

TECHNICAL REPORT No. 59-4

Oregon State Highway Department

W. C. WILLIAMS, State Highway Engineer

A Study of
One-Way Street Routings on Urban
Highways in Oregon



Prepared by

TRAFFIC ENGINEERING DIVISION
PLANNING SURVEY SECTION

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SAFETY IMPACT OF CONVERSION FROM TWO-WAY TO ONE-WAY STREET DIRECTION (PEDESTRIANS) IN OREGON CITIES						
TIME PERIOD	OREGON CITY	TRAFFIC VOLUMES	ACCIDENTS		ACCIDENT RATE	
			PED	ALL	PED	ALL
BEFORE		9,515	21	283	0.0221	0.2974
AFTER	Astoria	9,760	17	262	0.0174	0.2684
CHANGE		245	-4	-21	-21.08%	-9.74%
BEFORE		9,980	13	409	0.0130	0.4098
AFTER	Coos Bay	15,960	7	297	0.0044	0.1861
CHANGE		5980	-6	-112	-66.33%	-54.59%
BEFORE		NA	11	530	NA	NA
AFTER	Corvallis	NA	12	395	NA	NA
CHANGE		NA	1	-135	NA	NA
BEFORE		8,200	10	408	0.0122	0.4976
AFTER	Eugene	6,040	10	153	0.0166	0.2533
CHANGE		-2160	0	-255	35.76%	-49.09%
BEFORE		6,440	6	226	0.0093	0.3509
AFTER	Lebanon	8,630	6	266	0.0070	0.3082
CHANGE		2190	0	40	-25.38%	-12.17%
BEFORE		11,680	1	163	0.0009	0.1396
AFTER	Medford	11,090	3	84	0.0027	0.0757
CHANGE		-590	2	-79	215.96%	-45.72%
BEFORE		6,430	14	385	0.0218	0.5988
AFTER	Pendleton	7,555	16	490	0.0212	0.6486
CHANGE		1125	2	105	-2.73%	8.32%
BEFORE		4,120	5	155	0.0121	0.3762
AFTER	Redmond	7,235	2	164	0.0028	0.2267
CHANGE		3115	-3	9	-77.22%	-39.75%
BEFORE		19,600	27	1005	0.0138	0.5128
AFTER	Salem	20,500	27	1000	0.0132	0.4878
CHANGE		900	0	-5	-4.39%	-4.87%
BEFORE		14,530	22	602	0.0151	0.4143
AFTER	Springfield	16,800	5	431	0.0030	0.2565
CHANGE		2270	-17	-171	-80.34%	-38.08%
BEFORE		8,780	18	380	0.0205	0.4328
AFTER	The Dalles	17,295	10	522	0.0058	0.3018
CHANGE		8515	-8	142	-71.80%	-30.26%
BEFORE		5,835	8	209	0.0137	0.3582
AFTER	Tillamook	6,875	7	231	0.0102	0.3360
CHANGE		1040	-1	22	-25.74%	-6.19%
BEFORE	TOTAL,	105,110	145	4,225	0.0138	0.4020
AFTER	ALL	127,740	110	3,900	0.0086	0.3053
CHANGE	CITIES	22630	-35	-325	-37.58%	-24.05%

SOURCE: Oregon State Highway Department, Technical Report #b 59-4, April 1959,
"A Study of One-Way Street Routings on Urban Highways in Oregon", Salem, OR.

SAFETY IMPACT OF CONVERSION FROM TWO-WAY TO ONE-WAY STREET DIRECTION (INJURIES) IN OREGON CITIES						
TIME PERIOD	OREGON CITY	TRAFFIC VOLUMES	ACCIDENTS		ACCIDENT RATE	
			INJ	ALL	INJ	ALL
BEFORE		9,515	28	283	0.0294	0.2974
AFTER	Astoria	9,760	34	262	0.0348	0.2684
CHANGE		245	6	-21	18.38%	-9.74%
BEFORE		9,980	27	409	0.0271	0.4098
AFTER	Coos Bay	15,960	23	297	0.0144	0.1861
CHANGE		5980	-4	-112	-46.73%	-54.59%
BEFORE		NA	42	530	NA	NA
AFTER	Corvallis	NA	51	395	NA	NA
CHANGE		NA	9	-135	NA	NA
BEFORE		8,200	34	408	0.0415	0.4976
AFTER	Eugene	6,040	19	153	0.0315	0.2533
CHANGE		-2160	-15	-255	-24.13%	-49.09%
BEFORE		6,440	15	226	0.0233	0.3509
AFTER	Lebanon	8,630	20	266	0.0232	0.3082
CHANGE		2190	5	40	-0.50%	-12.17%
BEFORE		11,680	16	163	0.0137	0.1396
AFTER	Medford	11,090	5	84	0.0045	0.0757
CHANGE		-590	-11	-79	-67.09%	-45.72%
BEFORE		6,430	29	385	0.0451	0.5988
AFTER	Pendleton	7,555	36	490	0.0477	0.6486
CHANGE		1125	7	105	5.65%	8.32%
BEFORE		4,120	11	155	0.0267	0.3762
AFTER	Redmond	7,235	15	164	0.0207	0.2267
CHANGE		3115	4	9	-22.35%	-39.75%
BEFORE		19,600	102	1005	0.0520	0.5128
AFTER	Salem	20,500	76	1000	0.0371	0.4878
CHANGE		900	-26	-5	-28.76%	-4.87%
BEFORE		14,530	73	602	0.0502	0.4143
AFTER	Springfield	16,800	60	431	0.0357	0.2565
CHANGE		2270	-13	-171	-28.91%	-38.08%
BEFORE		8,780	30	380	0.0342	0.4328
AFTER	The Dalles	17,295	30	522	0.0173	0.3018
CHANGE		8515	0	142	-49.23%	-30.26%
BEFORE		5,835	15	209	0.0257	0.3582
AFTER	Tillamook	6,875	23	231	0.0335	0.3360
CHANGE		1040	8	22	30.14%	-6.19%
BEFORE	TOTAL,	105,110	380	4,225	0.0362	0.4020
AFTER	ALL	127,740	341	3,900	0.0267	0.3053
CHANGE	CITIES	22630	-39	-325	-26.16%	-24.05%

ACKNOWLEDGMENTS

The completion of this bulletin has been made possible only through the cooperation of several sections of the Traffic Engineering Division that were called upon to furnish data for the author, Dennis L. Peterson, Engineer Economist.

Particular recognition is extended to Gene Kinney, Chief Photographer of the Highway Department Travel Division, and Ralph P. Valentine, Pilot and Photogrammetrist for the Oregon State Board of Forestry for their contribution of aerial photographs.

PREFACE

Early in 1942 the routing of US99 through the cities of Eugene and Medford was changed to provide a one-way system through certain congested areas which had maintained a high volume of traffic and a relatively high accident experience.

This type of traffic control was a "stop-gap" measure designed to relieve congestion and reduce accidents with a minimum capital outlay.

In 1944, a brief analysis of the effectiveness of the one-way system in these two cities was made and the results from the standpoint of accident experience and increased capacity was so gratifying that similar installations were made in the cities of Lebanon and Pendleton.

In July, 1948, the 1944 analysis was printed with limited distribution. The interest in this report was so widespread that a further analysis seemed desirable.

In April, 1951, a report entitled "Oregon Urban One-Way Streets" was published. In that report the analysis of the one-way couplets in Lebanon and Pendleton was combined with the analysis previously prepared for the cities of Eugene and Medford.

The objectives of this report are to evaluate the effectiveness of one-way couplets in eight additional cities; to revise, correct, and expand the 1951 analysis of one-way couplets in Eugene, Medford, Lebanon, and Pendleton; and to combine this information so that a body of information can be made available under one cover.

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GLOSSARY

- Accident (or Collision):** A reported motor vehicle traffic accident which results in death, injury or property damage.
- Accident Rate:** The number of accidents per million vehicle miles.
- Accident Cost Rate:** The cost of accidents in dollars per million vehicle miles.
- Accident Severity Rate:** The number of personal injuries and fatalities per hundred million vehicle miles.
- Arterial Street (or Highway):** A general term designating a major highway, usually on a continuous or through route; includes through streets and freeways as separately defined below.
- Average Daily Traffic (ADT):** The number of vehicles passing a designated point during 24 hours of an average of the seven days of the week generally for the 52 weeks of the year, but such would also be applicable to any other specified period.
- By-Pass Route:** A highway intended to divert through traffic from a particular area by going around (or passing by) the area.
- Capacity, Practical:** The maximum number of vehicles that can pass a given point on a roadway or in a designated lane during one hour without the traffic density being so great as to cause unreasonable delay, hazard, or restriction to the drivers' freedom to maneuver under the prevailing roadway and traffic conditions.
- Casualty:** Either a personal injury or a fatality resulting from an accident.
- Central Business District (CBD):** That portion of a city comprising the over-all area of business concentration.
- Expressway:** A divided arterial highway for through traffic with full or partial control of access and generally with grade separations at intersections.
- Fatality:** Any death resulting from an accident within six months of the accident.
- Freeway:** An arterial divided highway with full control of access, no parking and no crossing movements at grade.
- One-Way Couplet:** A pair of one-way streets on which traffic moving in one direction is normally separated from that in the opposite direction on the other street by one city block.
- Personal Injury:** Any injury suffered by a person in an accident that requires treatment by a practitioner of medicine at some time within six months of accident. An injury is classed as an accident injury regardless of whether treatment was actually received.
- Property Damage:** Damage to or destruction of any property as the immediate and direct result of an accident. It does not include loss of human life or personal injury.
- Through Street:** Every street or portion thereof at the entrance to which vehicular traffic from intersecting streets is required by law to stop before entering or crossing.
- Travel Time:** The time of travel, including stops and delays except those off the traveled way.
- Vehicle Mile:** A quantitative measure of the amount of travel on a given section, and in all cases is computed by multiplying the average daily traffic for the section by its length.

CONCLUSIONS

1. Monetary savings can be realized by the motor vehicle user after a one-way couplet is established through the reduction of the accident-cost rate and the reduction of travel time.
2. Less congestion and a consequent reduction in travel time can be expected after a one-way couplet is established.
3. The accident rate will normally decline after a one-way couplet is established.
4. The accident severity rate will normally remain the same or decline after a one-way couplet is established.
5. A change in collision types can be expected after a one-way couplet is established.
6. A reduction in accident experience between intersections and at intersections can be expected after a one-way couplet is established. The greater percentage reduction will occur between intersections.

SUMMARY OF FINDINGS

1. Travel time decreased on each of the five highway sections for which travel time data were available after one-way couplets were established. The amount of this reduction varied from 5.8 to 39.9 percent, which values correspond to travel time savings ranging from 0.1 to 1.5 minutes.
2. Accident rate (accidents per million vehicle miles) reductions were observed in the cities of Coos Bay, Corvallis, Eugene, Lebanon, Redmond, Springfield and The Dalles after one-way couplets were established. The reductions ranged from 18.2 to 56.3 percent.
3. Accident rates in the cities of Astoria, Pendleton, Salem and Tillamook remained substantially unchanged after one-way couplets were established.
4. Accident severity rate (casualties per hundred million vehicle miles) reductions were observed in the cities of Coos Bay, Medford, Salem, Springfield and The Dalles after one-way couplets were established. The reductions ranged from 26.7 to 53.7 percent.
5. Accident severity rates in the cities of Astoria, Corvallis, Eugene, Lebanon, Pendleton, Redmond and Tillamook remained substantially unchanged after one-way couplets were established.
6. The accident cost rate (dollars per million vehicle miles) decreased on nine of the 12 highway sections studied after one-way couplets were established. The decrease ranged from 2.5 to 63.0 percent. Increases in the accident cost rate occurred in three cities and ranged from 20.4 to 59.2 percent.
7. The accident cost rate for all cities averaged \$12,000 per million vehicle miles in the "before" period while in the "after" period the accident cost rate averaged \$9,000 showing a reduction of 25 percent.
8. Rear-end, turning and pedestrian accident rates at intersections were reduced after one-way couplets were established. Other intersectional accident types remained substantially unchanged. The over-all intersectional accident rate showed a 26.4 percent reduction.
9. Rear-end, turning, pedestrian, sideswipe meeting, parking and backing accident rates between intersections were reduced after one-way couplets were established. Other non-intersectional accident type rates remained substantially unchanged. The over-all non-intersectional accident rate showed a 42.5 percent reduction.

INTRODUCTION

In the case of a large number of the cities in Oregon, the State Highway routes penetrate the Central Business District of the city. In the main, the streets over which such highways are routed are narrow and, as the street is fronted by the major business establishments of the city, through moving traffic, as well as traffic turning off or onto the highway, is relatively heavy. As these volumes increase, congestion and accidents also increase to the point where some treatment increasing practical capacity and reducing congestion becomes imperative. Such treatment may consist of one or more of the following:

1. Construction of routes (freeway or other) through, adjacent to or bypassing cities and/or their Central Business Districts.
2. Street widening.
3. Prohibition of parking.
4. Establishment of one-way couplets.

To properly treat such a problem, it is necessary to either provide a facility which will attract a sufficient amount of traffic from the highway passing through the Central Business District, or to institute measures which will increase the practical capacity of the existing highway.

In cities which are major shopping centers, a by-pass route does not attract enough traffic from the existing highway route to alleviate the problem because a large percentage of the traffic is local in character and cannot be diverted to a by-pass route. In these cities it is necessary to consider the possibility of developing some facility for the common use of both through and local traffic.

With the relatively low traffic volumes encountered in cities with populations comparable to those included in this study, there is seldom a traffic volume warrant for a freeway or expressway even though such a facility in the Central Business District would certainly be a partial solution to the problem.

Widening the existing highway is generally not feasible due to the limited width of the highway right of way and excessive costs of obtaining more in most Central Business Districts.

Prohibition of parking on the highway route is not readily acceptable in the small city because of opposition on the part of local business groups. With parking space at a premium, it is difficult to put into operation any traffic plan involving the wholesale elimination of parking.

In such a situation, the development of a one-way street couplet has offered a solution possible of realization from a cost standpoint, and on the basis of experience had to date, one that gives a maximum return in increased capacity and accident reduction per dollar expended.

The one-way couplets included in this study are located in the following cities which are also shown on the Frontispiece.

- | | | | |
|--------------|------------|--------------|-----------------|
| 1. Astoria | 4. Eugene | 7. Pendleton | 10. Springfield |
| 2. Coos Bay | 5. Lebanon | 8. Redmond | 11. The Dalles |
| 3. Corvallis | 6. Medford | 9. Salem | 12. Tillamook |

ANALYSIS

GENERAL

In order to compare traffic and accident data on a street system under different methods of traffic operation, it was necessary that the "before" and "after" periods be equal in duration. Furthermore, it was necessary to include the data for those streets which changed from low to high volume arterials by reason of the change in highway routing, as well as those portions of the original high volume streets which reverted to local service status and lower traffic volumes after the one-way couplet was established.

