	3,980	7,499	3,519	88
Mat-Su Valley	13,900	50,200	36,300	261
Total	151,800	220,400	68,600	45

Anchorage Transportation Model and Inventory Grid System

The CO inventories were based in large part on traffic activity outputs from the Anchorage Transportation Model. The model was developed using TransCAD travel demand modeling software. Because TransCAD is a GIS-based model, post-processing software was used to overlay a grid system on the inventory area. The post-processor was used to disaggregate the inventory area into grid cells, each one square kilometer in area.

Transportation activity estimates (e.g., vehicle miles of travel, number of trip starts, and vehicle speeds) were produced for each of the cells. The grid location of every roadway link in the transportation network is known. Thus, the attributes of a particular roadway link (e.g., traffic volume, speed, and prior travel time) can be assigned to a particular grid. If a roadway link crosses the boundary between two or more grids, its attributes are assigned to the appropriate grid in relation to the proportion of the length of link contained in each grid. In other words, if 80% of a roadway link lies within a particular grid, 80% of the vehicle travel is assigned to that grid and 20% to the other grid.

<u>Time-of-Day Estimates of CO Emissions</u>

Separate estimates of mobile CO emissions were prepared for the AM peak (7 a.m. – 9 a.m.), PM peak (3 p.m. – 6 p.m.) and off peak (9 a.m. – 3 p.m. and 6 p.m. – 7 a.m., combined). These estimates relied on time-of-day activity estimates (e.g., number of trip starts and VMT) generated by the Anchorage Transportation Model. A 24-hour inventory was compiled by summing the separate emission contributions from each time period.

A great deal of effort was devoted to developing a credible highway motor vehicle emissions inventory that reflects real world conditions and driver behavior in Anchorage. This inventory explicitly quantifies the CO emissions that occur during cold starts and lengthy warm-up idles that precede many vehicle trips. Separate estimates were made of the emissions associated with the initial warm-up idle period and the after-idle, "on-road" trip period.

As discussed earlier, a hybrid approach utilizing locally generated cold temperature idle emission data in combination with the MOBILE6 CO model was employed to compute motor vehicle emissions. An essential element of this hybrid approach is the use of "thermal state tracking" to determine how warmed up a vehicle is at three critical points in the vehicle trip:

- immediately prior to start-up,
- after the initial warm-up idle, and
- during the on-road or travel portion of the trip.

The emission rate of a vehicle at each of these three critical points is a function of its thermal state. Warm vehicles emit less CO than cold vehicles. Although the computation of thermal state is fairly complex, it is not conceptually difficult. The equations used to compute the thermal state of a vehicle include three basic factors:

- how long, and at what temperature, it was parked before it was started;
- how long it was idled before starting a trip; and
- how long it has been traveling and at what speed.

Intuitively, the effect of each of the three factors on the thermal state or degree of warmth of a vehicle is fairly obvious. One would expect that vehicles that are parked for long periods of time would be in a colder thermal state than those parked for short periods; a long warm-up idle period would result in a warmer thermal state than a short idle; and long travel time at a high rate of speed would result in a warmer vehicle than a short trip at slow speeds.

A spreadsheet model was developed that incorporates the results of the thermal state calculations described above along with post processor outputs from the Anchorage Transportation Model, outputs from the modified MOBILE6 emissions model, warm-up idle emission data from research conducted in Anchorage and Fairbanks and information derived locally on driver idling behavior. This spreadsheet allowed for separate computation of warm-up idle emissions and on-road trip emissions.

<u>Estimation of Warm-up Idle Emissions</u>

Three key sources of information were required to estimate idle emissions: (1) the duration of the idle period preceding the trip; (2) the amount of time since the vehicle last operated and has been cooling or "soaking" in ambient conditions; and (3) the idle emission rate. The idle emission rate is largely a function of engine and catalyst temperature and thus is dependent on idle duration and soak time.

Idle duration

Idle duration was quantified by the MOA Air Quality Program during the winter of 1997-98 as part of the Anchorage Driver Behavior Study. The objective of this field study was to observe and document winter season driver idling behavior prior to the beginning of a trip. Since direct questioning of drivers prior to a vehicle startup was likely to affect idling behavior, it was avoided. Over 1300 start up idles were observed and documented at various times and locations in Anchorage. In addition to documenting the duration of each of the idles, the trip origin (e.g., home, work, shopping, etc.), time of day, ambient temperature, weather and windshield icing conditions were also recorded. One important objective of the study was to develop estimates of median idle duration by trip purpose[‡] and time-of-day. The idle duration assumptions used to develop emissions estimates for 2007, 2017, and 2027 are

[‡] The Anchorage Transportation model categorizes all travel into four trip purposes. HBW (home-based work) trips include all trips that begin at home and end directly at work or trips that begin at work and end at home. HBO (home based other) trips are those that begin at home and end at a location other than work or begin at a non-work location and at end at home. NHB (non home-based) trips are those that begin and at a location other than home. Finally, the Anchorage model includes a fourth category of "truck" trips comprised of trips made by commercial trucks.

shown in Table 9. The longest idle duration was associated with trips originating at home for work, shopping, school or other during the AM peak.[§]

Table 9
Median warm-up idle duration by trip purpose and origin (in minutes)

	Home-based Work		Home-based Shopping		Home-based School		Home-based Other		Non-home Based Work		Non-home Based Non-Work		Truck	
	H	O	H	O	H	O	H	O	H	O	H	O	H	O
AM peak	7	3	7	1	7	1	7	1	NA	3	NA	1	NA	3
PM peak	3	1	2	1	2	1	2	1	NA	3	NA	1	NA	3
Off Peak	3	3	1	1	2	1	2	1	NA	2	NA	1	NA	1

Soak Time

Vehicle emissions of CO are highest just after startup and decrease rapidly as the engine warms. The emissions that occur during start up are largely a function of how long the engine has been shut off and cooling at ambient temperatures. Because these data suggest that soak time is a critical factor in determining vehicle CO emissions, it was important to develop credible estimates of soak times in Anchorage as part of the CO emission inventory preparation.

