Highway Accident Analysis Through Use Of IBM Punch Cards

PAUL R. TUTT, Senior Traffic Engineer, and
WILLIAM R. WELTY, Senior Traffic Engineer
Traffic Engineering Section, Division of Maintenance Operations
Texas Highway Department

● THE need for more extensive use of traffic accident records by Texas highway engineers has been recognized for many years. Until recently, however, there was no machinery set up which made the records readily available to the engineer, and the size of the job of setting up such machinery was rather formidable. The use of and availability of accident records at the district level were particularly poor, and this is probably the level at which the greatest benefit can be derived from the use of such records. For purposes of highway administration, Texas is divided into 25 districts, each of which includes about ten counties under a district engineer. These district organizations are the backbone of the Department, and it is here that accident records can be used directly and can be applied to specific problems.

The need for providing accident data at the district level was the most important factor to be considered in any accident analysis system that might be adopted. A brief survey of the situation indicated that if any such use of accident records was to be made, it would be necessary to set up a system which could furnish complete data regularly and in a form which lent itself to highway engineering uses. A further study of the situation showed that this would not be a small job, primarily because of the number of accidents, the number of miles of highway, and the yearly vehicle miles to be considered. Since the responsibility of the Highway Department lies primarily in rural areas, the analysis program was limited to rural highways and highway routes within cities of 2,500 population and less. It can be expanded to include larger cities if this is later found to be desirable.

There are about 23,500 miles of rural US and state highways in Texas and about 23,000 miles of rural farm to market roads. Over 16.5 billion miles were driven on these highways in 1954, and there were approximately 30,233 accidents. To handle such large volumes of information efficiently, it was decided, would require some sort of mechanical processing. A study of the methods used in other states was made, but no system was found which seemed to quite fill the need without considerable modification. It was, however, decided that IBM punch cards, which were used by several states, were the most feasible means of handling the data.

The source of the accident records is the files of the Statistical Division of the Texas Department of Public Safety. Texas law requires that a report be filed by each driver involved in an accident in which the total property damage amounts to $25 or more or in which any person is killed or injured. These reports are submitted to the Department of Public Safety where they are processed and filed. Considerable use of the reports and numerous analyses are made by the Department of Public Safety, none of which fills the needs of the highway engineer, primarily because exact location information and collision diagrams are not given sufficient consideration. The reports which the drivers and officers submit are on the standard accident report form recommended by the National Safety Council and are filed yearly by county and date. These records have been available to the highway engineers since 1939, but working with such a great volume of reports made extensive manual analyses extremely laborious. To add to the difficulty, although it increased rural reporting about 85 percent, a safety responsibility law became effective in Texas in 1952. This made it necessary for a large number of accident reports to be removed from the files for long periods of time and rendered the files almost useless as far as the highway engineers were concerned.

These difficulties, which the engineers encountered in trying to use the records as filed by the Department of Public Safety, led to the establishment of the Accident Analysis Section of the Division of Maintenance Operations of the Highway Department. It consists of a traffic analyst and four junior traffic clerks. After the reports have been

TEXAS POLICE OFFICERS' CONFIDENTIAL ACCIDENT REPORT — MAIL TO Department of Public Safety, No Austin Sta, Austin, Texas

LOCATION

PLACE WHERE ACCIDENT OCCURRED - County: Coke — City or town: Bronte

If accident was outside city limits indicate distance from nearest town: miles north-south / miles east-west of ☐ limits of ☐ center of — City or town

ROAD ON WHICH ACCIDENT OCCURRED - U.S. 277
Give name of street or highway number (U S or State) if no highway number, identify by name

Check and complete one only: ☒ AT ITS INTERSECTION WITH S.H. 158 (Name of intersecting street or highway number) / ☐ NOT AT INTERSECTION — feet north-south / feet east-west of
Show nearest intersecting street or highway, house number, bridge, railroad crossing, culvert, milepost, underpass, or other identifying landmark. Show exact distance

DO NOT WRITE IN THIS SPACE: No. / Loc. / S R / Fat rec. / Dr rec. / Code / Type / FAT / PI / PD

TIME

Date of Accident: April 20, 19 54 — Day of Week: Tuesday — Hour: 5:30 ☐ A M ☒ P M (If exactly noon or midnight, so state)

ROAD

CHARACTER (Check two)
☒ Straight road ☐ Curve
☒ Level ☐ On grade ☐ Hillcrest

SURFACE CONDITION (Check one)
☒ Dry ☐ Wet ☐ Muddy ☐ Snowy ☐ Icy

TRAFFIC CONTROL (Check one or more)
☐ Officer or watchman
☒ Stop-and-go or flashing light
☐ Stop sign
☐ Warning sign (curve, school, etc.)
☐ Railroad crossing gates
☐ Railroad automatic signal
☐ One way street
☐ Traffic lanes painted or marked
☒ Center stripe
☐ Specify Other
☐ No traffic control present

KIND OF LOCALITY (Check one to show that area within 300 feet was primarily)
☐ Manufacturing or industrial
☒ Shopping or business
☐ Residential district
☐ School or playground
☐ Open country
☐ Specify Other

LIGHT (Check one)
☒ Daylight ☐ Dusk ☐ Dawn ☐ Darkness - street lights ☐ Darkness - no street lights