METHODS OF ANALYSIS

Before and after accident data were developed for each one-way couplet for comparative purposes. In all but three cities, namely Eugene, Medford and Salem, it was possible to obtain accident data for three-year periods before and after the establishment of the one-way couplets. In the instance of these three cities where this was not possible, accident data were prepared for one-year periods.

It is generally recognized that immediately after a new traffic measure is applied, motorists require a period of time to accustom themselves to the revised traffic pattern. During this period, it is logical to assume that the traffic and accident data do not reflect a normal situation.

In the course of this study, the accident data in four cities were analyzed by statistical methods in an effort to establish the time at which the accident experience became stable after the one-way couplet was established and the amount of variation between the observed and expected accident experience during this transition period. Based on these tests, there was no clear and definite time at which the accident experience becomes stable, nor was there positive evidence of significant variation in the accident experience.

For this report an arbitrary transition period of approximately six months was selected for each city. During this period all data were omitted from the study to preclude the possibility of using abnormal data.

The Chi-Square Test was used to determine the significance of the change in accident experience on the streets affected by the establishment of the one-way couplet. Chi-Square (χ^2) is a numerical value resulting from a formula wherein the difference between the "before" total and the "after" total, and the size of each total are the main factors. This value is then compared against tabled values which, in effect, reveal the probability of the difference being due to chance.

If the probability that the difference in accident totals could have occurred by chance was six or more percent, it was said that the difference was not significant, or in other words, there was no change. On the other hand, if the chance element were present less than six percent of the time the difference was considered either highly significant or significant, depending on the size of the chance element. In these cases, it was said that there was an actual change in the accident experience.

Such a procedure has the advantage of taking the decision as to whether an increase or decrease in accident experience is significant out of the realm of opinion and placing it upon a factual basis. It was of particular value in cases where on the basis of percentage increase or decrease there appeared to be a significant difference.

A detailed explanation of the techniques used to determine statistical level of significance and

the meaning of the terms highly significant, significant and not significant in terms of probabilities is contained in the Appendix.

The cost of accidents was based on unit costs estimated by the National Safety Council^① to be \$21,800 for each death, \$950 for each personal injury and \$180 for each property damage (only) accident.

Travel time was measured by a License Recording Study wherein stations were established at each end of the section in question, and the license number and time of passing for each vehicle were recorded. License numbers were then matched and the elapsed time between stations was computed. These data are available for five of the 12 one-way couplets studied.

Summary tabulations showing these data were prepared and will be discussed hereinafter.

Vehicle Miles

Table I is a summary of the pertinent traffic and accident data for each of the 12 one-way couplets included in this study. The number of vehicle miles increased in every city with the exception of Eugene and Medford. The reduction in total vehicle miles in these two cities was due to wartime travel restrictions. In other cities, the increase was attributable to the length of the highway routing added by new construction and/or traffic volume increases resulting from both normal growth and diversion from other streets.

In some cities such as Redmond and The Dalles, the diversion was apparently considerable, probably because congestion on the original route was such that motorists used other streets which were more desirable than the original but less desirable than that offered by the one-way couplet.

^① 1951 National Safety Council Release.

TABLE I
COMPARISON OF TRAVEL TIME AND ACCIDENT DATA

City	Period of Study		Total Vehicle Miles			Travel Time			Total Accidents			Accident Rate		
	Before (Yrs.)	After (Yrs.)	Before (1,000's)	After (1,000's)	Change (%)	Before (Min.)	After (Min.)	Change (Min.)	Before	After	Change (%)	Before (Per mvm)	After (Per mvm)	Change (%)
Astoria	3	3	4,575	4,926	+ 7.7	①	②	.....	283	262	- 7.4	61.85	53.18	-14.0③
Coos Bay	3	3	8,198	13,622	+ 66.2	①	③	.....	409	297	-27.4	49.89	21.80	-56.3③
Corvallis	3	3	10,914	12,521	+ 14.7	3.78	3.56	-0.22	530	395	-25.5	48.56	31.17	-35.8③
Eugene	1	1	5,567	4,101	- 26.3	8.06	6.54	-1.52	408	153	-62.5	73.29	37.31	-49.1③
Lebanon	3	3	4,726	6,796	+ 43.8	1.86	1.76	-0.10	226	266	+17.7	47.82	39.14	-18.2③
Medford	1	1	9,720	9,079	- 6.6	①	①	.....	163	84	-48.5	16.77	9.25	-44.8③
Pendleton	3	3	8,663	10,169	+ 17.4	3.75	3.20	-0.55	385	490	+27.3	44.44	48.19	+ 8.4③
Redmond	3	3	5,097	9,168	+ 79.9	①	①	.....	155	164	+ 5.8	30.41	17.89	-41.2③
Salem	1	1	22,801	23,766	+ 4.2	①	①	.....	1,065	1,000	- 0.5	44.08	42.08	- 4.5③
Springfield	3	3	22,598	27,024	+ 19.6	①	③	.....	602	431	-28.4	26.64	15.95	-40.1③
The Dalles	3	3	7,306	15,042	+105.9	①	③	.....	380	522	+37.4	52.01	34.70	-33.3③
Tillamook	3	3	5,047	5,948	+ 17.9	3.56	2.14	-1.42	209	231	+10.5	41.41	38.84	- 6.2③
TOTALS OR AVERAGES			115,212	142,162	+ 23.4				4,755	4,295	- 9.7	41.27	30.21	-26.8

① No data available.
 ② Not significant.
 ③ Highly significant.
 ④ Significant.

Travel Time

The change in the time required for the average vehicle to negotiate the facility was considered to be the primary measure of the reduction of congestion on the traffic facility. Table I shows that travel time was reduced on each of the five one-way couplets for which travel time data were available. The amount of this reduction varied from 5.8 to 39.9 percent which values correspond to travel time savings ranging from 0.1 to 1.5 minutes. The one-way couplet, therefore, offers a means of reducing travel time of traffic because under one-way operation conflicts between opposing streams of traffic are eliminated, traffic signal systems operate more efficiently, delay arising from turning movements is reduced and motorists are able to pass slower moving vehicles on streets otherwise too congested for passing maneuvers.

Figure 1 graphically portrays a comparison of travel time before and after the one-way couplets were established.

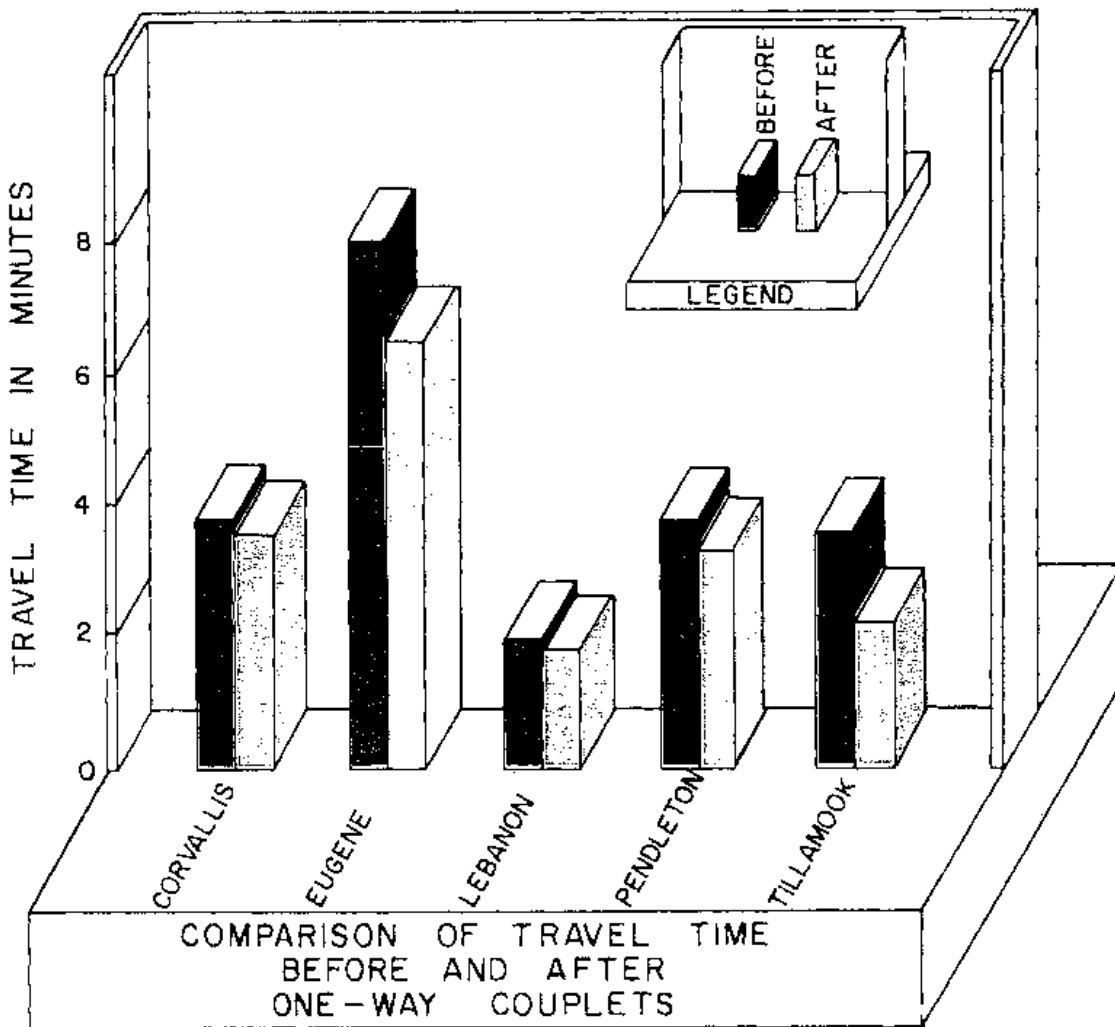


Figure 1

Accident Rates

Total accidents are not as meaningful as the accident rates which take into account the vehicle miles of travel. For example, the total accidents of the Second-Third Street One-Way Couplet in The Dalles increased 37.4 percent, but total vehicle miles increased 105.9 percent, and as a consequence the accident rate showed a decrease of 33.3 percent. Total accidents decreased on five of the one-way couplets, whereas the accident rate decreased on 11 of the 12 one-way couplets.

Analysis revealed that the reduction in accident rate was highly significant in seven cases, significant in one case and not significant in three cases. The increase in accident rate in Pendleton was found to be not significant. These findings indicated that the accident rate normally decreases after the establishment of a one-way couplet.

The "before" and "after" accident rates for each of the one-way couplets are shown graphically in Figure 2.

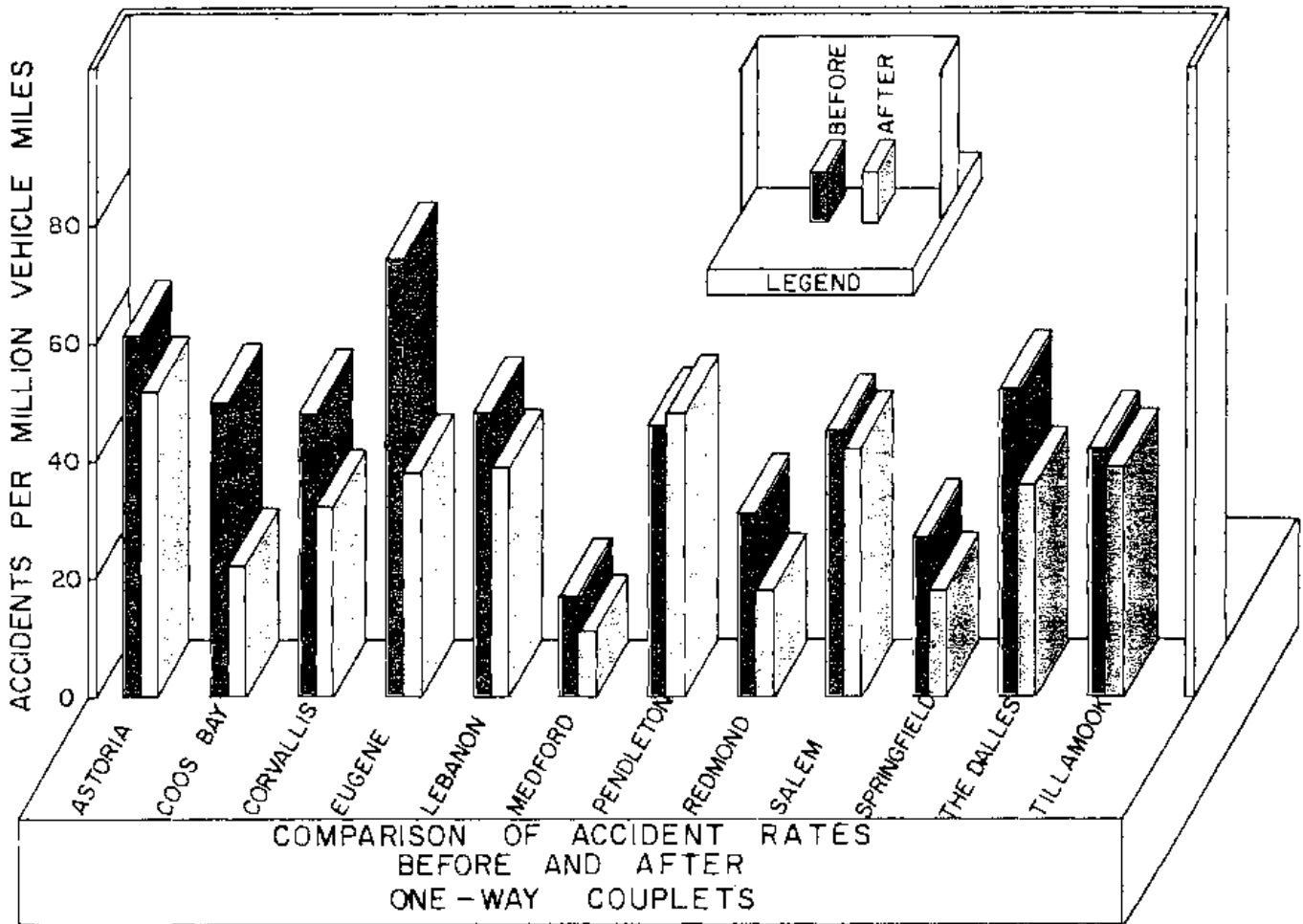


Figure 2

Accident Severity Rates

Table II shows a summary of the accident severity and accident cost data. The column headed "casualties" shows the actual number of persons injured and killed.