Fortunately, information was available from a local travel survey that allowed average vehicle soak times to be estimated for the a.m., mid-day, p.m. and night periods by trip purpose. Hellenthal and Associates conducted a household travel behavior survey of 1,548 Anchorage households between February 25 and April 12, 1992. Soak times were estimated by examining travel logs from the survey. Drivers recorded the time when each trip began and ended. The time elapsed between the end of one trip and the beginning of the succeeding trip was presumed to be equal to the soak time for that driver's vehicle. Estimates of average soak times derived from the Hellenthal travel behavior survey are shown in Table 10. Morning home-based trips originating at home have the longest average soak time (12 hours) while non home based trips and home based trips originating at a non-home location have the shortest average soak time (1 hour).

[§] 35% of home-based trips were assumed to begin with cars parked in garages and 65% outside. Warm-up idle time for cars parked inside was not quantified in the idling study but was assumed to be 30 seconds. The idle times shown in Table 9 reflect the weighted average of idle times for garage and outside-parked vehicles.

Table 10
Average soak time prior to trip start (in hours).

	Home-based Work		Home-based Shopping		Home-based School		Home-based Other		Non-home Based Work		Non-home Based Non-Work		Truck	
	H	O	H	O	H	O	H	O	H	O	H	O	H	O
AM peak	12	5	12	1	12	0.5	12	1	NA	4	NA	1	NA	2
PM peak	3	5	2	0.5	2	0.5	2	1	NA	5	NA	1	NA	2
Off Peak	3	5	1	0.5	2	0.5	2	1	NA	3	NA	1	NA	2

Estimation of Idle Emissions as a Function of Idle Duration and Soak Time

Emission data from the Alaska Cold Temperature Emission Study conducted in Anchorage and Fairbanks during the winter of 1998-99 were used to construct a lookup table that provided an estimate of the warm-up idle emissions (in grams CO per start) to idle duration and soak time. CO and HC emissions were measured during the first 20 minutes following a cold start. Although over 200 tests were conducted on light duty vehicles in Anchorage and Fairbanks, some were excluded from the database because of data gaps or other problems. Data from 111 valid tests were used to develop the relationships in the look up table. The lookup table is shown in Table 11.

No data were collected from commercial trucks during the idle study. These comprise a small part of the total vehicle population and are largely low-emitting heavy-duty diesel vehicles (HDDV). These vehicles were assumed to emit CO at 30% the rate of the average light duty vehicles (LDVs) that make up the majority of the Anchorage vehicle population. This assumption is consistent with MOBILE6 model estimates for HDDV versus LDV emission factors.

Table 11
Idle emission look up table for calendar year 2000
CO emissions (in grams per start) as a function of soak time and idle duration

Soak Time (hrs)	Warm up Idle Duration (min) 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0.0	1.0	2.7	4.7	6.2	7.3	8.2	9.0	9.7	10.3	10.8	11.3	11.7	12.1	12.5	12.8
0.5	4.0	11.0	15.1	17.9	20.2	22.0	23.6	24.9	26.1	27.2	28.1	29.0	29.8	30.5	31.2
1.0	10.0	19.7	25.4	29.4	32.6	35.1	37.3	39.2	40.8	42.3	43.6	44.8	46.0	47.0	48.0
1.5	15.2	27.1	34.0	39.0	42.8	45.9	48.6	50.8	52.9	54.7	56.3	57.8	59.2	60.4	61.6
2.0	19.6	33.3	41.3	47.0	51.4	55.0	58.1	60.7	63.0	65.1	67.0	68.7	70.3	71.8	73.1
2.5	23.5	38.8	47.7	54.0	58.9	62.9	66.3	69.2	71.8	74.1	76.2	78.1	79.9	81.5	83.1
3.0	26.9	43.5	53.2	60.1	65.4	69.7	73.4	76.6	79.4	81.9	84.2	86.3	88.2	90.0	91.6
4.0	32.4	51.2	62.1	69.9	76.0	80.9	85.1	88.7	91.9	94.7	97.3	99.6	101.8	103.8	105.7
5.0	36.6	57.1	69.2	77.7	84.3	89.7	94.3	98.2	101.7	104.8	107.6	110.2	112.6	114.8	116.8
6.0	39.7	61.6	74.4	83.5	90.5	96.3	101.1	105.4	109.1	112.4	115.4	118.2	120.7	123.0	125.2
7.0	42.1	65.0	78.3	87.8	95.2	101.2	106.3	110.7	114.6	118.1	121.2	124.1	126.7	129.2	131.5
8.0	43.8	67.5	81.3	91.1	98.7	104.9	110.2	114.7	118.7	122.3	125.6	128.6	131.3	133.8	136.2
9.0	45.2	69.4	83.5	93.5	101.3	107.7	113.1	117.7	121.9	125.5	128.9	131.9	134.7	137.3	139.7
10.0	46.2	70.8	85.2	95.4	103.3	109.8	115.3	120.0	124.2	127.9	131.3	134.4	137.2	139.9	142.3
12.0	49.1	75.0	90.1	100.9	109.2	116.0	121.7	126.7	131.1	135.1	138.6	141.9	144.9	147.6	150.2

Effect of Fleet Turnover on Idle Emission Factors

The MOBILE6 includes an algorithm, supported by vehicle testing data, to estimate the effect of fleet turnover on vehicle emission rates. The fleet turnover factors, implicit in the MOBILE6, were used to estimate the benefits of improvements in emission control technology as newer cleaner burning vehicles make their way into the Anchorage fleet. Although MOBILE6 does not provide explicit estimates of idle emissions, idle emissions can be estimated by computing the emission rate in grams per minute from the gram per mile emission rate predicted by vehicle traveling at 2.5 mph.[**] MOBILE6 outputs of this 2.5 mph emission rate were examined for years 2007, 2017, and 2027 and the rate of decline in the emission rate was computed. This rate of decline in the 2.5 mph emission rate was applied to estimate idle emission rates for each analysis year. The adjustment factors are shown in Table 12.

