Accidents Involving Vehicles Parked on Shoulders of Limited-Access Highways

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The extent of the problem of accidents involving vehicles on shoulders of limited-access highways was quantified. Accident data for a 3-year period, 1985 through 1987, were collected along with a survey of vehicles stopped on the shoulder on Interstates and parkways. Although the percentage of all accidents on Interstates and parkways involving a vehicle on the shoulder is small (1.8 percent), the percentage of fatal accidents involving a vehicle on the shoulder is significant (11.1 percent). The accident data revealed that the majority of shoulder vehicles had stopped for an emergency stop, as opposed to a leisure stop, with a large number involving an abandoned vehicle; the most common reason for stopping was mechanical failure; tractor-trailers were overrepresented in shoulder accidents; an unusually high percentage occurred in the time period of midnight to 6 a.m. The major contributing factors were alcohol involvement and the driver on the mainline falling asleep. Two types of observational surveys were taken. One survey represented what a driver would observe while driving from one point to another on an Interstate or parkway. This survey indicated that a driver would pass (in his direction of travel) an average of about one vehicle on the shoulder every 8 mi on an Interstate and every 17 mi on a parkway. The second survey was conducted in a circular route so that almost all stops would be observed. The highest percentage of stops were over 1 hr in length.

Stopping or parking on the shoulder of a highway, with the associated hazard of entering and leaving the traveled lanes, has been recognized as a cause of traffic accidents. This study was conducted to quantify the extent of the problem of accidents involving vehicles on shoulders of limited-access highways. Accident data were collected along with a survey of vehicles stopped on the shoulder on Interstates and parkways. The objectives of the study were to

1. Determine if an accident problem existed involving vehicles on the shoulder of the road,
2. Identify locations having the highest frequency of parked vehicles and accidents involving these vehicles,
3. Survey the number of vehicles using the shoulder, and
4. Make recommendations to reduce the frequency of usage and the number of accidents involving vehicles parked on shoulders.

PROCEDURE

Data were collected from two areas. One involved the assemblage of accident data, which were collected for a 3-year period (1985 through 1987) on all Interstates and parkways in Kentucky. This survey included a total of about 735 mi of Interstates and 566 mi of parkways. Accident records were manually searched to obtain related accidents. An accident was included if it involved a vehicle stopped on the shoulder, a vehicle entering or exiting the shoulder, an occupant from a vehicle stopped on the shoulder, a vehicle moving on the shoulder, or if the accident was caused by a vehicle on the shoulder even though that vehicle was not actually involved.

The second area involved an observational survey of vehicles stopped on the shoulders of Interstates and parkways. Vehicles entering or exiting the shoulder were also included. The surveys were conducted while driving; therefore, no direct contact was made with the drivers of the stopped vehicles. For each vehicle observed, information was collected concerning its location, direction, vehicle type, and an opinion regarding the reason for the vehicle using the shoulder. Most of the surveys were conducted to record the number of vehicles on the shoulder that would be encountered while traveling from one point to another on an Interstate or parkway. This type of survey would not result in observing most vehicles that stopped for only a short period. A second type of survey was conducted by driving a short circular route so that most stopped vehicles could be recorded.

RESULTS

Accidents

The number of accidents, obtained from accident records, involving a vehicle on the shoulder are presented in Table 1. A manual search of all accidents occurring on Interstates and parkways was conducted for the 3-year period 1985 through 1987. A total of 424 accidents was located. This total represents 1.8 percent of all accidents on Interstates and parkways. The majority of the accidents (389 accidents) were on Interstates. There are more miles of Interstate highways (about 735 mi) than parkways (about 566 mi) in Kentucky. Also, the traffic volume is higher on Interstates compared with parkways. The percentage of all accidents involving a vehicle on the shoulder was similar for Interstates and parkways (1.8 and 1.6 percent, respectively). The accident rate for accidents involving a vehicle both on Interstate and on parkway shoulders was 1.9 accidents per 100 million vehicle-mi (acc/100 mvm). The rate was substantially higher on Interstates, 2.0 acc/100 mvm, compared with parkways, 1.3 acc/100 mvm.

