Research Report
KTC-03-21/SPR258-03-2I

KENTUCKY TRANSPORTATION CENTER

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CRASH RATES AT INTERSECTIONS

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CRASH RATES AT INTERSECTIONS

by

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in cooperation with

Kentucky Transportation Cabinet
Commonwealth of Kentucky

and

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16. Abstract

The objectives of this study were to develop a database of intersections, match traffic crashes to these intersections, calculate crash rates for various types of intersections, and identify intersections with the highest crash rates. A procedure was used to: a) identify intersections, b) assign crashes to these intersections, c) determine entering traffic volume, d) calculate a crash rate for each intersection, and e) calculate a critical rate factor (CRF) for each intersection.

About 7,000 intersections were identified with almost 19,000 crashes related to these intersections for the three-year period of 2000 through 2002. The analysis identified 428 intersections that had a CRF of one or more while only 36 intersections had a CRF above two. As would be expected, the crash rates are higher in urban than in rural areas. In both rural and urban areas, the rate was highest for four-lane undivided highways and lowest for four-lane divided highways.

An Excel spreadsheet containing a list of all intersections of two or more state-maintained roadways was developed. The spreadsheet also contains crash and volume data for each intersection. The intersections with the highest critical rate factors can be identified. This list can be divided by highway district with the objective of investigating the intersections with the highest CRFs and determining if improvements should be implemented.

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EXECUTIVE SUMMARY

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An Excel spreadsheet containing a list of all intersections of two or more state-maintained roadways was developed. The spreadsheet also contains crash and volume data for each intersection. The intersections with the highest critical rate factors can be identified. This list can be divided by highway district with the objective of investigating the intersections with the highest CRFs and determining if improvements should be implemented.

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Duane Thomas	Division of Traffic, Committee Chairman
Jerry Gadberry	Division of Traffic (District 8)
Kenny Potts	Division of Traffic (District 2)
Steve Ross	Division of Planning
James Simpson	Division of Design
Joe Tucker	Division of Traffic
Jeff Wolfe	Division of Traffic

1.0 INTRODUCTION

1.1 Background

Crash rates in Kentucky are calculated for highway sections in terms of crashes per 100 million vehicle miles and for spots in terms of crashes per million vehicles. Using this procedure, when analyzing rates at an intersection, the rates for a spot on the major roadway has typically been used. Approximately 35 percent of all traffic crashes in Kentucky have been found to occur at intersections. A past study (1) calculated rates for specific types of intersections. There is a need to update the previous work on this subject and develop a more efficient and usable method of identifying crashes at intersections.

1.2 Research Study Objectives

The objectives of this study were to develop a database of intersections, match traffic crashes to these intersections, calculate crash rates for various types of intersections, and identify intersections with the highest crash rates.

2.0 PROCEDURE

2.1 Identify Intersections

The first step in this process was to develop a comprehensive database that identified all intersections in Kentucky involving two or more state-maintained roadways. The list only included state-maintained roads because traffic volumes are unavailable for county and local roads and crash data cannot be related to specific intersections on roads off the state-maintained system. Consequently, intersections of a state-maintained road with a local road were not included in the database.

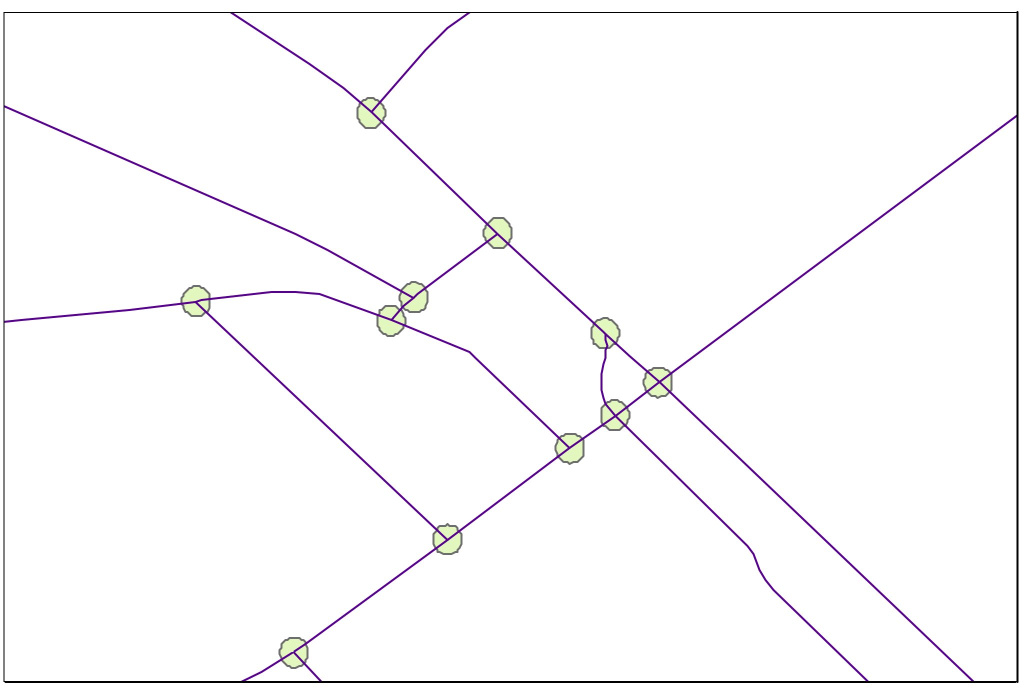
Intersections were placed into various categories related to the number of approaches to the intersection. The intersection types included three-way (T-intersections) and four-way (cross-intersections) with some five-way intersections. Each intersection was uniquely described using the county code, route number and milepoint for the major road. Since an intersection database has not been developed for Kentucky, the following process was used to create such a database.

The database development began with the use of the spatially linked milepoint log data. The milepoint log is maintained by the Division of Planning at the Kentucky Transportation Cabinet. The milepoint log database contains an inventory of the location of various landmarks including intersections for all state-maintained routes in Kentucky. This database is organized sequentially from the beginning to ending milepoint for all routes in all counties. This database has been updated to include all state-maintained intersections in Kentucky; however, there were two limitations which had to be addressed in the analysis.

First, the milepoint log database included several items that needed to be removed. For example, local road (city and county) intersections were included and an intersection with only a local road was not included in the analysis. There were several types of non-intersection items (such as bridges) in the database which were removed. The database also included interstate and other limited access interchanges which could not be used because of traffic crash and volume limitations. The second limitation was that each acceptable intersection was included twice within the milepoint log data. For instance, the intersection of US 25 with KY 922 in Fayette County would be identified once in the log of US 25 and also in the log of KY 922. This duplication could not be resolved by simple database logic because it is possible for such intersections to actually occur twice in the same county (in the event that two routes intersect twice in different parts of the county). Therefore, the duplications were eliminated through the means of spatial coincidence.

Several processes were employed in order to resolve the limitations of the milepoint log database. The processes involved using several functions of Microsoft Excel, Visual Basic code and ArcView including the Spatial Analyst extension. The primary goal of this step was to eliminate all records from the milepoint log that were not applicable intersections.

The milepoint log data were linked to a spatial database used in ArcView, called a shapefile. This shapefile, when plotted onto an existing map of Kentucky, indicates the location of each milepoint log entry by way of a node. The following figure shows an example of this shapefile (showing intersections of two state-maintained roads) in downtown Lexington.



Each node of the milepoint log layer is linked to several attributes (to a database called an attribute table) that describe the node's location as well as some of the roadway characteristics. The following attributes were used:

- County
- County Name
- Highway District
- Route Prefix
- Route Number
- Route Suffix
- Couplet ID (indicates one-way couplets)
- Milepoint
- Rse_unique (unique description of county and route)
- Direction
- Intersecting Road Description
- Bridge Number
- Intersection Type (tee, cross, etc)
- Intersection Control
- Interchange
- Exit Number

County boundaries and roadway shapefiles were also included in order to relate the data to the state of Kentucky. The roadway shapefile (also called a layer) defined the starting and ending milepoints along all road segments in each county. This quality was used later to plot crash locations along the state routes. The roadway shapefile was only comprised of state-maintained routes.