Table 12
Adjustment Factors Used to Modify Year 2000 Idle Emission Lookup Improvements due to Fleet Turnover(Year 2000 = 1.0)

Calendar Year	Adjustment for Cold Start Idles (soak > one hour)	Adjustment for Hot Start Idles (soak < one hour)
2007	0.741	0.715
2017	0.535	0.506
2027	0.448	0.406

Estimating the Effect of Engine Block Heater Usage on Warm-up Idle CO Emissions

Quantifying the benefits of engine block heater use was a principal objective of the Alaska Cold Temperature Emission Study. This study showed that engine block heaters reduced CO emissions by an average of 72% during the first 10 minutes of idle after a cold start. The municipality has hired a public opinion research firm to perform annual telephone surveys to determine engine block heater plug-in rates among Anchorage drivers at ambient temperatures below 15 °F. The survey firm estimated at-home plug-in rates before and after the Municipality and State began a television, radio and print media campaign aimed at increasing plug-in rates among Anchorage drivers. Survey data suggested that plug-in rates increased from about 10% before the campaign to 20% after the campaign for morning trips that begin at home.

In Anchorage almost all block heater usage occurs at home because electrical receptacles are not generally available at work places and other locations. For this reason, the emission inventory spreadsheet was configured to assign plug-in benefits only to trips that begin at home during the 6 a.m. – 9 a.m. period and for the first portion of the 9 a.m. – 3 p.m. mid-day period. Trips beginning at work, shopping centers, and other "non-home" locations were assumed to have a zero plug-in rate.

[**] This is the procedure recommended by EPA for estimating idle emissions in project-level conformity analysis.

Home-based morning trips comprise a small fraction of all trips taken over the entire day. When this is considered, the overall plug-in rate for all trips taken during the day is less than 2%. The plug-in rate assumptions used in the spreadsheet are shown in Table 13.

Table 13
Block heater plug-in rates by time-of-day, trip origin and trip purpose

	Home-based Work		Home-based Shopping		Home-based School		Home-based Other		Non-home Based Work		Non-home Based Non-Work		Truck	
	H	O	H	O	H	O	H	O	H	O	H	O	H	O
AM peak	20%	0%	10%	0%	20%	0%	20%	0%	0%	0%	0%	0%	0%	0%
PM peak	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Off Peak	10%	0%	0%	0%	0%	0%	5%	0%	0%	0%	0%	0%	0%	0%

The emission inventory spreadsheet used these block heater usage rates in conjunction with block heater CO reductions determined from the Alaska Cold Temperature Emission Study to estimate the air quality benefit of engine block heater use. Benefits were calculated for each grid cell and for each analysis year.

Spreadsheet Calculation of Warm-up Idle Emissions

The transportation model post-processor provides data on the number of home based work, home based other, home based school, home based shopping, non-home based work, non-home based non-work, and truck trips generated within each grid cell for a particular time period. The emission inventory spreadsheet uses this data along with user-supplied data on idle duration (Table 9), soak time (Table 10), per start idle emission estimates (Table 11) and block heater usage rates to estimate total idle emissions for each grid cell.

Estimation of On-Road Travel Emissions

On-road travel emissions were estimated on a grid-by-grid basis using travel outputs (vehicle miles traveled (VMT) and speed by road facility category[††] and trip purpose). The post processor also provided information that was used to indirectly develop grid-by-grid estimates of operating mode[‡‡] by facility category. These estimates of the travel activity and characteristics were used in conjunction with emission factor estimates generated by MOBILE6.

[††] The post-processor developed estimates of VMT and speeds for five facility categories which include (1) freeways and ramps; (2) major arterials; (3) minor arterials; (4) collectors; and (5) local roads. In addition, the post-processor estimated "intrazonal" VMT, travel that occurs within a traffic analysis zone and not explicitly accounted for by the travel demand model.

[‡‡] Operating mode refers to the thermal state of the vehicles traveling on a particular facility category within a particular grid. Warm engines emit less CO than cold ones. The operating mode is dependent on the soak time, idle duration, and the amount of time spent traveling on the road before arriving in the grid of interest.

VMT Estimation

The Anchorage Transportation Model and post-processor were used to estimate VMT within each of the grids in the inventory area. The transportation model was calibrated in 2004. Because there are 5 facility categories and 7 trip purposes, the VMT in each grid was disaggregated into 35 (5 x 7) different categories, each with potentially different travel activity characteristics. The number of VMT categories grows to 36 when intrazonal VMT is considered. The travel accrued within each of these seven trip purposes was assigned a different operating mode depending on the idle duration, soak time, and prior travel time associated with each trip purpose. Thus, freeway travel accrued by home-based work trips was likely assigned a different CO emission rate than freeway travel accrued by shopping trips.

Vehicle Speed Estimation

The Anchorage Transportation Model and its post-processor provide estimates of vehicle speeds by facility category and time-of-day. Thus for each grid, the post-processor generates an estimate of the average speed of vehicles traveling on freeways, major arterials, minor arterials, collectors and local streets. The speed estimates for these facility categories are average speeds and include periods when vehicles are stopped at signals or in traffic. Thus speed estimates generated by the model change in relation to the amount of congestion on the network. If network capacity is not expanded in relation to growth in VMT, slower speeds result.

Because the primary purpose of the transportation model is to evaluate the capacity needs of the roadway and transit network, the speed outputs generated by the model are not considered to be as important as VMT. Unlike VMT, modeled speed estimates are usually not reconciled to observed network values. Thus, modeled vehicle speed estimates can deviate substantially from observed speeds. Indeed, the vehicle speed estimates generated by the Anchorage Transportation Model were significantly higher than those measured in a travel time study conducted by the Municipality and the Alaska Department of Transportation in October – November and 2006.

