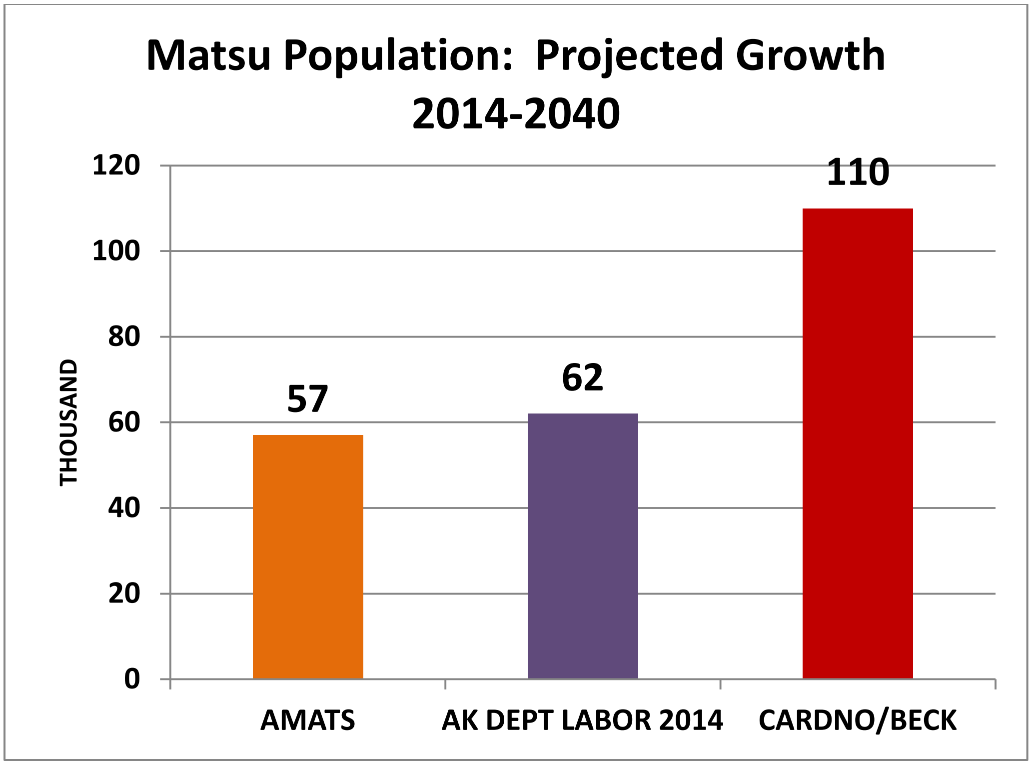
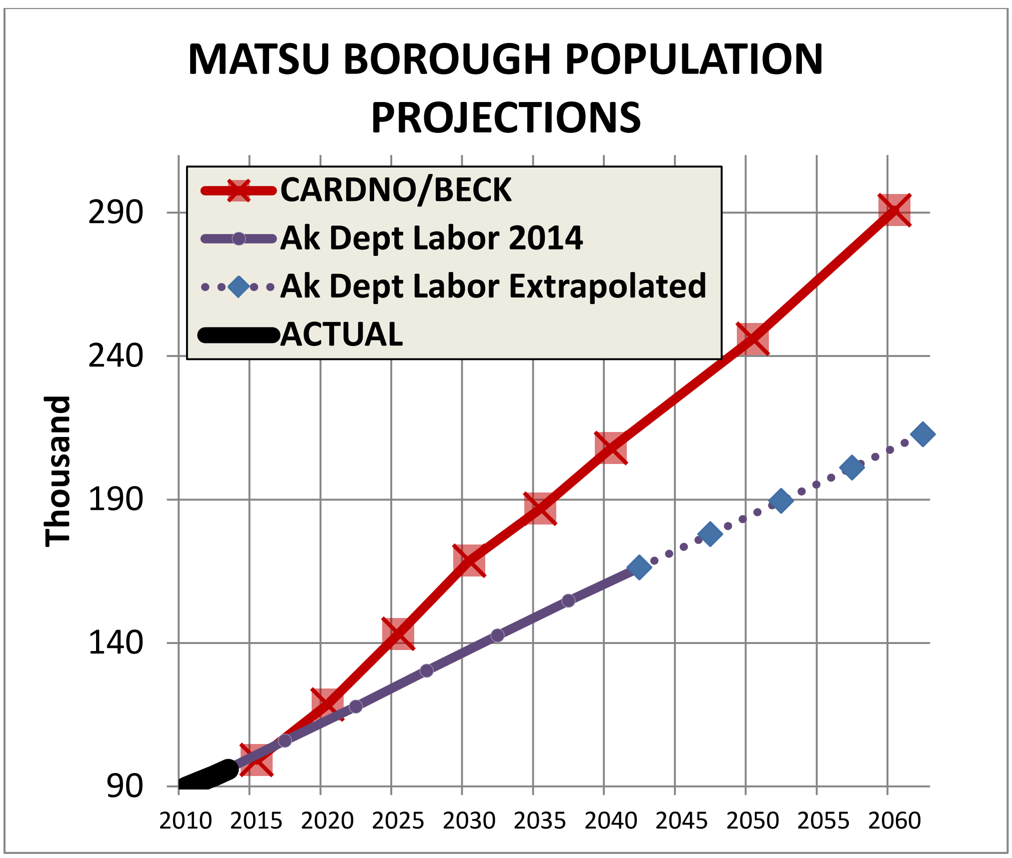