An ArcView script was used in order to eliminate the duplication of intersections that is an inherent component of the milepoint log data. This script was acquired from the Environmental Systems Research Institute's (ESRI) script database. By running the script, longitude and latitude values were appended to the attribute tables based on the locations of each node in the milepoint log data layer. These values were used later to eliminate duplicate intersections.

ArcView uses a Dbase IV format to store the data used in the attribute tables. This database was then opened in Excel to analyze the data. Initially, the database was comprised of 55,437 intersections. This size was about eight times the number of state-maintained which would be expected based on the results from a previous report (1). Several steps were taken to remove the duplicate and incorrect data. A new field was used to mark records for possible deletion. The first step involved marking all records that had no longitude or latitude values. Next, a temporary field was created to examine the description field. In most cases, the milepoint log database identifies an intersecting route in the first eight characters of the description field. For example, if the record is identifying US 25 at KY 922, the description field for US 25 would be:

KY 922 (Newtown Pike)

Because of this consistency, an Excel function was used to truncate the description field leaving only the route prefix and the route number for those that were actually state-maintained intersection. All records without either a US or KY (also FS for a few routes in Fayette and Jefferson Counties) prefix were marked for deletion. There were, however, some exceptions to this consistency. In some cases US or KY were used in the description field although not as a route prefix. These were easily identified since they did not have route numbers. Moreover, some description fields listed the local road name before the state route assignment (e.g. Newtown Pike – KY 922). This was rectified by manually examining each record since this was such a rare occurrence.

The next step involved removing certain records with specific characteristics. All intersections with an indicator in the junction field were marked for deletion since the intersection would already be identified by the major road. Additionally, all records with a bridge number (as indicated by a value in the bridge field) were marked for deletion. A check was also made to combine intersections that were within 0.02-miles of another intersection .

Because of traffic volume and crash data limitations, all interstate, parkways and other limited access ramps were unable to be analyzed as intersections. Therefore, any record with the word "RAMP" in the description field was marked for deletion. For this reason, KY 9000 and KY 9009 were also excluded since these are the route numbers for the Mountain Parkway.

The next step was to remove the duplicate records. A Visual Basic macro was used within Excel to determine which records were duplicates based on matching latitude and longitude values. The macro searched for each pair of coordinates and marked each occurrence with a sequential number. After the macro was executed, the database was sorted by the newly appended sequential number. Only records with a sequential number equal to one were kept. Prior to executing the macro, the database was sorted by route precedence in order to label the intersection using the major road's county, route and milepoint. A new field was added giving each intersection a unique ID.

2.2 Determining Intersection Volumes

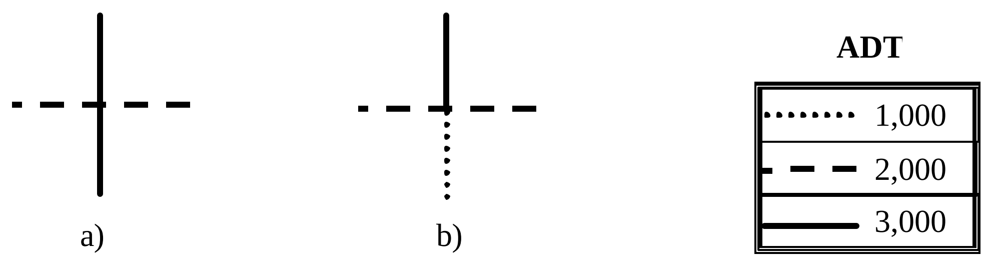
Traffic volumes for each approach were needed in order to calculate the total entering volume at each intersection. The most up-to-date average Annual Daily Traffic (AADT) data were available in the Highway Performance Monitoring System (HPMS) file. The data file is in DBASE IV format and included: the county and route (in RSE_UNIQUE format), the beginning and ending milepoints, and the ADT. This data were added to the ArcView project as an event theme. The event theme created a new spatial layer overtop of the existing roadway shapefile according to the beginning and ending milepoints indicating the ADT for that section. The result was a spatial description of the roadway volumes for any point along all state-maintained roads in Kentucky.

Buffer zones were drawn around all intersection nodes using a radius of 0.02 miles (105 feet). These buffer zones were used to clip only needed ADT sections; that is, any ADT section that was within 0.02 miles of an intersection. The resulting clipped shapefile was spatially joined with the intersection nodes. The criterion for the spatial join was each ADT section gained all of the attribute data from the nearest intersection node. The purpose of this join was to append the intersection ID number to each ADT section. This method was also used to count the number of approaches at each intersection. The buffer zones were used to clip the state route coverage shapefile and the data were joined to the intersection file resulting in a count of the number of approaches at each intersection.

In order to accurately calculate crash rates at intersections, the total ADT at each intersection was needed. This volume is defined by the sum of all entering vehicles. The ADTs given are bi-directional; therefore the formula for intersection volume becomes the sum of the ADTs at each approach divided by two.

$$\text{Number of Entering Vehicles} = \frac{\sum ApproachADT}{2}$$

However, the intersection volume is not simply half the sum of all ADTs in the aggregated database because the ADT sections do not always start and end at intersections. For example, consider the two intersections:



In intersection ‘a’ the total ADT is simply 2,000 plus 3,000, because the north and south approaches each have an ADT of 3,000 and the east and west approaches have an ADT of 2,000.

$$5{,}000 = (2{,}000+2{,}000+3{,}000+3{,}000)/2$$

In intersection ‘b’, because the ADT changes for the north-south road, the calculations become:

$$4{,}000 = (3{,}000+2{,}000+2{,}000+1{,}000)/2$$

The formulation makes it necessary to know the ADT at each approach and the number of approaches at each intersection. Therefore, a database was created by aggregating the clipped ADT shapefile data by the intersection ID. For example, if three ADT sections intersected the same intersection node, then each record would have the same intersection ID as the intersection node. The aggregation process would summarize the ADT section data by the intersection ID resulting in the ADTs at each section and a count of the number of sections intersecting the node based on the ID. This process also showed that no intersection had more than four different ADT sections (this does not imply that there were no intersections with five approaches).

The intersection ADTs could now be calculated based on this new data which was joined to the intersection database based on the intersection ID. The total number of approaches at each node (which was previously obtained in the intersection shapefile) and the number of ADT sections were used to develop four conditions to determine the sum of the ADTs at each intersection.

1. Four approaches and four ADT sections
2. Four approaches and two ADT sections
3. Three approaches and three ADT sections
4. All other conditions

The intersection ADT for the first and third conditions was determined by the sum of the ADTs divided by two. The intersection ADT for the second condition was determined by the sum of the two ADTs. Those meeting condition four were examined manually and the ADT was calculated accordingly. Those having fewer than three approaches were either missing ADT data or incorrectly identified as intersections. When possible, the ADT was estimated based on the nearest ADT section; otherwise, the intersection was marked for deletion.

The intersection file contains the county, highway district, route and milepoint of the major road, a list of up to three intersecting routes, the entering ADT, the number of approaches, and the highway characteristics of the major road. All records marked for deletion were removed resulting in 7,097 intersections with the information necessary to calculate rates.

2.3 Assign Crashes to Intersections

The next step was to assign crashes to each intersection. Three years of crash data were used. The most recent crash data extract was used to create a database containing the RSE_Unique and milepoint of all intersection crashes occurring between 2000 and 2002. Intersection crashes were identified using the directional analysis code. This database was added to the ArcView project and plotted as an event theme along the state road shapefile. The intersection buffer zones were used to count the number of crashes occurring at each intersection. However, the buffer zones were redrawn such that rural intersections had a 0.05-mile radius and urban intersections had a 0.02-mile radius. A 0.05-mile radius would be desirable for all intersections. However, it was not practical for urban locations given the proximity of neighboring intersections. A 0.02-mile radius was used for some rural intersections when an adjacent intersection was found to be within the 0.05-mile radius. Any crash occurring inside the buffer zone of an intersection was given the unique ID of that intersection. The unique IDs were summarized and added to the intersection file resulting in a total number of crashes at each intersection.