Because speed is an important variable in the estimation of CO emissions, the emission inventory spreadsheet was used to apply linear speed adjustment factors to the speed outputs from the model to bring them into closer agreement with speeds observed in the travel time study. In the travel time study, average vehicle speed was measured on freeways and major arterials during the a.m., mid day and p.m. peak periods. Because data were not available for minor arterials and collectors, speed adjustment factors for these facility categories were assumed to be identical to the adjustment factors determined for major arterials. The speed adjustments incorporated into the emission inventory spreadsheet are shown in Table 14.

Table 14
Speed Adjustment Factors

	Freeway			Major Arterial		
	AM	Off-Peak	PM	AM	Off-Peak	PM
Speed Study (measured)	56.5	59.7	57.2	31.6	31.9	27.3
Transportation Model Estimate	48.1	50.5	48.3	38.2	41.6	37.8
spreadsheet model correction factor	**1.17**	**1.18**	**1.18**	**0.83**	**0.77**	**0.72**

Note that model output freeway speeds were significantly slower than observed speed, so model speeds were adjusted upward by a correction factor varying from 1.17 to 1.18 depending on the time-of-day. Conversely, modeled speeds on arterials were higher than observed so modeled speed were adjusted downward with a correction factor that varied from 0.72 during the PM peak to 0.83 during the AM peak. These same adjustment factors were applied to minor arterials and collectors. A default speed of 15 miles per hour was assigned to all VMT on local roadways and 20 miles per hour for intrazonal travel.

Estimation of Vehicle Operating Mode

One of the most important variables in the estimation of vehicle CO emissions is the operating mode. Cold-started vehicles emit significantly more CO than hot started or hot-stabilized vehicles and the MOBILE6 model reflects this. CO emission factor estimates generated by the MOBILE6 model are very sensitive to user supplied inputs regarding operating mode.

For this reason, a great deal of effort was invested in developing credible local estimates of operating mode. Rather than use traditional definition of operating mode (i.e. fraction of VMT accrued by vehicles operating in cold start, hot start and hot stabilized modes), an alternative approach was developed that uses predictive coolant temperature equations to estimate the thermal state of a vehicle as a function of it's soak time, idle duration, and prior travel time. This can be expressed as:

$$\text{Operating mode} = f\ (\text{soak time, idle duration, prior travel time})$$

Sierra Research developed a method that provides a way to use MOBILE6 to compute emission factors that reflect thermal state or operating mode of a vehicle after a given soak, idle and travel time. Five customized soak distribution input files were used with MOBILE6 to reflect the impact of various thermal states on travel CO emissions.

An extensive look up table was then developed in the spreadsheet model that allowed the appropriate MOBILE6 emission factor to be selected based on the speed, soak time, idle duration, and prior travel time for vehicles traveling in each grid by both trip purpose and facility category. Soak time and idle duration were supplied as user inputs in the spreadsheet and were based on the local driver behavior studies discussed in the earlier section on estimation of idle emissions. These user inputs varied by time-of-day and trip purpose.

The third variable necessary in the estimation of operating mode was the average prior travel time of the vehicles traveling within the grid of interest. If vehicles had long prior travel times they were likely to be in a fully warm state, and hence, a large proportion of the VMT accrued in the grid would be in the hot fraction. Anchorage Transportation Model post-processor outputs were used to estimate prior travel time. The end result of this work was a spreadsheet look up table that allowed separate emission factor estimates to be generated for the 36 different categories of VMT in each grid.

MOBILE6 CO Model

The MOBILE6 CO model was configured to exclude the emissions impacts of the Supplemental Federal Test Procedure (SFTP), the so called “aggressive driving component” of the drive cycle used to compute emission factors. The effects of SFTP were disabled in the model to reflect observed drive cycle behavior in Alaska. Sierra Research conducted studies in Anchorage and Fairbanks to characterize the behavior of Alaskan drivers in the winter. As one might expect, they found a low proportion of driving in hard acceleration or hard deceleration modes when roads are often icy. They determined that the old FTP, without the so-called “aggressive driving supplement”, fairly approximated the winter drive cycle in Alaska. The primary effect of excluding the SFTP was to reduce emission factors computed for the on road portion of trip emissions. However, disabling the SFTP emission component in MOBILE6 has the secondary effect of reducing the benefits of fleet turnover on future emissions.

Vehicle registration distributions were based on data from detailed parking lot surveys conducted by ADEC during the winter of 2005. These surveys indicated that the in use vehicle population is newer than suggested by vehicle registration data.

Odometer measurements collected by the Anchorage I/M program allowed mileage accumulation rates of vehicles subject to I/M requirements to be estimated. Default mileage accumulation rates were used for diesels and other I/M exempt vehicles. An I/M program effectiveness of 85% and compliance rate of 90% was assumed for all analysis years.

Calculation of On Road CO Emissions

An Excel spreadsheet was developed to assemble the information necessary to calculate CO emissions from on road travel in each grid cell. As discussed earlier, the spreadsheet was used to compute the emission contributions of 36 possible categories of travel, with varying speeds and operating modes. The emissions from these various categories of travel were then summed to determine on-road emissions in each grid using the following formula:

$$\text{On-road emissions} = \sum_{i=1}^{36} (VMT_1 \times EF_1) + (VMT_2 \times EF_2) \ldots\ldots\ldots\ldots (VMT_{36} \times EF_{36})$$