SURFACE (Check one)
☐ Concrete ☒ Blacktop ☐ Brick ☐ Gravel ☐ Dirt
☐ Specify Other

DEFECTS (Check one or more)
☐ Defective shoulders ☐ Holes, deep ruts, bumps, etc ☐ Loose material on surface ☐ Under construction
☐ Specify Other ☒ No defects

WEATHER (Check one)
☒ Clear ☐ Raining ☐ Snowing ☐ Fog
☐ Specify Other

VEHICLES

VEHICLE No 1 -
Year Model: '52 Chev — Type of Vehicle: Panel Truck (Sedan, tractor-semi-trailer, taxi, etc) — Vehicle Registration: '54 Texas Z/Z 4102 (Year / State / Number) — Commodity Carried: (Butane, mixed freight etc) ☐ Loaded ☐ Empty

DRIVER: Mary Ellen Doe, 619 Lake Austin Boulevard, Austin, Texas (Name / Address / City and State) — Age: 19 — Sex: F

Race of Driver: W (White, negro, etc) — Driver's Occupation: Student (Carpenter, doctor, sales clerk, etc) — Driving Experience: 4 Years — Driver's License: Texas 93752001 (State / Number) ☐ Chauffeur's ☒ Operator's ☐ Com Op

Speed Before Accident: 30 m p h — Legal Speed Limit: 30 m p h — Maximum Safe Speed: 30 m p h — Approximate cost to repair vehicle $: 250.00

Owner: Wm. Doe (Name) — -Same- (Address) — Vehicle Removed To: home by owner (Name of garage, home by owner, driven away, etc.)

VEHICLE No 2 -
Year Model: '53 Merc — Type of Vehicle: Coach (Sedan, tractor-semi-trailer, taxi, etc.) — Vehicle Registration: '54 Texas Z/Z 4905 (Year / State / Number) — Commodity Carried: (Butane, mixed freight, etc) ☐ Loaded ☐ Empty

For Other vehicles use another form

DRIVER: John H. Rhoe, 2102 Lavaca Street, Austin, Texas (Name / Address / City and State) — Age: 40 — Sex: M

Race of Driver: W (White, negro, etc) — Driver's Occupation: Salesman (Carpenter, doctor, sales clerk, etc) — Driving Experience: 22 Years — Driver's License: Texas 99600007 (State / Number) ☐ Chauffeur's ☐ Operator's ☒ Com Op

Total vehicles involved

Speed Before Accident: 10 m p h — Legal Speed Limit: 30 m p h — Maximum Safe Speed: 0 m p h — Approximate cost to repair vehicle $: 100.00

Owner: -Same- (Name / Address) — Vehicle Removed To: driven away (Name of garage, home by owner, driven away, etc)

DAMAGE TO PROPERTY OTHER THAN VEHICLES: None (Name object, show ownership, and state nature of damage) — Approximate cost to repair $

CASUALTIES

No 1 - Name: N — Address: O — Age — Sex — Race — Taken to — Was person killed? — By — Date of Death — ☐ Driver ☐ Passenger ☐ Pedestrian ☐ In vehicle ☐ No ☐ Specify other

No 2 - Name — Address — Age — Sex — Race — Taken to — Was person killed? — By — Date of Death — ☐ Driver ☐ Passenger ☐ Pedestrian ☐ In vehicle ☐ No ☐ Specify other

Total

WITNESSES - In veh 2, ped 60ft east, etc

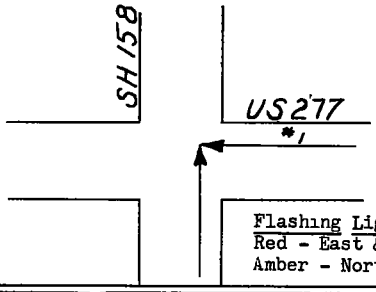
Name — Address: NONE — Where Was Witness

Name — Address

REV 67 1 1 52

Figure 1. Typical traffic accident report.

INDICATE ON THIS DIAGRAM WHAT HAPPENED



INSTRUCTIONS
1 Follow dotted lines to draw outline of roadway at place of accident
2 Number each vehicle and show direction of travel by arrow
3 Use solid line to show path before accident, dotted line after accident
4 Show pedestrian by
5 Show railroad by
6 Show distance and direction to landmarks, identify landmarks by name or number

WHAT DRIVERS WERE DOING *(Check one for each driver)*

Driver 1	Driver 2	
☒	☒	Going straight ahead
☐	☐	Making right turn
☐	☐	Making left turn
☐	☐	Making U turn
☐	☐	Slowing or stopping
☐	☐	Starting in traffic lane
☐	☐	Starting from parked position
☐	☐	Stopped in traffic lane
☐	☐	Properly parked
☐	☐	Backing
		(Check applicable items)
☐	☐	Passing
☐	☐	Avoiding vehicle, object or pedestrian
☐	☐	Skidded - before applying brakes
☐	☐	Skidded - after applying brakes
☐	☐	Driverless moving vehicle