In six cities there were more casualties during the "after" period. As shown previously, vehicle miles of travel on nine of the 12 one-way couplets studied also showed an increase during the same period. In general, vehicle miles of travel increased at a faster rate than casualties and as a result a higher accident severity rate was observed in only three cities after the one-way couplets were established.

Analysis revealed that the accident severity rate increases in these three cities were not significant. Reductions in the accident severity rate were observed in nine cities. The reduction was highly significant in three cities, significant in two cities and not significant in four cities. This indicated that the accident severity rate normally remains the same or decreases after the establishment of a one-way couplet.

Accident Cost Rates

Table II shows that the accident cost rates for nine of the 12 one-way couplets studied decreased after the one-way couplets were established. The unusually high increase in Medford was largely due to one accident wherein two persons were killed. These cases show that the accident cost rate can be reduced by the establishment of a one-way couplet. These data further illustrate that substantial savings to motor vehicle users can be realized after the establishment of a one-way couplet through the reduction of the accident cost rate.

TABLE II
COMPARISON OF ACCIDENT SEVERITY AND COST DATA

City	Period of Study		Casualties ⁽¹⁾			Accident Severity Rate			Cost of All Accidents			Accident Cost Rate		
	Before	After	Before	After	Change	Before	After	Change	Before	After	Change	Before	After	Change
	(Yrs.)	(Yrs.)	Number	Number	(Number)	(Casualties per 100 mvm)	(Casualties per 100 mvm)	(%)	(Dollars)	(Dollars)	(%)	(Dollars per mvm)	(Dollars per mvm)	(%)
Astoria	3	3	29	38	+ 9	633.88	771.36	+21.7 ⁽²⁾	\$ 73,450	\$ 77,140	+ 5.0	\$16,055	\$15,659	- 2.5
Coos Bay	3	3	39	30	- 9	475.71	220.24	-53.7 ⁽²⁾	126,480	77,820	-38.5	15,428	5,713	-63.0
Corvallis	3	3	54	63	+ 9	494.78	497.19	+ 0.5 ⁽²⁾	139,140	121,770	-12.5	12,749	9,610	-24.6
Eugene	1	1	44	19	-25	790.37	463.35	-41.4 ⁽²⁾	109,120	42,170	-61.4	19,601	10,284	-47.5
Lebanon	3	3	21	23	+ 2	444.35	338.43	-23.8 ⁽²⁾	78,600	66,130	-15.9	16,631	9,731	-41.5
Medford	1	1	22	9 ⁽³⁾	-13	226.34	99.13	-56.2 ⁽²⁾	47,360	64,290	+35.7	4,872	7,081	+45.3
Pendleton	3	3	39	44	+ 5	450.21	432.71	- 3.9 ⁽²⁾	101,130	144,190	+42.6	11,674	14,180	+21.5
Redmond	3	3	15	22	+ 7	294.28	239.97	-18.5 ⁽²⁾	40,170	68,390	+70.3	7,881	7,460	- 5.3
Salem	1	1	130	99	-31	570.16	417.90	-26.7 ⁽²⁾	286,040	260,370	- 9.0	12,545	10,991	-12.4
Springfield	3	3	92	72	-20	407.12	266.43	-34.6 ⁽²⁾	203,290	135,180	-33.5	8,996	5,002	-44.4
The Dalles	3	3	35	35	0	479.03	232.68	-51.4 ⁽²⁾	116,920	142,480	+21.9	16,002	9,472	-40.8
Tillamook	3	3	15	34	+19	297.20	571.69	+92.4 ⁽²⁾	49,170	69,740	+41.8	9,742	11,726	+20.4
TOTALS OR AVERAGES			535	488	-47	464.36	343.27	-26.1	\$1,370,870	\$1,269,670	- 7.4	\$11,899	\$ 8,931	-24.9

- (1) Persons injured and killed.
- (2) Not significant.
- (3) Highly significant.
- (4) Significant.
- (5) Includes two fatalities.

Collision Types

An independent study of six selected cities^① was conducted to determine the type of accidents which were susceptible to reduction by one-way treatment. One-way couplets were established in these cities after 1950. Accident data for three years prior to the establishment of the one-way couplets were compared with the accident data for three years after the one-way couplets were established. Collision type accident rates in terms of accidents per million vehicle miles were computed and are shown in Table III.

The intersectional accident rate decreased from 18.36 to 13.52 accidents per million vehicle miles, a 26.4 percent reduction. All intersectional accident type rates, with the exception of the sideswipe overtaking and non-collision accident rates, showed either a reduction or no change. Highly significant reductions occurred in the rear-end, turning and pedestrian categories. Changes in the other types were not significant.

With respect to non-intersectional accident rates, it is seen that the over-all rate was reduced from 20.27 to 11.65 accidents per million vehicle miles, a 42.5 percent reduction. Except for the increase in the sideswipe overtaking accident rate, all non-intersectional accident type rates showed a reduction or no change. The reductions in the rear-end, sideswipe meeting, turning, parking, pedestrian and backing accident rates were highly significant. Other changes were not significant.

In the aggregate, the accident rate showed a reduction from 38.63 to 25.17 accidents per million vehicle miles, a 34.8 percent reduction.

There is a popular theory that one-way couplets are effective in substantially reducing intersectional accidents due to the decrease in possible points of conflict. This theory was well substantiated by this study. By contrast, very little emphasis has been placed on the value of one-way couplets insofar as the reduction of non-intersectional accidents is concerned. The finding that the non-intersectional accident rate showed a greater percentage reduction than did the intersectional accident rate was therefore considered important and deserving of considerable emphasis.

^① Astoria, Coos Bay, Redmond, Springfield, The Dalles, Tillamook.

TABLE III

SUMMARY OF ACCIDENT RATES¹ BY COLLISION TYPE
FOR SIX SELECTED CITIES

		COLLISION TYPE													
		Angle	Head-on	Rear-end	Sideswipe Meeting	Sideswipe Overtaking	Turning	Parking	Non-Collision	Fixed Object	Pedestrian	Backing	Miscellaneous	Total Rate	Total Collisions
INTERSECTIONAL															
	Before	2.67	0.02	4.88	0	0.21	7.18	0.95	0.02	0.44	1.23	0.66	0.10	18.36	969
	After	2.27	0.01	3.66	0	0.34	4.89	0.87	0.04	0.28	0.54	0.57	0.05	13.52	1024
NON-INTERSECTIONAL															
	Before	0.08	0.15	6.42	0.74	2.18	1.16	7.54	0.10	0.68	0.42	0.70	0.10	20.27	1069
	After	0.01	0.05	2.98	0.05	2.60	0.65	4.21	0.07	0.53	0.09	0.32	0.09	11.65	883
GRAND TOTAL															
	Before	2.75	0.17	11.30	0.74	2.39	8.34	8.49	0.12	1.12	1.65	1.36	0.20	38.63	2038
	After	2.28	0.06	6.64	0.05	2.94	5.54	5.08	0.11	0.81	0.63	0.89	0.14	25.17	1907

¹/ Accidents per million vehicle miles.

ASTORIA

General

Prior to the establishment of the one-way couplet in the City of Astoria, US30 and US101 were routed as shown in Figure 3. The streets comprising this highway routing varied in width from 44 to 48 feet. The streets later to become a part of the one-way couplet were Commercial and Bond Streets. The width of Commercial Street ranged from 44 feet near 14th Street to 34 feet near Eighth Street. Eighth Street was 34 feet wide. There were no traffic signals on any of these streets.

The Bond-Commercial Street One-Way Couplet was established July 21, 1953. As illustrated in Figures 3 and 4, westbound traffic was routed over Bond Street and eastbound traffic was routed over sections of Eighth and Commercial Streets. Traffic signals at seven key intersections were put into operation on this date and the City of Astoria opened its one-way grid to traffic on the same day. The westbound leg of the highway couplet was 0.44 miles in length, and the over-all length of the eastbound leg was 0.48 miles.

For comparative purposes, the 36-month period from July 1, 1950 to June 30, 1953, was selected for the "before" period, and the 36-month period from May 1, 1954 to April 30, 1957, was chosen for the "after" period. The traffic data for the ten-month interim period were not used because it was assumed that they would not reflect a normal situation due to the revised traffic pattern.

Traffic Data

Traffic volumes on Bond Street during the "before" period averaged 4,710 vehicles per day and ranged from a high of 7,700 west of Eighth Street to a low of 2,000 east of 14th Street. Traffic volumes on Commercial Street averaged 4,805 vehicles per day, and ranged from a high of 6,500 near 11th Street to a low of 3,400 near Eighth Street. The average daily traffic on Eighth Street between Bond and Commercial Streets was 1,460 vehicles. There were 4,575,020 vehicle miles during the "before" period, and the average daily traffic for the three streets was 8,705 vehicles.

During the "after" period, traffic volumes on Bond Street averaged 4,630 vehicles per day and ranged from a high of 6,300 west of 14th Street to a low of 4,400 near Eighth Street. On Commercial Street and Eighth Street, traffic volumes were somewhat higher averaging 5,130 vehicles per day, and varying from 5,700 west of 14th Street on Commercial Street to 4,400 on Eighth Street. During the "after" period, the average daily traffic on the couplet was 9,370 vehicles, and vehicle miles of travel amounted to 4,926,355.

There were no travel time data available.

HIGHWAY ROUTE BEFORE AND AFTER ESTABLISHMENT OF ONE WAY COUPLET

City of Astoria

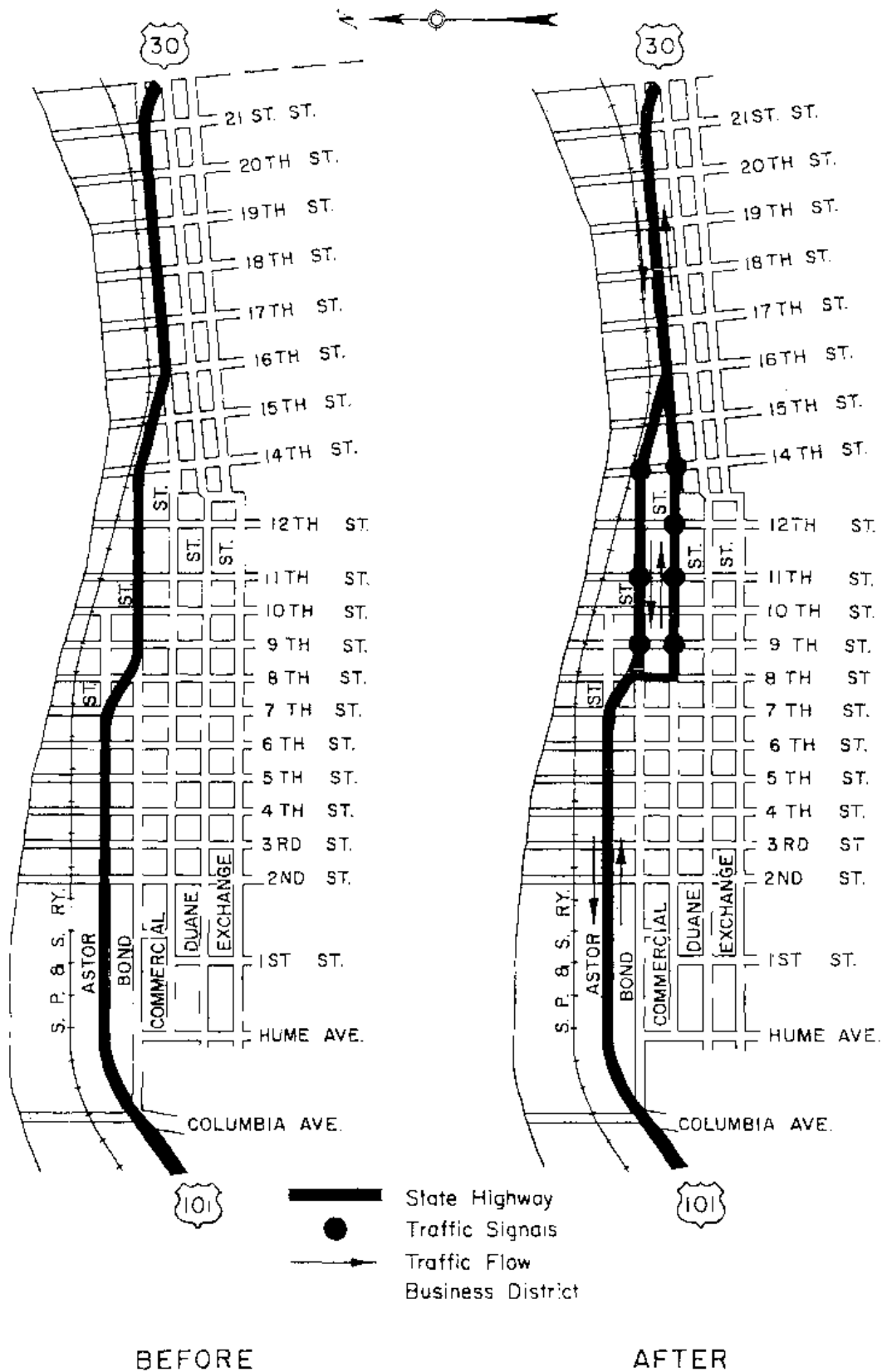


Figure 3

Accident Data

The pertinent accident data for each period of study are shown in Table IV.

TABLE IV
SUMMARY OF ACCIDENT DATA
Bond-Commercial Street One-Way Couplet
Astoria

<i>Item</i>	<i>Before Period 7/1/50-6/30/53</i>	<i>After Period 5/1/54-4/30/57</i>	<i>Percent Change</i>
Total Accidents	283	262	- 7.4
Accident Rate [Ⓐ]	61.85	53.18	-14.0
Persons Injured	29	38	+31.0
Persons Killed	0	0	0
Accident Severity Rate [Ⓑ]	633.88	771.36	+21.7
Accident Cost	\$73,450	\$77,140	+ 5.0
Accident Cost Rate [Ⓒ]	16,055	15,659	- 2.5

[Ⓐ] Accidents per million vehicle miles.

[Ⓑ] Injuries and fatalities per hundred million vehicle miles.

[Ⓒ] Cost of accidents per million vehicle miles.

This tabulation shows that the number of accidents and the accident rate decreased after the one-way couplet was established. The reduction in the accident rate was not significant, however. There was an increase in the frequency of persons injured and the accident severity rate after the one-way couplet was established. The increase in the accident severity rate was not significant.