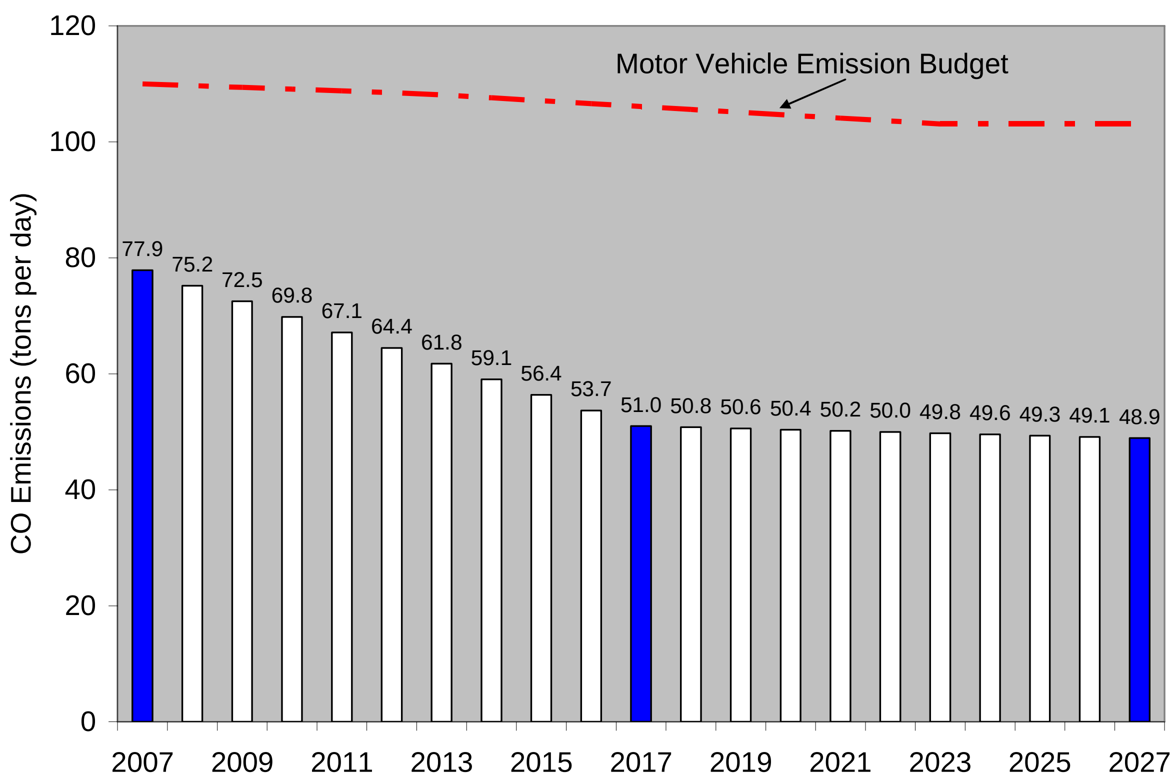
Results

The methodology described above was used to compute CO emissions from the Anchorage transportation network envisioned in the 2007-2027 LRTP and 2010-2013 TIP. Results for analysis years 2007, 2017 and 2027 are shown in Table 15.

Table 15
Projected CO Emissions from Transportation Network Envisioned in the 2007-2027 LRTP and 2010-2013 TIP

Analysis Year	Population	Total Vehicle Starts (per day)	Total VMT (mi/day)	Average Speed (mph)	Warm-up Idle Emissions (tons per day)	Travel Emissions (tons per day)	Total Mobile Source Emissions (tons per day)	Mobile Source Emissions Budget (tons per day)
2007	225,853	639,007	3,344,312	35.7	17.0	60.9	77.9	110.0
2017	248,767	682,017	3,709,166	37.2	12.9	38.1	51.0	106.1
2027	260,745	732,062	4,058,414	40.4	11.0	38.0	48.9	103.1

Figure 5
Projected CO Emissions from Anchorage Transportation Network Compared with Budget 2007-2027 Anchorage LRTP and 2010-2013 TIP



Other Conformity Requirements

Transit Service

Section 93.110 of the air quality conformity regulations state that the conformity determination for LRTPs must discuss how transit operating policies (including fares and service levels), and assumed transit ridership have changed since the previous LRTP conformity determination was approved.

According to the Municipality of Anchorage Public Transportation Department, there have been no changes in bus fares since they were increased from $1.50 to $1.75 in October 2005. There has been an increase in service levels and ridership over the past seven years. Figures 6 and 7 show how transit service levels (as indicated by weekday revenue hours) and weekday ridership have increased since 2002.

Figure 6
Trend in Transit Service (2002 -2008)