DRIVERS VIOLATIONS INDICATED *(Check one or more for each driver)*

Driver 1	Driver 2	
☐	☐	Had been drinking
☐	☐	Exceeded safe speed
☐	☐	Exceeded legal speed
☐	☒	Failed to grant right of way to vehicle
☐	☐	Following too closely
☐	☐	Passing without sufficient clearance
☐	☐	Passing in no passing zone
☐	☐	Passing on wrong side
☐	☐	Other improper passing
☐	☐	On wrong side of road - not passing
☐	☐	Failure to signal or improper signal
☐	☐	Improper turn - wide right turn
☐	☐	Improper turn - cut corner on left
☐	☐	Improper turn - from wrong lane
☐	☐	Railroad crossing violation
☐	☐	Disregard stop sign
☐	☐	Disregard stop-and-go light
☐	☐	Disregard warning sign
☐	☐	Improper parking location
☐	☐	Improper starting from parked position
☐	☐	Impeding traffic-too slow
☐	☐	Careless or reckless driving
☐	☐	Hit and Run (F S R A)
☐	☐	Overweight or oversize
☐	☐	Other improper action
☒	☐	No improper driving

WHAT PEDESTRIAN WAS DOING *(Check one)*

- ☐ Crossing at intersection - with signal
- ☐ Crossing at intersection - against signal
- ☐ Crossing at intersection - no signal
- ☐ Crossing at intersection - diagonally
- ☐ Crossing not at intersection
- ☐ Coming from behind parked cars
- ☐ Walking in roadway - *(Check two below)*
  - ☐ With traffic
  - ☐ Against traffic
  - ☐ Sidewalks available
  - ☐ Sidewalks not available
- ☐ Pushing or working on vehicle
- ☐ Other working on roadway
- ☐ Playing on roadway
- ☐ Hitching on vehicle
- ☐ Not on roadway - *(Explain)*
- ☐ *Specify other action*

CONDITION OF DRIVERS AND PEDESTRIAN

PHYSICAL

Driver 1	Driver 2	Ped	
☐	☐	☐	Ill
☐	☐	☐	Fatigued
☐	☐	☐	Apparently asleep
☐	☐	☐	Body defect (arms, legs, hearing, eyesight, paralysis, etc)
☒	☒	☐	Apparently normal
☐	☐	☐	Condition not known

Explain condition

DRINKING

Driver 1	Driver 2	Ped	
☒	☒	☐	Had not been drinking
☐	☐	☐	Not known whether drinking
			Had been drinking if so
☐	☐	☐	Obviously drunk
☐	☐	☐	Ability impaired
☐	☐	☐	Ability not impaired
☐	☐	☐	Not known if impaired

VEHICLE CONDITION *(Check one or more)*

Driver 1	Driver 2	
☐	☐	Defective brakes
☐	☐	Improper lights
☐	☐	Defective steering mechanism
☐	☐	Defective tires
☐	☐	Other defects
☒	☒	No defects
☐	☐	Defects not known
☐	☐	Chains in use

DRIVER VISION OBSCURED *(Check one or more in each section)*

Driver 1	Driver 2	
☐	☐	Rain, snow, etc on windshield
☐	☐	Windshield otherwise obscured
☐	☐	Vision obscured by load on vehicle
☐	☐	*Specify other*
☒	☒	Vision not obscured

Driver 1	Driver 2	
☐	☐	Trees, crops, etc
☐	☐	Building
☐	☐	Embankment
☐	☐	Signboard
☐	☐	Hillcrest
☐	☐	Parked vehicles
☐	☐	Moving vehicles
☐	☐	*Specify other*
☒	☒	Not obscured

DESCRIBE WHAT HAPPENED

No. 2 stopped at red flashing light then pulled into intersection hitting No. 1 broadside with right front of vehicle No. 2.

ARRESTS Name: John H. Rhoe — Charge: Fail to grant R.O.W. (vehicle)

Name — Charge

INVESTIGATION Time notified of accident: 4-20-54 (Date) 6:30 (Hour) ☐ AM ☒ PM — Time arrived at the scene: 4-20-54 (Date) 7:15 (Hour) ☐ AM ☒ PM

Where else was investigation made? scene only

Is investigation complete? ☒ Yes ☐ No

Were photographs taken? ☐ Yes ☒ No

Driver report forms furnished to ☒ Driver 1 ☐ Driver 2

★SIGNATURE Investigator's rank and name: T.H.P. — Department — Date of report: 4-20-54

IMPORTANT: The driver of every motor vehicle involved in an accident is required to submit a separate accident report even though the accident was investigated by an officer. Drivers' accident report forms are available at all city, county, and state police offices.

REV 6 F S 16 50

Figure 1. (Continued).