2.4 Calculate Crash Rates

The next step in the methodology involved the calculation of a critical rate factor (CRF). First, the actual crash rate for each intersection was calculated. This rate was calculated using the number of crashes linked to the intersection divided by the exposure, which was calculated based on the total entering volume for the intersection. An average statewide crash rate was assigned to each intersection based on the roadway type. Average crash rates were calculated for eight different roadway groups. The groups were divided into rural and urban categories and used the following highway types:

- Two-Lane
- Three-Lane
- Four-lane Divided
- Four-lane Undivided

The number of lanes at each intersection was determined by the number of through lanes on the major road as reported by the HPMS file. A previous report (1) organized this data by functional classification instead of number of lanes. However, it was decided to use the groups listed above to stay consistent with other research studies. These rates were calculated for each group using the number of crashes in a group divided by the exposure, which was calculated based on the total ADT at each intersection in a group.

The following formula was then used to calculate a critical crash rate for each intersection.

$$C_c = C_a + K\sqrt{\frac{C_a}{M}} + \frac{1}{2M}$$

in which

C_c = critical crash rate
C_a = average statewide crash rate for type of intersection
K = constant related to level of statistical significance selected
(a probability of 0.995 was used wherein K = 2.576)
M = exposure (for intersections, M is in terms of million vehicles (MV)

The roadway characteristics of the major road were used to determine the average crash rates at each intersection. The major road was determined by the road prefix and route number. A route with a “US” prefix was preferred over a “KY” prefix. The road with the lowest route number was used when the prefixes were the same. The road without a suffix was used in the event that two roads had the same route number and prefix.

The following formula was then used to calculate the actual crash rate for each intersection.

$$\frac{C_{\#} * 1{,}000{,}000}{3 * 365 * ADT_I}$$

in which

$C_{\#}$ = number of crashes at the intersection
ADT_I = total entering ADT at the intersection

The actual crash rate at an intersection was divided by the critical rate for each intersection to determine the critical rate factor (CRF).

3.0 RESULTS

The preceding procedure was used to: a) identify intersections, b) assign crashes to these intersections, c) determine entering traffic volume, d) calculate a crash rate for each intersection, and e) calculate a critical rate factor (CRF) for each intersection.

A summary of the number of intersections identified (in each of the highway type categories) with the number of crashes associated with these intersections and resulting crash rates is given in Table 1. About 7,000 intersections were identified with almost 19,000 crashes related to these intersections for the three-year period of 2000 through 2002. The analysis identified 428 intersections that had a CRF of one or more while only 36 intersections had a CRF above two. A list of the 50 intersections with the highest CRF is given in Table 2. All intersections with a CRF of one or more are given in Appendix A. The intersecting routes are given along with the number of crashes, crash rate, and CRF.

Crash data at the 10 intersections with the highest CRFs were manually analyzed to check the accuracy of the procedure. A summary of the results of the review of the data at these intersections is given in Appendix B. The analysis verified the accuracy of the procedure in assigning crashes to specific intersections.

The average crash rate is given in Table 1 by highway type. As would be expected, the crash rates are higher in urban than in rural areas. In both rural and urban areas, the rate was highest for four-lane undivided highways and lowest for four-lane divided highways.

4.0 RECOMMENDATIONS

An Excel spreadsheet containing a list of all intersections of two or more state-maintained roadways was developed. The spreadsheet also contains crash and volume data for each intersection. The intersections with the highest critical rate factors can be identified. This list can be divided by highway district with the objective of investigating the intersections with the highest CRFs and determining if improvements should be implemented.

5.0 REFERENCES

1. Agent, K.R.; "Accident Rates at Intersections," KTC-93-11, Kentucky Transportation Center, University of Kentucky, April 1993.

TABLE 1. SUMMARY OF INTERSECTION CRASHES AND RATES (2000-2002)

Highway Type		Number of Crashes	Number of Intersections	Number of Intersections with a CRF = 1	Average Crash Rate (C/MV)
Rural	*Two-Lane*	7,800	2,489	266	0.31
	Three-Lane	54	9	2	0.31
	Four-lane Divided	350	67	8	0.26
	Four-lane Undivided	100	13	2	0.37
Urban	*Two-Lane*	6,589	762	105	0.43
	Three-Lane	465	31	7	0.51
	Four-lane Divided	1,689	102	19	0.43
	Four-lane Undivided	1,731	3,624	19	0.57
		18,778	**7,097**	**428**	

TABLE 2. LIST OF INTERSECTIONS WITH HIGHEST CRFs

COUNTY	HIGHWAY DISTRICT	INTERSECTING ROADS	TOTAL NUMBER OF CRASHES	ACTUAL CRASH RATE (C/MV)	CRF
Christian	2	US-41A - KY-117	49	2.64	3.91
Jessamine	7	US-68 - KY-29	30	3.19	3.82
Jessamine	7	US-68 - KY-29	34	2.97	3.80
Laurel	11	KY-229 - KY-1189	23	3.04	3.37
Hardin	4	KY-220 - KY-447	20	3.26	3.34
McCracken	1	US-60 - KY-1852	23	2.80	3.19
Warren	3	KY-234 - KY-2158,KY-6144	20	2.89	3.10
Nelson	4	US-31E - US-62	51	2.52	3.05
McCracken	1	US-60 - KY-996	23	2.30	2.81
Jessamine	7	US-68 - KY-169	29	2.01	2.77
Hardin	4	US-31W - KY-84	14	2.88	2.70
Grant	6	US-25 - KY-491	20	2.32	2.69
Bullitt	5	KY-61 - KY-1526	35	2.24	2.53
Jessamine	7	US-68 - KY-169	27	1.82	2.52
Wayne	8	KY-90 - KY-1275,KY-90X	34	1.61	2.47
Carroll	6	US-42 - KY-320	24	1.83	2.45
Washington	4	US-150 - KY-55,KY-555	34	1.55	2.41
Perry	10	KY-80 - KY-451	11	2.65	2.32
Bullitt	5	KY-61 - KY-1020	21	1.79	2.31
Warren	3	US-231 - KY-2158	55	1.70	2.30
Knox	11	US-25E - KY-2417,KY-3041	37	1.40	2.28
Nelson	4	US-31E - KY-245	67	2.00	2.18
Lawrence	12	KY-3 - KY-32	28	1.44	2.17
Webster	2	KY-132 - KY-1340	7	3.31	2.15
Nelson	4	US-62 - KY-245	48	1.60	2.13
Garrard	7	KY-52 - KY-1295	8	2.87	2.12
Carroll	6	KY-55 - KY-389	5	4.50	2.11
Logan	3	US-68 - KY-1151	10	2.39	2.10
Woodford	7	KY-1681 - KY-1967	7	3.14	2.09
Madison	7	KY-388 - KY-1986	12	2.09	2.09
Warren	3	US-231 - KY-880,US-231X	80	1.37	2.08
Calloway	1	KY-464 - KY-1824	8	2.78	2.08
Hardin	4	US-31W - KY-313	57	1.73	2.05
Mercer	7	US-68 - US-127	45	2.03	2.02
Bourbon	7	US-27 - US-68X	53	1.73	2.02
Whitley	11	US-25W - KY-727	23	1.91	2.00
Fayette	7	KY-4 - KY-1927	69	1.34	2.00
Calloway	1	KY-94 - KY-1660	11	2.04	1.99
Madison	7	US-25 - KY-52	55	1.41	1.98
Marshall	1	US-68 - US-641	24	1.53	1.94
Garrard	7	US-27 - KY-39	19	1.44	1.93
Butler	3	KY-70 - KY-185	8	2.40	1.92
Madison	7	KY-627 - KY-2878	16	1.54	1.91
McCracken	1	US-45 - KY-731,US-62	48	1.37	1.89
Floyd	12	KY-302 - KY-1428	15	1.56	1.88
McCracken	1	US-60 - KY-305,KY-724	14	1.60	1.87
Muhlenberg	2	KY-175 - KY-181	6	2.88	1.86
Muhlenberg	2	US-62 - KY-176	24	1.23	1.85
Kenton	6	KY-236 - KY-2975	36	1.45	1.85
Shelby	5	US-60 - KY-1848	15	1.51	1.84

APPENDIX A.