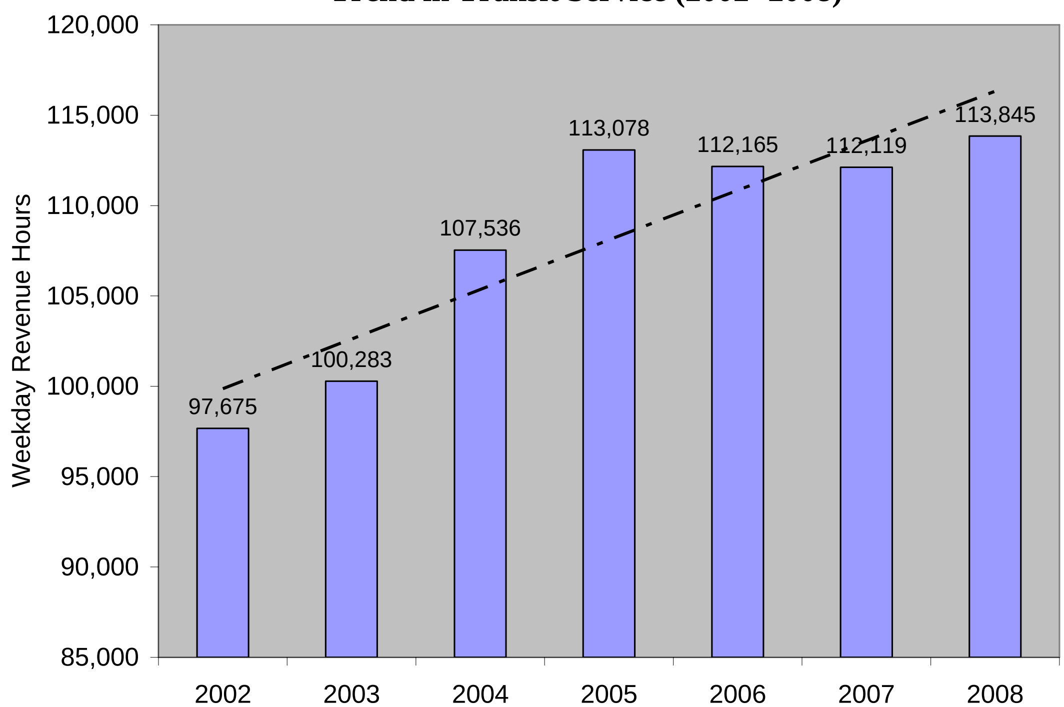
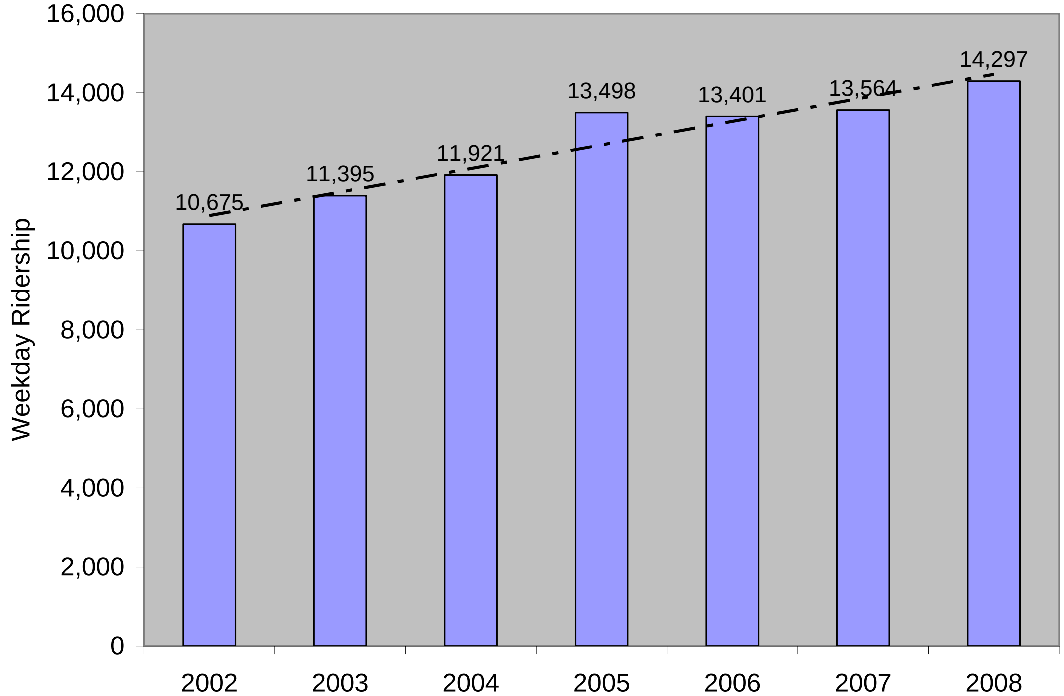


Figure 7
Trend in Transit Ridership (2002 -2008)



Transportation Control Measures (TCMs)

In maintenance areas such as the Municipality of Anchorage, priority must be given to the implementation of TCMs included in the SIP. According to Air Quality Conformity regulations (40 CFR Part 93), transportation control measures are defined as any measure that is specifically identified and committed to in the applicable implementation plan or any other measure for the purpose of reducing emissions or concentrations of air pollutants from transportation sources by reducing vehicle use or changing traffic flow or congestion conditions. Notwithstanding the above, vehicle technology-based, fuel-based and maintenance based measures which control the emissions from vehicles under fixed traffic conditions are not TCMs for the purposes of this subpart.

Ridesharing is the only TCM identified in CO Maintenance Plan and is fully funded in the Transportation Improvement Program. The Ridesharing consists of both carpooling and vanpooling elements. In 2007, when the last conformity determination was completed, there were 365 individuals in 181 carpools. At the end of 2008, the number of carpoolers was nearly the same; 361 individuals in 177 carpools. The vanpool program had a total 589 participants in 42 vanpools in 2007. By the end of 2008 this number had grown to 810 individuals in 52 vanpools. The vanpool program has experienced substantial growth since its inception and there is an on-going demand for more vanpools especially among long distance commuters living outside of Anchorage in the Matanuska Susitna Valley, Eagle River-Chugiak and Girdwood. Table 19 shows the growth that has occurred in the vanpool program over the past 13 years.

Table 19
Vanpool Program Participation (1996-2008)

Year	Number of Vanpools	Number of Vanpoolers
1996	9	126
1997	10	137
1998	11	151
1999	14	184
2000	18	231
2001	18	260
2002	21	270
2003	23	323
2004	24	363
2005	24	375
2006	41	569
2007	42	589
2008	52	810

CONCLUSION

This analysis has demonstrated that the 2010-2013 Anchorage Transportation Improvement Program is in conformance the Alaska State Implementation Plan for air quality and meets conformity requirements outlined in 40 CFR 93. Furthermore, it has been determined that transportation improvement program will not undermine the ability of the Municipality of Anchorage to maintain compliance with the national ambient air quality standard for CO.

Appendix

APPENDIX

SUMMARY OF NETWORK IMPROVEMENTS BY ANALYSIS YEAR

2007 Analysis Year

Name of Facility	Extent of Improvement	Type of Work
Elmore Road	Huffman Rd. to DeArmoun Rd.	Add new 2-lane facility
Pine Street	DeBarr Rd. to Reka Dr.	Add new 2 lane facility
Dowling Road	Lake Otis Blvd. to Old Seward Hwy.	Expand from 2 to 5 lanes
C Street	International Airport Rd. to Dimond Blvd.	Expand from 2 to 5 lanes
Glenn Hwy.	Airport Heights to Bragaw St.	Expand number of eastbound lanes from 2 to3
Abbott Loop Ext.	Tudor Rd. to 68th Ave..	Add new 4-lane facility
Abbott Loop Rd.	68th Ave. to Abbott Rd.	Expand from 2 to 3 lanes
C Street – Phase III	Dimond Blvd. to O'Malley Rd.	Add new 4 lane link
O'Malley and C Street	O'Malley /C Street Interchange	Full interchange improvements
Northern Lights Blvd.	Wisconsin to Nathaniel	Expand from 2 to 3 lanes
Arctic Blvd.	Fireweed Ln. to International Airport Rd.	Rehab. From 4 to 2 lanes plus a center turn lane from Fireweed Ln. to 36th Ave.