The "Cardno/Beck" projections were done for ADOT/KABATA and are taken from the December 5, 2014 "Comprehensive Traffic and Revenue Study for the Knik Arm Crossing Project".
The "AMATS" is from data adopted by AMATS Policy and Technical Committees for the 2040 Transportation Plan.
The "AK Dept Labor 2014" is from http://laborstats.alaska.gov/pop/projected/pub/popproj.pdf

Employment Regional Totals				
Region	**Cardno/Kabata 2040**	**HDR/MSB 2035**	**Difference**	**EMP Baseline 2015**
Big Lake	858	1,647	-789	470
Butte	1,361	863	498	702
Houston	846	1,779	-933	406
Knik	904	1,964	-1,060	568
North	751	1,034	-283	464
Palmer	13,363	11,519	1,844	6,122
Point MacKenzie	8,930	4,512	4,419	384
Wasilla	32,491	25,226	7,265	14,793
TOTALS	59,504	48,543		23,909

Population Regional Totals				
Region	**Cardno/Kabata 2040**	**HDR/MSB 2035**	**Difference**	**POP Baseline 2012**
Big Lake	7,186	9,387	-2,201	3605
Butte	10,897	6,690	4,207	5681
Houston	4,027	4,188	-161	2110
Knik	12,389	20,335	-7,946	6396
North	5,295	3,631	1,664	2517
Palmer	33,358	32,518	840	17178
Point MacKenzie	37,074	7,177	**29,897**	1692
Wasilla	97,662	92,195	5,467	50899
TOTALS	207,888	176,121		90,078

The “Cardno/Beck” projections were done in 2014 for ADOT/KABATA and are taken from the "Traffic Analysis Zone" or TAZ data obtained by Public Records Act request from ADOT/KABATA, with an estimated bridge completion date of 2019.

The “HDR/MSB 2035 column is taken from projections done by HDR for the adopted 2035 Mat-Su Borough Transportation Plan, and shows their forecasted population and employment projections assuming a tolled Knik Arm Bridge completed around 2019.

The 2012 and 2015 baseline data is page 33 of http://laborstats.alaska.gov/pop/projected/pub/popproj.pdf

While there are differences between the 2035 and 2040 estimate years by these different consultants, these clearly show Cardon/KABATA's overall assumptions that future employment and population growth will be skewed towards Point MacKenzie and away from existing growth areas like Knik, Big Lake, Willow and Houston

