Passenger and freight movements occur continually throughout Maine and the nation in an increasingly competitive global economy. The efficiency and safety of these movements is critical to Maine's vitality. This section's focus is on the performance of Maine's transportation system.

4.1 Highway Use

Measurements of the use of the highway system are an indication of the demands that are being placed on the system by its users, people who need to travel or move goods across the state. The following describes some key measures of highway use.

4.1.1 Annual Average Daily Traffic

The most basic measure of the use of a highway is Annual Average Daily Traffic (AADT) the total number of vehicles that pass a location on a roadway in one year, divided by 365. Estimates of AADT are used in the planning, design, and management of highway facilities. AADT is the measure used to track historic traffic growth and forecast future traffic growth at specific locations on the highway system. AADT is an important component of the measurements of highway safety and mobility performance. Existing and forecasted AADT also helps determine appropriate design standards for highways and bridges.

The statewide map in Figure 4.1.1 shows the relative AADT volumes on the arterial highways in Maine. Most of the higher volume arterials are in the southern half of the state. Interstate 95 and other arterials across the state are the backbone of Maine's highway network.

While AADT represents an annual average, daily traffic varies seasonally throughout the year. Figure 4.1.2 shows how traffic levels change from month to month for three types of highways. Each of the three patterns shows higher traffic volumes in the summer months and lower volumes in the winter months. The strongest pattern change is shown for highways with recreational traffic heavily affected by the summer peak in tourism. The most uniform pattern exists in urban locations and many suburban areas, which are dominated by commuting and other local traffic. The intermediate pattern change is typical of many rural arterial highways, which have a balanced mix of tourism and year-round traffic.

Figure 4.1.1. Arterial AADT

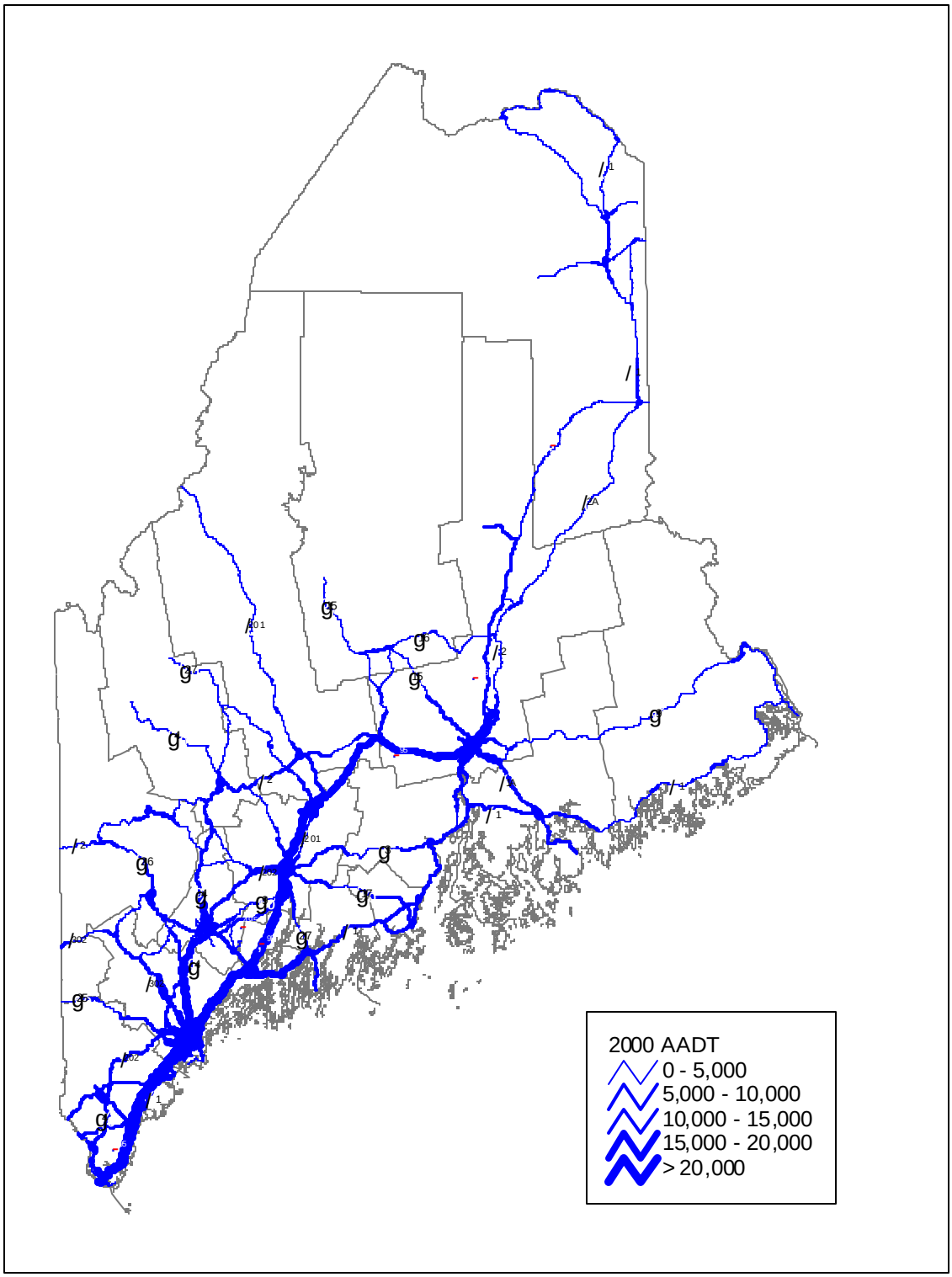
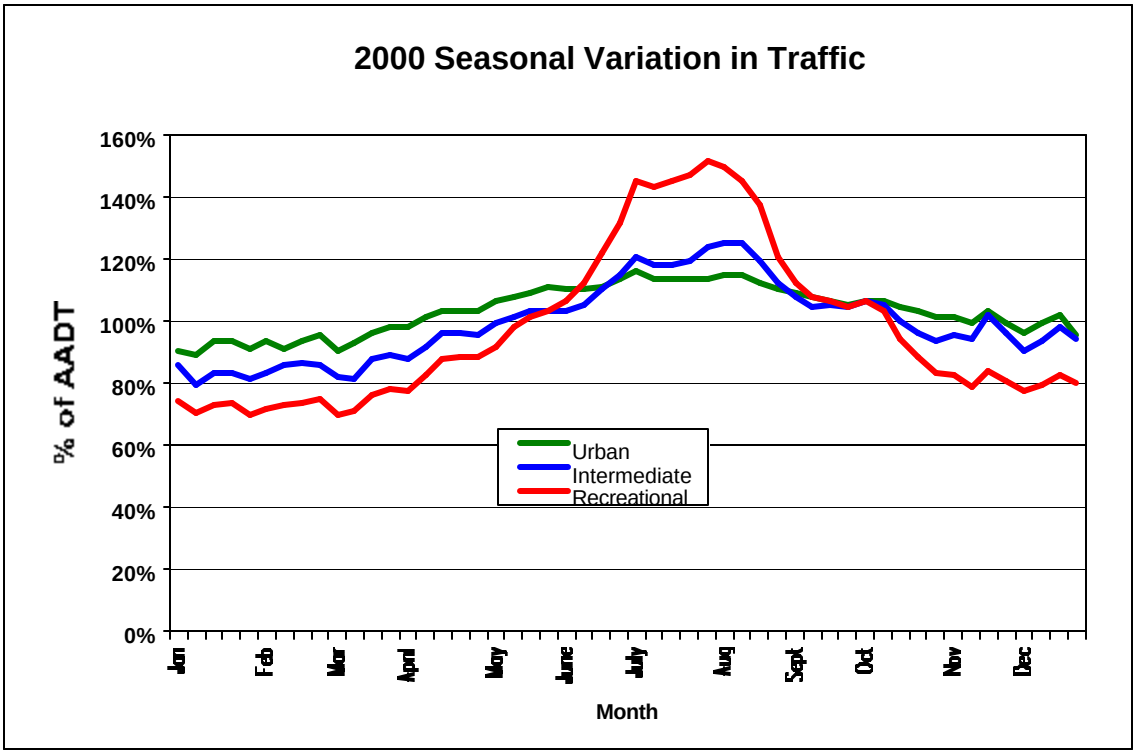


Figure 4.1.2



4.1.2 Vehicle-Miles Traveled

Vehicle-Miles Traveled (VMT) is the principal measure of the overall use of the highway system or significant portions of the system. In year 2000, statewide VMT was approximately 14 billion vehicle-miles. As an overall measure of use of the highway system, VMT is useful in tracking growth in highway travel, which affects overall system condition, performance, fuel use and air quality.

The chart in Figure 4.1.3 shows that VMT has been growing steadily statewide through the years. Continued growth in VMT is expected in the foreseeable future.

A further breakdown of statewide VMT in 2000 is shown in Table 4.1.1. Light vehicles, which include passenger cars, light trucks, and motorcycles, account for more than 90% of all vehicles on the highway system. Rural areas account for about 74% of all vehicle miles. The highest percentage of heavy trucks can be found on the rural Interstate system, where single-unit trucks and tractor-trailers comprise 13% of the total VMT.