Serial 78121

TEXAS HIGHWAY DEPARTMENT
DIVISION OF MAINTENANCE OPERATIONS
TRAFFIC ENGINEERING SECTION
ACCIDENT ANALYSIS CODE SHEET

Coded by _____
Punched by _____
Checked by _____

Serial Number					County			Control				Highway Number 1 Section		F.A.		Milepost		Type	Width		Curves	Sight Restriction	
7	8	1	2	1	0	4	1	0	2	6	4	0	4	4	1	4	4	1	2	0	0	0	0
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24

Highway Number 2 Section		F.A.		Type		Width		Intersection Type		Direction of Travel No.1	No.2	Type of Accident	Manner of Collision	Contributing Factor		Car Number 1 Maneuver		From		To		Car Number 2 Maneuver		From		To	
0	1	4		1		2	0	4	1	1	7	2	2	0	8	0	0	1	0	1	0	1	0	0	1	4	5	0	1
25	26	27		28		29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52

Violation	Driver Condition No.1	No.2	Vehicle Condition No.1	No.2	Date Mo.	Day	Yr.	Day of Week	Time		Alignment	Surface Type	Surface Condition	Road Defects	Traffic Control	Locality Type	Weather	Vehicle Type No.1	No.2	Speed Before Accident No.1	No.2	Number of Vehicles	Number Killed	Number Injured		
2	1	1	1	1	4	2	0	4	3	1	7	1	2	1	9	3	2	1	2	1	4	2	2	0	0		
53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80

Figure 2. Typical code sheet.

STATISTICAL DIVISION
TEXAS DEPARTMENT OF PUBLIC SAFETY

CODE HEADINGS

1 SERIAL NUMBER - COLUMNS 1-5
2 COUNTY - COLUMNS 6-8
3 CONTROL, HIGHWAY NO. 1 - COLUMNS 9-12
4 SECTION, HIGHWAY NO. 1 - COLUMNS 13-14
5 FEDERAL AID STATUS, HIGHWAY NO 1 - COLUMN 15
6 MILEPOST, HIGHWAY NO 1 - COLUMNS 16-18
7 ROADWAY TYPE, HIGHWAY NO 1 - COLUMN 19
8 ROADWAY WIDTH, HIGHWAY NO 1 - COLUMNS 20-21
9. EXCESSIVE CURVES, HIGHWAY NO 1 - COLUMN 22
10 SIGHT DISTANCE RESTRICTION, HIGHWAY NO. 1 - COLUMNS 23-24
11 SECTION, HIGHWAY NO 2 - COLUMNS 25-26
12 FEDERAL AID STATUS, HIGHWAY NO. 2 - COLUMN 27
13. ROADWAY TYPE, HIGHWAY NO 2 - COLUMN 28
14 ROADWAY WIDTH, HIGHWAY NO. 2 - COLUMNS 29-30
15. INTERSECTION TYPE - COLUMNS 31-32
16. DIRECTION OF TRAVEL BEFORE ACCIDENT - COLUMNS 33-34
17. TYPE OF ACCIDENT - COLUMN 35
18 MANNER OF COLLISION - COLUMN 36
19. CONTRIBUTING FACTORS - COLUMNS 37-38
20 MANEUVER - COLUMNS 39-41 and 46-48
21. FROM - COLUMNS 42-43 and 49-50
22 TO - COLUMNS 44-45 and 51-52
23 VIOLATION - COLUMN 53
24. CONDITION OF DRIVER - COLUMNS 54-55
25 CONDITION OF VEHICLE - COLUMNS 56-57
26. MONTH - COLUMN 58
27 DAY OF MONTH - COLUMNS 59-60
28. YEAR - COLUMN 61
29 DAY OF WEEK - COLUMN 62
30 TIME - COLUMNS 63-64
31 ROADWAY ALIGNMENT - COLUMN 65
32. SURFACE TYPE - COLUMN 66
33 SURFACE CONDITION - COLUMN 67
34 ROAD DEFECTS - COLUMN 68
35 TRAFFIC CONTROL - COLUMN 69
36 TYPE OF LOCALITY - COLUMN 70
37 WEATHER CONDITION - COLUMN 71
38. TYPE OF VEHICLE - COLUMNS 72-73
39 VEHICLE SPEED BEFORE ACCIDENT - COLUMNS 74-75
40 NUMBER OF VEHICLES - COLUMN 76
41 FATALITY AND NUMBER - COLUMN 77
42. PERSONAL INJURY AND NUMBER - COLUMN 78

Figure 3. Code headings showing the categories of data which are transferred from the accident report to the IBM punch card.

processed by the Department of Public Safety, they are turned over to the Highway Department for coding. This is normally about 15 to 20 days after the date of occurrence of the accident. The reports are coded and returned to the Department of Public Safety for filing or transfer to another section. During the coding process, all of the information of engineering value is taken from the report as shown in Figure 1 and converted into numerical form as shown on the code sheet in Figure 2. This coding is, of course, the most fundamental part of the system. Much of the information on the report can be coded into numerical form merely by assigning numbers to each of the items in the particular category. The location and the collision diagram, however, presented a more complicated problem. A list of the code headings is shown in Figure 3.

The location of the accident as described in the original report (Figure 1) is either at or in terms of measured distance from some easily describable spot. In order to code the location, it was necessary to translate the information into a basic, consistent form. The most practical means for doing this was found to be the use of the Road Inventory Log Line Diagrams. A sample of a page from this log is shown in Figure 4. These are prepared by the Highway Planning Survey for all of the designated roads in the state and provide considerable data about each road including a milepost designation which indicates the mileage from the county line. These milepost data were used to show the location of the accident in the code. The coder first locates the accident on the log using the description of the location given in the original report. From the log, the coder then transcribes the control number, which is a breakdown of the highway system; the section number, which is a breakdown of the control number; and the milepost, which indicates the location of the accident to the nearest tenth mile. The location of the accident has now been established. The collision diagram remains as the next major difficulty.