Table 5-13
T&R Estimates for Two-Lane, Two-Way KAC Project

Year	Annual Average Daily Traffic			Annual T&R		Proportion of the Base Case Gross Toll Revenue
	Passenger Cars	Commercial Vehicles	Total	Transactions	Gross Toll Revenue (3)	
2021(1) (4)	3,400	300	3,700	1,272,800	$7,190,000	100.0%
2022(2) (4)	5,300	500	5,800	1,995,200	$11,646,000	100.0%
2023(4)	7,900	700	8,600	2,958,400	$17,557,000	100.0%
2024(4)	11,300	1,000	12,300	4,231,200	$25,729,000	100.0%
2025	15,400	1,400	16,800	5,779,200	$36,154,000	100.0%
2026	16,600	1,600	18,200	6,260,800	$40,417,000	99.0%
2027	17,700	1,700	19,400	6,673,600	$44,134,000	97.8%
2028	18,900	1,800	20,700	7,120,800	$48,186,000	96.1%
2029	20,000	2,000	22,000	7,568,000	$52,797,000	96.2%
2030	21,200	2,100	23,300	8,015,200	$57,239,000	95.1%
2031	22,200	2,200	24,400	8,393,600	$61,469,000	92.3%
2032	23,300	2,400	25,700	8,840,800	$66,664,000	91.0%
2033	24,300	2,500	26,800	9,219,200	$71,207,000	88.8%
2034	25,300	2,600	27,900	9,597,600	$75,993,000	87.1%
2035	26,300	2,800	29,100	10,010,400	$81,567,000	86.1%
2036	26,900	2,900	29,800	10,251,200	$85,781,000	84.5%
2037	27,500	3,000	30,500	10,492,000	$90,111,000	83.1%
2038	28,100	3,100	31,200	10,732,800	$94,655,000	82.3%
2039	28,700	3,200	31,900	10,973,600	$99,332,000	81.1%
2040	29,300	3,300	32,600	11,214,400	$104,122,000	80.0%
2041	29,700	3,300	33,000	11,352,000	$107,855,000	79.2%
2042	30,000	3,300	33,300	11,455,200	$111,469,000	78.7%
2043	30,300	3,400	33,700	11,592,800	$115,919,000	78.5%
2044	30,600	3,400	34,000	11,696,000	$119,673,000	77.6%
2045	30,800	3,400	34,200	11,764,800	$123,278,000	76.5%
2046	31,100	3,500	34,600	11,902,400	$128,191,000	76.7%

Ramp up Schedule:

60% ramp-up factor when bridge opens in 2021; 70% ramp-up factor in 2022; 80% ramp-up factor in 2023; 90% ramp-up factor in 2024; and no further adjustments.

Land-Use Lag Factors:

64% land-use lag factor when bridge opens in 2021; 73% land-use lag factor in 2022; 82% land-use lag factor in 2023; 91% land-use lag factor in 2024; and no further adjustments.

Footnotes:

(1) Bridge assumed opened to traffic on January 1, 2021 with a passenger car toll of $5.00 per transaction and a commercial vehicle toll of $13.00 per transaction.

(2) Assumes inflationary toll rates increases at 2.5% per year beginning on January 1, 2022 for passenger cars and commercial vehicles.

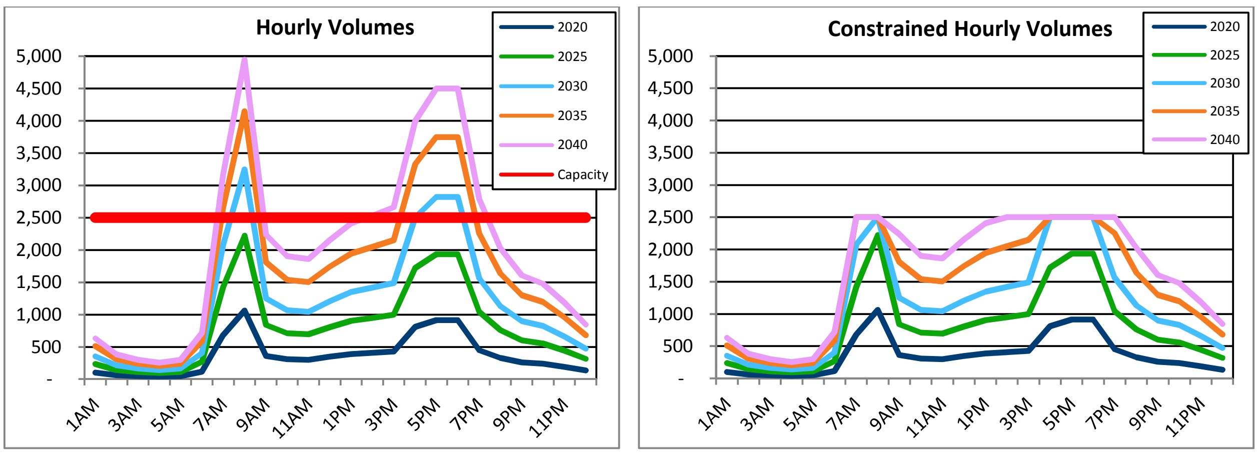
(3) Assumes the average commercial vehicle toll is 2.6 times the passenger vehicle toll.