Figure 5 graphically shows a comparison of the accident rates for three consecutive 12-month periods immediately preceding the establishment of the one-way couplet, with the accident rates for three consecutive 12-month periods immediately following the ten-month transition period. In addition, the composite accident rates for the "before" and "after" periods of study are shown. This graph shows that during the "after" period of study the accident rate for each year was lower than the rate for the preceding year.

Table V shows the accident data for each period of study arranged by collision type. This listing shows that after the one-way couplet was established, there was an appreciable reduction of turning, parking and fixed object accidents. On the other hand, rear-end and sideswipe overtaking accidents increased considerably in number.

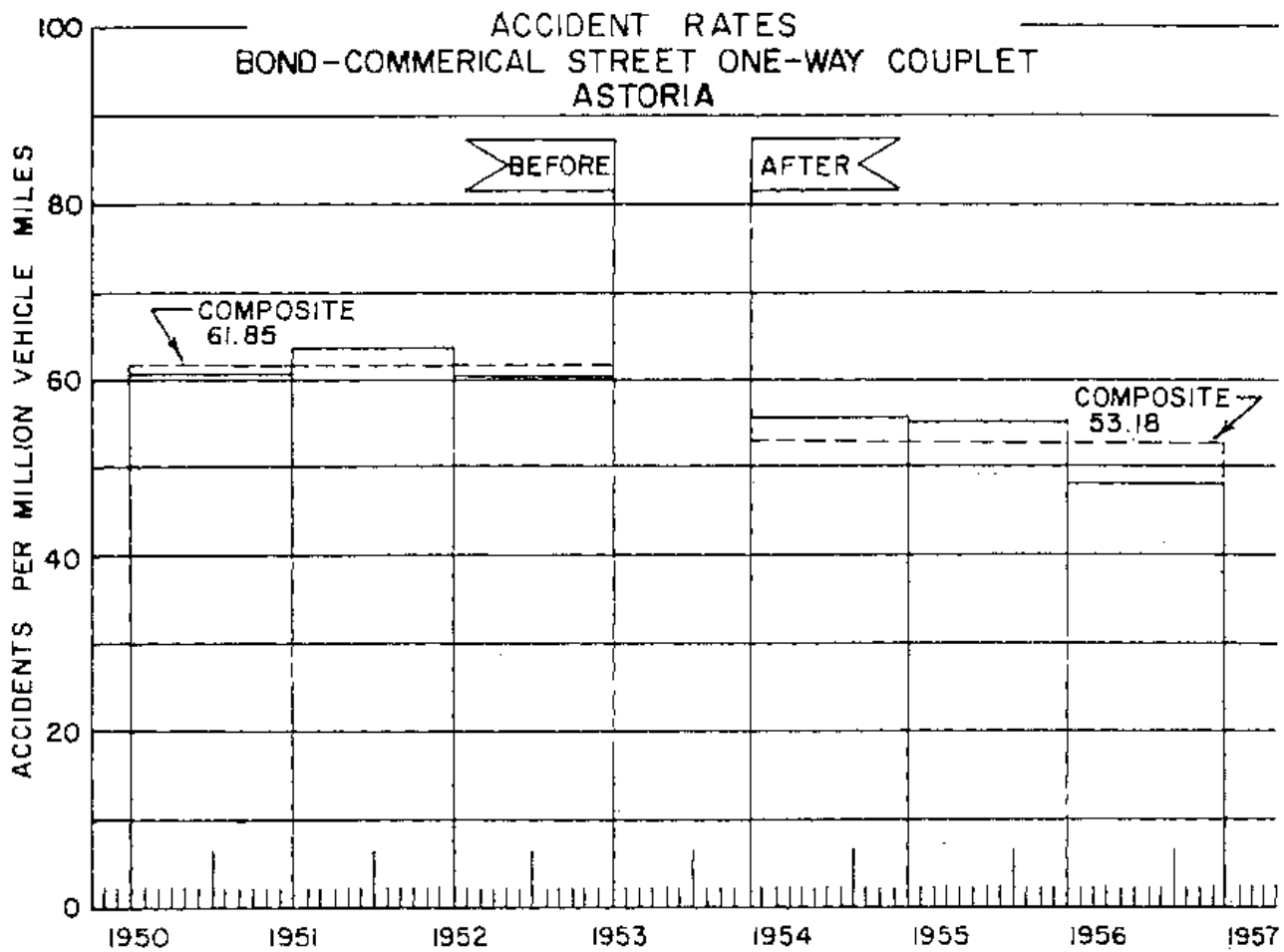


Figure 5

Summary

The accident rates for the streets in question during the years prior to the establishment of the Bond-Commercial Street One-Way Couplet were more than double the state-wide accident rate for urban portions of Primary State Highways. Since the decrease in the accident rate after the one-way couplet was established was not significant, it can be concluded that the one-way couplet did not change the situation.

TABLE V
ACCIDENT LISTING
Bond-Commercial Street One-Way Couplet
Astoria

City	LOCATION	COLLISION TYPE											CLASSIF.			Persons Killed	Persons Injured	REMARKS	
		Angle	Head-on	Rear-end	Sideswipe Meeting	Sideswipe Overtaking	Turning	Parking	Non-Collision	Fixed Object	Pedestrian	Backing	Miscellaneous	ALL COLLISIONS	Fatal				Non-Fatal	Prop. Damage
	INTERSECTIONAL																		
	Before	13	1	24	-	1	53	4	1	7	17	5	1	127	-	22	105	-	22
	After	15	-	39	-	5	33	2	1	2	16	10	3	126	-	24	102	-	28
	NON-INTERSECTIONAL																		
	Before	-	1	25	1	18	6	65	-	26	4	8	2	156	-	6	150	-	7
	After	-	-	35	1	26	3	47	-	19	1	2	2	136	-	10	126	-	10
	ALL ACCIDENTS																		
	Before	13	2	49	1	19	59	69	1	33	21	13	3	283	-	28	255	-	29
	After	15	-	74	1	31	36	49	1	21	17	12	5	262	-	34	228	-	38

The before period includes all accidents which occurred during the period from July 1, 1950 to June 30, 1953 between the termini of the one-way couplet on those streets which were a part of US101 & US30 before the establishment of the one-way couplet and on those streets which later became a part of the one-way couplet. The after period includes all accidents which occurred after the establishment of the one-way couplet during the period from May 1, 1954 to April 30, 1957 on the foregoing sections.

COOS BAY

General

US101 was routed over Broadway in the City of Coos Bay as shown in Figure 6 before the Broadway-Bayshore Drive One-Way Couplet was established. The width of Broadway varied from 26 feet on the north to 40 feet on the south. Traffic signals existed at the intersections of Central, Anderson, and Curtiss Avenues with Broadway. Bayshore Drive, later to become a part of the one-way couplet, was only 0.30 miles in length and it was terminated by Market Avenue on the north and Curtiss Avenue on the south.

On November 7, 1951, the Broadway-Bayshore Drive One-Way Couplet was established. As shown in Figures 6 and 7 Broadway was designated a one-way southbound street, and Bayshore Drive was designated a one-way northbound street. The establishment of this one-way couplet necessitated the construction of the northerly portion of Bayshore Drive, and later the installation of a traffic signal at the intersection of Central Avenue and Bayshore Drive. The southbound leg of this couplet was 0.75 miles in length, and the northbound leg was 0.81 miles in length.

The 36-month period from November 1, 1948 to October 31, 1951 was taken for the "before" period of study and the 36-month period May 1, 1952 to April 30, 1955 was selected as the "after" period of study. It will be noted that the "after" period of study started about six months after the one-way couplet was established.

Traffic Data

During the "before" period, traffic volumes on Broadway averaged 9,320 vehicles per day and ranged from a high of 10,000 just south of Central Avenue to a low of 8,000 near Fir Avenue. The average daily traffic on Bayshore Drive was only 1,615 vehicles. In the aggregate, there were 8,198,264 vehicle miles of travel during the "before" period and the average daily traffic for both streets combined was 9,980 vehicles.

During the "after" period, traffic volumes on Broadway averaged 8,130 vehicles per day, and ranged from a high of 8,700 just south of Central Avenue to a low of 8,000 at either end of Broadway. On Bayshore Drive, the average daily traffic was 7,830 vehicles. Traffic volumes on Bayshore Drive varied from a high of 9,500 vehicles per day just south of Central Avenue to a low of 7,000 near the north end of the couplet. During the "after" period, the average daily traffic on the couplet was 15,960 vehicles and vehicle miles of travel totaled 13,521,689.

There were no travel time data available.

Accident Data

The salient accident data for each period of study are presented in Table VI.

TABLE VI
SUMMARY OF ACCIDENT DATA
Broadway-Bayshore Drive One-Way Couplet
Coos Bay

<i>Item</i>	<i>Before Period</i> 11/1/48-10/31/51	<i>After Period</i> 5/1/52-4/30/53	<i>Percent</i> <i>Change</i>
Total Accidents	409	297	- 27.4
Accident Rate ^①	49.89	21.80	- 56.3
Persons Injured	38	30	- 21.1
Persons Killed	1	0	-100
Accident Severity Rate ^②	475.71	220.24	- 53.7
Accident Cost	\$126,480	\$77,820	- 38.5
Accident Cost Rate ^③	15,428	5,713	- 63.0

① Accidents per million vehicle miles.

② Injuries and fatalities per hundred million vehicle miles.

③ Cost of accidents per million vehicle miles.

Examination of this table discloses that there was a marked improvement in all accident categories after the one-way couplet was established. The reductions in the accident rate and accident severity rate were highly significant.

Figure 8 graphically portrays a comparison of the accident rates for three consecutive 12-month periods immediately preceding the establishment of the one-way couplet with the accident rates for three consecutive 12-month periods immediately following the six-month transition period. The composite accident rates for both periods of study are also shown. It can be seen that the accident rate for each 12-month period after the one-way couplet was established was lower than the accident rate for the preceding period.

Table VII shows the accident data for each period of study arranged by collision type. This listing discloses that after the one-way couplet was established, there was an appreciable reduction of rear-end, sideswipe, meeting, pedestrian, and backing accidents. On the other hand, angle and sideswipe overtaking accidents increased considerably in number.

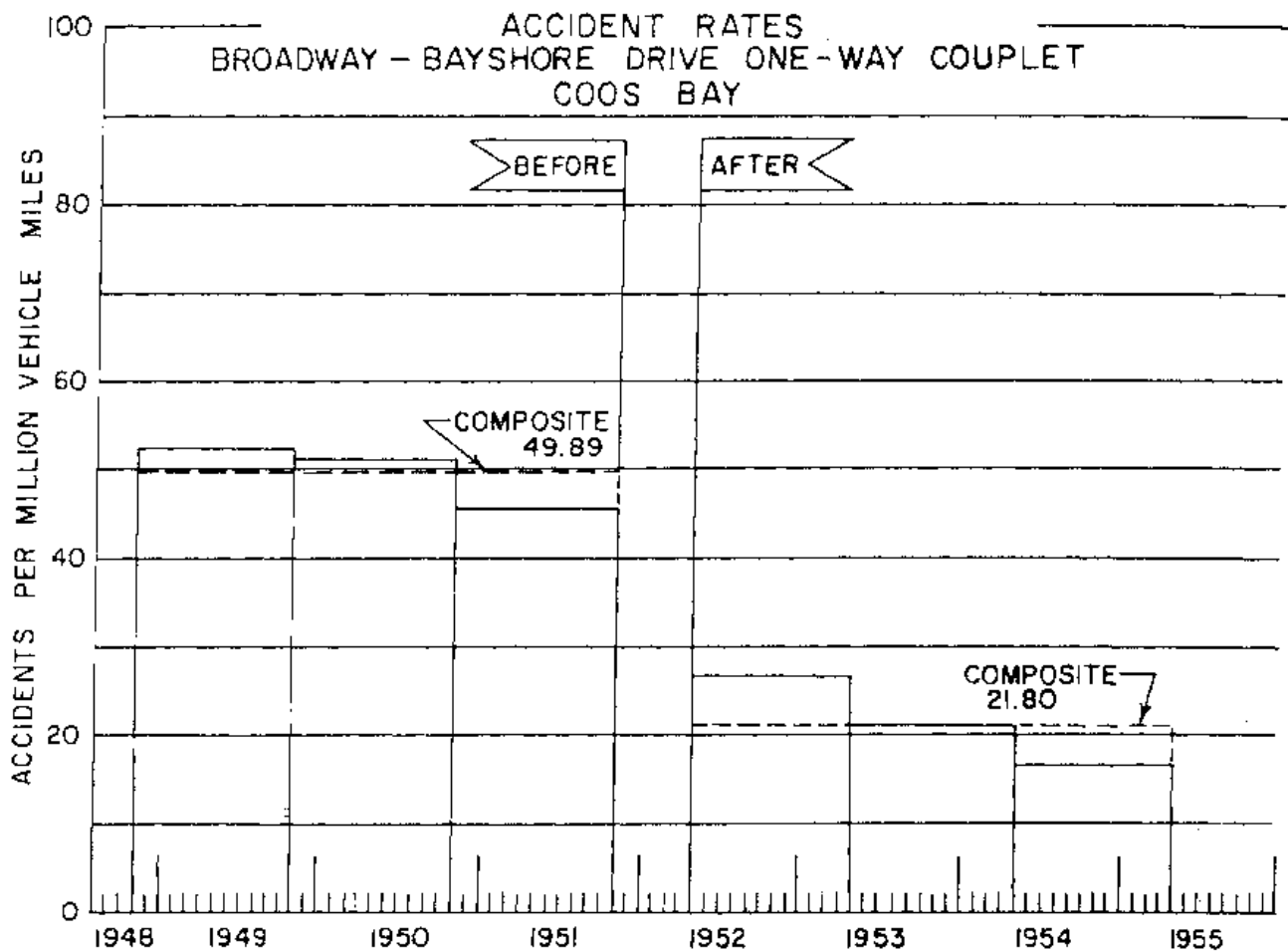


Figure 8

Summary

There were very real traffic problems on Broadway prior to the establishment of the one-way couplet. As the records show, the street was quite narrow, traffic volumes were high, and as a result the accident rate was about twice as high as the state-wide accident rate for urban portions of Primary State Highways. After the one-way couplet was established, the accident rate declined to a level only slightly above the state-wide accident rate for urban portions of Primary State Highways. The one-way couplet also alleviated the capacity problem and the monetary savings realized by the road user through the reduction of the accident rate and less congestion were substantial.

In light of these findings, it was concluded that the Broadway-Bayshore Drive One-Way Couplet was of great benefit to the motoring public and the local area.