The majority of accidents (71 percent) involved a vehicle actually stopped on the shoulder. The next most common accident involved a vehicle pulling from the shoulder back onto the main roadway (14 percent). The third most common accident was a secondary accident in which a vehicle on the

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TABLE 1 NUMBER OF ACCIDENTS INVOLVING A VEHICLE ON THE SHOULDER (INTERSTATES AND PARKWAYS)

TYPE OF ACCIDENT	1985	1986	1987	TOTAL
Vehicle Stopped on Shoulder	112	91	97	300
Vehicle Pulling from Shoulder	21	20	17	58
Vehicle Pulling onto Shoulder	9	3	5	17
Motorist Outside Vehicle	4	3	7	14
Secondary Accident	8	9	7	24
Vehicle Moving on Shoulder	8	0	3	11
All	162	126	136	424

shoulder was not actually involved (5.7 percent). This type of accident would occur when a vehicle would pull from the shoulder and a vehicle on the mainline would make an evasive maneuver to avoid the shoulder vehicle, causing an accident. Smaller numbers of accidents were noted for vehicles pulling onto the shoulder (4.0 percent), a motorist outside the vehicle (3.3 percent), and a vehicle moving on the shoulder (2.6 percent). There was no general upward or downward trend in shoulder-type accidents over the 3-year study period, although the largest number occurred in 1985.

The severity of accidents involving a vehicle on the shoulder is presented in Table 2. Of the 424 accidents, 22 involved a fatality, 155 involved injuries, and 247 were property damage only. The 22 accidents involving a fatality represent 11.1 percent of all fatal accidents on Interstates and parkways during the 3-year period, while the 155 injury accidents represent 2.8 percent of all injury accidents. A total of 26 fatalities and 296 injuries resulted from these accidents. Of the 296 injuries, 100 were classified as incapacitating, 112 were classified as nonincapacitating, and 84 were classified as a possible injury. The most severe accident type was the pedestrian accident involving a motorist outside a stopped vehicle. The second most severe accident type involved a vehicle stopped on the shoulder.

Most of the injuries occurred to occupants of the mainline vehicle. Of the 26 fatalities, 20 involved an occupant of the mainline vehicle. Also, 84 percent of the incapacitating injuries and 68 percent of all injuries were associated with the mainline vehicle.

The narrative description and accident diagram given in the police reports were reviewed to determine the reason for stopping on the shoulder. As presented in Table 3, the reason for stopping was determined for about 63 percent of the accidents. When the broad categories presented in Table 3 were considered, the reason for most stops (using the accident data base) involved what was classified as an emergency situation. A much smaller percentage involved what was classified as a leisure activity, while an even smaller percentage involved a work vehicle.

A more detailed explanation for stopping is presented in Table 4. The most common explanation was mechanical failure. A large number of abandoned vehicles would also fall into this category. Other common emergency explanations for stopping were

- Stopping for or being involved in another accident,
- Police vehicle stopping a vehicle,
- Tire problem,
- Bad weather such as heavy rain, and
- Assisting another driver.

The most frequently mentioned leisure explanations were resting, sleeping, changing drivers, and looking at a map. There were instances in which the probable reason for stopping would have been related to leisure but a sufficient explanation was not given. For example, a number of accidents involved a tractor-trailer stopped near the end of an on-ramp. In many instances, this stopping is done when the driver rests, but it could not be classified as a leisure stop unless sufficient information was available.

Various characteristics of the accidents involving a vehicle on the shoulder were summarized and compared to all statewide accidents (see Table 5). When the type of vehicle involved in the accident was considered, the percentage of tractor-

TABLE 2 SEVERITY OF ACCIDENTS INVOLVING A VEHICLE ON THE SHOULDER (INTERSTATES AND PARKWAYS, 1985–1987)

	SEVERITY			
TYPE OF ACCIDENT	FATAL	INJURY	PDO*	TOTAL
Vehicle Stopped on Shoulder	18	111	171	300
Vehicle Pulling From Shoulder	1	21	36	58
Vehicle Pulling onto Shoulder	0	5	12	17
Motorist Outside Vehicle	3	11	0	14
Secondary Accident	0	7	17	24
Vehicle Moving on Shoulder	0	0	11	11
ALL	22	155	247	424

*Property-damage-only accident.