The mileposts which were used in establishing the location of the accidents follow a definite pattern over the state. They normally increase from north to south on north-south highways and from west to east on west-east highways. This being the case, it was decided to use the direction of increasing milepost numbers on the major highway involved as the basis for showing the direction of travel of a vehicle. The other possible directions are indicated as shown in Figure 5. Thus, if a car is traveling in the direction opposite to the milepost numbers, it is coded as 5.

The next step in the preparation of the collision diagram is the manner of collision. The possibilities here are shown in Figure 6. The From, Maneuver and To codes complete the collision diagram. The From codes, some of which are shown in Figure 7, show where the vehicle was before it started the maneuver which led to the accident. The Maneuver code (Figure 8) shows what maneuver the vehicle made, and the To code, which uses the same items as the From code, shows where the vehicle went or intended to go. Thus, with Direction of Travel, From, Maneuver and To, the path of the vehicle has been established. This process can be repeated for a second vehicle if one is involved. The accident then occurred at the point where the two paths cross. Knowing the manner in which the two vehicles collided adds the final touch to the collision diagram.

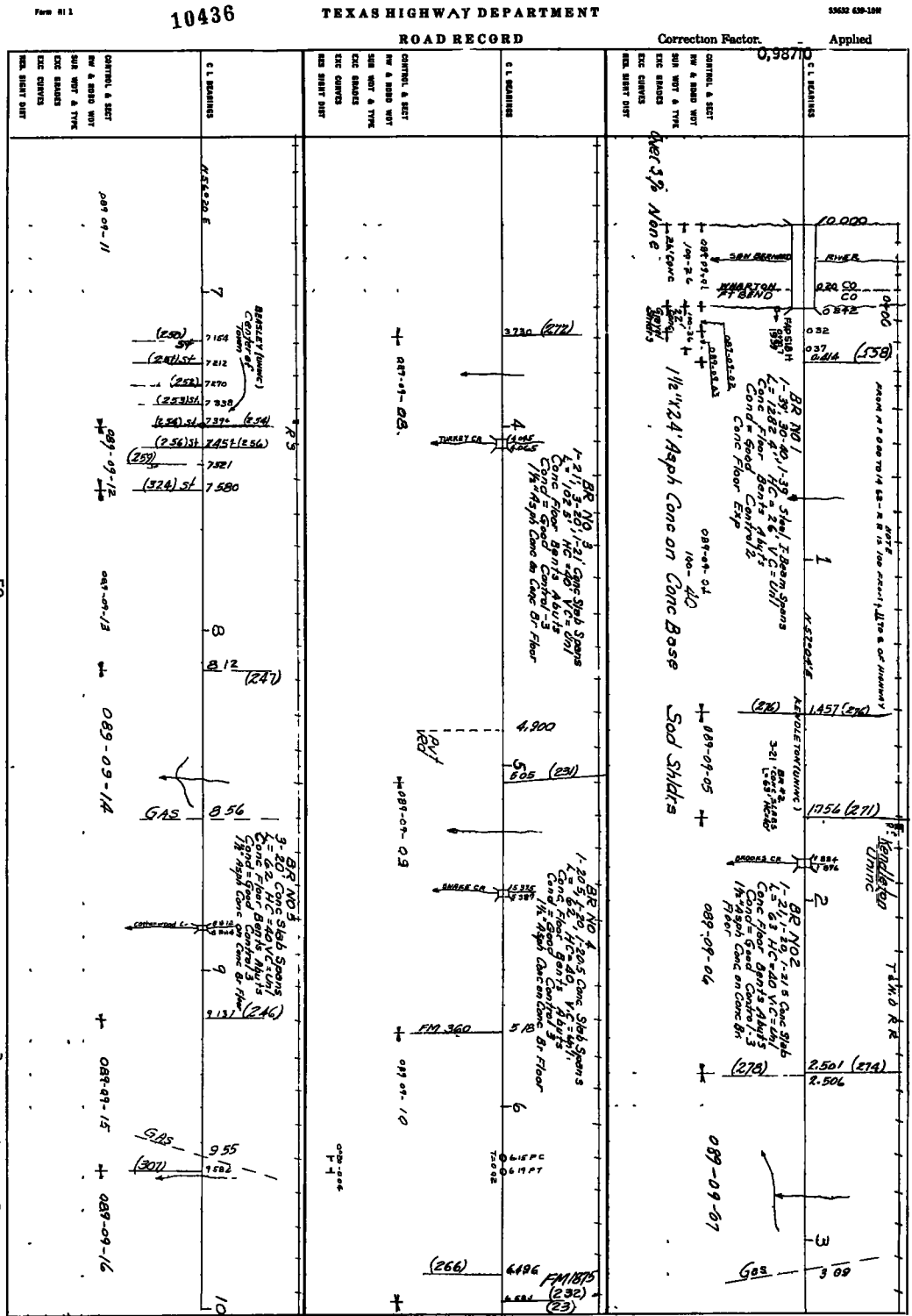
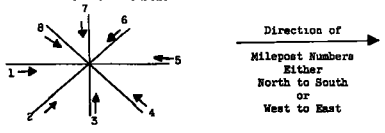


Figure 4. Typical sheet from road inventory log line diagram showing a section of US 277 in Coke County.