Figure 4.1.3. Trends in Statewide VMT

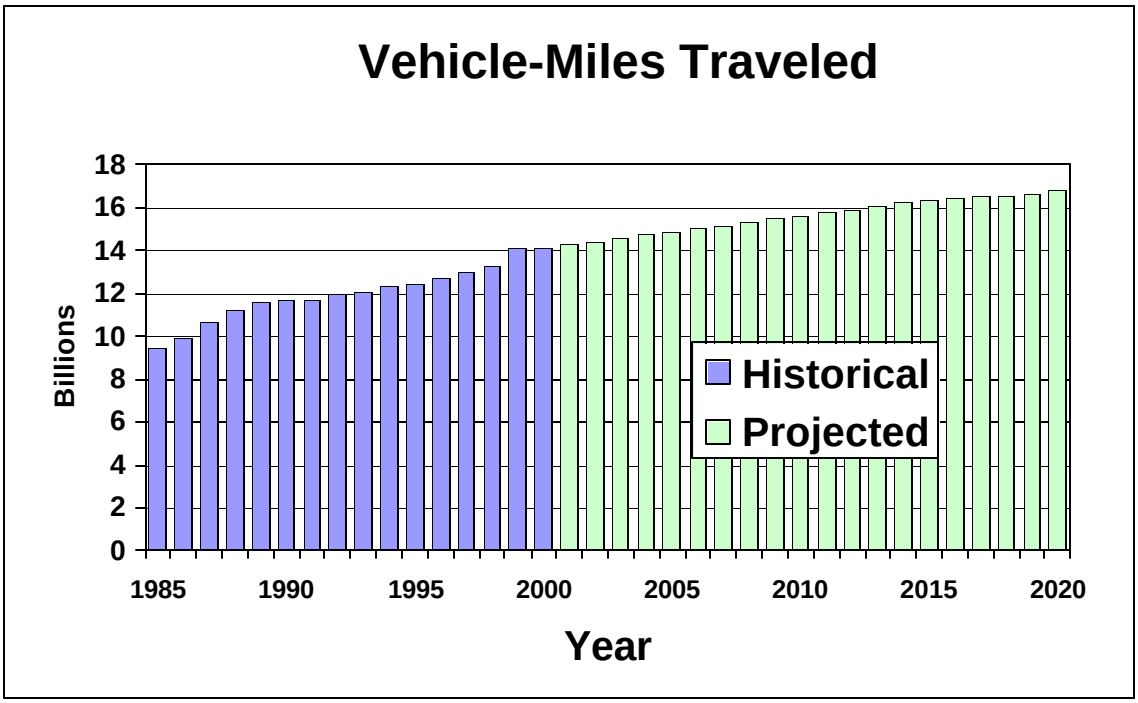


Table 4.1.1 2000 VMT by Vehicle Type and Federal Functional Class

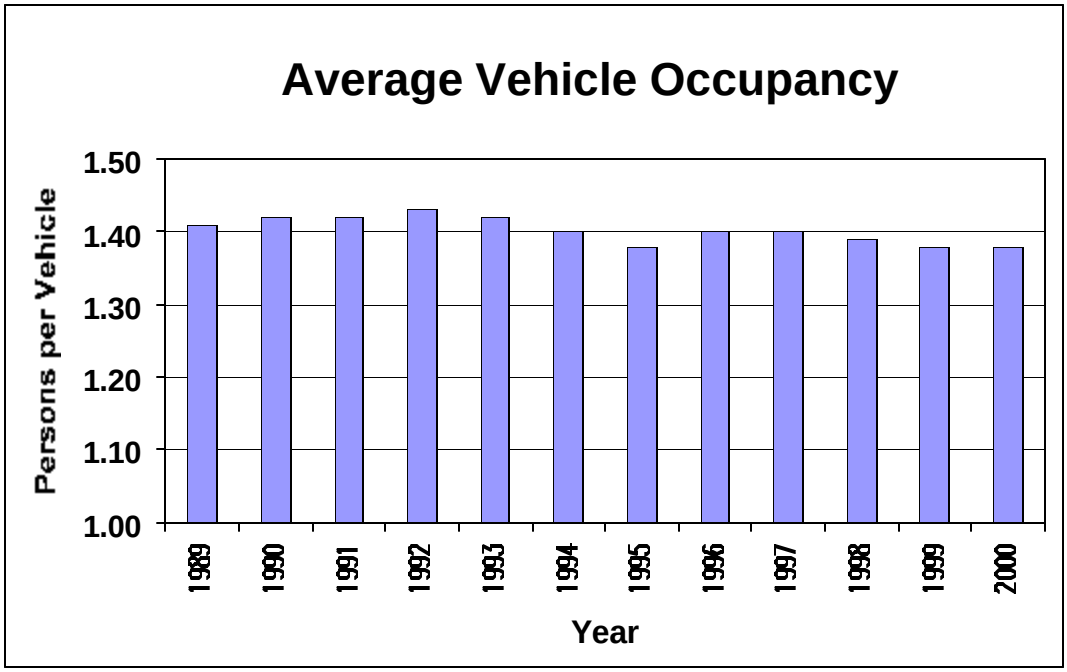
Area Type	Federal Functional Class	Light Vehicle	Single Unit Truck	Tractor-Trailer	VMT (billion)	Percent of Grand Total
Urban	Interstate	92%	1%	7%	0.6	4%
	Other Freeway & Expressway	98%	1%	1%	0.2	1%
	Other Principal Arterial	96%	2%	3%	1.0	7%
	Minor Arterial	97%	1%	2%	0.9	7%
	Collector	97%	2%	1%	0.7	5%
	Local	96%	4%	0%	0.3	2%
	Total Urban	96%	2%	3%	3.7	26%
Rural	Interstate	86%	4%	9%	2.3	16%
	Other Principal Arterial	95%	1%	4%	1.9	13%
	Minor Arterial	94%	2%	4%	1.9	13%
	Major Collector	96%	2%	2%	2.4	17%
	Minor Collector	93%	5%	2%	0.8	6%
	Local	94%	6%	0%	1.2	8%
	Total Rural	93%	3%	4%	10.5	74%
Grand Total		93%	3%	4%	14.2	100%

4.1.3 Average Vehicle Occupancy

Average Vehicle Occupancy (AVO) is the average number of occupants (driver and passengers) in vehicles on the highway. This indicator is used to convert vehicle-based measures, such as VMT, to person-based measures, such as person-miles traveled (PMT). AVO is estimated from data compiled in thousands of crash records each year. This method has proven to be a reliable source of AVO information for highway traffic overall.

The trend shown in Figure 4.1.4 indicates that the statewide AVO has been slowly decreasing. This slow decrease may be the result of dispersed patterns of land development, reduced household size, reduced carpooling, and increased levels of auto ownership.

Figure 4.1.4

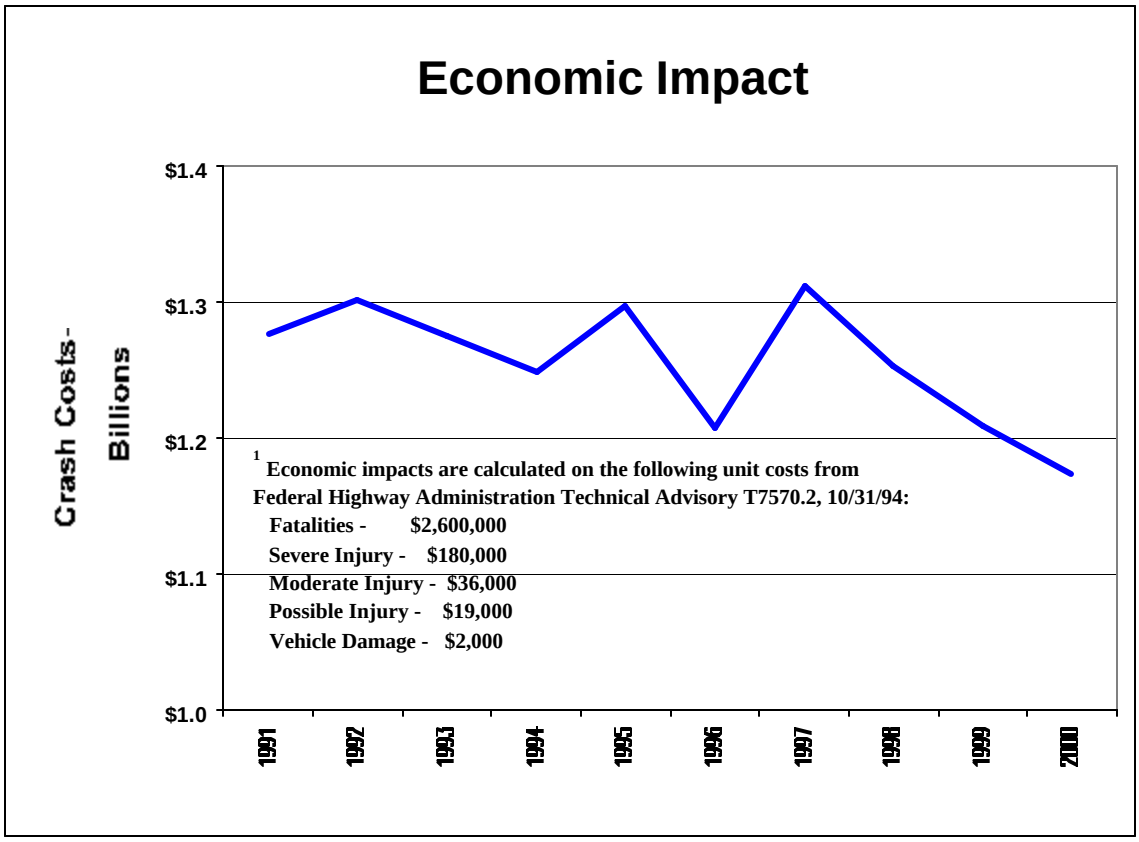


4.2 Safety Performance

Motor vehicle crashes in Maine result in significant economic and societal impacts. While these impacts are generally on the decline, they are still very significant. For instance, the economic impact of crashes occurring on public roads in Maine in 2000 was nearly $1.2 billion (see Figure 4.2.1). This represents about a 7% reduction in economic impact over the past 10 years and can be attributed to safer roads and safer vehicles. The toll taken on families and friends who have lost loved ones is immeasurable, however.

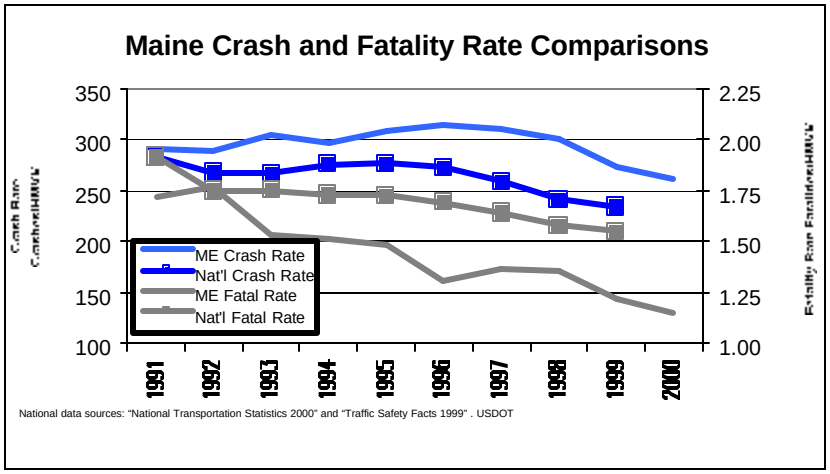
According to Maine law, a police report must be filed whenever a collision results in combined damage of $1,000, bodily injury or death. Prior to 1999, the minimum reportable damage was $500. MaineDOT maintains a database for all police-reported crashes that have occurred on all public roads from 1989 to the present. For the purposes of this report, crash data is presented for the 10-year period of 1991 through 2000. Generally speaking, highway safety performance is improving; however, there remain several significant issues and concerns that need attention.