LIST OF INTERSECTIONS WITH CRF OF 1 OR MORE

APPENDIX A. ALL INTERSECTIONS WITH A CRF GREATER THAN ONE

COUNTY	INTERSECTING ROUTES	MILEPOINT*	TOTAL NUMBER OF CRASHES	ACTUAL RATE (C/MV)	CRF
Christian	US-41A - KY-117	3.967	49	2.64	3.91
Jessamine	US-68 - KY-29	4.504	30	3.19	3.82
Jessamine	US-68 - KY-29	5.094	34	2.97	3.80
Laurel	KY-229 - KY-1189	7.673	23	3.04	3.37
Hardin	KY-220 - KY-447	16.766	20	3.26	3.34
McCracken	US-60 - KY-1852	5.757	23	2.80	3.19
Warren	KY-234 - KY-2158,KY-6144	10.303	20	2.89	3.10
Nelson	US-31E - US-62	13.972	51	2.52	3.05
McCracken	US-60 - KY-996	3.810	23	2.30	2.81
Jessamine	US-68 - KY-169	7.488	29	2.01	2.77
Hardin	US-31W - KY-84	4.192	14	2.88	2.70
Grant	US-25 - KY-491	21.670	20	2.32	2.69
Bullitt	KY-61 - KY-1526	18.415	35	2.24	2.53
Jessamine	US-68 - KY-169	7.314	27	1.82	2.52
Wayne	KY-90 - KY-1275,KY-90X	12.721	34	1.61	2.47
Carroll	US-42 - KY-320	6.819	24	1.83	2.45
Washington	US-150 - KY-55,KY-555	8.556	34	1.55	2.41
Perry	KY-80 - KY-451	4.620	11	2.65	2.32
Bullitt	KY-61 - KY-1020	16.270	21	1.79	2.31
Warren	US-231 - KY-2158	9.000	55	1.70	2.30
Knox	US-25E - KY-2417,KY-3041	24.221	37	1.40	2.28
Nelson	US-31E - KY-245	15.400	67	2.00	2.18
Lawrence	KY-3 - KY-32	15.520	28	1.44	2.17
Webster	KY-132 - KY-1340	10.070	7	3.31	2.15
Nelson	US-62 - KY-245	15.939	48	1.60	2.13
Garrard	KY-52 - KY-1295	8.483	8	2.87	2.12
Carroll	KY-55 - KY-389	5.767	5	4.50	2.11
Logan	US-68 - KY-1151	2.948	10	2.39	2.10
Woodford	KY-1681 - KY-1967	11.082	7	3.14	2.09
Madison	KY-388 - KY-1986	1.967	12	2.09	2.09
Warren	US-231 - KY-880,US-231X	10.601	80	1.37	2.08
Calloway	KY-464 - KY-1824	11.790	8	2.78	2.08
Hardin	US-31W - KY-313	24.408	57	1.73	2.05
Mercer	US-68 - US-127	7.031	45	2.03	2.02
Bourbon	US-27 - US-68X	6.765	53	1.73	2.02
Whitley	US-25W - KY-727	32.928	23	1.91	2.00
Fayette	KY-4 - KY-1927	13.669	69	1.34	2.00
Calloway	KY-94 - KY-1660	7.698	11	2.04	1.99
Madison	US-25 - KY-52	16.257	55	1.41	1.98
Marshall	US-68 - US-641	9.662	24	1.53	1.94
Garrard	US-27 - KY-39	3.130	19	1.44	1.93

APPENDIX A. ALL INTERSECTIONS WITH A CRF GREATER THAN ONE (continued)

COUNTY	INTERSECTING ROUTES	MILEPOINT*	TOTAL NUMBER OF CRASHES	ACTUAL RATE (C/MV)	CRF
Butler	KY-70 - KY-185	30.000	8	2.40	1.92
Madison	KY-627 - KY-2878	0.220	16	1.54	1.91
McCracken	US-45 - KY-731,US-62	9.224	48	1.37	1.89
Floyd	KY-302 - KY-1428	2.512	15	1.56	1.88
McCracken	US-60 - KY-305,KY-724	6.122	14	1.60	1.87
Muhlenberg	KY-175 - KY-181	18.583	6	2.88	1.86
Muhlenberg	US-62 - KY-176	10.541	24	1.23	1.85
Kenton	KY-236 - KY-2975	2.007	36	1.45	1.85
Shelby	US-60 - KY-1848	3.616	15	1.51	1.84
Harrison	US-62 - KY-1842	1.286	10	1.91	1.84
Kenton	KY-1303 - KY-1829	1.513	23	1.69	1.84
Warren	US-231 - KY-884	9.603	57	1.26	1.83
Warren	US-68 - US-231	9.334	64	1.46	1.83
Hardin	US-31W - KY-1815	27.732	55	1.27	1.83
Warren	US-31W - US-231X	11.805	37	1.42	1.83
Boone	US-42 - KY-338	5.673	13	1.61	1.82
Warren	US-31W - US-231	10.567	60	1.24	1.82
Hopkins	KY-70 - KY-254	19.946	28	1.54	1.81
Larue	US-31E - KY-61,KY-1618	8.486	19	1.07	1.80
McCracken	KY-131 - KY-284	3.603	16	1.92	1.79
Meade	US-60 - KY-144	7.992	16	1.40	1.79
Kenton	KY-8 - KY-2374	6.954	24	1.58	1.77
Breathitt	KY-1812 - KY-2462	3.340	8	2.08	1.77
Meade	US-31W - KY-868,KY-1638	2.090	31	1.04	1.75
McCracken	US-45 - KY-1310	8.896	33	1.39	1.75
Jefferson	KY-155 - KY-1747	11.395	92	1.07	1.75
Nelson	US-31E - US-62	14.205	44	1.68	1.74
Hopkins	US-41 - KY-281,US-41A	17.548	51	1.21	1.73
Warren	US-231 - KY-880	15.510	35	1.34	1.73
Johnson	KY-40 - KY-321	9.102	23	1.14	1.73
McCracken	US-45X-1 - US-60X	2.815	14	1.93	1.72
Campbell	US-27 - KY-824	4.952	18	1.25	1.72
Warren	US-31W - KY-3225	14.424	46	1.63	1.71
Hardin	US-31W - KY-434	23.967	40	1.27	1.71
Larue	US-31E - KY-210	10.093	16	1.30	1.70
Meade	KY-144 - KY-941	23.058	5	2.88	1.70
Breathitt	KY-15 - KY-1098,KY-1812	14.644	14	1.38	1.70
Edmonson	KY-259 - KY-728	17.153	8	1.93	1.69
Graves	KY-121 - KY-303	1.145	15	1.33	1.69
McCracken	KY-131 - KY-284	5.815	18	1.66	1.69
Anderson	US-127 - KY-151,US-127B	8.897	25	1.06	1.68

APPENDIX A. ALL INTERSECTIONS WITH A CRF GREATER THAN ONE (continued)