TABLE 3 REASON FOR STOPPING (ACCIDENT DATA)

REASON	NUMBER	PERCENT ALL	PERCENT EXCLUDING UNKNOWN
Emergency	224	52.8	83.9
Leisure	34	8.0	12.7
Work	9	2.1	3.4
Unknown	157	37.0	DNA

trailers involved in shoulder accidents was much higher than for all statewide accidents. Considering all accidents, about 2 percent of all vehicles are tractor-trailers. For shoulder accidents, about 25 percent of the vehicles on the shoulder were tractor-trailers as were about 21 percent of the mainline vehicles. The percentage of single-unit trucks involved in shoulder accidents was also somewhat higher than statewide but not to the extent as determined for tractor-trailers. The percentage of tractor-trailers, as the shoulder vehicle, increased during nighttime hours. About 37 percent of the vehicles on the shoulder, in accidents occurring between 9 p.m. and 6 a.m., were tractor-trailers as compared with 25 percent for all hours of the day.

When light condition and time of accident were analyzed, it was determined that a higher percentage of shoulder accidents occurred during darkness, especially during early morning hours, compared to all accidents. About 36 percent occurred during darkness when there was no roadway lighting (compared to about 12 percent statewide). The percentages of shoulder accidents (25 percent) were much higher than for all accidents (about 7 percent) between the hours of midnight and 6:00 a.m. Conversely, the percentages of shoulder accidents were much lower than for all accidents between the hours of noon and 6:00 p.m.

The severity of shoulder accidents was substantially higher than for all accidents. Approximately 5 percent of shoulder accidents involved a fatality with another 36 percent involving an injury.

Contributing factors relating to the driver (as listed on the police report) determined that shoulder accidents had a higher percentage of accidents involving alcohol or drugs and accidents in which a driver fell asleep or lost consciousness compared to all accidents. The most common contributing factors were alcohol involvement and the driver's falling asleep. The alcohol involvement was almost always related to the driver of the mainline vehicle. These factors relate to the high percentage of late-night and early-morning accidents. Vehicular factors typically were not listed as a contributing factor. Slippery surface was listed as an environmental contributing factor more often than for all accidents.

A higher percentage of shoulder accidents was determined to occur under snow and ice conditions compared with all accidents. This increase would explain the high percentage of shoulder accidents that occurred in January and February.

When roadway character was considered, a higher percentage of shoulder accidents occurred on straight sections having a grade compared with all accidents, and a lower percentage on curves and straight and level sections.

TABLE 4 EXPLANATION FOR STOPPING (ACCIDENT DATA)

EXPLANATION	NUMBER
Mechanical Problem	72
Other Accident	34
Abandoned Vehicle	25
Police Vehicle	20
Tire Problem	19
Bad Weather	18
Assist Other Driver	12
Parked at Ramp	12
Work Vehicle	8
Rest	7
Sleeping	6
Pickup Item that Fell from Vehicle	6
Passing in Emergency Lane	5
Changing Drivers	5
Looking at Map	4
Out of Gas	4
Missed Exit	4
Making U-turn	4
Check on Vehicle	4
Restroom	3

TABLE 5 CHARACTERISTICS OF ACCIDENTS INVOLVING A VEHICLE ON THE SHOULDER (INTERSTATES AND PARKWAYS, 1985–1987)