Figure 4.2.1



4.2.1 National Comparisons

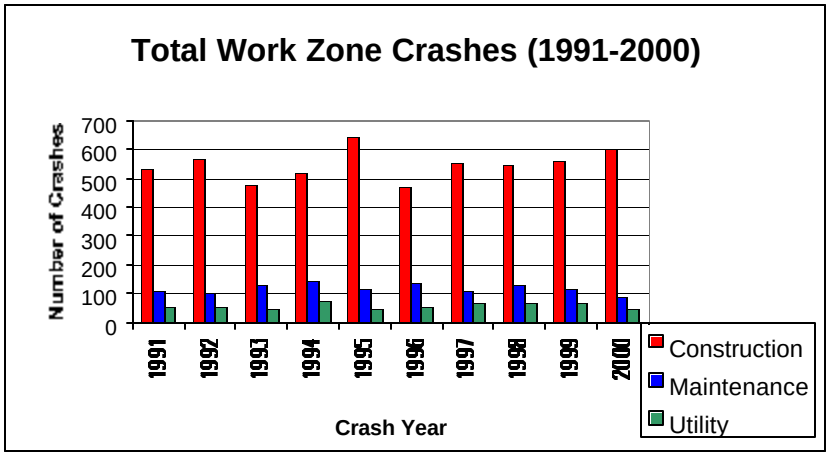
Figure 4.2.2



Maine's crash rate, expressed as the number of crashes per hundred million vehicle miles traveled (HMVM) was 17% higher than the national average in 1999. Maine's crash rate dropped about 8% from 1991 to 1999, while the change nationally was a decrease of more than 17%, (see Figure 4.2.2). The slower reduction in overall crash rate may be due to Maine's rural nature and winter weather conditions. Rural and urban crash rates are discussed in section 4.2.2.

Though Maine experiences a crash rate well above the national average, its fatality rate is now significantly lower than the national average. The fatality rate on Maine public roads has dropped 1.5 times faster than the national average for the period 1991 through 1999. Maine's fatality rate has dropped a significant 33% over the past ten years, down to a rate of 1.15 fatalities per HMVM in 2000. In 1998, Maine had the 15th lowest fatality rate in the nation (Source: Traffic Safety Facts 1998, National Highway Traffic Safety Administration).

Figure 4.2.3



Maine ranks high nationally in two areas—fatality rates in work zones and crashes involving utility poles. More than 7,200 crashes and 25 deaths occurred in Maine work zones from 1991 through 2000. Work zones are road or roadside areas where construction, maintenance or utility work is being conducted. Workers in these areas are particularly vulnerable, but serious driver injuries occur in these areas as well. The changing road and traffic conditions in work zones

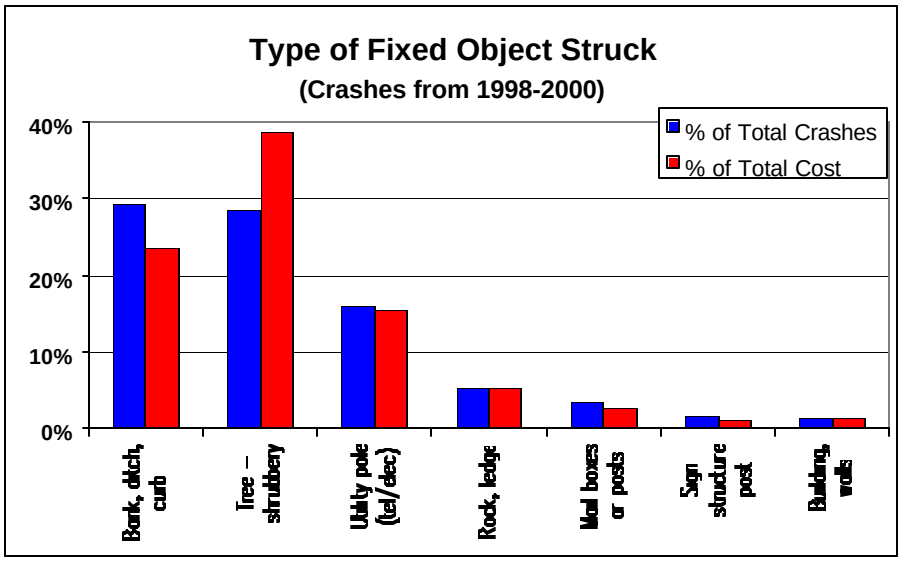
require full driver attention and reduced speed. Excessive speed and driver distraction/inattention are the leading contributing factors to crashes in work zones.

Currently, Maine ranks eighth nationally in the fatality rate involving utility poles. This high rate is partially due to many of the state roads being rural 2 lane highways, where run off road crashes are common and often result in striking a fixed object.

Fixed objects including utility poles near roadsides present a serious hazard to vehicles involved in Run Off Road crashes. Figure 4.2.4 below summarizes the top types of objects struck. Even though Maine ranks high nationally for its fatality rate involving utility poles, crashes involving other objects such as embankments, ditches and trees result in significantly greater economic impacts. The number of crashes involving utility poles has stayed relatively constant over the 10-year period but fatalities have decreased, while vehicle miles traveled have increased. MaineDOT has completed a utility pole crash study that contributed to the development of a revised utility pole location policy. This policy includes standards regarding the elimination of multiple pole lines within the highway corridor and defines standard pole offsets based on the roadway classification. As MaineDOT undertakes transportation projects, utility pole locations are reviewed with respect to the revised policy. To further evaluate location and corridor utility pole crash problems, maps can now be generated for utility companies to identify where utility pole relocations are needed most. MaineDOT has stepped up its program to improve pole location offsets, making improvements on more miles of highway each year.

Another fixed object concern is rigid guardrail ends. A guardrail improvement program is underway to help minimize the crash severity of vehicles that strike guardrail ends.

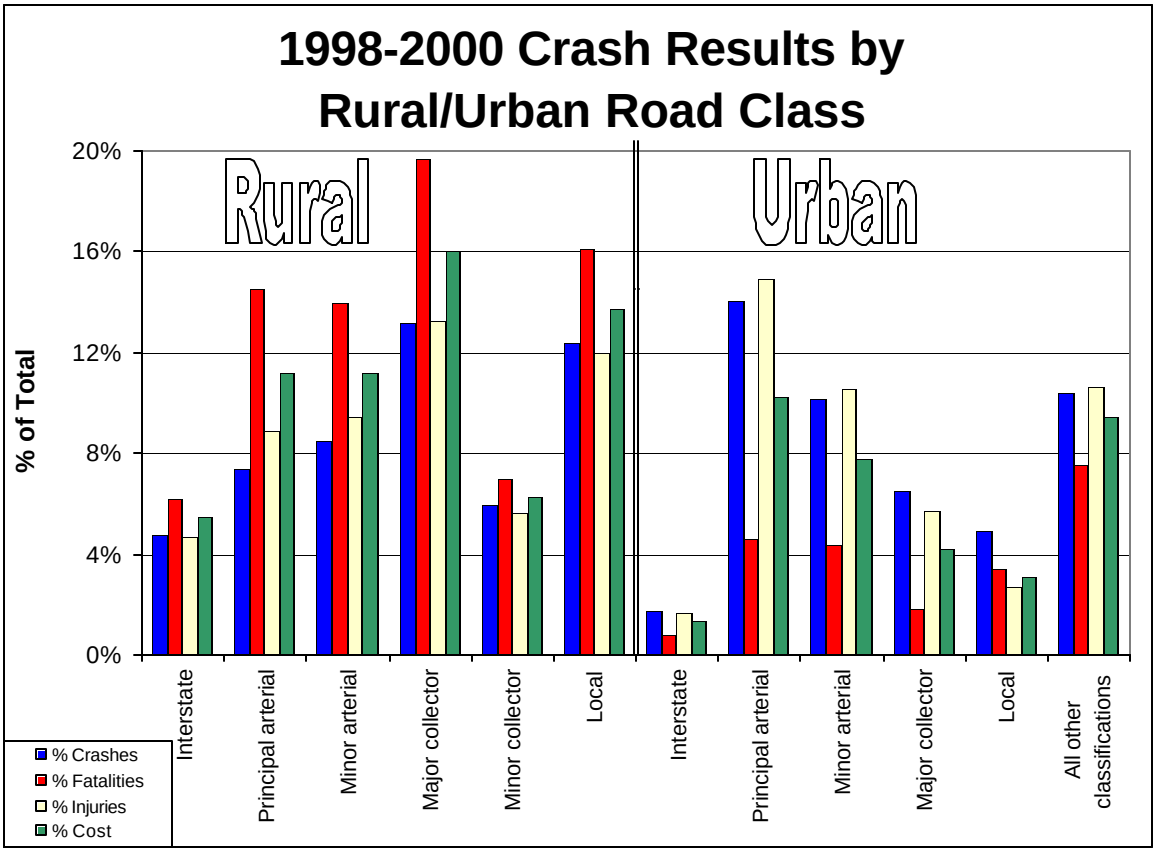
Figure 4.2.4



4.2.2 Urban-Rural Safety Trends

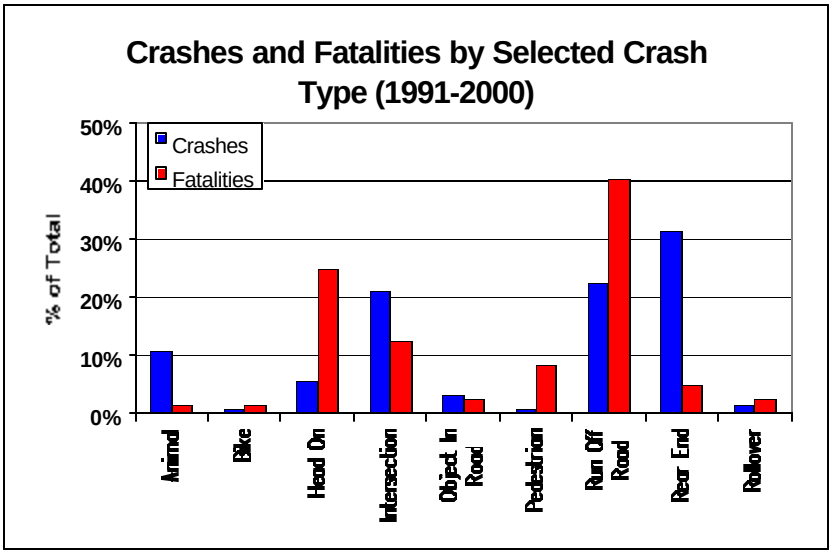
Maine is a rural state, and this is reflected in the generally higher number of crashes and their human toll on rural roads, as illustrated in Figure 4.2.5. While the percentage of crashes occurring on rural versus urban roads varies for road classification with no clear pattern, the percentage of fatalities and total economic losses are significantly greater in rural settings for any given road class. The leading rural fatal crash types on non-interstate highways are Head On and Run Off Road. Unsafe speed is a contributing factor in more than half of rural Run Off Road fatal crashes. MaineDOT will soon undertake a new initiative to identify methods to address Run Off Road and Head On Crashes on rural roads. Plans include education through MaineDOT's public awareness campaign, identifying and piloting techniques and technologies that would best improve road safety, and implementing updated design guidelines provided in MaineDOT's updated State Standards Highway Design Guide.