COUNTY	INTERSECTING ROUTES	MILEPOINT*	TOTAL NUMBER OF CRASHES	ACTUAL RATE (C/MV)	CRF
Marshall	US-641 - KY-408	8.558	13	1.42	1.68
Floyd	KY-3 - KY-321	1.060	16	1.27	1.68
Metcalfe	KY-90 - KY-163	4.721	10	1.63	1.67
Graves	KY-97 - KY-303	6.850	4	3.50	1.67
Shelby	US-60 - KY-395	19.338	11	1.52	1.66
Breathitt	KY-1812 - KY-2471	3.390	9	1.72	1.66
Muhlenberg	US-62 - KY-181	11.355	18	1.19	1.66
Boone	KY-18 - KY-842	14.630	98	1.32	1.65
Graves	US-45 - KY-408	25.361	17	1.20	1.65
Marshall	KY-58 - KY-1949	4.809	6	2.26	1.63
Henderson	US-60 - KY-136,KY-425	8.710	24	1.41	1.63
Washington	KY-528 - KY-555	2.560	10	1.56	1.63
Muhlenberg	US-62 - US-431	17.930	19	1.12	1.62
Laurel	US-25 - KY-192	10.505	45	1.14	1.61
Jefferson	KY-61 - KY-1065	3.951	70	1.02	1.61
Trigg	KY-139 - KY-272	14.415	5	2.58	1.61
Grant	US-25 - KY-36	8.994	7	1.93	1.60
Todd	KY-181 - KY-507	19.311	6	2.17	1.60
Hardin	US-31W - KY-222	9.530	10	1.51	1.59
Warren	US-31W - US-68	20.905	13	1.06	1.58
Boone	KY-842 - KY-3503	0.802	23	1.37	1.57
Knott	KY-160 - KY-899	8.155	12	1.33	1.57
McCracken	KY-450 - KY-3075	4.282	7	1.85	1.56
Garrard	KY-39 - KY-1131	11.613	3	4.30	1.56
Union	KY-360 - KY-666	4.880	3	4.28	1.56
Marshall	US-641 - KY-348,US-641-1	8.815	19	1.05	1.55
Barren	US-31E - KY-70	23.046	10	1.44	1.55
Montgomery	KY-646 - KY-3363	2.232	4	2.96	1.54
Mason	KY-9 - KY-11	7.560	17	0.90	1.54
Christian	US-41 - US-68	11.909	26	1.26	1.54
Carlisle	KY-1203 - KY-1741	3.115	2	7.91	1.53
Washington	US-150 - KY-528	9.249	15	1.14	1.53
Muhlenberg	US-431 - KY-277	18.962	12	1.27	1.52
Madison	KY-595 - KY-876	16.014	5	2.31	1.52
Wayne	KY-90 - KY-92	11.034	21	1.34	1.52
Laurel	US-25 - US-25E,US-25W	0.344	35	0.82	1.51
Laurel	US-25 - KY-3434	15.147	18	1.04	1.51
Warren	US-31W - KY-526	20.404	16	1.09	1.51
Trimble	US-42 - KY-2871	11.613	4	2.82	1.50
McCracken	US-60X - KY-305	1.311	15	1.53	1.50
Clay	US-421 - KY-80,KY-2076	16.915	20	0.81	1.50

APPENDIX A. ALL INTERSECTIONS WITH A CRF GREATER THAN ONE (continued)

COUNTY	INTERSECTING ROUTES	MILEPOINT*	TOTAL NUMBER OF CRASHES	ACTUAL RATE (C/MV)	CRF
Kenton	KY-1303 - KY-1829	2.072	30	1.16	1.49
Martin	KY-3 - KY-40	11.405	7	1.71	1.49
Bullitt	KY-61 - KY-2673	14.660	18	1.00	1.49
Marion	US-68 - KY-55	10.690	32	1.50	1.48
Garrard	KY-52 - KY-1150	4.231	8	1.54	1.48
Harrison	KY-32 - KY-1298	14.456	5	2.18	1.47
Jefferson	US-42 - US-60-1,US-60	0.805	24	1.22	1.47
Boone	US-42 - KY-338,KY-1292	5.125	10	1.33	1.47
Lewis	KY-9 - KY-57	28.380	11	1.25	1.46
Lincoln	KY-78 - KY-198	7.089	6	1.84	1.46
Christian	US-41 - KY-1453	0.016	5	2.13	1.45
Floyd	KY-3 - KY-321	2.672	12	1.17	1.45
Laurel	KY-192 - KY-363	19.342	36	1.05	1.44
Madison	US-421 - KY-1016	7.397	10	1.28	1.44
Bullitt	KY-1450 - KY-1526	1.895	26	1.15	1.44
Floyd	US-23 - KY-979	0.869	22	0.89	1.43
Boone	KY-536 - KY-2852	4.376	4	2.56	1.43
Marshall	US-641 - KY-1445	8.115	9	1.36	1.43
Warren	KY-2158 - KY-2629	0.538	12	1.57	1.43
Jefferson	KY-1447 - KY-1932	0.000	25	1.16	1.43
Nelson	KY-245 - KY-332	6.529	15	1.03	1.42
Muhlenberg	US-62 - KY-189	16.471	14	0.87	1.42
Gallatin	US-42 - US-127	11.878	9	1.33	1.41
Pike	KY-319 - KY-1056	0.000	8	1.43	1.41
Harlan	US-119 - US-421	13.952	11	0.97	1.41
Mason	KY-8 - KY-2511	12.241	10	1.71	1.41
Montgomery	KY-213 - KY-713	9.132	4	2.48	1.41
Boone	KY-18 - KY-1017	16.632	45	1.29	1.41
Jefferson	US-31E - US-150	15.901	22	1.19	1.41
Trigg	KY-139 - KY-929	16.999	7	1.54	1.40
Boyle	KY-37 - KY-300	16.301	5	2.00	1.40
Grayson	US-62 - KY-920	21.598	19	0.92	1.40
Nelson	US-150 - KY-245	1.697	21	1.20	1.40
Fayette	KY-922 - KY-1973	5.148	14	1.42	1.40
Fleming	KY-697 - KY-1336	0.000	2	6.07	1.40
Shelby	KY-53 - KY-362	13.792	6	1.71	1.40
Knott	KY-15 - KY-160	3.927	10	1.23	1.40
Floyd	KY-550 - KY-850	2.080	5	1.97	1.39
Pulaski	KY-39 - KY-70	15.128	6	1.70	1.39
McCracken	KY-999 - KY-1014	2.253	5	1.95	1.39
Larue	US-31E - KY-84	9.680	12	1.09	1.38

APPENDIX A. ALL INTERSECTIONS WITH A CRF GREATER THAN ONE (continued)

COUNTY	INTERSECTING ROUTES	MILEPOINT*	TOTAL NUMBER OF CRASHES	ACTUAL RATE (C/MV)	CRF
Logan	KY-103 - KY-1038	7.812	4	2.37	1.38
Madison	US-25 - KY-876,US-25X	15.500	50	0.91	1.38
Pulaski	US-27 - KY-80B,LN-9008	16.854	44	0.94	1.38
Fulton	KY-125 - KY-1099	5.386	7	1.49	1.38
Franklin	US-60 - KY-420	8.353	19	1.21	1.37
McCracken	US-45 - KY-1286	6.699	32	1.02	1.37
Jefferson	KY-1447 - KY-1932	0.000	24	1.11	1.37
Taylor	KY-289 - KY-3211	2.950	6	1.65	1.37
Marshall	US-641 - KY-80	1.224	13	1.04	1.37
Hopkins	KY-70 - KY-109	7.096	7	1.47	1.36
Nelson	US-31E - KY-1430	14.612	25	1.09	1.36
Calloway	KY-121 - KY-774	14.963	17	1.25	1.36
Marshall	KY-58 - KY-1477	11.183	5	1.88	1.36
Jefferson	US-31E - KY-2860	15.423	47	1.21	1.36
Allen	US-31E - US-231,KY-980	8.610	13	1.02	1.35
Shelby	KY-395 - KY-2867	7.255	3	3.09	1.35
Boone	US-42 - KY-3060	9.378	20	1.16	1.35
Jessamine	KY-169 - KY-1267	16.360	6	1.60	1.35
Whitley	US-25W - KY-727-1	32.977	15	1.30	1.35
Kenton	KY-8 - KY-17	7.402	22	1.12	1.34
Grant	US-25 - KY-36	10.442	9	1.22	1.34
Hardin	KY-144 - KY-1646	3.835	17	1.22	1.34
Jefferson	KY-907 - KY-1865	6.310	38	0.94	1.34
McCracken	US-45 - US-60	9.870	29	1.02	1.34
McCracken	US-60 - KY-1154	1.968	11	1.08	1.33
Logan	US-68 - KY-79	12.368	11	1.05	1.32
Pike	US-119 - KY-1426	2.672	15	0.93	1.32
Christian	US-41 - KY-1682	14.786	18	1.17	1.32
Madison	KY-52 - KY-876	10.910	46	0.88	1.31
Todd	US-79 - KY-181,KY-2128	0.281	9	1.18	1.31
Pendleton	US-27 - KY-22	10.286	10	1.11	1.31
Marshall	US-641 - KY-58,KY-408	8.270	12	1.01	1.30
Franklin	KY-420 - KY-2261	4.471	14	1.52	1.30
McCracken	KY-358 - KY-996	9.162	5	1.74	1.30
Ohio	US-62 - US-231	9.731	15	0.90	1.30
Graves	KY-94 - KY-303	10.485	5	1.72	1.29
Martin	KY-3 - KY-40	11.245	8	1.24	1.29
Boone	KY-20 - KY-237	16.620	28	0.97	1.28
Henry	KY-22 - KY-55	7.420	11	1.02	1.28
Perry	KY-476 - KY-3351	11.533	4	2.04	1.28
Hickman	KY-307 - KY-924	2.268	3	2.75	1.28