VARIABLE	CATEGORY	NUMBER	PERCENT	PERCENTAGE STATEWIDE (1986)
Type Vehicle on Shoulder	Automobile	273	64.4	93.0
	Single-Unit Truck	25	5.9	3.1
	Tractor Trailer	105	24.8	2.0
	Other	20	4.7	1.9
Type Vehicle on Mainline	Automobile	314	74.1	93.0
	Single-Unit Truck	18	4.2	3.1
	Tractor Trailer	88	20.8	2.0
	Other	45	10.6	1.9
Light Condition	Daylight	204	48.1	70.9
	Dawn	14	3.3	1.2
	Dusk	8	1.9	2.5
	Darkness-Lighted	47	11.1	13.2
	Darkness-Not Lighted	151	35.6	12.1
Time	0:01 am - 3:00 am	60	14.2	4.9
	3:01 am - 6:00 am	48	11.3	2.5
	6:01 am - 9:00 am	69	16.3	10.0
	9:01 am - Noon	47	11.1	14.5
	12:01 pm - 3:00 pm	50	11.8	20.1
	3:01 pm - 6:00 pm	55	13.0	24.8
	6:01 pm - 9:00 pm	50	11.8	13.9
	9:01 pm - Midnight	44	10.4	9.2
Severity	Fatal	22	5.2	0.5
	Injury	155	36.6	22.1
	Property Damage Only	247	58.3	77.4
Human Contributing Factors	Unsafe Speed	42	9.9	7.3
	Fail to Yield ROW	34	8.0	16.7
	Alcohol Involvement	56	13.2	5.7
	Drug Involvement	6	1.4	0.2
	Fell Asleep	46	10.8	1.0
	Lost Consciousness	6	1.4	0.2
Vehicular Contributing Factors	Tire Failure	3	0.7	0.9
	Steering Failure	2	0.5	0.4
Environmental Contributing Factors	Slippery Surface	62	14.6	7.6
	Inproperly Parked Vehicle	13	3.1	0.4
Road Surface Condition	Dry	292	68.9	78.0
	Wet	58	13.7	18.8
	Snow-Ice	74	17.5	3.0
Month	January	54	12.7	7.0
	February	46	10.8	7.5
	March	30	7.1	7.6
	April	29	6.8	8.1
	May	34	8.0	8.9
	June	36	8.5	8.4
	July	33	7.8	8.6
	August	32	7.5	8.6
	September	29	6.8	8.0
	October	32	7.5	9.2
	November	33	7.8	8.9
	December	35	8.3	9.2
Roadway Character	Straight-Level	228	54.0	63.7
	Straight-Grade	138	32.5	17.5
	Straight-Hillcrest	11	2.6	2.8
	Curve-Level	20	4.7	7.4
	Curve-Grade	25	5.9	7.6
	Curve-Hillcrest	2	0.5	1.2

TABLE 6 NUMBER OF ACCIDENTS BY HIGHWAY

HIGHWAY	NUMBER OF ACCIDENTS
I 75	137
I 65	79
I 64	77
I 71	34
I 24	21
I 275	19
I 264	17
Western Ky Parkway	10
Pennyrile Parkway	9
Bluegrass Parkway	5
I 471	3
Green River Parkway	3
Purchase Parkway	3
I 265	2
Cumberland Parkway	2
Daniel Boone Parkway	2
Audubon Parkway	1

The number of shoulder accidents summarized by highway is presented in Table 6. The largest number of accidents was on the longer and higher volume Interstates with I-75 having the highest number followed by I-65 and I-64. Sections of Interstates within certain counties having the highest number of accidents are presented in Table 7. The high volume section of I-75 in northern Kentucky (Kenton and Boone Counties) had the highest number of accidents. Shoulder accidents were also prevalent on other sections of I-75 and on I-65 in counties with heavy traffic volumes.

A list was made of the accidents sorted by route and milepoint. This list was reviewed to determine if locations having high numbers of accidents could be identified. A list of locations having four or more accidents within a 1-mi section is presented in Table 8. Thirteen sections were identified; the shoulder accidents were generally scattered. The section of road having the highest concentration of this type of accident was I-75 from milepoint (MP) 180 to MP 191. This is a high-volume section of Interstate between the US-42 interchange and the Ohio border in northern Kentucky. This section of I-75 had 47 accidents in an 11.6-mi section with an accident rate of 4.5 acc/100 mvm. This rate was substantially higher than the overall rate for shoulder accidents. The locations of rest areas, interchanges, and toll plazas were noted and compared with the location of the accidents. Although there were some accidents, there was no trend or high percentage of accidents at these locations.