2017 Analysis Year

Project Number	Name of Facility	Extent of Improvement	Type of Work	Exempt
206	Victor Road	100th Ave. to Dimond Blvd.	Expand from 2 to 3 lanes	No
401	O'Malley Road	Seward Hwy. to Hillside Drive	Expand from 2 to 4 lanes bet. Seward Hwy. and Lake Otis and 3 lanes bet. Lake Otis and Hillside Drive	No
203	Fireweed Lane	Spenard Rd. and Seward Hwy.	Reconstruct from 4 to 3 lanes	No
406	Spenard Road	Minnesota Dr. to Hillcrest Dr.	Reconstruct from 4 to 3 lanes	No
416	Dowling Road Ext.	Laurel St. to Abbott Lp. Rd.	Add 4 lane extension of Dowling Road	No
404	Old Seward Hwy.	O'Malley Rd. to Brandon Rd.	Reconstruct from 2 to 5 lanes bet. O'Malley and Huffman. 3 lanes bet. Huffman and Brandon	No
407	Huffman Road	Old Seward Hwy. to Lake Otis Blvd.	Expand from 2 to 4 lanes	No
409	Abbott Road	Lake Otis Blvd. to Birch Rd.	Expand from 2 to 4 lanes from Lake Otis to Abbott Rd. and 2 to 3 lanes from Abbott Loop to Birch	No
415	Lake Otis Blvd.	Northern Lights Blvd. to DeBarr Road	Expand from 3 to 5 lanes	No
Project included in 502	Ingra-Gambell Extension	3rd Avenue to Ship Creek Ave.	Add new 2 lane facility	No
209	Glenn Highway	Gambell to McCarry	Expand from 4 to 6 lanes	No
308	Dowling Rd. Ext.	Raspberry Rd. to Old Seward Hwy.	Extend and Expand Dowling Rd. from Old Seward Hwy. to Minnesota Dr. as a 4 lane facility	No
417	Northwood Drive	88th Ave. to Dimond Blvd.	Add new 2 lane facility and bridge	No
418	100th Ave.	Minnesota Dr. to King Street	Add new 2 lane facility	No
507	Jewel Lake Road	Raspberry Rd. to Dimond Blvd.	Reconstruct Jewel Lake Road to operate as a 2 lane with center turn lane	No

2017 Anchorage Bowl Projects (cont'd)

Project Number	Name of Facility	Extent of Improvement	Type of Work	Exempt
601	Lake Otis Pkwy./Tudor Rd. intersection	Lake Otis Pkwy & Tudor Rd.	Additional left and right turn lanes where needed to improve capacity and efficiency of existing intersection. Finished configuration will have 2 left turn lanes at each leg of the intersection.	Yes
405	Eklutna River Bridge	Glenn Highway at Eklluna River	Commercial vehicle bridge clearance warning system	Yes
217	Independence Dr.	Colony Street to O'Malley Rd.	Add new 2 lane link	No
303	New Seward Hwy.	O'Malley Rd. to 36th Ave.	Expand from 4 to 6 lanes with frontage road improvements	No
211	Creekside Couplet	2 lanes	Add collector couplet north and south of DeBarr Road within Town Center	No
301	International Airport Rd. Ext.	Old Seward Hwy. to Brayton	Grade separation and extension of International Airport Road under the Seward Hwy. (4 lane major arterial between Brayton and Homer)	No
304	68th Ave. Ext.	Homer Dr. to Brayton Dr.	Grade separation and extension of 68th Ave. under the Seward Hwy. (2 lane collector between Brayton and Homer).	No
305	76th Ave. Ext.	Homer Dr. to Brayton Dr.	Grade separation and extension of 76th Ave. under the Seward Hwy. (2 lane collector between Brayton and Homer)	No
306	92nd Ave.	Homer Dr. to Seward Hwy. to Brayton Dr.	Grade separation and extension of 92nd Ave. under the Seward Hwy. (2 lane collector between Brayton and Homer	No

2017 Anchorage Bowl Projects (cont'd)

Project Number	Name of Facility	Extent of Improvement	Type of Work	Exempt
628	92nd Ave./Academy Extension	Brayton Dr. to Abbott Road	Add new2 lane collector by extending 92nd Ave. to Abbott Rd.	No
309	Glenn Hwy Corridor Improvements	Glenn Hwy./Bragaw St. Interchange	Full interchange improvements	No
419	Muldoon Rd. Improvements	Tudor Rd. to Glenn Hwy.	Landscaping and pedestrian improvements (No lane expansion)	Yes
618	40th Ave. Ext.	Arctic Blvd. to Eureka St.	Add new 2 lane collector facility	No
707	Glenn Hwy. at Eagle River	Hiland Road to Artillery Rd.	Make spot improvements at Hiland Road, and Artillery Rd. interchanges and add a 3rd lane between Hiland Rd. and Artillery Rd.	No
204	DeArmoun Rd. Phase II	140th Ave. to Hillside Dr.	Reconstruction of existing alignment. No lane expansion.	Yes
215	3RD Ave. Surface Rehab.	Post Rd. to Reeve Blvd.	Restripe from 4 lane to 3 lane	No
216	Hartzell Rd. Ext.	Lore Rd. to 79th Ave.	Add new 2 lane collector bet. Lore Rd. and 79th Ave.	No
219	Lake Otis Pkwy.	Abbott Rd. to 68th Ave.	Pavement rehab and addition of traffic signal at 72nd Ave.	Yes
221	Raspberry Rd. Ext.	Rovenna St. to Arctic Blvd.	Add new 2 lane minor arterial facility	No
224	Northern Lights Blvd.	Postmark Dr. to Nathaniel Ct.	Upgrade to urban standards with center turn lane where needed	No
225	92nd Ave.	Minnesota Dr. to King St.	Add new 2 lane minor arterial facility	No
226	40th Ave. Ext.	Lake Otis Pkwy. To Piper St.	Add new 2 lane collector connection from Lake Otis Pkwy. To Piper St.	No
414	Arctic Blvd.	Fireweed Ln. to International Airport Rd.	Upgrade from 4 to 5 lanes from 36th Ave. to Tudor Rd.	No
604	48th Ave./Boniface Pkwy. Ext	48th Ave./Bragaw to Boniface Pkwy./Tudor Rd.	Add new 4 lane major arterial	No