APPENDIX A. ALL INTERSECTIONS WITH A CRF GREATER THAN ONE (continued)

COUNTY	INTERSECTING ROUTES	MILEPOINT*	TOTAL NUMBER OF CRASHES	ACTUAL RATE (C/MV)	CRF
Muhlenberg	US-431 - KY-246	8.020	7	1.32	1.28
Grant	US-25 - KY-2942	21.092	9	1.13	1.28
Christian	US-41A - KY-400	0.004	30	0.95	1.28
Floyd	US-23 - KY-1428	10.538	19	0.80	1.28
Madison	US-25 - KY-2875,US-25X	19.932	26	0.99	1.27
Ohio	US-62 - US-231	10.590	17	0.83	1.27
McLean	KY-81 - KY-136	12.580	10	1.06	1.27
Webster	KY-132 - KY-857	12.379	4	2.01	1.27
Henry	KY-153 - KY-1861	0.000	4	2.00	1.26
Pendleton	KY-1054 - KY-3180	2.720	2	4.61	1.26
Elliott	KY-7 - KY-32	7.173	7	1.29	1.26
Laurel	KY-192 - KY-3012	18.161	11	1.00	1.26
Simpson	KY-100 - KY-1008	8.719	9	1.52	1.26
Harlan	KY-38 - KY-72-1	0.021	10	1.05	1.26
Warren	US-31W - US-68	14.670	29	0.94	1.26
McCracken	US-62 - KY-787,US-68	15.513	16	0.84	1.26
Hopkins	US-41 - KY-138	27.638	6	1.42	1.26
Magoffin	KY-7 - KY-1471	16.294	3	2.64	1.26
Shelby	KY-12 - KY-43	0.000	6	1.42	1.25
Scott	US-62 - US-460B	6.000	13	0.91	1.25
Warren	US-31W - KY-1402	17.089	32	0.90	1.25
Larue	KY-210 - KY-470	9.508	7	1.26	1.24
Grayson	US-62 - KY-259	20.787	21	0.87	1.24
Nelson	US-62 - KY-162	18.097	6	1.38	1.24
Rowan	KY-32 - KY-377	4.593	11	0.97	1.23
Campbell	KY-9 - KY-1998	16.538	29	0.91	1.23
Elliott	KY-7 - KY-556	7.043	7	1.24	1.23
Breckinridge	KY-259 - KY-737	4.041	5	1.57	1.23
Boone	KY-18 - KY-3157	14.748	62	1.01	1.22
Lawrence	US-23 - KY-2565	14.560	12	0.91	1.22
Jefferson	US-60 - KY-2048	2.735	20	1.02	1.22
Grant	KY-22 - KY-36	5.758	6	1.35	1.22
Daviess	US-431 - KY-2245	14.445	24	0.96	1.22
Kenton	KY-177 - KY-2042	5.836	4	1.86	1.22
Muhlenberg	KY-181 - KY-189	12.479	13	0.88	1.22
Nelson	US-62 - KY-61	2.327	6	1.35	1.22
Muhlenberg	US-431 - KY-70	9.834	8	1.12	1.21
Laurel	KY-192 - KY-3432	16.746	6	1.34	1.21
Barren	US-68 - KY-255	3.971	6	1.34	1.21
Hardin	KY-222 - KY-1136	4.243	5	1.53	1.21
McCreary	US-27 - KY-92,KY-1651	4.608	12	0.90	1.21

APPENDIX A. ALL INTERSECTIONS WITH A CRF GREATER THAN ONE (continued)

COUNTY	INTERSECTING ROUTES	MILEPOINT*	TOTAL NUMBER OF CRASHES	ACTUAL RATE (C/MV)	CRF
Fayette	KY-1927 - KY-1973	6.067	7	1.64	1.21
Crittenden	US-60 - US-641	9.204	14	0.84	1.21
McCracken	US-45X - US-45X-1,US-60X	2.039	15	1.11	1.20
Carroll	US-42 - KY-36	4.519	6	1.32	1.20
Martin	KY-3 - KY-645	9.709	9	0.84	1.20
Pulaski	KY-1577 - KY-1642	0.000	8	1.09	1.20
Logan	US-79 - KY-2146,US-431	11.813	20	0.99	1.20
Campbell	US-27 - KY-10	9.899	28	0.89	1.19
Harrison	US-27 - US-62	4.126	10	0.96	1.19
Lewis	KY-8 - KY-59,KY-2525	17.512	10	0.96	1.19
Todd	KY-171 - KY-507	7.542	3	2.36	1.19
Jefferson	KY-146 -	2.565	23	0.93	1.19
Fayette	US-27 - US-60-1	6.368	33	0.84	1.19
Hardin	US-31W - KY-3005	19.478	45	0.77	1.18
McLean	US-431 - KY-136	6.038	10	0.94	1.17
Graves	KY-58 - KY-131	8.156	6	1.26	1.17
Scott	US-25 - KY-620	8.587	8	1.06	1.17
Logan	KY-103 - KY-663	1.153	3	2.28	1.17
Barren	US-31E - KY-87	1.222	7	1.14	1.17
Taylor	KY-527 - KY-744	5.694	3	2.27	1.17
Knox	US-25E - KY-312	25.650	28	0.86	1.17
Bullitt	KY-44 - KY-61	12.215	24	0.66	1.17
Breathitt	KY-15 - KY-3231	17.651	16	0.76	1.17
Nelson	US-150 - KY-49	0.440	13	1.13	1.17
Daviess	KY-144 - KY-405	1.651	11	1.22	1.17
Bourbon	US-27 - US-68	8.667	18	0.99	1.17
Jefferson	KY-155 - KY-1932	13.590	69	0.93	1.17
Kenton	KY-7 - KY-1120	23.194	18	0.99	1.16
Henderson	US-41 - KY-416	3.172	6	1.25	1.16
McCreary	KY-92 - KY-701	14.303	4	1.71	1.16
Jefferson	KY-155 - KY-1819	9.024	24	0.90	1.16
McCracken	US-62 - KY-786	6.739	7	1.13	1.16
Henderson	US-60 - KY-145	2.934	9	0.97	1.16
Crittenden	KY-506 - KY-1077	9.008	2	3.70	1.16
Shelby	US-60 - KY-53,KY-55	11.398	24	0.89	1.16
Fayette	US-60 - KY-1723	6.975	28	0.85	1.16
Henderson	KY-1539 - KY-2183	3.859	3	2.22	1.15
McCracken	US-45 - KY-305	11.716	15	1.04	1.15
Christian	US-68B - KY-107	5.168	13	0.81	1.15
Jefferson	US-60A - KY-1020	3.409	35	1.05	1.14
Floyd	KY-979 - KY-3379	14.023	5	1.38	1.14

APPENDIX A. ALL INTERSECTIONS WITH A CRF GREATER THAN ONE (continued)