Figure 4.2.5



4.2.3 General Crash Trends

Figure 4.2.6

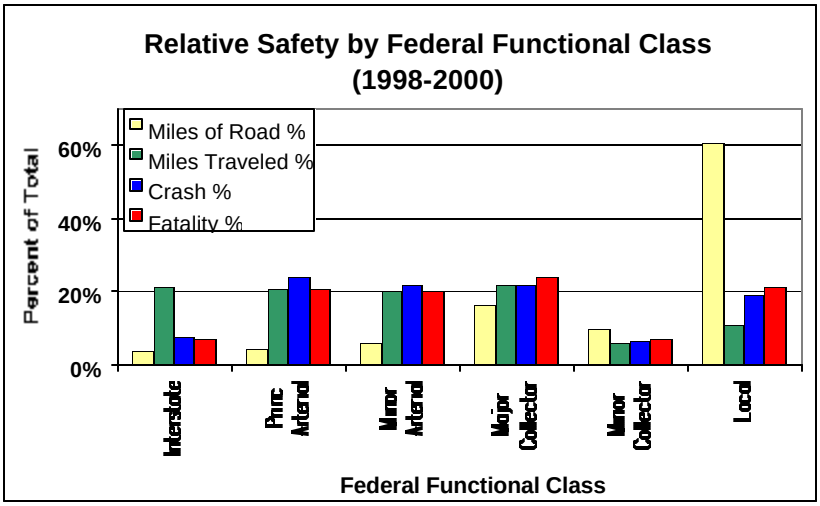


Crash and fatality data for the most severe crash types for the period 1991-2000 period are shown in Figure 4.2.6. Rural and urban crash type trends differ. Not surprisingly, Run Off Road crashes are the most prevalent in rural areas, while Rear End and Intersection crashes are most common in urban locations. Rear End crashes account for more than 30% of all crashes and are the most prevalent crash type on Maine's public roads. However, they tend to be much less severe than Run Off Road crashes, which account for more than 40% of all fatalities in Maine. Head On crashes represent just 4% of total crashes, but account for over 25% of all fatalities. Head On crashes tend to be more severe than other crash types due to the combined forces of the opposing vehicles. As stated in the prior report section, MaineDOT is undertaking efforts to reduce the number and severity of Run Off Road and Head On crashes.

4.2.4 Relative Safety by Federal Functional Road Classification

Interstate roads are the safest roads in Maine, as is illustrated in Figure 4.2.7. This is primarily because the interstate system is designed to a high standard with significant clear zones along the roadside. Clear zones are roadside areas free of obstacles that also allow vehicle recovery. MaineDOT continues to improve clear zones on non-interstate roadsides to provide improved ability for vehicles to safely recover from problems. Close roadside proximity of trees, utility poles, culvert ends, embankments and stone/ledge all are evaluated in project design. Also, the interstate roads are divided with controlled access, so there are few traffic conflicts. Vehicles travel in the same direction and side friction is introduced only periodically at on and off ramps and when lane change maneuvers occur.

Figure 4.2.7



Non-interstate principal arterials, minor arterials and major collector roads each experience about 20% of the total vehicle miles of travel, crashes and fatalities. Local roads exhibit the greatest ratio of crashes and fatalities per mile driven for both urban & rural road classes. This is likely due to the additional traffic conflicts caused by stopping vehicles, turning traffic and lower design standards(local roads are not designed to the standards as state roads). Local roads account for approximately 60% of the total public road mileage in Maine but only 10% of the vehicle miles traveled.

4.2.5 Safety Impacts of Posted Speed Limit

In general, roads having higher posted speed limits are built to higher design standards and have fewer driveways and other conflict points than roads with lower posted speeds. As the speed limit increases, crash rates on Maine roads decrease (Figure 4.2.8), but the severity of the crashes is greater at higher speeds (Figure 4.2.9) because of the greater force of impact. The estimated unit crash cost rises from less than $8,000 per crash at 25 mph speed limits to nearly $16,000 per crash at 50 mph. The fatality rate averages between 0.8 to 1.0 fatalities per Hundred Million Vehicle Miles (HMVM) at speeds lower than 45 mph, then rises to a peak of 1.8 fatalities per HMVM at 45 mph, the legal limit on most roads. The fatality rate drops to 0.4 fatalities per HMVM at 65 mph. The reduction in fatality rates at the highest speed is likely due to the higher design standards used on interstate roads.

Figure 4.2.8

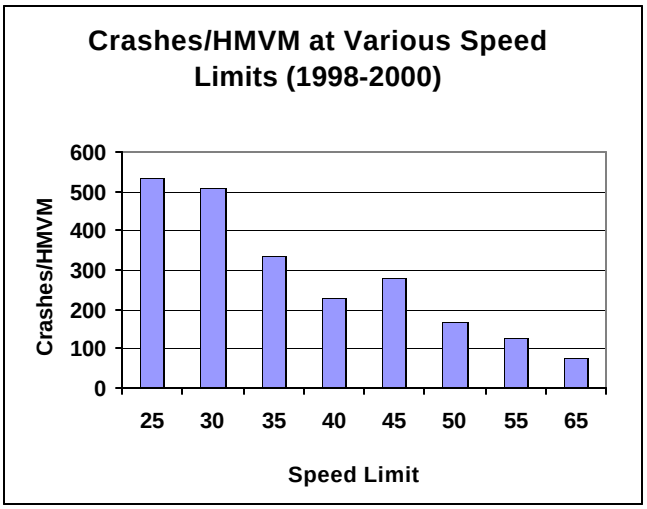
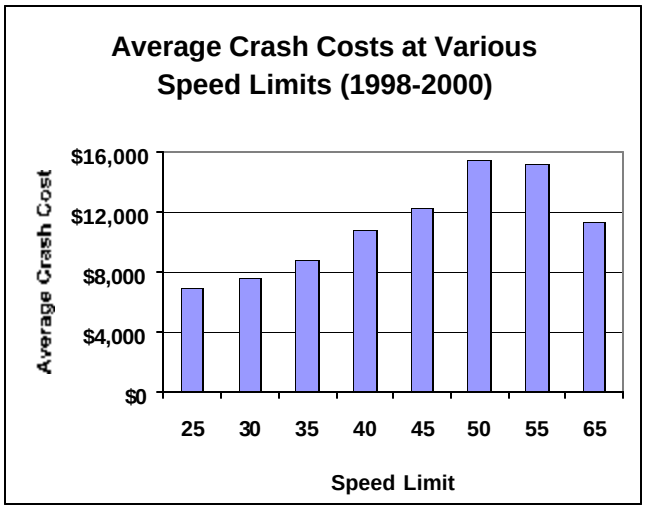


Figure 4.2.9



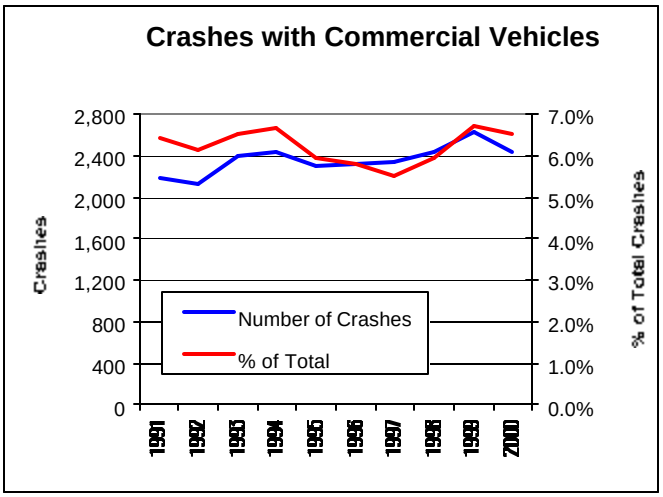
4.2.6 Primary Human Contributing Factors Affecting Safety

The primary contributing factors (human elements) for crashes in Maine are Driver Inattention (25%), Failure to Yield Right of Way (13%), Illegal or Unsafe Speed (12%) and Following Too Close (6%). While Failure to Yield may be the result of poor sight distances at intersections or difficulties for drivers to identify an upcoming intersection, the other contributing factors relate to driver attitudes. MaineDOT is undertaking a new media campaign intended to increase public awareness of the various issues affecting transportation safety in Maine. Over time, this increased public awareness should lead to changes in driver behavior and attitude, and result in improvements to transportation safety in Maine. This reflects the USDOT "4 E's" approach to highway safety—Engineering, Enforcement, Education, and Emergency Services. The Engineering aspect is automatically considered part of MaineDOT's role, but it is also involved in the other three "E's" as well. Speed enforcement is budgeted in certain highway projects due to high traffic volumes, known speeding problems or other safety factors. MaineDOT's Transportation Safety Media Campaign is aimed at Educating the public on a wide range of safety topics. MaineDOT is also involved with several interagency groups such as the Maine Transportation Safety Coalition, which includes groups/agencies involved in Emergency response, and another inter-agency group involved with identifying the medical outcomes of crashes.

4.2.7 Commercial Vehicle Safety

In 2000, there were 2,400 crashes involving commercial vehicles on Maine's public roads. This number is up from about 2,200 crashes in 1991. This represents a 10% increase over the past 10 years (Figure 4.2.10) and is primarily due to greater use of trucks in transporting America's goods. There has also been an increase in the number of crashes involving four-axle single units.