The age and sex of the drivers involved in the shoulder accidents were compared to statewide statistics (see Table 9). There was a lower percentage of teenage drivers involved in shoulder accidents, while the percentage of male drivers was higher. The age and sex distribution of the driver of the mainline and the shoulder vehicle was similar for the shoulder accidents.

Surveys of Stopped Vehicles

Three types of analyses were conducted using the data collected for vehicles stopped on the shoulders. For each survey, the date, route, starting time, and ending time were noted. The first type of analysis involved summaries of the number of vehicles stopped per mile as a function of several variables. This analysis used the data collection procedure to represent what a driver would observe while driving from one point to another on an Interstate or parkway.

TABLE 7 HIGHEST NUMBER OF ACCIDENTS BY HIGHWAY AND COUNTY

HIGHWAY	COUNTY	NUMBER OF ACCIDENTS
I 75	Kenton	41
I 75	Boone	19
I 75	Madison	17
I 65	Hardin	16
I 65	Bullitt	14
I 75	Grant	14
I 64	Jefferson	13
I 71	Jefferson	13
I 75	Fayette	12
I 75	Laurel	10
I 65	Warren	11
I 65	Jefferson	10

TABLE 8 LOCATIONS HAVING FOUR OR MORE ACCIDENTS WITHIN A 1-mi SECTION

	MILEPOINT RANGE	NUMBER OF ACCIDENTS
I 65	73.7-74.7	4
	89.2-90.1	4
	94.8-95.2	4
	118.0-119.0	4
	122.0-122.5	5
	132.2-133.2	4
I 75	28.0-28.9	4
	180.0-180.5	5
	181.1-181.7	4
	183.7-184.7	8
	187.5-188.5	7
	188.6-189.4	5
	190.0-190.9	7

The second type of analysis involved summarizing the information collected for each vehicle. The vehicle type and an opinion concerning the reason for stopping on the shoulder were noted for each vehicle. A subjective opinion was given as to whether the reason the vehicle had stopped should be classified in emergency, leisure, or work categories. In some instances, such as a flat tire, the reason for the stop was obvious. However, in many cases, the reason was not obvious and a subjective opinion was given. For example, a vehicle was classified as abandoned if no occupants were observed when driving past the vehicle. If the vehicle had engine problems and was then abandoned, the stop was classified as an emergency. However, if there was no evidence of any problem, the stop was classified as leisure in nature.

The third type of analysis used data collected by driving a short section of an Interstate in a circular route for a period of time.

A summary of the surveys giving the average number of vehicles stopped per mile on the shoulder is presented in Table 10. This summary represents over 8,000 mi of observations, which were made as a vehicle was driven along a section of road (not in a circular path). The data represent what a driver would encounter when driving from one point to another on an Interstate or parkway. Obviously, most vehicles that stopped for only a short period would not be observed unless the stop coincided with the data collection. Therefore, data were not collected on the length of the stop using this procedure. The number of vehicles stopped per mile was higher on Interstates than on parkways. The data show that, on the average, a driver would encounter one shoulder vehicle per 8 mi on an Interstate compared to 17 mi on a parkway (in the vehicle's direction of travel). The difference relates to the higher traffic volumes on Interstates. The number of vehicles stopped per mile was similar for daylight and darkness conditions. When the day of the week was considered, the highest rates were observed for Tuesday, Wednesday, and Thursday. There was not a large variation determined when starting time was considered, but the period of noon to 4 p.m. had the highest rate.