COUNTY	INTERSECTING ROUTES	MILEPOINT*	TOTAL NUMBER OF CRASHES	ACTUAL RATE (C/MV)	CRF
Breckinridge	KY-79 - KY-105,KY-2201	1.888	4	1.65	1.14
Allen	KY-101 - KY-234	5.861	4	1.65	1.14
Meade	KY-1816 - KY-1882	3.718	4	1.64	1.14
Calloway	KY-821 - KY-822	0.000	12	1.13	1.14
Lyon	KY-93 - KY-293,KY-1055	12.942	5	1.37	1.14
Owen	KY-22 - KY-845	15.548	4	1.63	1.14
Crittenden	US-60 - KY-91,KY-120	9.501	16	0.73	1.13
Montgomery	US-460 - KY-713	3.660	4	1.62	1.13
Laurel	KY-192 - KY-1006	18.505	29	0.98	1.13
Marion	KY-49 - KY-55	17.815	13	1.08	1.13
Whitley	US-25W - KY-312-1	33.278	13	1.08	1.13
Knox	KY-830 - KY-1232	4.469	5	1.35	1.13
Estill	KY-52 - KY-499	6.748	11	0.85	1.13
Scott	US-25 - US-460B	2.038	41	1.00	1.13
Bullitt	KY-61 - KY-1450	19.201	18	0.95	1.13
Boone	US-25 - KY-842	8.448	20	0.91	1.13
Grant	US-25 - KY-491	22.629	10	0.89	1.13
McCracken	US-62 - KY-1286	10.754	19	0.93	1.13
Christian	KY-115 - KY-911	1.239	13	1.07	1.13
McCracken	US-60 - KY-724	5.450	8	0.99	1.12
Hardin	US-62 - KY-84	4.476	8	0.99	1.12
Carlisle	KY-123 - KY-1591	7.390	3	2.09	1.12
Wayne	KY-90 - KY-90X,KY-3284	9.601	17	0.96	1.12
Grayson	KY-88 - KY-1214	2.426	4	1.59	1.12
Boyd	US-23 - US-23X	19.100	33	0.78	1.12
Larue	KY-210 - KY-1618	6.994	7	1.06	1.12
Pulaski	KY-1577 - KY-3261	2.213	11	1.14	1.12
Bourbon	US-68X - KY-1678	0.293	20	0.90	1.12
Madison	KY-876 - KY-2327	7.382	33	0.92	1.11
Oldham	KY-53 - KY-146	7.055	15	0.73	1.11
Henry	KY-22 - KY-322	3.473	5	1.32	1.11
Grayson	US-62 - KY-187	18.952	7	1.05	1.11
Pike	US-460 - KY-80	14.374	9	0.91	1.11
Hopkins	US-41 - KY-260	22.509	7	1.04	1.10
Hopkins	KY-336 - KY-481,KY-2171	3.336	4	1.55	1.10
Logan	US-68 - US-68X,US-431	8.297	13	1.04	1.10
Todd	US-41 - KY-181	2.507	5	1.30	1.10
Larue	KY-61 - KY-3204	10.474	9	0.74	1.10
Boyle	US-127 - US-127B,US-150B	3.442	42	0.96	1.10
Pike	US-460 - KY-1460	2.678	13	0.76	1.10
Perry	KY-80 - KY-451	4.378	6	1.14	1.10

APPENDIX A. ALL INTERSECTIONS WITH A CRF GREATER THAN ONE (continued)

COUNTY	INTERSECTING ROUTES	MILEPOINT*	TOTAL NUMBER OF CRASHES	ACTUAL RATE (C/MV)	CRF
Pulaski	US-27 - KY-80	16.782	37	0.74	1.09
Franklin	US-127 - KY-1665	2.224	16	0.69	1.09
Hardin	KY-313 - KY-1500	14.553	8	1.29	1.09
Boone	US-25 - KY-338	4.859	13	0.75	1.09
McCracken	US-60 - KY-284	16.466	26	1.07	1.09
Bracken	KY-352 - KY-875	3.253	2	3.19	1.09
Warren	US-31W - KY-3225	16.122	29	0.78	1.09
Caldwell	US-641 - KY-902	3.202	5	1.27	1.09
Christian	US-41A - KY-380	14.410	24	0.82	1.09
Daviess	KY-56 - KY-279	11.817	6	1.12	1.09
Taylor	KY-527 - KY-744	5.849	3	1.95	1.08
Anderson	KY-151 - KY-512	0.860	7	1.01	1.08
Jefferson	US-150 - KY-1020	2.560	35	0.88	1.08
Bullitt	KY-61 - KY-480	12.928	8	0.93	1.08
Jefferson	KY-61 - KY-2053	0.648	24	0.81	1.08
Martin	KY-40 - KY-292	19.510	9	0.87	1.08
Boone	KY-842 - KY-1017	6.135	41	0.95	1.08
Boyd	KY-538 - KY-3294	3.219	5	1.25	1.08
Boyle	KY-52 - KY-1805	1.586	6	1.10	1.08
Calloway	KY-94 - KY-822	9.249	12	1.04	1.08
Whitley	US-25W - KY-1193	24.861	8	0.92	1.07
Graves	KY-94 - KY-381	14.092	4	1.47	1.07
Lawrence	KY-3 - KY-644	12.581	4	1.47	1.07
Calloway	KY-94 - KY-1483	12.420	6	1.09	1.07
Jessamine	KY-29 - KY-3433	8.329	13	1.00	1.07
Graves	US-45 - KY-1276	20.555	11	0.78	1.07
Boyle	US-150 - KY-34	14.101	13	0.99	1.07
Breathitt	KY-15 - KY-30	14.866	8	0.91	1.07
Lincoln	US-27 - KY-328	3.127	7	0.98	1.07
Butler	US-231 - KY-79	8.228	6	1.08	1.06
Knott	KY-160 - KY-550	11.030	8	0.91	1.06
Pulaski	KY-80 - KY-461	28.037	11	0.78	1.06
Ohio	US-231 - KY-69,KY-1543	13.217	11	0.77	1.06
Marshall	US-68 - KY-962	18.004	5	1.21	1.06
Nelson	US-150 - KY-605	3.859	9	0.85	1.06
Christian	KY-109 - KY-1682	12.090	9	1.16	1.06
Carroll	KY-36 - KY-227	8.998	11	0.77	1.06
McCracken	KY-994 - KY-1014	5.641	4	1.43	1.06
McCracken	KY-999 - KY-1954	4.206	4	1.42	1.05
Marion	US-68 - KY-55S	11.309	13	0.97	1.05
Carlisle	KY-1372 - KY-1377	0.000	2	2.94	1.05

APPENDIX A. ALL INTERSECTIONS WITH A CRF GREATER THAN ONE (continued)