DIRECTION OF TRAVEL BEFORE ACCIDENT - COLUMNS 33-34

In this column the direction of travel of the vehicle is recorded It is measured with reference to the milepost numbering on the major highway That is to say, if mileposts on Highway No 1 are numbered from west to east, a car traveling from west to east on Highway No 1 would be going ahead and therefore be punched in number 1 A car approaching from the south on a lesser highway would be coming from the right and therefore punched in number 3 Right rear and opposite right, etc , should be used for traffic approaching at an angle Column 33 refers to Vehicle No 1 and Column 34 refers to Vehicle No 2

1 - Ahead
2 - Right rear
3 - Right
4 - Opposite right
5 - Opposite
6 - Opposite left
7 - Left
8 - Left rear
9 - No second vehicle*
0 - Unknown vehicle



*This would apply for Column 34 where only one vehicle was involved

Figure 5. Page from Code Manual showing the code for Direction of Travel.

MANNER OF COLLISION - COLUMN 36

In this column code the manner of collision as follows This information will come from the sketch on the back of the report and from the discussion

1 - Non-collision
2 - Right angle
3 - Head-on
4 - Sideswipe, same direction
5 - Sideswipe, opposite direction
6 - Left turn
7 - Right turn
8 - Rear end
9 - Parking maneuver
+ - Fixed object
0 - Other (includes animal or pedestrian)

Figure 6. Page from Code Manual showing the code for Manner of Collision.

If only one car was involved, the From, Maneuver and To codes plus the Manner of Collision code show at what point the vehicle became involved in an accident.

It might be well to point out some of the basic considerations which guided the thinking in setting up the code. The reason for setting up a system was to provide information which could be used in preventing future accidents. This being the case, the events leading up to and including the first collision were thought to be of prime importance. Subsequent events are not particularly important as far as accident prevention work is concerned. Complete data on only two vehicles and drivers were included, and although more than two vehicles are often involved, it was thought that the cause of the accident lies with the collision of the first two. Other vehicles subsequently involved become so as the direct result of the first collision and probably would not have been in an accident at all had not the first collision occurred. By limiting the amount of coded data in this manner, it was felt that the percentage of pertinent information, that is data which can actually be put to use in determining means of preventing future accidents, was kept at a very high level.

The coding and the code sheet shown in Figure 2 are the first step in the process. From the code sheet, the data are transferred to an IBM card as shown in Figure 9. This involves merely punching the numbers from the code sheet into the card. Complete data on each accident have now been transferred to a single IBM card. In this form, it is highly versatile since it can be manipulated quickly and inexpensively into any order required and can be listed mechanically.

Since the system was put into operation on July 1, 1954, the records for the last six months of the year 1954 are the only ones now complete and the listings published. The 1955 records are in the process of being completed and will be published in the very near future. Three standard forms of presenting the data are in use at the present time along with county spot maps which are not a product of the punch card process but which add considerably to the general usefulness of the information. These are (1) the master tabulation, Figure 10, which is a complete tabulation of all the data on each card listed by county and highway section and in increasing milepost order within the section - a section being a breakdown of the highway system with a numerical designation not duplicated in the state and

FROM - COLUMNS 42-43 and 49-50

In these columns code where the vehicle was before the accident or before beginning the maneuver which led to the accident Columns 42 and 43 refer to Vehicle No 1 and Columns 49 and 50 refer to Vehicle No 2

Highway and Right-of-Way Features

Highway No 1

01 - Lane to right of center line or median
02 - Second lane to right of center line or median
03 - Third or more lane to right of center line or median
04 - Right shoulder
05 - Parallel parking stall on right
06 - Angle parking stall on right
07 - Sidewalk parallel to highway on right
08 - Sidewalk at right angles to highway from right
09 - Island or divider on right
10 - Bridge end or rail on right
11 - Parking area off shoulder on right
12 -
13 -
14 -
15 - Lane to left of center line or median
16 - Second lane to left of center line or median
17 - Third or more lane to left of center line or median
18 - Left shoulder
19 - Parallel parking stall on left
20 - Angle parking stall on left
21 - Sidewalk parallel to highway on left
22 - Sidewalk at right angles to highway from left
23 - Island or divider on left
24 - Bridge end or rail on left
25 - Parking area off shoulder on left
26 -

Figure 7. Page from Code Manual showing the code for From and To. The same items are used for both From and To.

ranging in length from about 5 to 25 miles; (2) Tabulation No. 2, which is a summary of accidents by section, broken down by severity and manner of collision; and (3) an accident rate tabulation by highway section, Figure 11, wherein the accident data have been correlated with vehicle miles, which are also on IBM punch cards, making it pos-

MANEUVER - COLUMNS 39-41 and 46-48 MAJOR HEADING BREAKDOWN

In these columns code the maneuver which the vehicle was making, preparing to make or attempting to make at the time of the accident. Columns 39-41 refer to Vehicle No 1 and Columns 46-48 refer to Vehicle No. 2

The following tabulation is a breakdown of the major categories of maneuvers. It will be necessary to get the actual code from the following pages.