A summary of individual vehicle data from the surveys is presented in Table 11. A total of 1,565 vehicles stopped on shoulders was observed. The largest percentage of vehicles was automobiles (65.1 percent). The next highest percentage was tractor-trailers (22.6 percent) followed by single-unit trucks (11.1 percent). About one-half of the stops were classified as leisure in nature with slightly over one-third classified as emergencies. The remainder of the stops were classified as work-related. This percentage of leisure stops was higher than that determined from the accident data. A reason would be that the narrative contained in the accident report in many instances gave an explanation of the reason for abandoning the vehicle. Typically, a comment was noted related to the vehicle on the shoulder. Almost one-third of all the vehicles observed on the shoulder were abandoned. Most of the work vehicles were

TABLE 9 DRIVER CHARACTERISTICS (ACCIDENT DATA)

VARIABLE	CATEGORY	PERCENT	PERCENTAGE STATEWIDE (1986)
Age	16-19	7.0	15.1
	20-24	14.8	17.9
	25-34	31.7	26.3
	35-44	21.0	16.4
	45-54	11.7	9.4
	55 or above	13.9	14.9
Sex	Male	78.1	62.7
	Female	21.9	37.3

TABLE 10 VEHICLES STOPPED PER MILE

CATEGORY	VARIABLE	LENGTH SURVEYED	VEHICLES STOPPED TOTAL	VEHICLES STOPPED DIRECTION TRAVEL	VEHICLES STOPPED/MILE TOTAL	VEHICLES STOPPED/MILE DIRECTION TRAVEL
Route	I 75	1016.9	212	124	.21	.12
	I 275	13.8	5	3	.36	.22
	I 64	1576.4	272	170	.17	.11
	I 264	88.0	20	14	.23	.16
	I 65	833.0	194	100	.23	.12
	I 265	175.3	47	22	.27	.13
	I 24	279.0	41	26	.15	.09
	I 71	77.0	16	10	.21	.13
	Bluegrass Pkwy	1567.8	186	106	.12	.07
	Western Ky Pkwy	1523.3	171	78	.11	.05
	Mountain Pkwy	477.3	88	39	.18	.06
	Green River Pkwy	139.0	13	9	.09	.06
	Audubon Pkwy	47.0	1	1	.02	.02
	Pennyrile Pkwy	155.0	6	5	.04	.03
	Purchase Pkwy	211.4	22	15	.10	.07
	Daniel Boone Pkwy	57.0	24	5	.42	.09
	Cumberland Pkwy	178.0	21	16	.12	.09
Light Condition	Daylight	6151.3	1030	560	.17	.09
	Darkness	2218.3	307	181	.14	.08
Day	Sunday	747.5	84	45	.11	.06
	Monday	500.1	52	27	.10	.05
	Tuesday	2571.2	471	259	.18	.10
	Wednesday	1747.5	321	170	.18	.10
	Thursday	1496.1	249	150	.17	.10
	Friday	1147.8	141	78	.12	.07
	Saturday	205.0	21	14	.10	.07
Starting Time	Midnight - 4:00 am	775.0	124	64	.16	.08
	4:01 am - 8:00 am	456.5	67	35	.15	.08
	8:01 am - Noon	2896.9	500	272	.17	.09
	Noon - 4:00 pm	2361.3	423	226	.18	.10
	4:01 pm - 8:00 pm	1096.1	129	74	.12	.07
	8:01 pm - Midnight	829.4	96	72	.12	.09
Type Route	Interstate	4059.4	807	469	.20	.12
	Parkway	4355.8	532	274	.12	.06

TABLE 11 SUMMARY OF INDIVIDUAL VEHICLE DATA FROM SURVEY

CATEGORY	VARIABLE	NUMBER	PERCENT
Type of Vehicle	Automobile	1019	65.1
	Single Unit Truck	173	11.1
	Tractor Trailer	353	22.6
	Other	20	1.3
Reason for Stop	Emergency	579	37.0
	Leisure	771	49.3
	Work	215	13.7
Comment Concerning Vehicle	Abandoned	491	31.4
	DOT Vehicle	182	11.6
	Flashers On	138	8.8
	Driver in Vehicle	126	8.1
	Hood Up/Working on Vehicle	125	8.0
	Stopped Past Toll Plaza/ Rest Area	125	8.0
	Person Beside Vehicle	45	2.9
	Police Giving Ticket	32	2.0
	Giving Assistance	28	1.8
	Pulling onto Road	26	1.7
	Flat Tire	23	1.5
	Adjusting Load on Trailer	23	1.5