(4) Ramp-Up and Land-Use Lag factors applied.

The process of constraining the hourly volumes resulted in a 4.6% reduction in the AWDT for 2030, a 12.7% reduction in 2035 and an 18.3% reduction in 2040. The time-of-day pattern of traffic under these conditions is quite unusual. Traffic volumes increase to the maximum flow rate early in the morning and stay at that level throughout the day.

In order to help understand how this was accomplished, hourly distributions of traffic were prepared using a combination of the period forecasts for the KAC Project and the time of day pattern of traffic counted on the Glenn Highway, shown on the left side of **Figure 5-4**. The sum of the hourly volumes under each line is the daily traffic volume. Once again, these hourly distributions were constructed so as to match the AWDT forecasts by period (AM peak, PM peak and off-peak) for the KAC Project. The hourly volumes were then constrained to a maximum hourly flow rate of 2,500 vehicles per hour, shown on the right side of Figure 5-4. The constrained daily volume is the sum of the constrained hourly volumes. This process does not allow for the natural phenomena of peak-period spreading.

Figure 5-4
Hourly Traffic Distributions



The AWDT traffic forecasts with constraints on the hourly flow rates were used in the revenue model along with the assumptions about tolling, annualization and ramp-up described at the beginning of this chapter. The results are shown in **Table 5-13**. The first model year with any noticeable impact is 2030, but because of interpolation the T&R estimates start to decline in 2026. In 2040, the T&R estimates for the two-lane, two-way KAC Project are 23.3% lower than the estimates for the four-lane KAC Project. When the KAC is open and T&R reach the levels reported in these outer years, ADOT&PF intends to complete Phase II, i.e., construct the two additional lanes.

This page shows the "truncation" of the hourly traffic flow rates assumed by CDM Smith, in an attempt to account for their predicting more daily traffic than will actually fit on a 2 lane bridge. Refer to the following pages taken from the US Federal Highway Administration 2010 Highway Capacity Manual.

The fact that actual 2008 traffic patterns measured at the 4-lane Glenn Highway Eklutna Flats measuring station showed hourly flow rates exceeding 2,500 vehicles/hour for only 2 hours out of the day, with a daily rate of ~30,000 AADT versus the 8+ hours capped at 2,500 vehicles/hour shown here, indicates just how "*unusual*" CDM Smith's hourly rates are.

The fact that those 30,000 annual average daily traffic rates on the Glenn Highway are measured on a 4-lane highway, versus CDM Smith/KABATA's estimate of 34,600 AADT on a 2-lane bridge emphasizes, again, just how "*unusual*" CDM Smith's Traffic and Revenue forecasts are.

This page is from ADOT/KABATA's Traffic & Revenue Forecast available at http://knikarmbridge.com/wp-content/uploads/2015/06/Comprehensive-TR-Study-for-the-Knik-Arm-Crossing-Project-September-30-2015-No-Appendices-Compressed-v.4.pdf

- Level terrain, and
- No impediments to through traffic (e.g., traffic signals, turning vehicles).

Traffic can operate ideally only if lanes and shoulders are wide enough not to constrain speeds. Lanes narrower than 12 ft and shoulders narrower than 6 ft have been shown to reduce speeds, and they may increase percent time-spent-following (PTSF) as well.

The length and frequency of no-passing zones are a result of the roadway alignment. No-passing zones may be marked by barrier centerlines in one or both directions, but any segment with a passing sight distance of less than 1,000 ft should also be considered to be a no-passing zone.

On a two-lane highway, passing in the opposing lane of flow may be necessary. It is the only way to fill gaps forming in front of slow-moving vehicles in the traffic stream. Restrictions on the ability to pass significantly increase the rate at which platoons form in the traffic stream, since motorists are unable to pass slower vehicles in front of them.

Basic Relationships

Exhibit 15-2 shows the relationships among flow rate, average travel speed (ATS), and PTSF for an extended directional segment of two-lane highway under base conditions. While the two directions of flow interact on a two-lane highway (because of passing maneuvers), the methodology of this chapter analyzes each direction separately.

Exhibit 15-2(b) illustrates a critical characteristic that affects two-lane highways. Low directional volumes create high values of PTSF. With only 800 pc/h, PTSF ranges from 60% (with 200 pc/h opposing flow) to almost 80% (with 1,600 pc/h opposing flow).