Figure 4.2.10

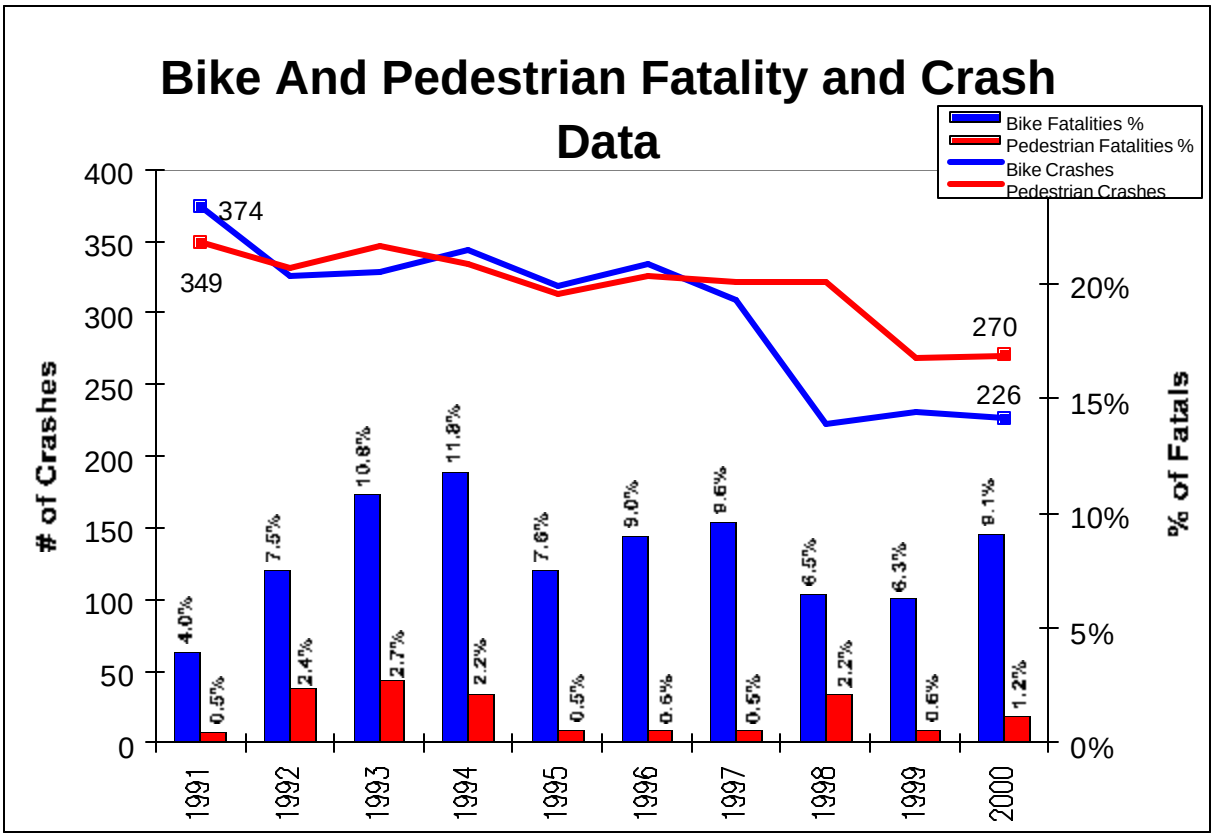


Six-axle trailers have shown the greatest increase in crash activity, most likely due to their increased use. Increased numbers of larger trucks/tractor trailers are being used primarily because they can carry additional weight. Their axle configuration actually decreases road wear. A typical six-axle vehicle carrying 100,000 pounds causes about 7% less pavement consumption than a five-axle trailer carrying 88,000 (maximum allowed for some special commodities such as concrete products, pulp wood, logs, wood chips or farm produce). (Note: Neither of the vehicles described would be allowed on Maine Interstates, but would be allowed on the Maine Turnpike.) The result of this shift to larger truck combinations is fewer vehicles can carry more product with less road degradation, and an overall decrease in truck units on the road. Although these trucks are less problematic in terms of impact to the road, safety implications are likely to arise and will require close monitoring. Commercial vehicle use is expected to grow well into the foreseeable future, though truck-to-train intermodal facilities have also increased in use.

4.2.8 Bicycle and Pedestrian Safety

Both bicycle and pedestrian crashes have decreased over the last 10 years. However, the fatality rates, expressed as a percent of total Maine traffic fatalities have fluctuated significantly for both. The decrease in crash frequency may be due to decreases in bicyclists and pedestrians rather than improvement in their safety. A new MaineDOT policy to pave road shoulders and a new policy currently under consideration for sidewalks may help turn the trend to increase bicycle and pedestrian uses of the public road system.

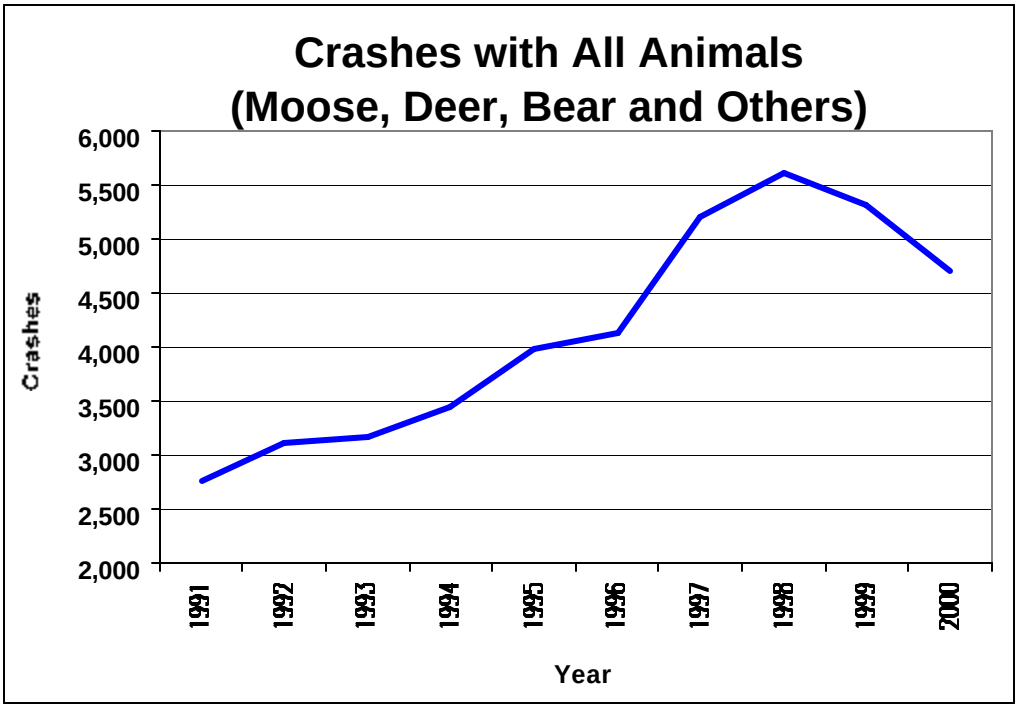
Figure 4.2.11



4.2.9 Crashes with Animals

Collisions with animals increased dramatically from 1991 through 2000, from 2,767 such incidents in 1991 to a high of 5,605 in 1998. The number of crashes involving animals has been on the decline since then. A number of factors may be affecting the increase in crashes including sprawl which fragments animal's habitat and increases overall vehicle travel. MaineDOT is working with the Maine Department of Inland Fisheries and Wildlife, the Office of the Secretary of State, the Department of Public Safety, Maine State Police, Maine Turnpike Authority and others to address concerns resulting from crashes involving large animals, particularly moose. Each year, two to three people are killed in collisions with moose. To date, this working group has conducted extensive research, issued an interim report and developed a map depicting moose crash locations. Additionally, the group was successful in obtaining a Maine Outdoor Heritage Fund grant for the production of a short movie on crashes involving moose for inclusion in all driver education courses. Three public service announcements were also developed and aired on major television stations. MaineDOT intends to continue participating with the multi-agency work group and will implement test projects for promising techniques to reduce the number of crashes involving large animals.

Figure 4.2.12



4.2.10 Motorcycle Safety

For the period 1990 through 1999, Maine crashes involving motorcycles dropped about 15% (Table 4.2.1). In the same timeframe, crashes involving motorcycles on the national level dropped about 47%. Injury levels have also decreased more on the national level than in Maine. Over the same timeframe, Maine data suggests a slight reduction in fatalities, while the national fatality number has decreased by about twice that rate. It is not known at this time why national data are significantly better than for Maine. This is particularly troubling since Maine's motorcycling season is significantly shorter than most of the rest of the country. MaineDOT will conduct more analysis to better define the reason for the discrepancy between Maine and national experience.

Maine and National Motorcycle Crash Comparisons

Table 4.2.1

	Maine			National		
Year	**Fatalities**	**Injuries**	**Crashes**	**Fatalities**	**Injuries**	**Crashes**
1990	18	559	653	3,244	84,000	103,000
1991	21	541	638	2,806	80,000	106,000
1992	18	418	509	2,395	65,000	72,000
1993	9	470	539	2,449	59,000	72,000
1994	13	472	530	2,320	57,000	67,000
1995	14	280	524	2,227	57,000	63,000
1996	15	354	425	2,161	55,000	66,000
1997	9	426	448	2,116	53,000	61,000
1998	15	384	455	2,294	49,000	54,000
1999	16	425	475	2,472	50,000	57,000
2000	15	396	439			
Ten Year Trend	**-11%**	**-26%**	**-15%**	**-25%**	**-42%**	**-47%**

4.2.11 Highway Railroad Grade Crossings

There are currently 628 active railroad grade crossings at public roads in Maine. Of these, 259 are located on arterial and collector roads, and 369 cross local roads. Active warning devices (gates, flashing lights and bells, flashing lights, and flagged) are present at 71% of the currently active crossings. (A flagged crossing is one in which the train comes to a stop prior to the crossing and railroad personnel control vehicular traffic and direct the train safely through the crossing.) Table 4.2.2 lists warning device type by road classification. There are no passive warning devices on arterial roads and only 10 passive warning devices remain on collector roads. Nationally, 21% of the crossings have gates (compared to Maine's 12%) and 19% have only bells or lights (compared to Maine's 54%).

Table 4.2.2

Type of Crossing Protection Provided							
	Number of Active Railroad Crossings	Active Protection			Passive Protection		
Fed functional class		Gates	Flashing Lights or Flashing Lights & Bells	Flagged	Cross-bucks	Stop Signs	None
Other principal arterial	30	12	15	3	-	-	-
Minor arterial	49	15	33	1	-	-	-
Major collector	132	25	94	7	6	-	-
Minor collector	48	1	42	1	4	-	-
Local	362	25	155	16	163	2	1
Seasonal, Other	7	-	2	-	4	-	1
Total	**628**	**78**	**341**	**28**	**177**	**2**	**2**

Partially due to the relatively low volume of railroad activity, Maine at-grade railroad crossings have an excellent safety record. As can be seen in Table 4.2.3, only a handful of vehicle-train crashes occur annually at Maine's public at-grade crossings, and there have been no fatalities as a result of this type of crash since 1992.

