Program for Determination of High-Accident Locations

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ABRIDGMENT

•FOR TWENTY YEARS, the Oregon State Highway Department has compiled motor vehicle traffic accident data, coded on machine cards, in the form of individual detail records containing pertinent information taken from official accident reports. Because Oregon law requires all accidents involving any property damage, personal injury, or death to be reported, these reports represent a high percentage of all accidents occurring in the state.

Before the advent of the high-speed computer, use of these accident data was limited by simple data processing equipment and manual decoding techniques. Various types of accident summaries had been developed, most importantly: (a) tabulation of the number of accidents, personal injuries, and fatalities for selected intersections; and (b) tabulation of the number of accidents and the accident rate per million vehicle-miles by section of highway for the state highway system. The usefulness of these analyses was limited because the intersectional accident summaries did not include a measurement of exposure and most sections used for the accident-rate summary were too long to pinpoint high-accident locations closely enough that corrective measures could be determined.

In 1962, a series of IBM 1401 computer programs was developed to summarize accidents and compute accident rates by highway sections. The following criteria were set:

1. The analysis would be developed using basic data in the format already available.
2. An accident-rate calculation would be included so that the accident experience could be evaluated in terms of an exposure factor as well as total number of accidents.
3. The data must be available for sections sufficiently short to permit pinpointing of hazardous locations so that probable causes of high-accident rates could be located with reasonable certainty.
4. The tabulation produced could be used directly by the engineering staffs in the district offices without need of additional decoding or interpretive analysis.

Form of Basic Data

To facilitate machine operation and reduce storage requirements, the accident records for each calendar year are placed on tapes, with the urban and rural accident cards (Figs. 1 and 2) sorted separately. Mileage control data for the state highway system including vehicle-miles of travel have also been recorded on cards (Fig. 3) and put on tape. Finally, intersection control cards were devised containing the identification for each intersection on the state highway system, the highway index number, mile point, route number, and name of the intersecting road or street. Because of differences in the coding procedure used on the accident records and in the format desired for the final listings, separate programs had to be developed for the urban and rural analysis (Figs. 4 and 5).

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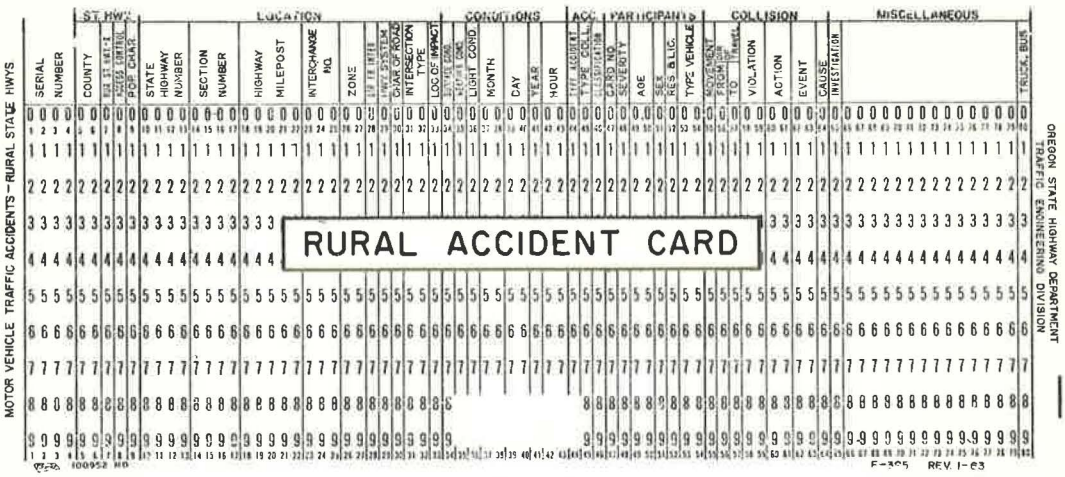

Figure 1.