TABLE 12 TYPE OF VEHICLE VERSUS REASON FOR STOP SURVEYS

	REASON FOR STOP (PERCENT)		
	EMERGENCY	LEISURE	WORK
Automobile	42.3	44.7	13.0
Single Unit Truck	26.0	32.9	41.0
Tractor Trailer	26.3	72.0	1.7

Department of Highways (DOH) vehicles. When the type of vehicle was related to the reason for stopping, it was determined that the percentage of leisure-related stops was much higher for tractor-trailers than automobiles (see Table 12). The percentages of leisure and emergency stops for automobiles were almost identical. When the type of vehicle was related to lighting conditions, the percentage of vehicles on the shoulder classified as tractor-trailers was higher during the nighttime (see Table 13).

Three sections of Interstates were used for the circular route surveys. Data between adjacent interchanges were collected. Two sections were 16 mi in length; one was 14 mi in length. Data were collected during daylight for 2 days and during one nighttime period for each location. A total of about 29 hr of daytime data and 12 hr of nighttime data were collected. Two observers drove separate vehicles in the circular path. Given the short section length and the use of two vehicles, all but a few short stops on the shoulder were observed.

A summary of the locations and times for the circular route surveys along with the number of vehicles observed is presented in Table 14. Using an estimate that approximately one-half the average daily traffic (ADT) would travel during the survey periods, the number of stops per million vehicle miles was calculated. The values ranged from about 260 stops/mvm on I-75 from MP 90 to MP 104, to approximately 320 stops/mvm on I-64 from MP 53 to MP 69, to about 510 stops/mvm on I-75 from MP 120 to MP 136. The high number of stops at one I-75 location was related to trucks stopped near a rest area and a weigh station.

The types of vehicle observed during the circular path surveys is presented in Table 15. As presented previously in Table 11, the highest percentage was for automobiles with a high percentage of tractor-trailer trucks. The percentage of trucks determined from these surveys was higher than that indicated in Table 11. The percentage of tractor-trailer trucks was extremely high at night.

The length of stop observed during the circular route surveys is presented in Table 16. The categories used were under 20 min, 20 to 60 min, and over 60 min. The largest percentage (about one-half of the stops) were over 60 min. These stops would be the emergency stops and the longer leisure stops when the driver would be sleeping.

SUMMARY

Although the percentage of all accidents on Interstates and parkways involving a vehicle on the shoulder is small (1.8 percent), the percentage of fatal accidents involving a vehicle on the shoulder is significant (11.1 percent). The most common type of accident involved a vehicle stopped on the shoulder with the second most common type involving a vehicle pulling from the shoulder. An analysis of the accident data revealed that the large majority of shoulder vehicles had stopped for an emergency stop as opposed to a leisure stop. A large number of the accidents involved a collision with an abandoned vehicle. The most common reason for stopping, as determined by reviewing the accident reports, was related to a mechanical failure. Tractor-trailers were determined to be overrepresented in shoulder accidents when compared with all accidents. About 25 percent of vehicles on the shoulders were tractor-trailers compared with 2 percent of all vehicles involved in an accident. The percentage of shoulder accidents occurring during darkness, in which the highway was not lighted, was much higher for shoulder accidents compared with all accidents. The period of midnight to 6 a.m. had a higher percentage of shoulder accidents compared with all accidents. The severity of shoulder accidents was high when compared with all accidents. The major contributing factors for this type of accident were alcohol involvement and the driver on the mainline falling asleep. Slippery surfaces were also listed in a large percentage of these accidents, especially related to snow and ice conditions.