Table 4.2.3

Year	Number of Crashes at Railroad Crossings	Fatalities	Incapacitating Injuries	Evident Injuries	Possible Injuries
1991	15	1	0	3	3
1992	8	1	0	0	3
1993	6	0	0	1	1
1994	6	0	1	1	1
1995	8	0	0	3	2
1996	6	0	0	0	2
1997	12	0	1	2	3
1998	8	0	1	1	1
1999	5	0	1	2	0
2000	5	0	0	2	0
Total	**79**	**2**	**4**	**15**	**16**

With the advent of higher speed passenger rail service in December of 2001 (Amtrak Boston to Portland), the safety of grade crossings may be reduced due to increased train speeds, additional train movements, driver risk-taking and rail trespassing. All 17 public grade crossings along the Amtrak line have been outfitted with gates and lights. Because freight rail shares the same tracks, all of the warning devices on the Amtrak line provide consistent warning times by monitoring train speed. Traffic signals are pre-empted with the railroad grade

crossing warning systems where the traffic signals could cause traffic queues to encroach on the tracks. Maine Operation Lifesaver and Amtrak also have launched emergency services training and a public awareness campaign to educate first responders, schoolchildren, travelers and the general public about railroad safety. Given the exemplary safety record, MaineDOT intends to continue its recent investment rate for grade crossing safety improvements.

4.2.12 Public Awareness Initiatives

More than 80% of all police accident reports indicate some form of human error. In order to address the many and varied transportation safety issues, many of which are due to human elements, MaineDOT has expanded upon previous successful Work Zone Safety Awareness Week public awareness activities. In 2000 and 2001, MaineDOT lead the state multi-agency Work Zone Safety Awareness Week (WZSAW) campaigns in coordination with the national WZSAW emphasis. The last two year's efforts included a highly publicized Design-A-Poster contest that resulted in hundreds of entries from Maine fourth graders, a MaineDOT employee contest and a general public contest. This emphasis on protecting workers and motorists in highway work zones was again a core focus in 2002, with media attention being sought to continue to increase driver safety awareness.

Expanded media attention to work zones is not the only safety topic MaineDOT is targeting with its media campaign. Run Off Road, Head On and other crash types and causal factors lead to many highway deaths and injuries. MaineDOT has teamed up with a major television station (WGME-13) and a media consultant to assist in the development of a yearlong public awareness campaign to address these and other significant traffic safety issues. Activities have included the development of a MaineDOT safety character, Flash, who is used at various public appearances.

Flash also appears in a series of television commercials sponsored by WGME-13, MaineDOT and Lee Auto Malls. The commercials air at all times of the day. The character provides some initial shock value with his antics, which, it is hoped, will lead to memorable safety messages. WABI-TV in Bangor has also been airing the commercials since July 1, 2002. Additionally, WGME-13 broadcasts safety tips every Monday, Wednesday and Friday at 5:40 and 6:40 AM on its Daybreak News program. MaineDOT felt it was necessary to provide safety tips as part of the news rather than with public service announcements to obtain greater viewer attention and credibility. A different transportation safety topic is covered each week.

WGME-13 is also committed to running several feature news stories on various safety issues. It is hoped that this effort will generate significant media and public interest and help modify driver behavior over time.

4.3 Highway Mobility

Mobility is the ability of people and goods to move from one place to another. The arterials in the highway system provide most of the mobility in Maine. While representing only 12% of the road mileage, arterials account for more than 60% of the vehicle-miles traveled (VMT) statewide. For this reason, the performance of the arterials in serving the mobility needs of the state is an important part of the system evaluation. The following describes key indicators of highway mobility performance.

4.3.1 Posted Speed

The speed limit (posted speed) of a roadway is an important indicator of the facility's potential to provide mobility. Roads with higher posted speeds can serve the movement of people and goods more efficiently than low-speed roads.

Interstate highways, other principal arterials, and minor arterials account for more than 3,000 miles of Maine's road network. Table 4.3.1 shows the percentage breakdown of arterial mileage by posted speed. Half of Maine's arterial mileage is posted at 55 mph or higher. Two-thirds of the mileage is posted at 50 mph or higher.

Percentage of Arterial Mileage by Posted Speed

Table 4.3.1

Posted Speed (mph)	Percentage of Arterial Mileage
65	23%
60	0%
55	27%
50	18%
45	10%
40	5%
35	7%
30	3%
25	7%
Total	**100%**

Posted speeds vary by functional class and area type. Higher functional classes tend to have higher posted speeds; also, roads in rural areas generally have higher posted speeds than urban areas. Table 4.3.2 shows the average posted speed of urban and rural functional classes of arterials, weighted by mileage in each class. With posted speeds that are generally 65 mph, rural interstate highways provide

the highest level of highway mobility in Maine. At the other extreme, minor arterials in urban areas have a weighted average posted speed of about 31 mph.

Average Posted Speed by Functional Class

Table 4.3.2

Functional Class	Average Posted Speed	
	Urban	Rural
Interstate & Expressway	57.7	64.2
Other Principal Arterial	33.9	49.2
Minor Arterial	31.1	48.1

4.3.2 Utilization of Capacity

In addition to posted speed, Annual Average Daily Traffic (AADT) and hourly highway capacity (C) are important factors in the measurement of mobility. While AADT is a measure of use, C is the maximum number of vehicles that can pass by a location on a highway during a single hour. When AADT is divided by C, the AADT/C ratio measures how intensely a highway is utilized. If traffic volumes increase over time but the capacity remains the same, the AADT/C ratio also increases. As a highway facility's AADT/C ratio increases, the average speed of vehicles on that facility tends to decrease. This decrease in average speed is evidence of reduced mobility.

Table 4.3.3 shows a breakdown of arterial mileage by area type and by ranges of AADT/C, based on volume data for the year 2000. Nearly 80% of all arterial miles are in the low and very low ranges of AADT/C where the traffic-carrying capacity of the roadway is never challenged. Only about 2% of the mileage is in the high or very high ranges where capacity is routinely reached. Most urban mileage is in the low, moderate, and moderately high ranges of AADT/C. The majority of rural mileage is in the low and very low ranges.

Arterial Mileage in 2000 by AADT/C Range

Table 4.3.3

Range of AADT/C	Operates at Capacity (Typ.)	Urban Miles	Rural Miles	Total Miles	% of Arterials
Very Low (0-2)	Never	70	1307	1377	43.4%
Low (2-4)	Never	164	947	1111	35.0%
Moderate (4-6)	Rarely in peak hours	166	236	403	12.7%
Moderately High (6-8)	Seasonally in peak hours	108	103	211	6.7%
High (8-10)	Routinely in peak hours	37	21	58	1.8%
Very High (> 10)	For prolonged peak periods	12	1	13	0.4%

Table 4.3.4 shows the average AADT/C ratios for urban and rural functional classes of arterials. As indicated, the arterials in urban areas are more heavily utilized than rural arterials. Among the functional classes, interstate and expressway mileage has lower utilization of capacity than other arterial classes, mainly due to their ability to carry relatively large numbers of vehicles (close to 2,000 vehicles/lane/hour). This high capacity is made possible by multiple lanes, full control of access, and a median to separate the two directions of flow. Other principal arterials, with their high transportation importance and lower capacity (often less than 1,000 vehicle/lane/hour), have the heaviest utilization of capacity.

Average AADT/C by Functional Class

Table 4.3.4

Functional Class	Average AADT/C	
	Urban	Rural
Interstate & Expressway	3.58	2.54
Other Principal Arterial	5.30	2.68
Minor Arterial	4.77	2.02

As traffic volumes increase on Maine's arterials over the next 20 years, the AADT/C ratio on most arterial mileage can be expected to increase. Table 4.3.5 shows the projected breakdown of arterial by AADT/C range in 2020 if no changes are made to the arterial network. A comparison of Table 4.3.5 with Table 4.3.3 shows the likely shift to the higher ranges of AADT/C. The amount of arterial mileage in the very high range could increase nearly fourfold, from 13 to 50 miles. Mileage in the high range could more than double, going from 58 to 128 miles. At the other end of the spectrum, mileage in the low and very low ranges could decrease by nearly 300 miles.

Arterial Mileage in 2020 by AADT/C Range

Table 4.3.5

Range of AADT/C	Operates at Capacity (Typ.)	Urban	Rural	Total	Percentage
Very Low (0-2)	Never	54	1133	1187	37.4%
Low (2-4)	Never	124	884	1008	31.8%
Moderate (4-6)	Rarely in peak hours	149	370	518	16.3%
Moderately High (6-8)	Seasonally in peak hours	124	163	287	9.0%
High (8-10)	Routinely in peak hours	72	56	128	4.0%
Very High (> 10)	For prolonged peak periods	38	11	50	1.6%

The potential increase in the utilization of arterial capacity could lead to more arterial miles being pushed to the limits of their capacity more often. These strains on capacity would lead to increased levels of traffic congestion on arterials in the future. Figures 4.3.1 and 4.3.2 show, in map form, the capacity utilization of the Maine arterial network in 2000 and the potential utilization in 2020, respectively. The increasing demands on capacity are evidenced by the spread of red and orange levels of utilization on arterials in the southern and central regions of the state, an indication that additional highway capacity will be needed in the future.

4.3.3 VHT and Delay

While vehicle-miles traveled (VMT) is an overall measure of travel on the highway system, an overall measure of the amount of time spent traveling is vehicle-hours traveled (VHT). Because time has value, evaluation of VHT allows the estimation of travel time costs and benefits.

Ideally, travel would be free flowing for all travelers. However, the presence of many travelers on our arterial network creates interference in the free flow of traffic. As a result, travel speeds decline and travel times increase. The increase in travel time caused by the interference among vehicles is called delay, which can be considered as the excess travel time due to traffic interference (congestion). Delay is an added cost to the traveler. If actions are taken to reduce delay in the highway network, these reductions in delay are considered to be mobility benefits of the actions.

The level of congestion on a highway facility or system can be measured by the proportion of total VHT represented by delay. This proportion is defined as the delay ratio. The relationships between total VHT, delay and the delay ratio are shown in Table 4.3.6, which also shows that delay expressed as VHT can be converted to delay costs expressed in dollars.