COUNTY	INTERSECTING ROUTES	MILEPOINT*	TOTAL NUMBER OF CRASHES	ACTUAL RATE (C/MV)	CRF
Madison	KY-595 - KY-1617	0.000	4	1.42	1.05
Allen	US-31E - KY-100	7.415	9	0.84	1.05
Marion	US-68 - KY-208	9.875	15	0.91	1.05
Pendleton	US-27 - KY-330	8.334	8	0.89	1.05
Harlan	US-421 - KY-413	17.941	5	1.18	1.05
Jessamine	KY-169 - KY-1981	4.218	3	1.81	1.05
Jefferson	US-31E - KY-1747	7.245	36	0.70	1.04
Christian	US-41 - KY-107	12.199	15	0.91	1.04
Pendleton	US-27 - KY-17	11.764	8	0.88	1.04
Jefferson	KY-864 - KY-1065	4.471	20	0.82	1.04
Mason	US-62 - KY-9	14.387	24	0.77	1.04
Laurel	KY-1223 - KY-3431	1.139	6	1.42	1.04
Union	KY-360 - KY-666	5.083	2	2.85	1.04
Montgomery	US-460 - KY-11	7.316	8	0.88	1.04
Boyd	KY-3 - KY-1937	6.908	4	1.38	1.04
Knox	US-25E - KY-233	21.715	14	0.68	1.04
Washington	KY-555 - KY-1754	14.354	5	1.16	1.04
Boone	KY-18 - KY-237	11.811	34	0.70	1.04
Daviess	US-231 - KY-3143	10.479	13	0.95	1.03
Scott	US-62 - KY-1973	4.000	8	0.87	1.03
Hopkins	US-41 - KY-70-1	16.249	19	0.83	1.03
Jefferson	KY-864 - KY-1065	4.324	17	0.86	1.03
Todd	KY-181 - KY-848	4.040	4	1.37	1.03
Jefferson	US-31E - KY-155	13.126	36	0.92	1.03
McCreary	KY-90 - KY-896	7.002	3	1.75	1.03
Jefferson	US-60 - KY-146	5.765	54	0.84	1.03
Muhlenberg	KY-181 - KY-890	3.996	3	1.75	1.03
Meade	KY-144 - KY-1692	16.730	5	1.14	1.03
Knox	US-25E - KY-1629	25.942	24	0.76	1.02
Madison	US-25X - KY-388	1.634	18	0.83	1.02
Nelson	KY-458 - KY-1066	4.079	2	2.76	1.02
Carter	KY-1 - KY-773	6.909	6	1.01	1.02
Shelby	KY-362 - KY-1408	3.394	3	1.73	1.02
Trigg	US-68 - US-68X	20.740	10	0.76	1.02
Butler	US-231 - KY-70	11.520	11	0.73	1.02
Jefferson	US-60A - KY-1020	3.157	29	0.96	1.02
Franklin	KY-12 - KY-2815	0.095	2	2.73	1.02
Rockcastle	US-150 - KY-461	8.709	11	0.73	1.02
Warren	KY-743 - KY-2630	1.514	3	1.72	1.02
Simpson	KY-100 - KY-1008	10.648	12	0.96	1.02
Jessamine	KY-29 - KY-2332	10.497	10	1.04	1.02

APPENDIX A. ALL INTERSECTIONS WITH A CRF GREATER THAN ONE (continued)

COUNTY	INTERSECTING ROUTES	MILEPOINT*	TOTAL NUMBER OF CRASHES	ACTUAL RATE (C/MV)	CRF
Graves	KY-408 - KY-440	3.381	3	1.71	1.01
Butler	KY-79 - KY-1153	8.239	3	1.71	1.01
Pike	US-460 - KY-3226	4.278	11	0.73	1.01
Rockcastle	US-25 - KY-1249,US-150	13.883	10	0.76	1.01
Harrison	US-27 - US-62	5.996	10	1.03	1.01
Hopkins	US-41 - KY-70,KY-481	15.421	23	0.76	1.01
Hopkins	US-41 - KY-1178	16.464	19	0.80	1.01
McCreary	US-27 - KY-700	10.794	9	0.79	1.01
Marion	KY-84 - KY-412	9.401	3	1.68	1.01
Scott	US-62 - US-460,US-460B	9.138	32	0.92	1.01
Hardin	KY-447 - KY-2802	0.419	7	1.23	1.01
Bullitt	KY-44 - KY-2723	9.285	4	1.30	1.00
Shelby	US-60 - KY-53	9.712	24	0.74	1.00
Calloway	US-641 - KY-1824	12.348	10	0.75	1.00
McCracken	KY-358 - KY-1564	2.724	2	2.63	1.00
Hardin	KY-86 - KY-1375	11.790	5	1.10	1.00
Christian	US-41A - KY-380	14.145	23	0.75	1.00
Grayson	US-62 - KY-720	31.216	4	1.30	1.00

APPENDIX B

SUMMARY OF CRASH DATA AT 10 INTERSECTIONS WITH HIGHEST CRITICAL RATE FACTOR

Christian County; US 41A at KY 117; CRF=3.913

The procedure identified 49 crashes at this location. A review of the crash reports at this location found 44 crashes directly related to the intersection. The remaining crashes were correctly assigned to the intersection given the milepoint listed on the report but were found to have occurred at an adjacent location. This intersection has four approaches with right-of-way controlled by a traffic signal. Of the 44 crashes, 20 involved a rear end collision while 19 involved an opposing left turn collision. The 20 rear end collisions were equally divided between northbound and southbound vehicles. Of the 19 opposing left turn collisions, 16 involved a northbound driver turning left across the path of a southbound vehicle. This intersection will be reconstructed as part of the reconstruction of US 41A.

Jessamine County; US 68 (MP 4.504) at KY 29; CRF=3.822

The procedure identified 30 crashes while a review of reports found 29 crashes. Also one-half of the crashes were rear end collisions on KY 29 which were coded on that road. This is a “Y” type of intersection with a stop sign on the KY 29 approach. The most common crash on US 68 was an “opposing left turn” type with this type of crash accounting for almost all the injury crashes. This intersection is part of a section of US 68 which will be reconstructed.

Jessamine County; US 68 (MP 5.094) at KY 29; CRF=3.795

The procedure identified 34 crashes with only 25 found when the crash data were reviewed. This was one of two intersections between US 68 and KY 29. The milepoint on KY 29 was the same at both intersections and the rear end crashes on KY 29 were assigned to both intersections. A review of the data found that almost all of the rear end crashes occurred at the other intersection reducing the number at this “T” intersection. Right of way is controlled by a stop sign on KY 29. The most common type of crash was an angle collision involving a driver from the side road pulling into the path of a vehicle on US 68. This intersection is part of a section of US 68 which will be reconstructed.

Laurel County; KY 229 at KY 1189; CRF=3.369

The 23 crashes obtained from the crash data agreed with the number listed in the identification program. This intersection has four approaches with traffic controlled by stop signs on KY 1189. Most of the crashes were right angle with a driver pulling up to a stop on KY 1189 and then attempting to cross KY 229. Most of the crashes involved either westbound on KY 1189 and southbound on KY 229 or eastbound and northbound vehicles.

Hardin County; KY 220 at KY 447; CRF=3.343

The 20 crashes obtained from the crash data agreed with the number obtained by the identification procedure. This intersection has four approaches with traffic controlled by stop signs on KY 220. All but one of the crashes were angle crashes involving a vehicle stopping on KY 220 and then pulling into path of a vehicle on KY 447.

McCracken County; US 60 at KY 1852; CRF=3.193

The 23 crashes in the crash data base agree with the number identified in the procedure. This section of US 60 has been reconstructed with this intersection replaced.

Warren County; KY 234 at KY 2158; CRF=3.099

There were 20 crashes located in the data base which agreed with the number found in the identification procedure. This intersection has four approaches with a traffic signal installed. Of the 20 crashes, 9 were rear end, 7 were angle, and 3 were opposing left turn. Several of the angle collisions involved a driver disregarding a red signal.

Nelson County; US 31E (MP 13.972) at US 62; CRF=3.046

There are two intersections of US 31E and US 62 within about 0.3 mile in Bardstown. The milepoint for US 62 is the same for both intersections and many of the crashes were located using the US 62 milepoint. The intersection identified in the procedure was the western of the two intersections. A review of the crash data showed that about 54 crashes could be related to that intersection. This compares to 51 crashes using the identification process. This intersection is an example of the process which must be conducted when a route has the same milepoint at two intersections and crashes are located using that route. Most of the crashes were rear end.

McCracken County; US 60 at KY 996; CRF=2.814

The 23 crashes found in the crash data agreed were the same as that from the identification procedure. This section of US 60 has been reconstructed with the intersection currently having four approaches with right of way controlled by a traffic signal. The most common types of crashes were rear end, angle, and opposing left turn.

Jessamine County; US 68 (MP 7.488) at KY 169; CRF=2.771

There are two intersections of US 68 and KY 169 within about 0.2 mile but no crashes were coded on KY 169 which is the route with the same milepoint for both intersections. Review of the crash data file found 29 crashes at this intersection which was the same number found in the identification procedure. Of those, 18 were rear end and 7 involved an impact with a fixed object.