TABLE VII

ACCIDENT LISTING

Broadway-Bayshore Drive One-Way Couplet
Coos Bay

LOCATION		COLLISION TYPE												CLASSIF.					REMARKS	
City	Coos Bay	Angle	Head-on	Rear-end	Sideswipe Meeting	Sideswipe Overtaking	Turning	Parking	Non-Collision	Fixed Object	Pedestrian	Backing	Miscellaneous	ALL COLLISIONS	Fatal	Non-Fatal	Prop. Damage	Persons Killed		Persons Injured
INTERSECTIONAL																				
	Before	14	-	87	-	4	77	6	-	7	12	10	2	219	1	16	202	1	22	
	After	29	1	51	-	5	60	6	1	11	5	4	-	173	-	18	155	-	23	
NON-INTERSECTIONAL																				
	Before	-	-	68	16	32	9	53	1	4	1	6	-	190	-	11	179	-	16	
	After	-	-	20	1	44	4	44	2	3	2	2	2	124	-	5	119	-	7	
ALL ACCIDENTS																				
	Before	14	-	155	16	36	86	59	1	11	13	16	2	409	1	27	381	1	38	
	After	29	1	71	1	49	64	50	3	14	7	6	2	297	-	23	274	-	30	

The before period includes all accidents which occurred during the period from November 1, 1948 to October 31, 1951 between the termini of the one-way couplet on US101 before the establishment of the one-way couplet and on the flanking street which later became a part of the one-way couplet. The after period includes all accidents which occurred after the establishment of the one-way couplet during the period from May 1, 1952 to April 30, 1955 on the foregoing sections and on newly constructed extensions.

CORVALLIS

General

Prior to the establishment of the one-way couplet in the City of Corvallis, Van Buren and Third Streets served as the route for US99W as illustrated in Figure 9. Van Buren Street was 32 feet in width; and Third Street was 46 feet wide between Van Buren and Adams Street, 32 feet wide from Adams Street to the bridge over the Willamette River, which was 24 feet in width. The portions of these two streets studied were 1.19 miles in length.

The streets later to become a part of the one-way couplet were Harrison and Fourth Streets. Harrison Street was 46 feet in width throughout the 0.32 miles studied, Fourth Street was 32 feet wide except for the two-block section between Jackson and Madison Streets which was 54 feet wide. Fourth Street terminated at "C" Street, a point 0.67 miles south of Van Buren Street. There were no traffic signals on any of these four streets.

Fourth Street was extended south across the Willamette River to an intersection with Third Street during the summer of 1949. Then, on August 24, 1949, the Van Buren, Fourth-Harrison, Third Street One-Way Couplet as shown in Figures 9 and 10 was opened to traffic. Northbound motorists were directed over Third and Harrison Streets and southbound traffic was routed via Van Buren and Fourth Streets. On September 1, 1951, the widening of Fourth Street from 32 feet to 54 feet between Van Buren and Jackson Streets and Madison and Jefferson Streets was accomplished.

The southbound leg of this one-way couplet was 1.16 miles in length, and the northbound leg was 1.26 miles in length. Traffic signals at Van Buren, Monroe, Jefferson and "A" Street intersections with Third and Fourth Streets were put in operation on June 21, 1951. The traffic signals at the Madison Street intersections with Third and Fourth Streets were installed on September 15, 1952.

This couplet served as the route of US99W until September, 1954, when Harrison and Van Buren Streets were replaced by a one-way routing extending north on Third and Fourth Streets.

For comparative purposes, the 36-month period from August 1, 1946, to July 31, 1949, was chosen for the "before" period. The "after" period was considered as being that period of time from September 1, 1949, which was about three months after the one-way couplet was established, to August 31, 1954. In order to obtain data for a three-year period after the one-way couplet was established, and before Harrison and Van Buren Streets were deleted from the one-way couplet, it was not possible to start the "after" period of study at a later date.

HIGHWAY ROUTE BEFORE AND AFTER ESTABLISHMENT OF ONE WAY COUPLET

City of Corvallis

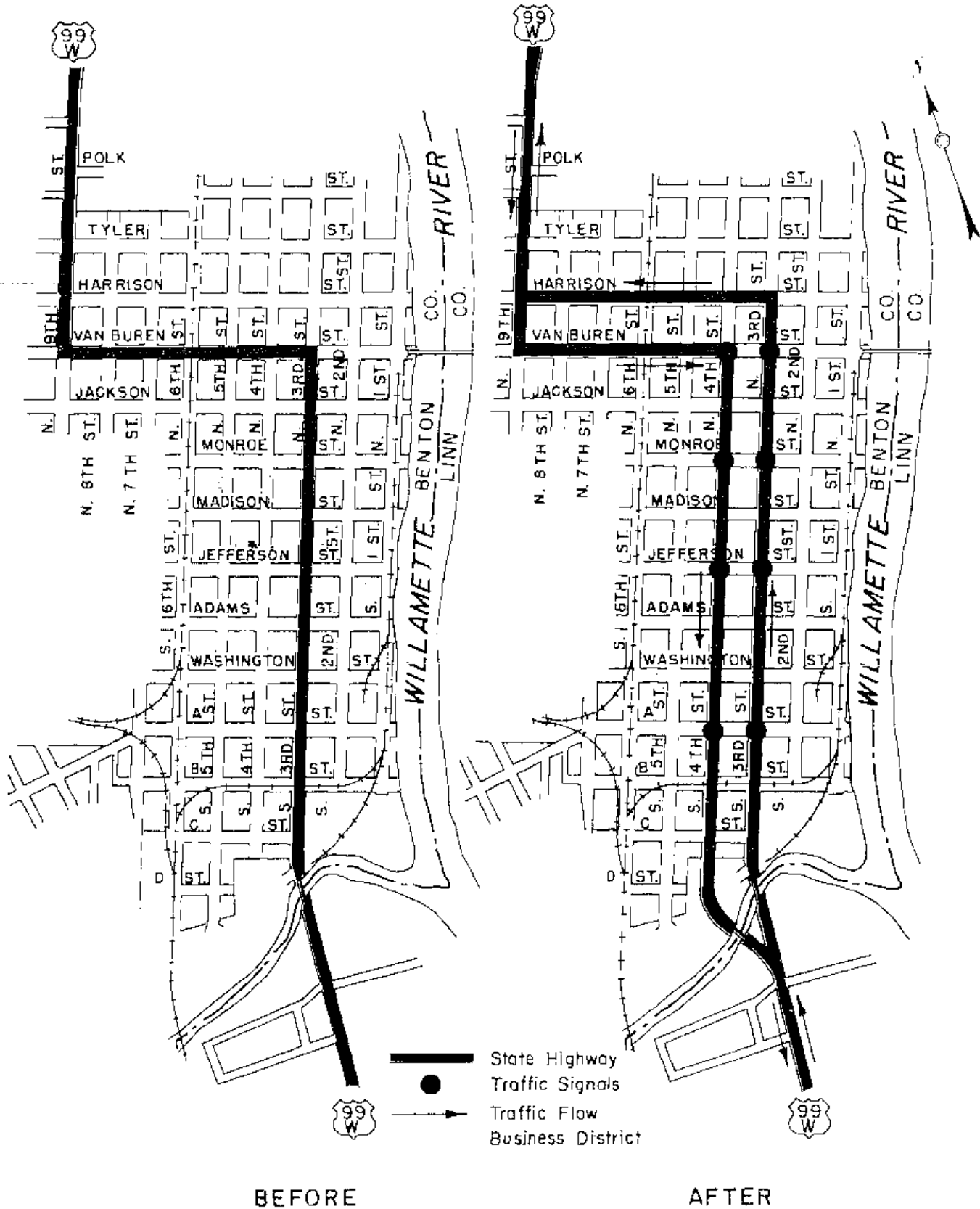


Figure 9

Traffic Data

During the "before" period, traffic volumes on Van Buren and Third Streets averaged 5,665 and 6,995 vehicles per day, respectively, while Harrison and Fourth Streets carried only 1,945 and 1,555 vehicles per day, respectively. There were 10,913,882 vehicle miles of travel during the "before" period, and the average daily traffic for this corridor of travel was 8,040 vehicles.

The flow of traffic during the "after" period was more uniformly distributed. The average daily traffic was 4,380 vehicles on Van Buren Street, 4,415 on Fourth Street, 4,570 on Harrison Street, and 5,045 on Third Street. The one-way couplet as a whole carried an average of 9,325 vehicles per day, and vehicle miles of travel amounted to 12,520,660.

During the "before" period, it required 3.78 minutes to negotiate the section in one direction. This corresponds to a running speed of 18.9 MPH. After the one-way couplet was established, travel time was reduced to 3.56 minutes, and the running speed was increased to 20.2 MPH. This was a savings of 0.22 minutes, or a 5.8 percent reduction in travel time.

Accident Data

The pertinent accident data for each period of study are presented in Table VIII.

TABLE VIII
SUMMARY OF ACCIDENT DATA

Van Buren-Fourth-Harrison-Third Street One-Way Couplet
Corvallis

Item	Before Period 8/1/46-7/31/49	After Period 9/1/51-8/31/54	Percent Change
Total Accidents	530	395	-25.5
Accident Rate ^①	48.56	31.17	-35.8
Persons Injured	54	63	+16.7
Persons Killed	0	0	0
Accident Severity Rate ^②	494.78	497.19	+0.5
Accident Cost	\$139,140	\$121,770	-12.5
Accident Cost Rate ^③	12,749	9,610	-24.6

- ① Accidents per million vehicle miles.
- ② Injuries and fatalities per hundred million vehicle miles.
- ③ Cost of accidents per million vehicle miles.

This tabulation shows that there was a marked improvement in the accident record after the one-way couplet was established. Fewer accidents in combination with more vehicle miles of travel during the "after" period resulted in a 35.8 percent reduction in the accident rate. Analysis reveals that this reduction was highly significant. The increase in the accident severity rate was not significant.

The accident rates for three consecutive 12-month periods immediately preceding the establishment of the one-way couplet and three consecutive 12-month periods following the transition period are shown graphically in Figure 11.

Table IX shows the accident data for each period of study arranged by collision type. This listing reveals that after the one-way couplet was established the decrease in total accidents was largely due to the improvement shown in the angle and parking categories. Angle collisions decreased from 136 to 68, and parking accidents were reduced from 111 to 53.

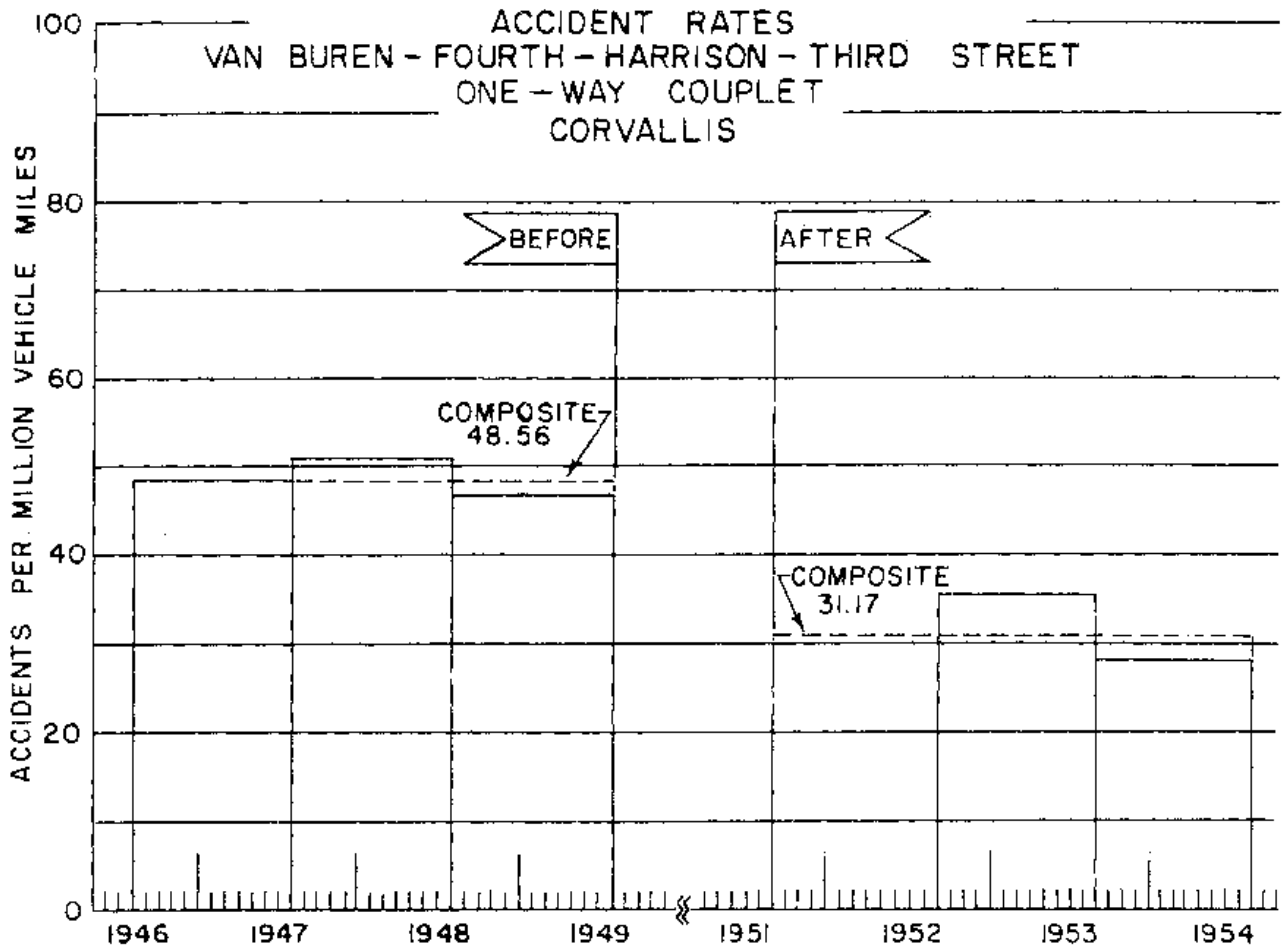


Figure II

Summary

After the one-way couplet was established in Corvallis, traffic was more uniformly distributed over the four streets studied. Congestion was reduced and there was a highly significant reduction in the accident rate. These factors attest to the effectiveness of this facility.