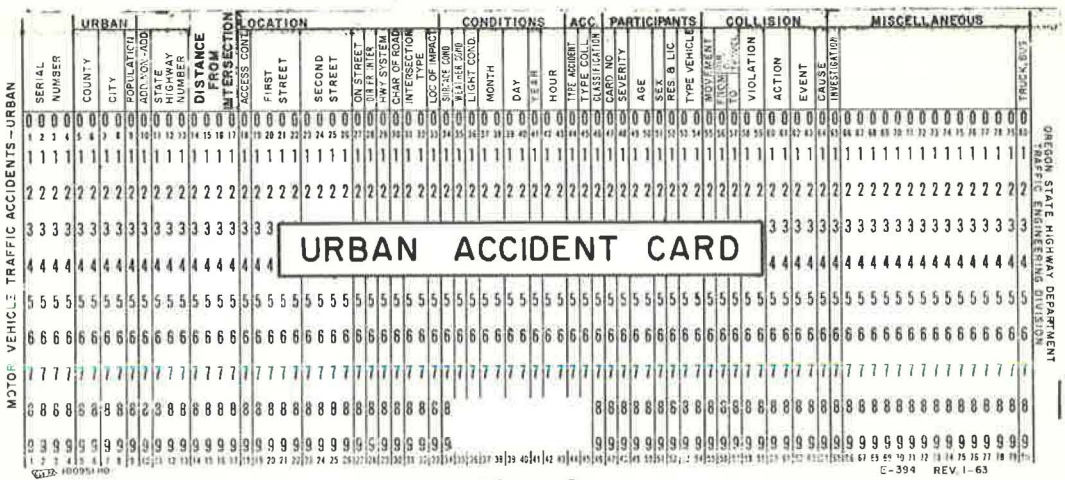

Figure 2.

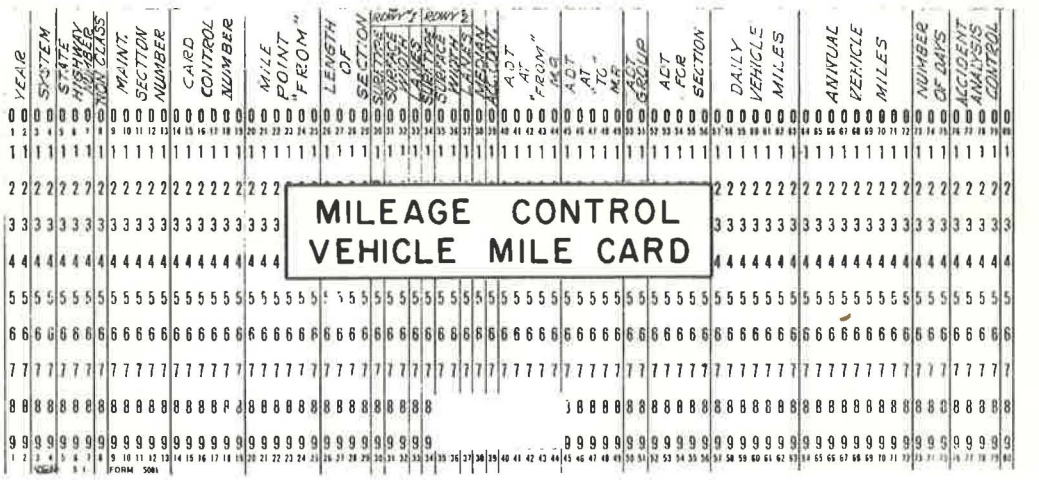

Figure 3.