In multilane uninterrupted flow, typically acceptable speeds can be maintained at relatively high proportions of capacity. On two-lane highways, service quality (as measured by PTSF) begins to deteriorate at relatively low demand flows.

Personal Cars per hour, not including commercial vehicles, which ADOT/KABATA predicts to be over 10% of the traffic

CAPACITY AND LOS

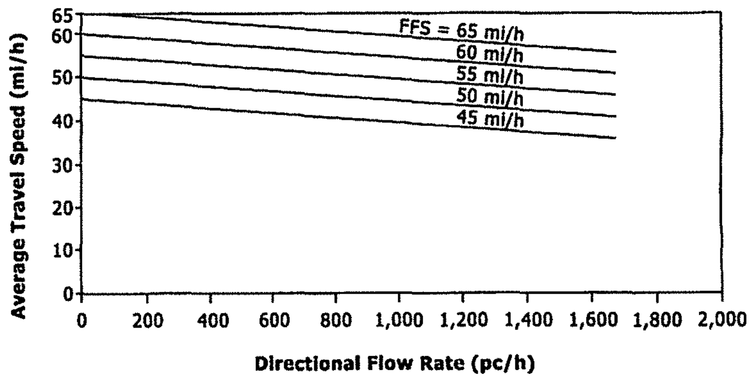
Capacity

The capacity of a two-lane highway under base conditions is 1,700 pc/h in one direction, with a limit of 3,200 pc/h for the total of the two directions. Because of the interactions between directional flows, when a capacity of 1,700 pc/h is reached in one direction, the maximum opposing flow would be limited to 1,500 pc/h.

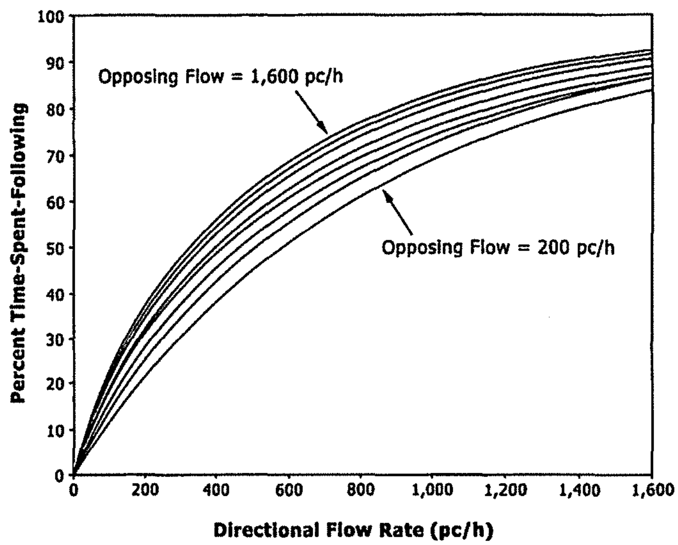
Capacity of a two-lane highway under base conditions is 1,700 pc/h in one direction, with a maximum of 3,200 pc/h in the two directions.

Capacity conditions, however, are rarely observed—except in short segments. Because service quality deteriorates at relatively low demand flow rates, most two-lane highways are upgraded before demand approaches capacity.

Exhibit 15-2
Speed–Flow and PTSF Relationships for Directional Segments with Base Conditions



(a) ATS Versus Directional Flow Rate



(b) PTSF Versus Directional Flow Rate

Capacity is important for evacuation and special event planning.

However, estimation of capacity conditions is important for evacuation planning, special event planning, and evaluation of the downstream impacts of incident bottlenecks once cleared.

Two-way flow rates as high as 3,400 pc/h can be observed for short segments fed by high demands from multiple or multilane facilities. This may occur at tunnels or bridges, for example, but such flow rates cannot be expected over extended segments.

Capacity is not defined for bicycles on two-lane highways because of lack of data. Bicycle volumes approaching capacity do not often occur on two-lane highways except during special bicycle events, and little information is available on which to base a definition.

Levels of Service

Automobile Mode

Because of the wide range of situations in which two-lane highways are found, three measures of effectiveness are incorporated into the methodology of this chapter to determine automobile LOS.