TABLE IX

ACCIDENT LISTING

Van Buren-Fourth-Harrison-Third Street One-Way Couplet
Corvallis

LOCATION		COLLISION TYPE											CLASSIF.					REMARKS	
City	Corvallis	Angle	Head-on	Rear-end Sideswipe Meeting	Sideswipe Overtaking	Turning	Parking	Non-Collision	Fixed Object	Pedestrian	Backing	Miscellaneous	ALL COLLISIONS	Fatal	Non-Fatal	Prop. Damage	Persons Killed		Persons Injured
INTERSECTIONAL																			
	Before	134	-	30	1	1	103	4	-	1	9	9	-	292	-	33	259	-	45
	After	66	-	50	-	4	118	2	1	7	12	11	-	271	-	48	223	-	59
NON-INTERSECTIONAL																			
	Before	2	1	51	7	32	22	107	-	4	2	10	-	238	-	9	229	-	9
	After	2	1	18	5	25	13	51	-	3	-	6	-	124	-	3	121	-	4
ALL ACCIDENTS																			
	Before	136	1	81	8	33	125	111	-	5	11	19	-	530	-	42	488	-	54
	After	68	1	68	5	29	131	53	1	10	12	17	-	395	-	51	344	-	63

The before period includes all accidents which occurred during the period from August 1, 1946 to July 31, 1949 between the termini of the one-way couplet on those streets which were a part of US99W before the establishment of the one-way couplet and on those streets which later became a part of the one-way couplet. The after period includes all accidents which occurred after the establishment of the one-way couplet during the period from September 1, 1951 to August 31, 1954 on the foregoing sections and on newly constructed extensions.

EUGENE

General

The routing of US99 in the City of Eugene was as shown in Figure 12 prior to the establishment of the Sixth-Seventh Avenue One-Way Couplet. There were four traffic signals at intersections on Willamette Street and one at the intersection of Broadway and Oak Street. Seventh Avenue, later to become a part of the one-way couplet, was terminated at Garfield Street.

The Sixth-Seventh Avenue One-Way Couplet was established on February 2, 1942, after Seventh Avenue was extended northward to an intersection with US99. As illustrated in Figures 12 and 13, north-bound traffic was routed via High Street and Sixth Avenue, and Pearl Street and Seventh Avenue became the southbound routing. Each leg of this one-way couplet was 1.86 miles in length.

Because of the lengthy nature of the section and high traffic volumes, it was felt that the data for a 12-month period before the couplet was established and a like period of time after the couplet was established would be adequate. Accordingly, the years 1941 and 1943 were used for comparative purposes. It will be noted that the "after" period of study started 11 months after the one-way couplet was established.

This one-way couplet was eventually extended eastward to Mill Street on September 1, 1951. At that time Mill Street, a four-lane divided facility, replaced High and Pearl Streets as the north-south portion of the one-way couplet. While the original routing is delineated by white paint, the revised north-south portion of the routing is faintly visible on the aerial view (Figure 13) taken in 1958.

Traffic Data

During the "before" period, traffic volumes averaged 8,200 vehicles per day and the vehicle miles of travel for this period totaled 5,566,980.

Due to wartime driving restrictions and gasoline rationing, traffic volumes in the "after" period were lower, the average being 6,040 vehicles per day. There were 4,100,556 vehicle miles of travel during this period.

Travel time is a measure of congestion on a facility. During the "before" period it required 8.06 minutes to negotiate the facility in one direction, and after the one-way couplet was established the travel time was reduced to 6.54 minutes. This was a savings of 1.52 minutes, or in other words, a 19 percent reduction in travel time.

HIGHWAY ROUTE BEFORE AND AFTER ESTABLISHMENT OF ONE WAY COUPLET

City of Eugene

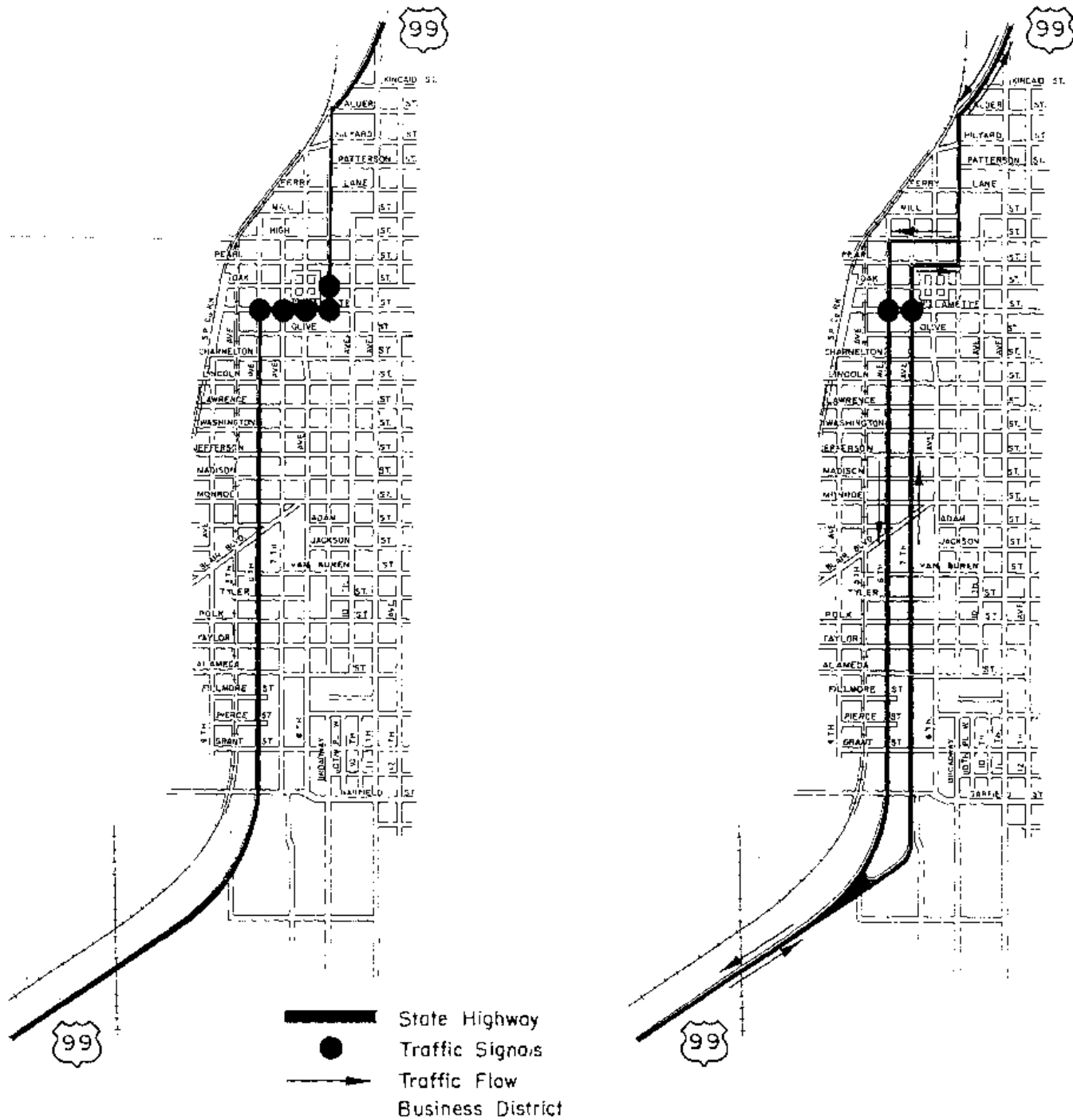
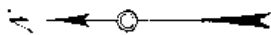


Figure 12

Accident Data

The pertinent accident data for each period of study are given in Table X.

TABLE X
SUMMARY OF ACCIDENT DATA
Sixth-Seventh Avenue One-Way Couplet
Eugene

<i>Item</i>	<i>Before Period 1/1/41-12/31/41</i>	<i>After Period 1/1/43-12/31/43</i>	<i>Percent Change</i>
Total Accidents	408	153	--62.5
Accident Rate ^①	73.29	37.31	-49.1
Persons Injured	44	19	-56.8
Persons Killed	0	0	0
Accident Severity Rate ^②	790.37	463.35	-41.4
Accident Cost	\$109,120	\$ 42,170	-61.4
Accident Cost Rate ^③	19,601	10,284	-47.5

① Accidents per million vehicle miles.

② Injuries and fatalities per hundred million vehicle miles.

③ Cost of accidents per million vehicle miles.

It can be seen that there was a sizeable reduction in all accident categories after the one-way couplet was put in operation. The reduction in the accident rate was highly significant. While the accident severity rate decreased 41.4 percent, analysis revealed that this was not a significant reduction.

The accident rates for the two periods of study are graphically shown in Figure 14.

Table XI shows the accident data for each period of study arranged by collision type. This listing discloses that after the one-way couplet was established, the greatest improvement occurred in the angle collision category. These accidents decreased in number from 143 to 44. Other types that were reduced appreciably in number include rear-end, turning, and parking accidents.

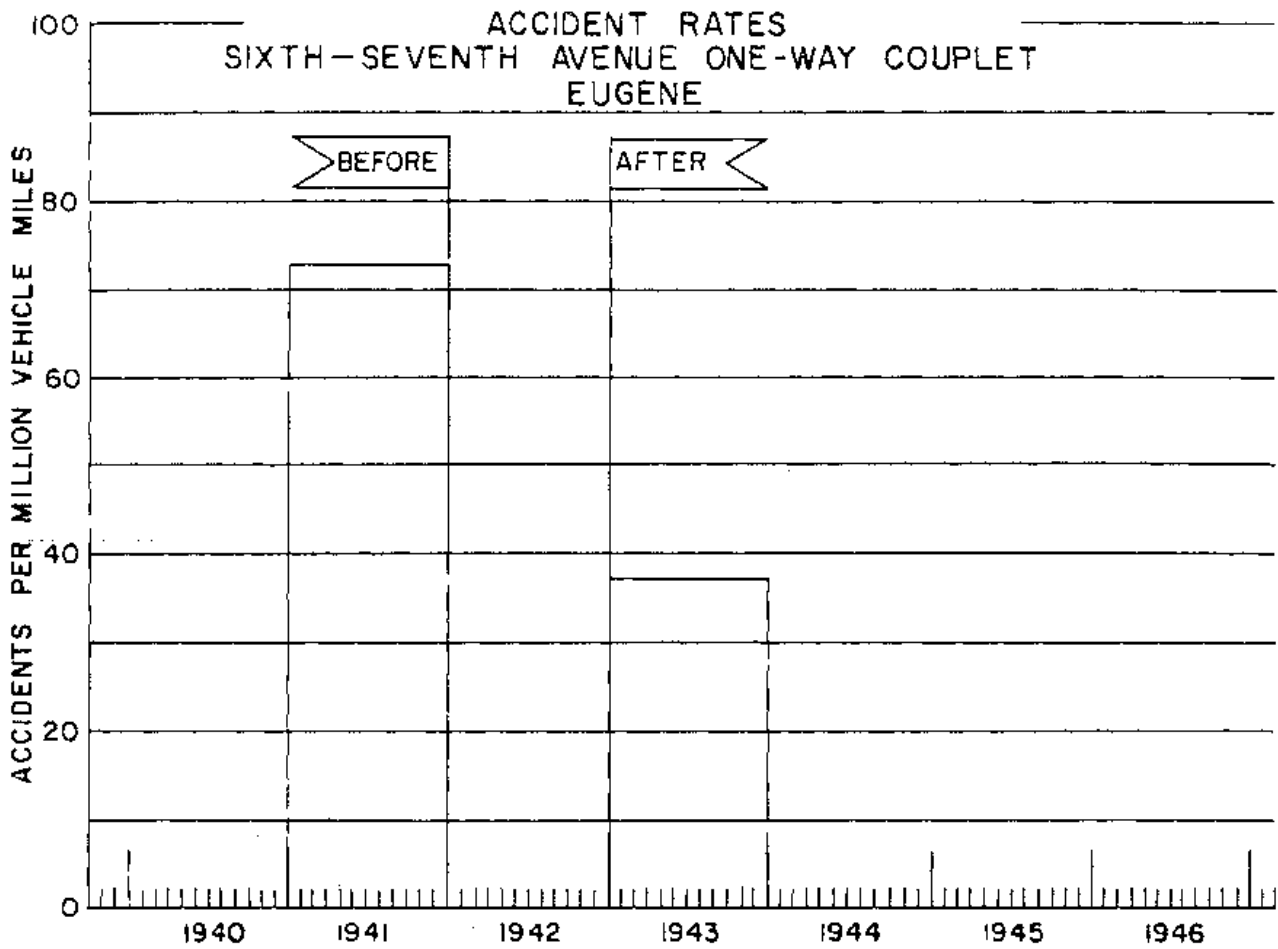


Figure 14

Summary

The establishment of the Sixth-Seventh Avenue One-way Couplet resulted in less congestion and fewer and less serious accidents. These are the optimum results of an effective one-way couplet.

TABLE XI
ACCIDENT LISTING

Sixth-Seventh Avenue One-Way Couplet
Eugene

LOCATION City Eugene	COLLISION TYPE												CLASSIF.			REMARKS			
	Angle	Head-on	Rear-end	Sideswipe Meeting	Sideswipe Overtaking	Turning	Parking	Non-Collision	Fixed Object	Pedestrian	Backing	Miscellaneous	ALL COLLISIONS	Fatal	Non-Fatal		Prop. Damage	Persons Killed	Persons Injured
ALL ACCIDENTS																			
Before	143	2	64	18	1/	99	56	3	1	10	2/	12	408	-	34	374	-	44	
After	44	2	17	7	1/	43	26	-	1	10	2/	3	153	-	19	134	-	19	
(Intersectional and Non-Intersectional Totals not available)																			

1/ Accident records did not distinguish between types of Sideswipe Collisions

2/ Included in Miscellaneous Collisions.

The before period includes all accidents which occurred during the period from January 1, 1941 to December 31, 1941 between the termini of the one-way couplet on those streets which were a part of US99 before the establishment of the one-way couplet and on those streets which later became a part of the one-way couplet. The after period includes all accidents which occurred after the establishment of the one-way couplet during the period from January 1, 1943 to December 31, 1943 on the foregoing sections and on newly constructed extensions.

LEBANON

General

Prior to the establishment of the one-way couplet in the City of Lebanon, US20 was routed over Main Street as shown in Figure 15. Main Street was 36 feet in width from Carolina Street to the Lebanon-Santiam Canal Bridge, and 20 feet in width to the south of the bridge. The section of Main Street involved in this study was 0.67 miles in length. The sections of the city streets, Park and Carolina Streets, later to be incorporated into the one-way couplet, were 0.56 miles in length.

The Main-Park Street One-Way Couplet was established July 1, 1948. As illustrated in Figures 15 and 16, southbound traffic was routed over Main Street and northbound traffic was routed over Park Street and Carolina Street. The establishment of this one-way couplet required the construction of an extension of Park Street from the Lebanon-Santiam Canal to an intersection with Main Street. The Park-Carolina Street leg of the couplet was 0.77 miles in length, and was 44 feet in width between Ash and Grant Streets, 22 feet in width south of Oak Street, and 32 feet in width in the remaining sections. Parking was prohibited on the east side of Park Street throughout the 32-foot sections and on the south side of Carolina Street.