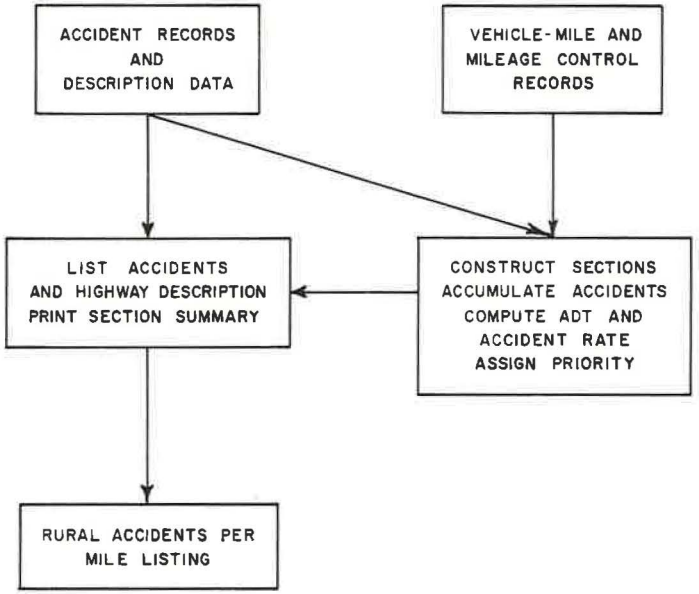

Figure 4. Schematic diagram of rural accident per mile program.

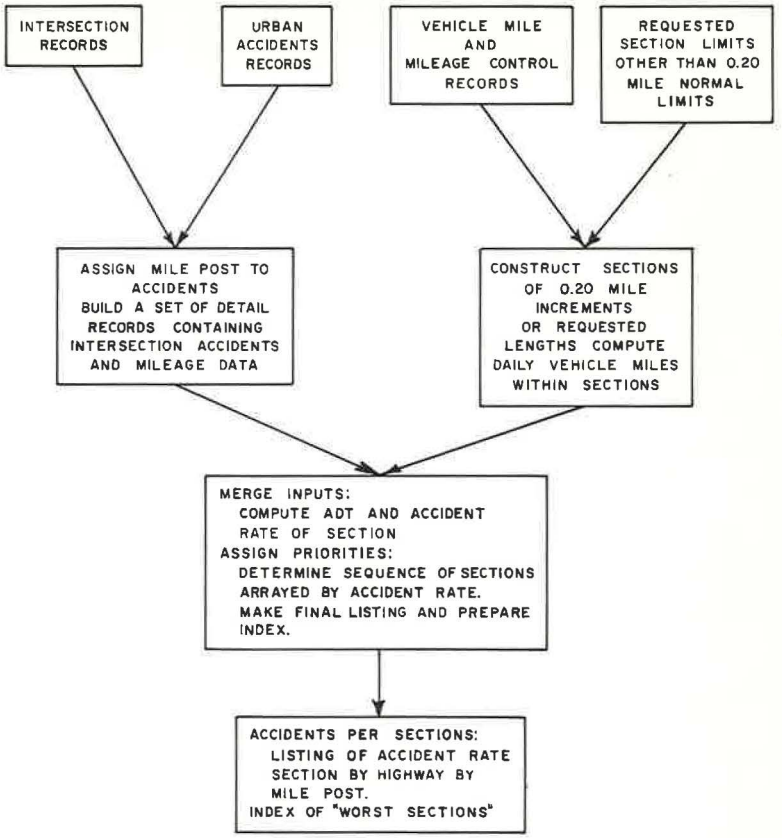

Figure 5. Schematic diagram of urban accident per section program.

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                          PACIFIC HIGHWAY                1
INTERSECTION        NON-INTERSECT    TOTAL BY MILE     PRIOR YEAR               ACC
MILEPOST ACC.       MILEPOST ACC.      ACC. KIL. INJ.    INT. OTH

                       7.35    2                                        RE-- 1 BCK- 1
                       7.36    1                                        SSO- 1
                       7.40    2                                        FO-- 2
                       7.49    2                                        SSO- 1 NC-- 1
                       7.50    2                                        RE-- 1 NC-- 1
                    7.59* HWY W 1W UXING PACIFIC
                       7.77    1                                        NC-- 1
                       7.80    1                                        FO-- 1
                       7.84    1                                        FO-- 1
                       7.85    1                                        FO-- 1
                       7.86    1                                        RE-- 1
                       7.89    1                                        SSO- 1
                       7.90    2                                        RE-- 1 FO-- 1
                       7.91    1                                        SSO- 1
                       7.94    1                                        SSO- 1
                       7.97    1                                        FO-- 1
                       7.98    1                                        RE-- 1
                    7.99* MULT WASH CO L
          TOTAL M.P.   7              37     2   22      4    12                 RATE   4.91   ADT 20573   PRIORITY  781