Codes

001-050 - Moving Ahead
051-100 - Turning
101-150 - Passing
151-200 - Driving Across Centerline, Not Passing
201-290 - Driving Off Of and Onto the Roadway
291-300 - Lost Control on Roadway
301-400 - Parked, Stopped or Moving Slowly
401-450 - Pedestrian Maneuver
451-475 - Animal Maneuver, Other than Animal Drawn Vehicle
476-500 - Train Maneuver

Animal Drawn Vehicle maneuvers will be the same as other vehicles

U turning vehicles shall be considered as left turning vehicles unless a specific U turn code is provided.

MANEUVER
CODES

Turning - Codes 051-100

051 - Making right turn
052 - Making prohibited right turn
053 - Making right turn from wrong lane
054 - Making right turn into wrong lane
055 - Making wide right turn
056 - Cut right turn too short

075 - Making left turn
076 - Making prohibited left turn
077 - Making left turn from wrong lane
078 - Making left turn into wrong lane
079 - Making wide left turn
080 - Cut left turn too short

091 - Making U turn
092 - Making prohibited U turn
093 - Making U turn from wrong lane
094 - Making U turn into wrong lane
095 - Making wide U turn
096 - Cut U turn too short

MANEUVER
CODES

Moving Ahead - Codes 001-050

001 - Going ahead in lane to right of centerline or median
002 - Going ahead in 2nd lane to right of centerline or median
003 - Going ahead in 3rd lane to right of centerline or median
004 - Going ahead on right shoulder
005 - Going ahead in middle lane of three lane road
006 - Going around curve to right to right of centerline or median
007 - Going around curve to left to right of centerline or median

Figure 8. Part of Code Manual showing the major breakdown of the maneuver code and part of the maneuver codes items.

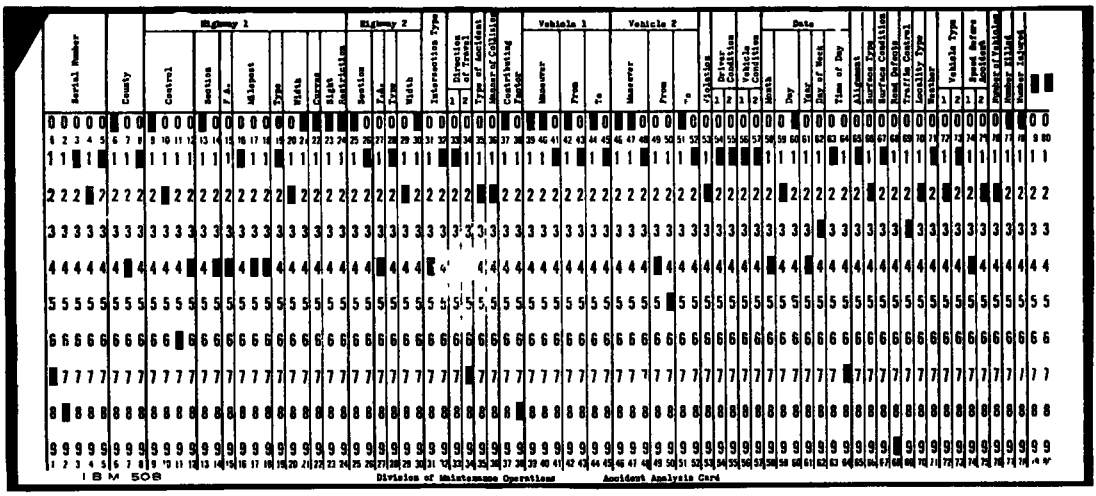
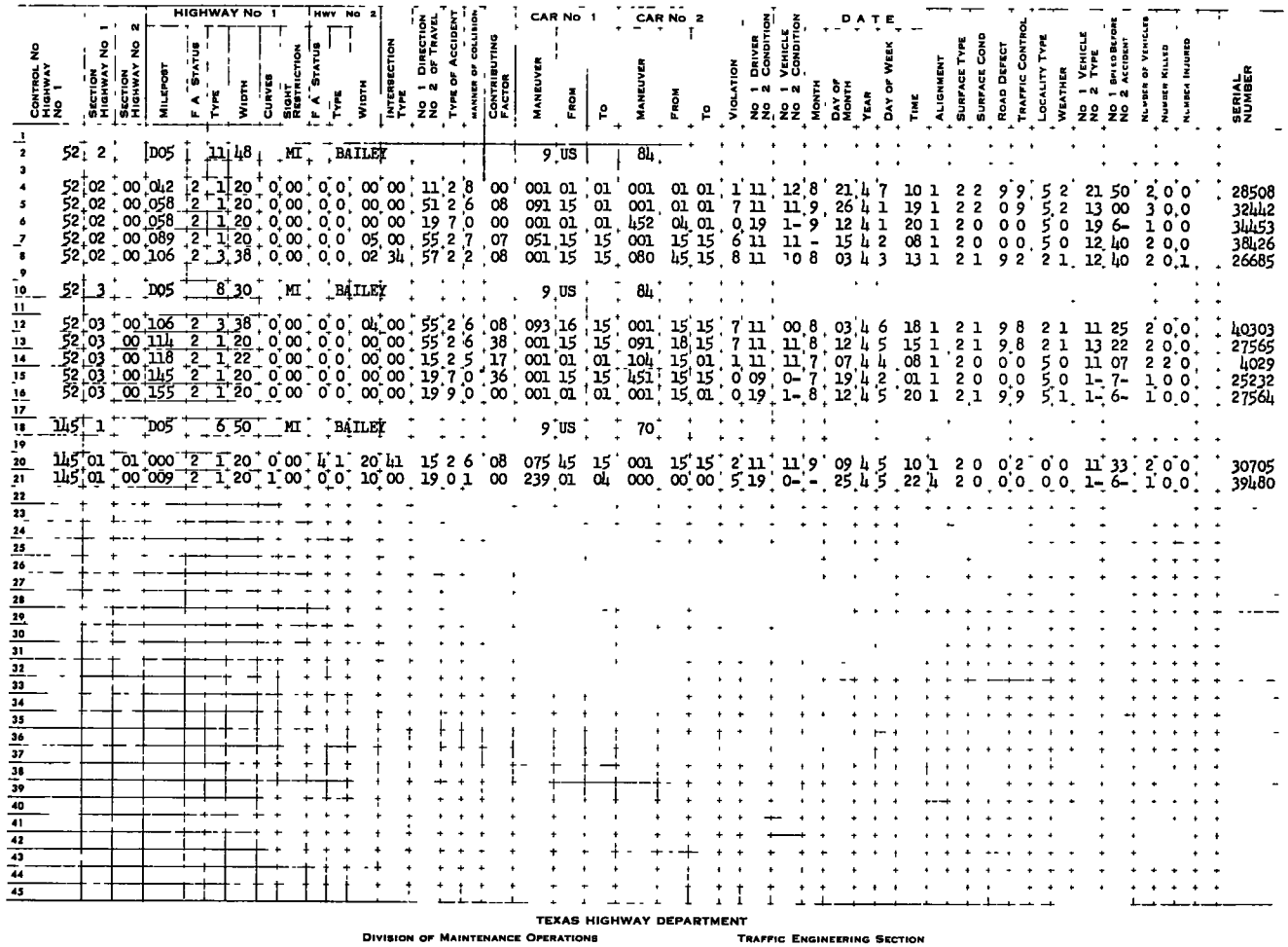