For comparative purposes, the three-year period January 1, 1945 to December 31, 1947 was chosen for the "before" period, and the three-year period January 1, 1949 to December 31, 1951 was selected for the "after" period. It will be noted that the "after" period of study began six months after the one-way couplet was established.

Traffic Data

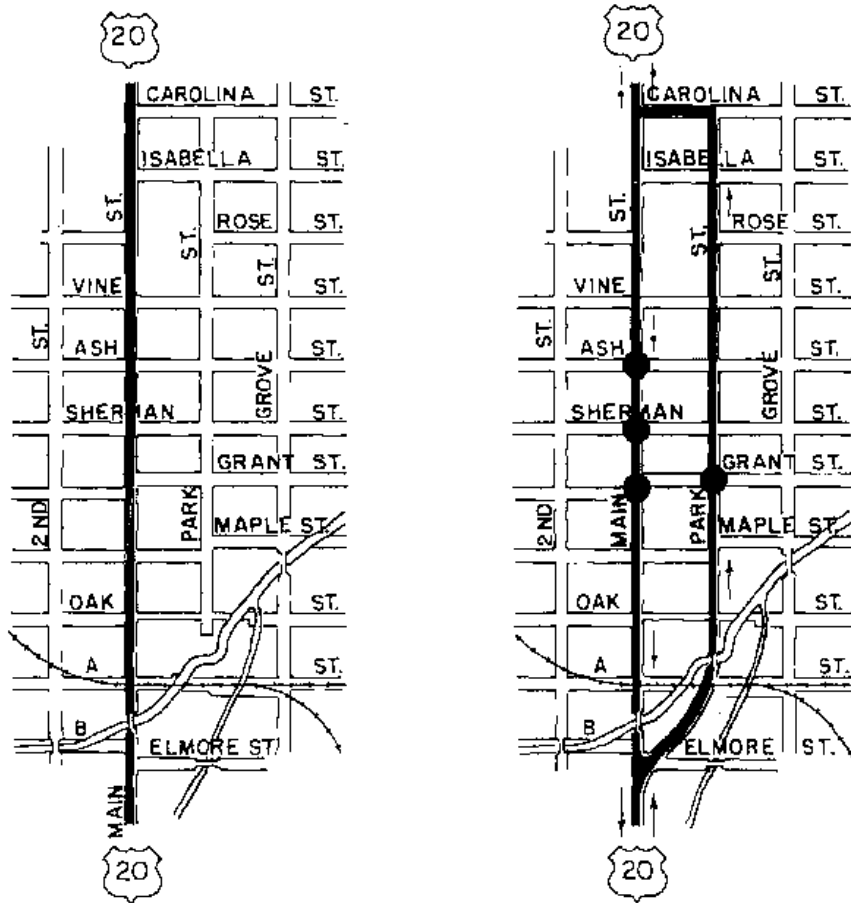
During the "before" period traffic volumes on Main Street averaged 5,465 vehicles per day. The average daily traffic on Park and Carolina Streets was 1,165 vehicles. There were 4,726,020 vehicle miles of travel during this period, and the average daily traffic for all three streets was 6,440 vehicles.

Traffic volumes on Main Street, the southbound leg of the one-way couplet, averaged 4,375 vehicles per day during the "after" period. Traffic volumes were slightly lower on the northbound leg, the average being 4,255 vehicles per day. The average daily traffic for the one-way couplet during the "after" period was 8,630 vehicles, and the vehicle miles of travel totaled 6,796,061.

During the "before" period, it required 1.86 minutes of travel time to negotiate one direction of the section of Main Street under consideration. After the one-way couplet was established the travel time on Main Street was reduced to 1.76 minutes. This was a savings of 0.10 minutes, or a 5.38 percent reduction.

HIGHWAY ROUTE BEFORE AND AFTER ESTABLISHMENT OF ONE WAY COUPLET

City of Lebanon



BEFORE

AFTER

Figure 15

Accident Data

The pertinent accident data for each period of study are shown in Table XII.

TABLE XII
SUMMARY OF ACCIDENT DATA
Main-Park Street One-Way Couplet
Lebanon

Item	Before Period 1/1/45-12/31/47	After Period 1/1/49-12/31/51	Percent Change
Total Accidents	226	266	+ 17.7
Accident Rate [Ⓐ]	47.82	39.14	- 18.2
Persons Injured	20	23	+ 15.0
Persons Killed	1	0	-100.0
Accident Severity Rate [Ⓑ]	444.35	338.43	- 23.8
Accident Cost	\$78,600	\$66,130	- 15.9
Accident Cost Rate [Ⓒ]	16,631	9,731	- 41.5

Ⓐ Accidents per million vehicle miles.

Ⓑ Injuries and fatalities per hundred million vehicle miles.

Ⓒ Cost of accidents per million vehicle miles.

It can be seen that with the exception of the increase in total accidents and the total persons injured, there was a noticeable improvement in the accident record after the one-way couplet was established. Although total accidents and personal injuries increased, they in themselves do not represent a true picture of the effects of the one-way couplet. Even though the total accidents increased, there was a reduction in the accident rate of 18.2 percent. This reduction was significant. The accident severity rate decreased 23.8 percent in spite of an increase in casualties. This reduction, however, is not significant.

Figure 17 graphically shows a comparison of the accident rates for three consecutive 12-month periods preceding the establishment of the one-way couplet, with the accident rates for three consecutive 12-month periods immediately following the six-month transition period. In addition, the composite accident rates for the "before" and "after" periods of study are shown.

Table XIII shows the accident data for each period of study arranged by collision type. This listing discloses that after the one-way couplet was established, there was an appreciable reduction of rear-end and sideswipe meeting accidents. On the other hand, sideswipe overtaking and turning movement accidents increased considerably in number.

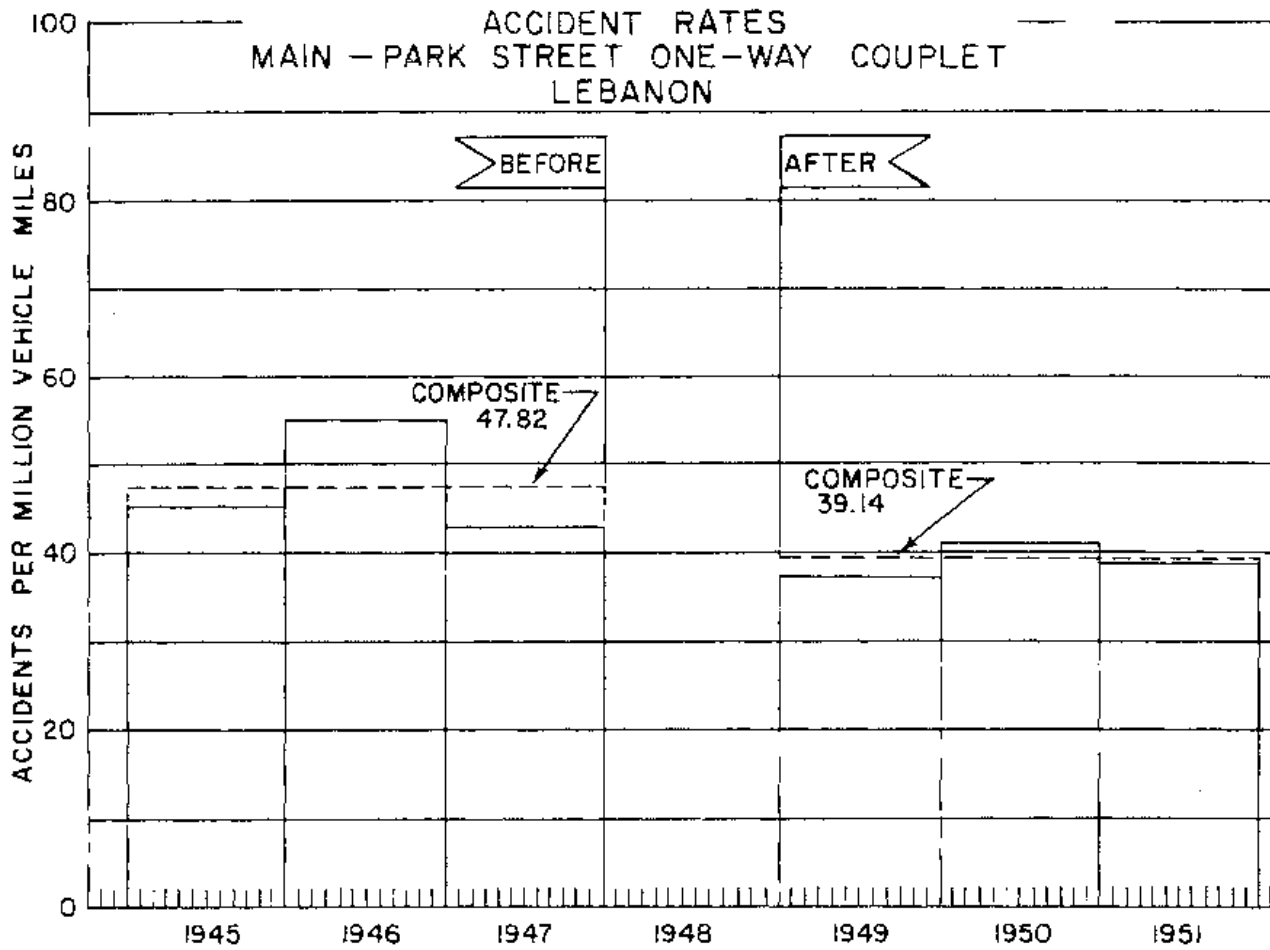


Figure 17

Summary

From an accident standpoint, the Main-Park Street One-Way Couplet was reasonably effective, primarily because of the decrease in sideswipe meeting and rear-end accidents. The cause of the unfavorable sideswipe overtaking accident experience was undoubtedly due to the narrowness of Main Street.

The one-way couplet did, in addition, bring about some relief from congestion, and a considerably lower accident cost rate. These economic benefits were good indicators of the efficiency of the facility.

TABLE XIII
ACCIDENT LISTING

Main-Park Street One-Way Couplet
Lebanon

LOCATION		COLLISION TYPE											CLASSIF.					REMARKS		
City	Lebanon	Angle	Head-on	Rear-end	Sideswipe Meeting	Sideswipe Overtaking	Turning	Parking	Non-Collision	Fixed Object	Pedestrian	Backing	Miscellaneous	ALL COLLISIONS	Fatal	Non-Fatal	Prop. Damage		Persons Killed	Persons Injured
INTERSECTIONAL																				
	Before	31	-	10	2	-	51	4	2	2	6	5	-	113	-	15	98	-	19	
	After	38	-	8	-	1	78	13	-	2	5	7	-	152	-	14	138	-	16	
NON-INTERSECTIONAL																				
	Before	2	-	27	5	10	5	58	1	1	-	4	-	113	1	-	112	1	1	
	After	2	2	14	1	34	5	44	1	4	1	6	-	114	-	6	108	-	7	
ALL ACCIDENTS																				
	Before	33	-	37	7	10	56	62	3	3	6	9	-	226	1	15	210	1	20	
	After	40	2	22	1	35	83	57	1	6	6	13	-	266	-	20	246	-	23	

The before period includes all accidents which occurred during the period from January 1, 1945 to December 31, 1947 between the termini of the one-way couplet on US20 before the establishment of the one-way couplet and on those streets which later became a part of the one-way couplet. The after period includes all accidents which occurred after the establishment of the one-way couplet during the period from January 1, 1949 to December 31, 1951 on the foregoing sections and on newly constructed extensions.

MEDFORD

General

Prior to the establishment of the Court Street, Central Avenue-Riverside Avenue One-Way Couplet, US99 was routed over Riverside Avenue in the City of Medford as shown in Figure 18. There was a traffic signal at the Main Street intersection. The section of Riverside Avenue involved in this study was 2.21 miles in length. Court Street and Central Avenue, later to become a part of the one-way couplet, served the core of the business district. There were traffic signals at the Sixth and Main Street intersections. The combined length of the sections of Court Street and Central Avenue was 2.28 miles.

The Court Street, Central Avenue-Riverside Avenue One-Way Couplet was established March 8, 1942. As illustrated in Figures 18 and 19, northbound traffic was directed over Riverside Avenue and southbound traffic was routed via Court Street and Central Avenue. The length of the northbound leg of the one-way couplet was 2.21 miles, and the length of the southbound leg was 2.28 miles.

Adequate data for the three-year period prior to the establishment of the one-way couplet in Medford were not available. Therefore, the length of the "before" and "after" periods of study was limited to one year. The year 1941 was chosen as the "before" period, and 1943 was selected as the "after" period. It will be noted that the "after" period of study started about ten months after the one-way couplet was established.