1. *ATS* reflects mobility on a two-lane highway. It is defined as the highway segment length divided by the average travel time taken by vehicles to traverse it during a designated time interval.
2. *PTSF* represents the freedom to maneuver and the comfort and convenience of travel. It is the average percentage of time that vehicles must travel in platoons behind slower vehicles due to the inability to pass. Because this characteristic is difficult to measure in the field, a surrogate measure is the percentage of vehicles traveling at headways of less than 3.0 s at a representative location within the highway segment. PTSF also represents the approximate percentage of vehicles traveling in platoons.
3. *Percent of free-flow speed* (*PFFS*) represents the ability of vehicles to travel at or near the posted speed limit.

On Class I two-lane highways, speed and delay due to passing restrictions are both important to motorists. Therefore, on these highways, LOS is defined in terms of both ATS and PTSF. On Class II highways, travel speed is not a significant issue to drivers. Therefore, on these highways, LOS is defined in terms of PTSF only. On Class III highways, high speeds are not expected. Because the length of Class III segments is generally limited, passing restrictions are also not a major concern. In these cases, drivers would like to make steady progress at or near the speed limit. Therefore, on these highways, PFFS is used to define LOS. The LOS criteria for two-lane highways are shown in Exhibit 15-3.

Exhibit 15-3
Automobile LOS for Two-Lane Highways

LOS	Class I Highways		Class II Highways	Class III Highways
	ATS (mi/h)	PTSF (%)	PTSF (%)	PFFS (%)
A	>55	≤35	≤40	>91.7
B	>50–55	>35–50	>40–55	>83.3–91.7
C	>45–50	>50–65	>55–70	>75.0–83.3
D	>40–45	>65–80	>70–85	>66.7–75.0
E	≤40	>80	>85	≤66.7

Because driver expectations and operating characteristics on the three categories of two-lane highways are quite different, it is difficult to provide a single definition of operating conditions at each LOS.

Two characteristics, however, have a significant impact on actual operations and driver perceptions of service:

- *Passing capacity*: Since passing maneuvers on two-lane highways are made in the opposing direction of flow, the ability to pass is limited by the opposing flow rate and by the distribution of gaps in the opposing flow.
- *Passing demand*: As platooning and PTSF increase in a given direction, the demand for passing maneuvers increases. As more drivers are caught in a

platoon behind a slow-moving vehicle, they will desire to make more passing maneuvers.

Both passing capacity and passing demand are related to flow rates. If flow in both directions increases, a difficult trend is established: as passing demand increases, passing capacity decreases.

At LOS A, motorists experience high operating speeds on Class I highways and little difficulty in passing. Platoons of three or more vehicles are rare. On Class II highways, speed would be controlled primarily by roadway conditions. A small amount of platooning would be expected. On Class III highways, drivers should be able to maintain operating speeds close or equal to the free-flow speed (FFS) of the facility.

At LOS B, passing demand and passing capacity are balanced. On both Class I and Class II highways, the degree of platooning becomes noticeable. Some speed reductions are present on Class I highways. On Class III highways, it becomes difficult to maintain FFS operation, but the speed reduction is still relatively small.

At LOS C, most vehicles are traveling in platoons. Speeds are noticeably curtailed on all three classes of highway.

At LOS D, platooning increases significantly. Passing demand is high on both Class I and II facilities, but passing capacity approaches zero. A high percentage vehicles are now traveling in platoons, and PTSF is quite noticeable. On Class III highways, the fall-off from FFS is now significant.

At LOS E, demand is approaching capacity. Passing on Class I and II highways is virtually impossible, and PTSF is more than 80%. Speeds are seriously curtailed. On Class III highways, speed is less than two-thirds the FFS. The lower limit of this LOS represents capacity.

LOS F exists whenever demand flow in one or both directions exceeds the capacity of the segment. Operating conditions are unstable, and heavy congestion exists on all classes of two-lane highway.

Bicycle Mode

Bicycle LOS is based on a traveler-perception model.

Bicycle levels of service for two-lane highway segments are based on a bicycle LOS (BLOS) score, which is in turn based on a traveler-perception model. This score is based, in order of importance, on five variables:

- Average effective width of the outside through lane,
- Motorized vehicle volumes,
- Motorized vehicle speeds,
- Heavy vehicle (truck) volumes, and
- Pavement condition.

The LOS ranges for bicycles on two-lane highways are given in Exhibit 15-4. The same LOS score is used for multilane highways, as described in Chapter 14.