Figure 9. Typical IBM punch card.

TABULATION NO. 1, MASTER LISTING



TEXAS HIGHWAY DEPARTMENT

DIVISION OF MAINTENANCE OPERATIONS — TRAFFIC ENGINEERING SECTION

Figure 10. Typical sheet from the master tabulation showing complete data on some of the accidents in Anderson County.

County Knox — District 25

Highway	Control	Section	Length in Miles	Vehicle Miles in 1000's	Fatalities	Number of Accidents: Fatal	Fatal + Injury	Total	Accident Rates Per 100 Million Vehicle Miles: Total	Fatality	Fatal Accident	Fatal + Injury
S 283	98	4	15 9	5			1	3	328 7			109.5
S 283	98	5	12.5	8			1	4	273 9			68.4
US 82	135	2	11 0	15			1	4	168 5			42.1
US 82	135	3	18 6	24			2	4	91 3			45.6
US 277	157	2	11 1	16			4	13	395.7			121.7
SH 222	496	1	10 2	9			1	6	365 2			60.8
SH 222	496	2	.4		1	1	2	8				
FM 143	496	4	7.6	2								
FM 1043	496	5	2 4									
FM 267	538	1	10 9	3								
FM 267	538	2	17 5	2				1	275 9			
FM 1756	538	5	3.1					1				
FM 266	758	1	7.6	1				2	95.8			
FM 1587	1512	1	5.1	1				2	95 8			

Figure 11. Typical sheet from the accident rate tabulations for the sections of road in Knox County.

sible to compute accidents rates for each of the 5,000 sections of the Texas highway system. Four rates for each section are shown. They are Fatality Rate, Fatal Accident Rate, Fatal + Injury Accident Rate and Total Accident Rate. The Fatal + Injury Rate is used because for such short units of road, the number of accidents is often very small and the rates erratic. By figuring a rate which included both fatal and injury accidents, the sample was as large as possible and at the same time included only those categories of accidents for which the percentage of accidents reported was very high.

These rate calculations are an excellent example of the extreme adaptability of IBM punch cards in accident analyses. Four rates were computed for each of about 5,000 sections, making a total of about 20,000 computations which were accomplished mechanically in about two days. This would have been nearly impossible by any other method.

The master tabulation provides the districts with information which can be applied to specific locations, making it possible to construct collision diagrams — the most fundamental use of accident records. Tabulation No. 2 and the rate figures are valuable in making comparisons and in evaluating sections of road in terms of improvements and needed improvements. In addition to these, there are endless possibilities for analyses with the records in punch card form. Special studies covering any phase of the information in the card can be made quickly and easily, making the accident records applicable to use in many phases of highway research.

The mechanics of the system, which has been in operation since July 1, 1954, operate very smoothly. Although the amount of data accumulated up to this time is too small for a final evaluation, all indications are that the districts are making considerable use of the information furnished them and that the system will prove to be of great benefit.