The largest number of shoulder accidents occurred on I-75, particularly in the high-volume section in northern Kentucky in Kenton County.

An observational survey of shoulder vehicles was conducted representing what a driver would observe while driving from one point to another on an Interstate or parkway. The data included over 8,000 mi of travel, and indicated that a driver

TABLE 13 TYPE OF VEHICLE VERSUS LIGHTING CONDITION SURVEYS

TYPE OF VEHICLE	LIGHTING CONDITION (PERCENT) DAY	NIGHT
Automobile	68.3	55.6
Single Unit Truck	12.0	8.2
Tractor Trailer	18.7	34.1
Other	1.0	2.1

TABLE 14 SUMMARY OF CIRCULAR ROUTE SURVEYS

ROUTE	LENGTH (MILES)	ADT	TIME PERIOD	NUMBER OF VEHICLES STOPPED
Interstate 64 (Milepoint 53-69)	16	20,300	9:50 am - 3:50 pm	21
			11:30 am - 3:30 pm	27
			10:00 pm - 2:00 am	4
Interstate 75 (Milepoint 90-104)	14	30,800	9:05 am - 1:45 pm	24
			11:50 am - 4:00 pm	28
			10:00 pm - 2:00 am	4
Interstate 75 (Milepoint 120-136)	16	23,900	9:50 am - 3:30 pm	41
			12:00 pm - 3:40 pm	31
			10:00 pm - 1:45 am	26

TABLE 15 TYPE OF VEHICLE OBSERVED DURING CIRCULAR ROUTE SURVEYS

VEHICLE TYPE	NUMBER			PERCENT		
	DAY	NIGHT	ALL	DAY	NIGHT	ALL
Automobile	105	5	110	61.0	14.7	53.4
Single Unit Truck	22	0	22	12.8	0.0	10.7
Tractor Trailer	35	28	63	20.3	82.4	30.6
Other	10	1	11	5.8	2.9	5.3

TABLE 16 LENGTH OF STOP OBSERVED DURING CIRCULAR ROUTE SURVEYS

LENGTH OF STOP	NUMBER			PERCENT		
	DAY	NIGHT	ALL	DAY	NIGHT	ALL
Under 20 minutes	35	5	40	20.3	14.7	19.4
20 - 60 minutes	48	18	58	27.9	29.4	28.2
Over 60 minutes	89	19	108	51.9	55.9	52.4

would pass (in his direction of travel) an average of about one vehicle on the shoulder every 8 mi on an Interstate and every 17 mi on a parkway. The number of vehicles encountered was similar during day and night conditions. The most common vehicle noted was an automobile with the percentage of tractor-trailers observed similar to the percentage found in the accident data. The highest percentage of stops was classified as leisure-related (49.3 percent) but the percentage of stops classified as an emergency was not substantially less (37.0 percent). The most frequent comment noted was that the vehicle was abandoned (31.4 percent).

An observational survey was also conducted while traveling in a circular route so that almost all stops would be observed. The highest percentage of stops was over 1 hr in length. These stops were the emergency stops and the longer leisure stops when a driver was sleeping. The percentage of stops by tractor-trailers was high, especially at night.

CONCLUSIONS

Although the number of shoulder-related accidents did not represent a high percentage of accidents on Interstates and parkways, the severity of the accidents (11.1 percent of all fatal accidents) indicates that a problem exists that should be addressed. The types of countermeasures that should be considered include

1. Placement of regulatory signs restricting shoulder parking to emergencies only in areas of high-frequency stops (near rest areas and interchanges),
2. Encouragement of police to investigate every vehicle observed stopped on the shoulder,
3. Encouragement of towing of all abandoned vehicles,
4. Increase in public awareness that abandoned vehicles will be towed if left on the shoulder,
5. Increase in public awareness of the hazards associated with parking a vehicle on the shoulder,
6. Construction of additional rest areas,
7. Installation of motorist emergency telephones, and
8. Provision of a standard design for shoulders, to include a section of indentations near the roadway edge to give an audible warning to drivers that their vehicle is off the roadway.

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