2017 Anchorage Bowl Projects (cont'd)

Project Number	Name of Facility	Extent of Improvement	Type of Work	Exempt
705	Tudor Rd. Access Management	New Seward Hwy. to Arctic Blvd.	Access management and turn restrictions. Local connections modified to make adjacent property access to other roads. (No lane expansions)	Yes
706	Tudor Rd. Access Management	New Seward Hwy. to Patterson St.	Access management and turn restrictions. Local connections modified to make adjacent property access to other roads. (No lane expansions)	Yes
No project number	Spenard Rd./36th Couplet	Create two way couplet	Part of Minnesota Corridor project	No
No project number	Knik Arm Crossing–Phase 1	Mat-Su Borough side of Knik Arm to 3rd Ave. downtown Anchorage	Construction of a two lane bridge with toll facilities and four lane major arterial connecting to A/C Viaduct	No

2027 Analysis Year

Project Number	Name of Facility	Extent of Improvement	Type of Work	Exempt
302	New Seward Hwy./O'Malley Rd. Interchange	Old Seward Hwy. to New Seward Hwy.	Freeway system interchange at New Seward Hwy. and O'Malley and interchange at Old Seward Hwy. and O'Malley Rd.	No
515	C St/Oceandock Rd. Access Ramp	C St. Viaduct to Ocean Dock Rd.	Reconstruct ramp at Ship Creek	Yes
621	Minnesota Dr. Frontage Road	Dimond Blvd. to Raspberry Rd.	Add new frontage road on east side of Minnesota Dr. Only	No
502	Ingra-Gambell Extension to Whitney Rd. Should include connection to Ship Creek	3rd Ave. to Whitney Road	Add new 2 lane link	No
311	New Seward Hwy.	O'Malley Rd. to Rabbit Creek	Ramp and pedestrian facility improvements (No lane expansion)	Yes
518	Postmark Dr./International Airport Rd. Grade Separation	Postmark Rd to International Airport Rd.	Grade separation of International Airport Rd. over Postmark Dr.	No
501	Whitney Rd.	North C Street to Post Rd.	Upgrade Whitney Rd. to urban industrial standards (No lane expansion)	Yes
609	Jewel Lake Rd./International Airport Rd. grade separation	Jewel Lake Rd. & International Airport Rd.	Grade separation of International Airport Rd. and Jewel Lake Rd. with realignment of railroad.	No
610	Muldoon/Glenn Hwy. Interchange	Glenn Hwy. & Muldoon Rd.	Reconstruction of ramps. to meet current safety standards	Yes
510	Minnesota Dr. (Northbound)	16th Ave. to 26th Ave.	Expand from 2 to 3 lanes	No
514	A Street and C Street	9th Ave. to Tudor Rd.	Expand from 3 to 4 lanes	No
702	Elmore Rd. Ext.	Rabbit Creek Rd. to DeArmoun Rd.	Add new 2 lane collector to complete the grid	No
603	Glenn Hwy./New Seward Highway Connection	Glen Hwy./Airport Heights. to New Seward Hwy. /Tudor Road	Freeway connection, ramps, and frontage roads	No
632	Lake Otis Pkwy. Ext.	DeBarr Rd. to Glenn Hwy.	Add new 4 lane major arterial connecting Airport Heights at the Glenn Hwy. with Lake Otis Pkwy at DeBarr Rd.	No

2027 Analysis Year (Cont'd)

Project Number	Name of Facility	Extent of Improvement	Type of Work	Exempt
638	Minnesota Dr./Tudor Rd. interchange	Minnesota Dr. & Tudor Rd.	Add grade separated interchange	No
627	Minnesota Dr. Corridor	International Airport Rd. to Northern Lights Blvd.	Extend controlled access from International Airport Rd. through an interchange at Tudor Rd. and widen the arterial to 8 lanes north of Tudor	No
639	Glenn Hwy. HOV	Boniface Pkwy. Interchange to Artillery Road Interchange in Eagle River	Add additional lane in both directions and designate non SOV lanes	No
710	Glenn Hwy. HOV	Artillery Rd. Interchange to Peters Creek Interchange	Add additional lane in both directions and designate non SOV lanes	No
708	Rabbit Creek Rd.	New Seward Hwy. to Goldenview Dr.	Upgrade to 3-lane arterial	No
709	Railroad. Grade separation at Spenard Rd and at C Street	Spenard Road and at C St.	Railraod grade separation. (Does not change transportation demand model)	Yes
802	84th Ave.	Hartzell Rd. to Lake Otis	Add new 2 lane collector	No
803	Oilwell Road	Muldoon Interchange to Elmendorf Access Gate	Expand from 2 to 4 lane minor arterial	No
805	Huffman Road	Elmore Rd. to Birch Rd.	Upgrade existing collector facility	Yes
806	Birch Road	Huffman Rd. to O'Malley Rd.	Upgrade existing collector facility	Yes
807	Bragaw Street	Northern Lights Blvd. to Providence Dr.	Add new facility creating a north access into the U-MED District. For conformity purposes facility was modeled as a 4 lane major arterial.	No
808	Mountain Air Drive	Rabbit Creek to 164th Ave.	Extend a 2 lane collector to provide access to new development	Yes, not regionally significant
809	Unnamed	Goldenview Drive to Potter Valley Road	Extend a 2 lane collector to connect Goldenview Dr. with Potter Valley Rd.	Yes, not regionally significant
No project number	Knik Arm Crossing– Phase 2	Loop Road at Government Hill to 3rd Ave. downtown	Construction of a four lane viaduct over Ship Creek connecting Government Hill to Ingra-Gambell couplet	No