Vehicle-Hours Traveled and Delay in 2000 by Functional Class

Table 4.3.6

Area Type	Functional Class	Total VHT (millions)	% of VHT	Delay VHT (millions)	Delay Ratio	Delay Costs ($ millions)	% of Delay
Urban	Interstate & Expressway	11.2	5%	0.7	0.06	7	2%
	Other Principal Arterial	37.0	17%	11.9	0.32	119	33%
	Minor Arterial	38.6	18%	12.7	0.33	127	35%
Rural	Interstate & Expressway	38.1	18%	1.0	0.03	10	3%
	Other Principal Arterial	43.9	21%	5.5	0.13	55	15%
	Minor Arterial	43.1	20%	4.7	0.11	47	13%
Combined		**212.0**	**100%**	**36.6**	**0.17**	**366**	**100%**

Figure 4.3.1 AADT/C on Arterials in 2000

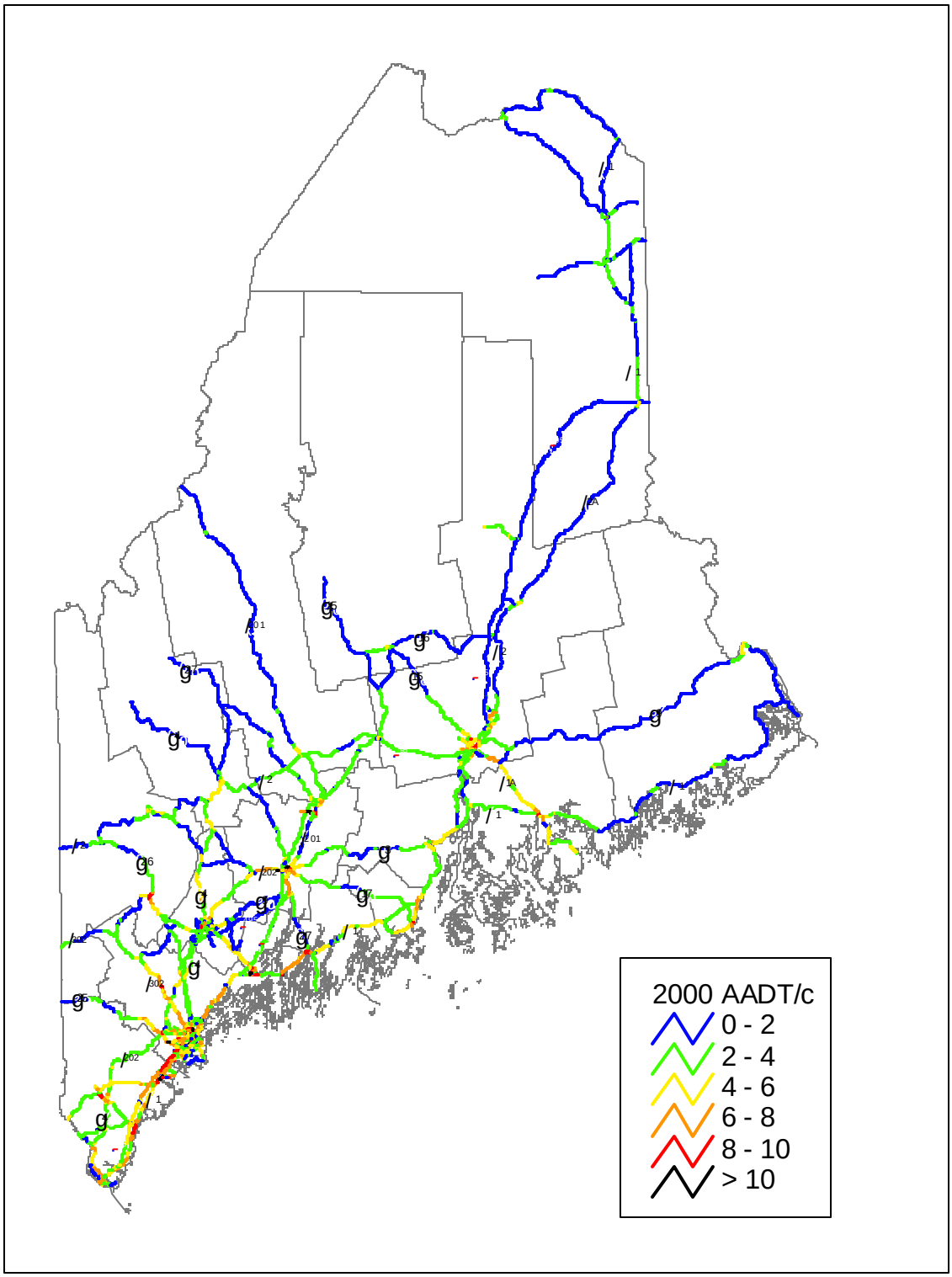
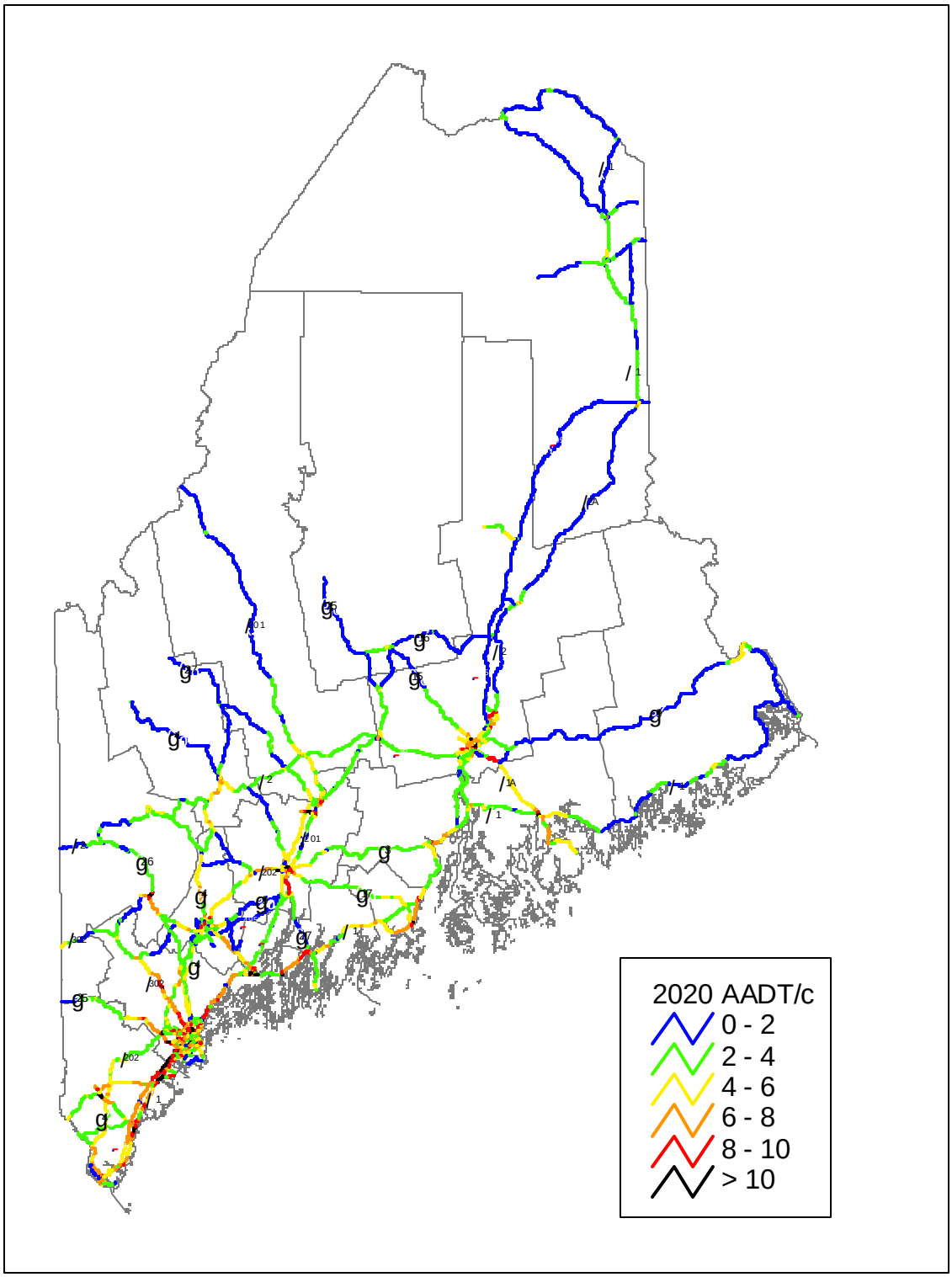


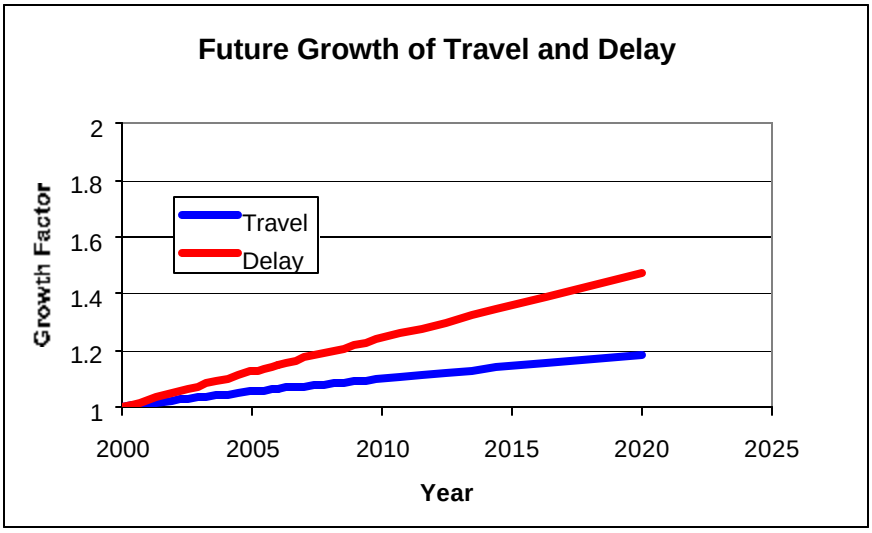
Figure 4.3.2 AADT/C on Arterials in 2020



Overall, it is estimated that delay on Maine's arterials in 2000 exceeded 36 million vehicle-hours, with delay costs of more than $360 million dollars. Although rural arterials have more VHT, most of the delay occurs on urban non-Interstate arterials where capacity is limited, traffic volumes are high, and land use access is generally uncontrolled.

Figure 4.3.3. shows the effect of future travel growth on delay on the existing arterial network (with no mobility improvements). The chart shows that growth in delay, measured in VHT, would more than double the growth in travel, measured in vehicle-miles traveled (VMT). When the growth of delay exceeds the growth in travel, the travelers will experience higher levels of congestion and reduced travel efficiency.