                       8.03    1                                        FO-- 1
                       8.07    1                                        SSO- 1
                       8.10    3                                        RE-- 2 FO-- 1
                       8.43    1                                        FO-- 1
                       8.50    1                                        FO-- 1
                       8.69    1                                        RE-- 1
                       8.77    1                                        FO-- 1
          TOTAL M.P.   8               9          6           9                  RATE   1.42   ADT 17266   PRIORITY 1806

                       9.11    1                                        FO-- 1
                       9.23    1                                        NC-- 1
                       9.31    2                                        FO-- 2
                    9.34* WASH CLACKAMAS CO LINE
                       9.88    1                                        SSO- 1
          TOTAL M.P.   9               5          2      1    7                  RATE    .80   ADT 16907   PRIORITY 186

                      10.00    1                                        MIS- 1
  10.03     1                                                           SSO- 1
                   10.08* CLACK WASH CO LINE
                      10.34    1                                        RE-- 1
                      10.64    1                                        RE-- 1
          TOTAL M.P.  10               4          2      2    6                  RATE    .68   ADT 15854   PRIORITY 188

  11.03     2                                                           RE-- 1 TRN-
  11.09     1                                                           TRN- 1
  11.25     1                                                           ANG- 1
                      11.27    1                                        FO-- 1
                      11.35    1                                        FO-- 1
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Figure 6. Output format of rural accident per mile program.

HIGHWAY 1-E, ROUTE US99E, SALEM - CONTINUED

MILE-POINT	HIGHWAY-STREET NAME	CROSS-STREET NAME		ACCIDENTS TOTAL	INT- SCTN	NON-SCTN	CASUALTIES I	F	TYPE OF COLLISION
S 50.80		BEGIN SECTION							
S 50.81	COMMERCIAL ST	LESLIE ST							
S 50.86	COMMERCIAL ST			2		2			RE-- 1 SSC- 1
S 50.87	COMMERCIAL ST			1		1			SSO- 1
S 50.88	COMMERCIAL ST	MISSION ST		6	6		4		ANG- 1 RE-- 2 TRN- 3
S 50.89	COMMERCIAL ST			2		2	2		RE-- 1 PRK- 1
S 50.90	COMMERCIAL ST			1		1			RC-- 1
S 50.93	COMMERCIAL ST			1		1			RE-- 1
S 50.95	COMMERCIAL ST	KEARNEY ST		2		2			RE-- 1 PRK- 1
	SECTION LENGTH 0.20		TOTALS	15	6	9	6		RATE 33.72 ADT 12220 PRIORITY 4
S 51.00		BEGIN SECTION							
S 51.02	COMMERCIAL ST	RUSH ST							
S 51.03	COMMERCIAL ST			1		1			PRK- 1
S 51.08	COMMERCIAL ST	OWENS ST		6	4	2			RE-- 3 TRN- 3
S 51.15	COMMERCIAL ST	MILLER ST							
	SECTION LENGTH 0.20		TOTALS	7	4	3			RATE 17.16 ADT 11210 PRIORITY 17
S 51.20		BEGIN SECTION							
S 51.22	COMMERCIAL ST	WILSON ST		1	1				RE-- 1
S 51.29	COMMERCIAL ST	MYERS ST		2	2				ANG- 2
S 51.36	COMMERCIAL ST	LEFELLE ST							
	SECTION LENGTH 0.20		TOTALS	3	3				RATE 8.09 ADT 10185 PRIORITY 22
S 51.40		BEGIN SECTION							
S 51.43	COMMERCIAL ST	LINCOLN ST		1	1				TRN- 1
S 51.50	COMMERCIAL ST	WASHINGTON ST							
S 51.57	COMMERCIAL ST	SUPERIOR ST							
	SECTION LENGTH 0.20		TOTALS	1	1				RATE 2.77 ADT 9905
S 51.60		BEGIN SECTION							
S 51.62	COMMERCIAL ST	LIBERTY ST CONN							
S 51.63	COMMERCIAL ST	OXFORD ST							
S 51.68	COMMERCIAL ST			1		1			BCK- 1
S 51.70	COMMERCIAL ST	RURAL ST		10	7	3	3		ANG- 2 RE-- 5 SSO- 3
S 51.74	COMMERCIAL ST			1		1			NC-- 1
S 51.75	COMMERCIAL ST	JERRIS ST		1		1	1		RE-- 1