Figure 4.3.3



To moderate the growth of delay, actions must be taken to reduce VMT growth, improve control of access on arterials, and/or increase future capacity in the arterial network. If these actions are successful in holding the growth in delay to the same rate as the growth in travel, then current levels of congestion and mobility can be maintained.

4.4 Use of Passenger Transportation Modes

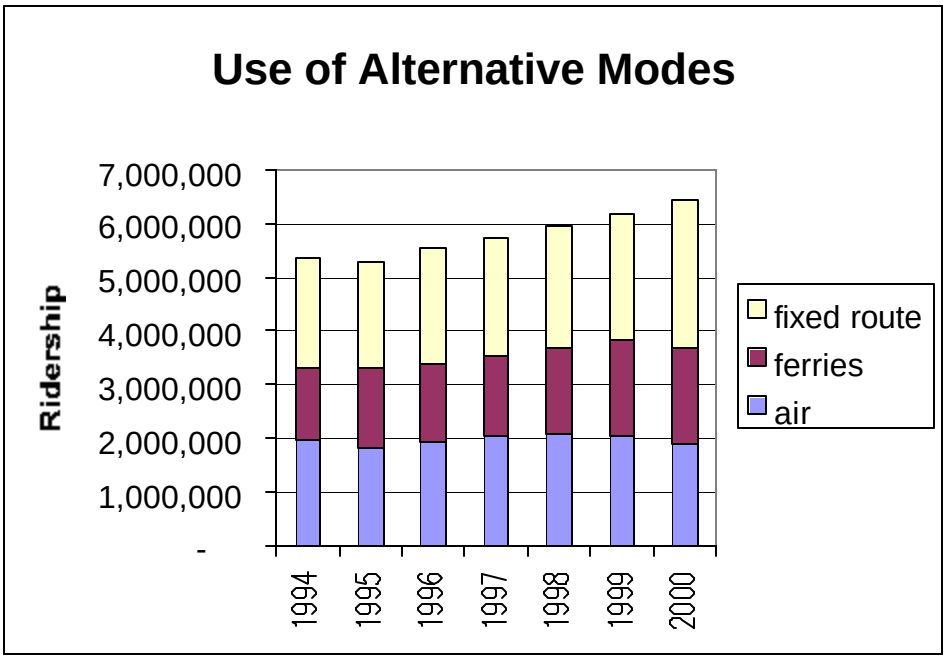
From 1994 to 2000 ridership on ferries, airplanes, and buses in Maine grew by more than one million riders, from 5.3 million to 6.4 million, a 20% increase in growth. The decrease in air travel in response to the September 11, 2001 terrorist attacks is expected to continue. Decreased ridership and increasing insurance and security costs jeopardize commercial air service to Maine's smaller airports. Ridership on buses and ferries is expected to continue to increase.

Ridership in Millions

Table 4.3.7

Year	Air	Ferries	Buses	Total
1994	1.94	1.37	2.04	5.35
1995	1.83	1.46	1.99	5.28
1996	1.93	1.46	2.16	5.55
1997	2.03	1.50	2.21	5.74
1998	2.06	1.61	2.28	5.95
1999	2.04	1.80	2.34	6.19
2000	1.90	1.76	2.79	6.45

Figure 4.3.4



With the return of passenger rail service and the implementation of *Explore Maine,* increased utilization of alternative transportation modes is expected to continue to grow.

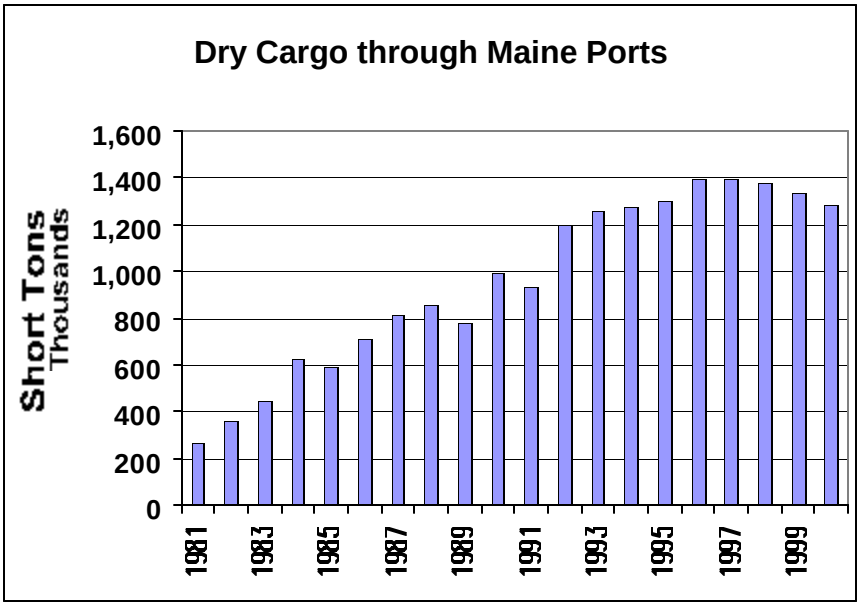
Projections for Amtrak service between Portland and Boston are 330,000 riders annually. *Explore Maine* estimates that 88,000 new tourists will come to Maine by alternative modes each year. In September 2000, the Maine Rail Concept and Feasibility study forecasted that a seasonal train between Portland and Montreal would attract more than 300,000 Canadian travelers annually. The Bangor, Trenton corridor study estimates that transit services between Bangor and Mount Desert Island will attract 190,000 riders a year. The combined impacts of these services are expected to represent an increase of nearly 1 million riders to passenger transportation systems.

4.5 Freight Transportation

4.5.1 Cargo Ports

In 2001, Maine's ports moved 1,249,413 short tons of dry cargo, both bulk and breakbulk. Additionally, Portland and Searsport handle roughly 125 million barrels of petroleum products. In the past 10 years, port traffic has increased roughly 3.3% a year. It has been held back by the lack of a new facility at Searsport, however, a new facility in Searsport will be completed in 2003.

Figure 4.5.1



4.5.2 Freight Rail

Currently, the Maine freight rail system is in transition. The Bangor & Aroostook Railroad is in Chapter 11 bankruptcy. A new owner, Montreal Maine and Atlantic Railway, will acquire the BAR system before the end of the calendar year 2002. MMA intends to operate and revitalize the entire system. St. Lawrence & Atlantic Railroad's parent company, Emons Holdings, Inc., was recently acquired by Genesee & Wyoming, Inc., a short-line railroad holding company with assets in five countries. Its new operation has been beneficial to shippers. Guilford Transportation, Inc. is in stable condition.

4.5.3 Motor Carrier

In 1998, motor carriers shipped 89 percent of Maine's manufactured freight. The great preponderance of truck freight market share in Maine reflects the nation-wide business trend toward just in time delivery. The need to reduce warehouse inventories and promote responsive delivery systems to customers, along with generally more favorable rate structures, favors motor carriers over rail in Maine as a transport mode. High truck usage results in greater highway congestion, pavement consumption, and bridge stress, which impact the Maine transportation system. The safety and continued integrity of the highway system with respect to heavy vehicle traffic is therefore, vital to Maine's economic well being. MDOT initiatives like the heavy Haul Truck Network and Commercial Vehicle Service Plan seek to insure the safer and more efficient flow of truck traffic in Maine.

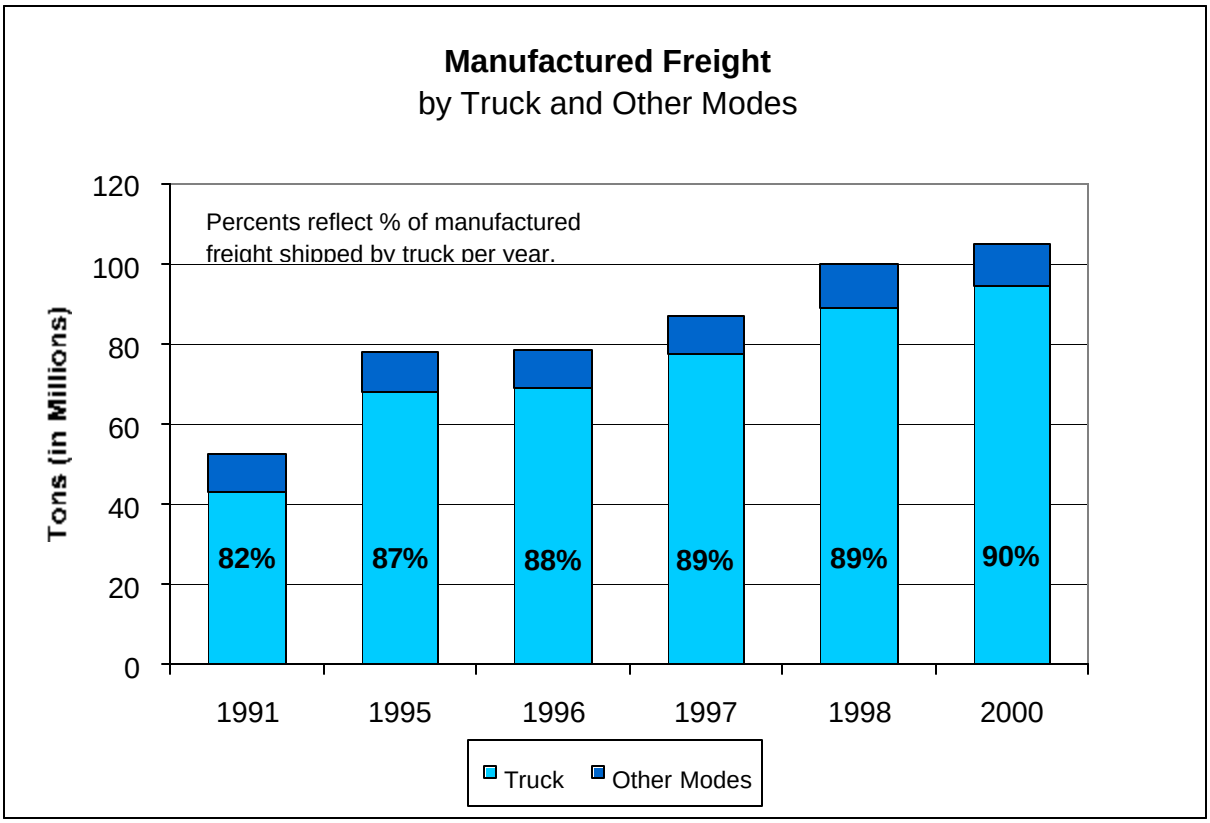



Figure 4.5.2