Figure 7. Output format of urban accident per section program.

Rural Accident Program Series

Since the highway number and mile point are coded on each rural accident card, a straightforward operation was possible involving the matching of accident and vehicle-mile cards with a subsequent calculation. As accidents and vehicle-miles are accumulated by one-mile sections, composite accident rates are calculated from the two sets of data. Finally, the sections are arrayed in sequence by accident rates and assigned a priority rating, with the number one priority being that section with the highest accident rate. To provide convenient geographic references for persons using the final listing, a separate set of cards was created which identified selected mile points with a brief locational description. These are merged into the final tape after the calculations are completed and before the print-out of the final listing (Fig. 6).

Urban Accident Program Series

Accidents in urban areas (within the corporate limits of cities) are coded as occurring either at an intersection or in terms of distance and direction from an intersection. For precise location, distances are coded in feet. This coding procedure made the analysis and programming steps for urban accidents much more complicated than for rural accidents.

Work on intersection control records had been started previously because the information was required for other accident summaries, but only selected intersections were included. For this program, however, it was imperative that the intersection reference be as complete as possible. Otherwise, both intersections and the accidents occurring at them would not appear in the listing.

To make the listing as useful as possible, the procedure for delineating the accident-rate sections had to be carefully defined. A standard distance of 0.20 mile was used for each section. Specifications for the beginning and ending termini were as follows: (a) municipal boundaries, (b) beginning or ending of a highway, (c) the beginning or ending of a break or discontinuity in the mile-point sequence of a highway, such as would be caused by mile-point equations, (d) the beginning or ending of a mileage control change such as occurs at the beginning or end of a couplet, and (e) any particular mile point specified by a set of control cards.

The first step in the program sequence matches the accident records with the intersection control records, thus locating the accident by highway mile point. A set of detail records is then made containing accident data and a mile-point reference for each intersection. At the same time, the sections are defined, vehicle-miles are computed, and the two sets of data are compatible for merging into the subsequent operation. At this stage, the accident rates are computed for each section and the sections are arrayed by these rates. Priority numbers are then assigned by position in the array. An example of the final listing is shown in Figure 7.

Application of Analysis

To make maximum use of this accident analysis procedure in the identification and correction of high-accident locations, listings are prepared semiannually. Besides a complete listing of the state highway system containing priority sequence on a statewide basis, listings are also prepared for each geographic division of the highway department. These listings contain only the sections in the respective divisions with the priority numbers assigned accordingly.

Approximately 100 locations have been investigated to date and appropriate measures have been taken to correct deficiencies. Corrective measures taken include the installation of signs and pavement markings, installation of traffic signals, correction of superelevation, and in one case complete redesign of an intersection. Since the program has been in effect only a short time, the effectiveness of corrective measures taken so far cannot be fully evaluated. However, in one example involving minor improvement, sign installation, the accident rate was reduced 54 percent; in another, involving extensive reconstruction, accidents have been reduced 89 percent. A secondary use of the listings is to provide before-and-after accident comparisons to determine the effectiveness of corrective measures taken as a result of this program.