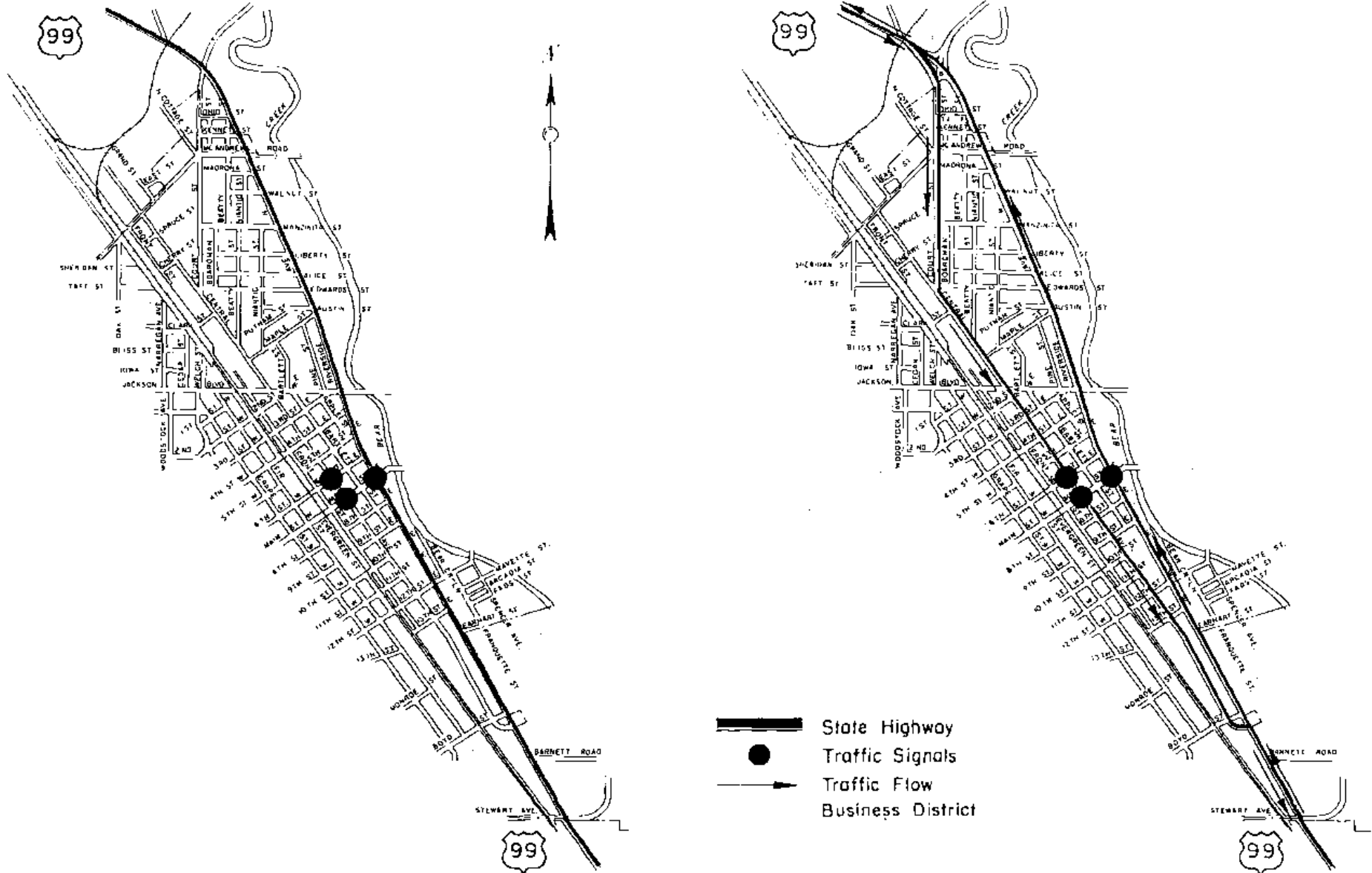
Traffic Data

During the "before" period, the average daily traffic was 11,680 vehicles, and vehicle miles of travel amounted to 9,720,096. Traffic volumes during the "after" period averaged 11,090 vehicles per day, and there were 9,079,229 vehicle miles of travel. In all probability, the decrease in traffic volumes was due to wartime driving restrictions and gasoline rationing.

There were no travel time data available.

HIGHWAY ROUTE BEFORE AND AFTER ESTABLISHMENT OF ONE WAY COUPLET

City of Medford



BEFORE

AFTER

Figure 18

Accident Data

Table XIV contains a summary of the relevant accident data for each period of study.

TABLE XIV

SUMMARY OF ACCIDENT DATA

Court Street, Central Avenue-Riverside Avenue One-Way Couplet
Medford

Item	Before Period 1/1/41-12/31/41	After Period 1/1/43-12/31/43	Percent Change
Total Accidents	163	84	- 48.5
Accident Rate ^①	16.77	9.25	- 44.8
Persons Injured	22	7	-68.2
Persons Killed	0	2	0
Accident Severity Rate ^②	226.34	99.13	- 56.2
Accident Cost	\$47,360	\$64,290	+35.7
Accident Cost Rate ^③	4,872	7,081	+45.3

① Accidents per million vehicle miles.

② Injuries and fatalities per hundred million vehicle miles.

③ Cost of accidents per million vehicle miles.

This tabulation reveals that during the "after" period, the accident rate was considerably lower than the accident rate for the "before" period. This reduction was highly significant. The accident severity rate decreased 56.2 percent. This was a significant reduction. On the surface, the higher accident costs and accident cost rate gave the impression that accidents occurring on the couplet were very costly. However, the "freak" occurrence of two deaths in one accident distorted these two values and pointed up the great effect fatalities have on monetary analysis.

The accident rates for each period of study are graphically shown in Figure 20.

Table XV shows the accident data for each period of study arranged by collision type. This listing reveals that the reduction in total accidents after the one-way couplet was established was largely due to the fact that angle accidents were reduced in number from 45 to 13. Other appreciable reductions occurred in the rear-end, turning, and parking categories.

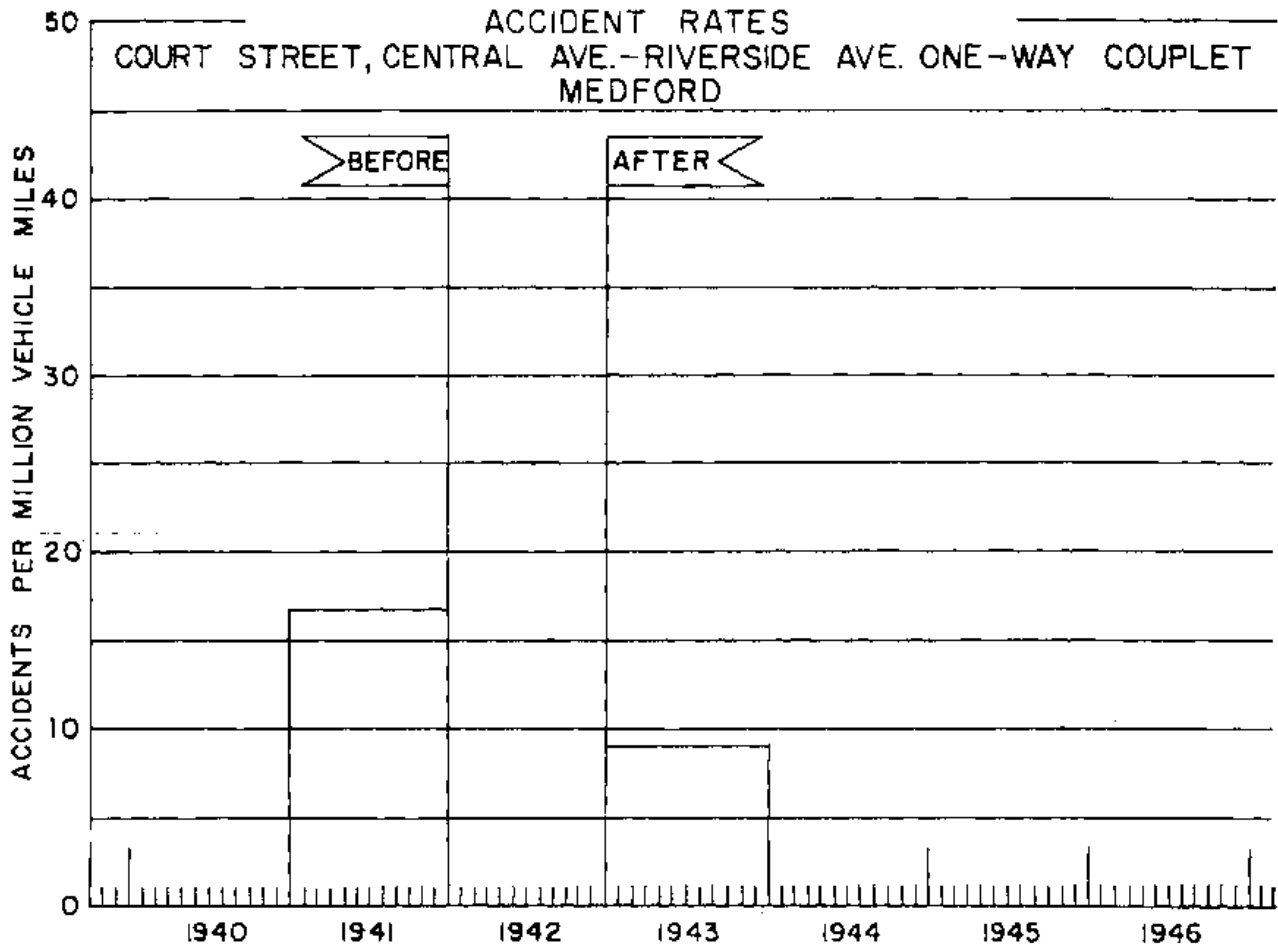


Figure 20

Summary

Under one-way operation many points of conflict were eliminated and the accident experience was considerably lower than the accident experience when two-way streets were in effect. This condition substantiates the theory that accidents decrease as points of conflict decrease.

In view of this finding, it can be concluded that the Court Street, Central Avenue-Riverside Avenue One-Way Couplet proved to be an efficient facility.

PENDLETON

General

Prior to the establishment of the Court-Dorian Avenue One-Way Couplet in Pendleton, US30 was routed via Court Avenue as shown in Figure 21. The section of Court Avenue considered was 1.23 miles in length. There were no traffic signals. Dorian Avenue, a parallel street one block south of Court Avenue which was later to become a part of the one-way couplet, was 1.04 miles in length. The difference in length was due to the fact that Dorian Avenue was terminated at S.W. 13th Street. There were no signalized intersections on Dorian Avenue either.

The Court-Dorian Avenue One-way Couplet was established on September 9, 1948, which date was shortly after the construction of an extension of Dorian Avenue to an intersection with Court Avenue, and the installation of traffic signals at the intersections of Court and Dorian Avenues with Main Street. As illustrated in Figures 21 and 22, westbound traffic was routed via Court Avenue and eastbound traffic was directed over Dorian Avenue. Each of these streets was 1.23 miles in length.

For comparative purposes, the 36-month period from September 1, 1945 to August 31, 1948 was used for the "before" period, and the 36-month period from January 1, 1949 to December 31, 1951 was chosen for the "after" period. The beginning date of the "after" period of study was scheduled so as to omit the first four months immediately following the opening of the one-way couplet from the study because it was felt that the data for these four months would not reflect a normal situation due to the changed driving requirements.

Traffic Data

Traffic volumes on Court Avenue during the "before" period averaged 4,405 vehicles per day and ranged from a high of 6,000 near Main Street to a low of 3,000 near the western terminus of the one-way couplet. Traffic volumes on Dorian Avenue averaged 2,395 vehicles per day, and varied from a high of 3,500 near Main Street to 1,000 near its western terminus. The average daily traffic for these two streets during the "before" period was 6,430 vehicles, and vehicle miles of travel amounted to 8,662,554.

During the "after" period, traffic volumes on Court Avenue averaged 4,025 vehicles per day with a high of 6,000 near Main Street and a low of 2,500 near the western terminus of the one-way couplet. On Dorian Avenue, traffic volumes were somewhat lower, averaging 3,530 vehicles per day, and ranging from a high of 5,000 near Main Street to a low of 2,500 near the western terminus. During the "after" period, the average daily traffic on the couplet was 7,555 vehicles, and vehicle miles of travel amounted to 10,168,585.

During the "before" period it required 3.75 minutes travel time to negotiate the section in one direction. After the one-way couplet was established, travel time was reduced to 3.20 minutes. This amounted to a 15 percent reduction.

HIGHWAY ROUTE BEFORE AND AFTER ESTABLISHMENT OF ONE WAY COUPLET

City of Pendleton

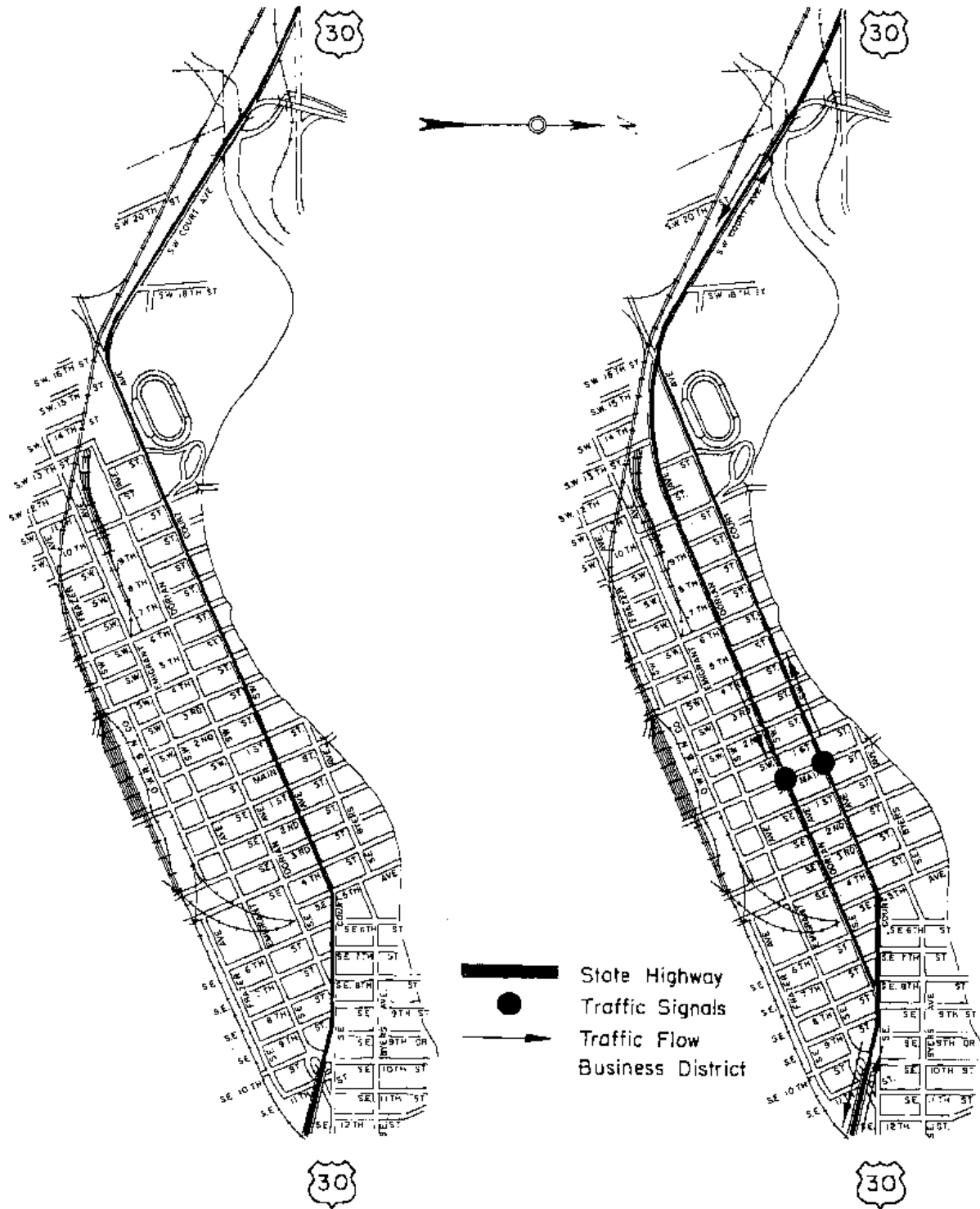


Figure 21

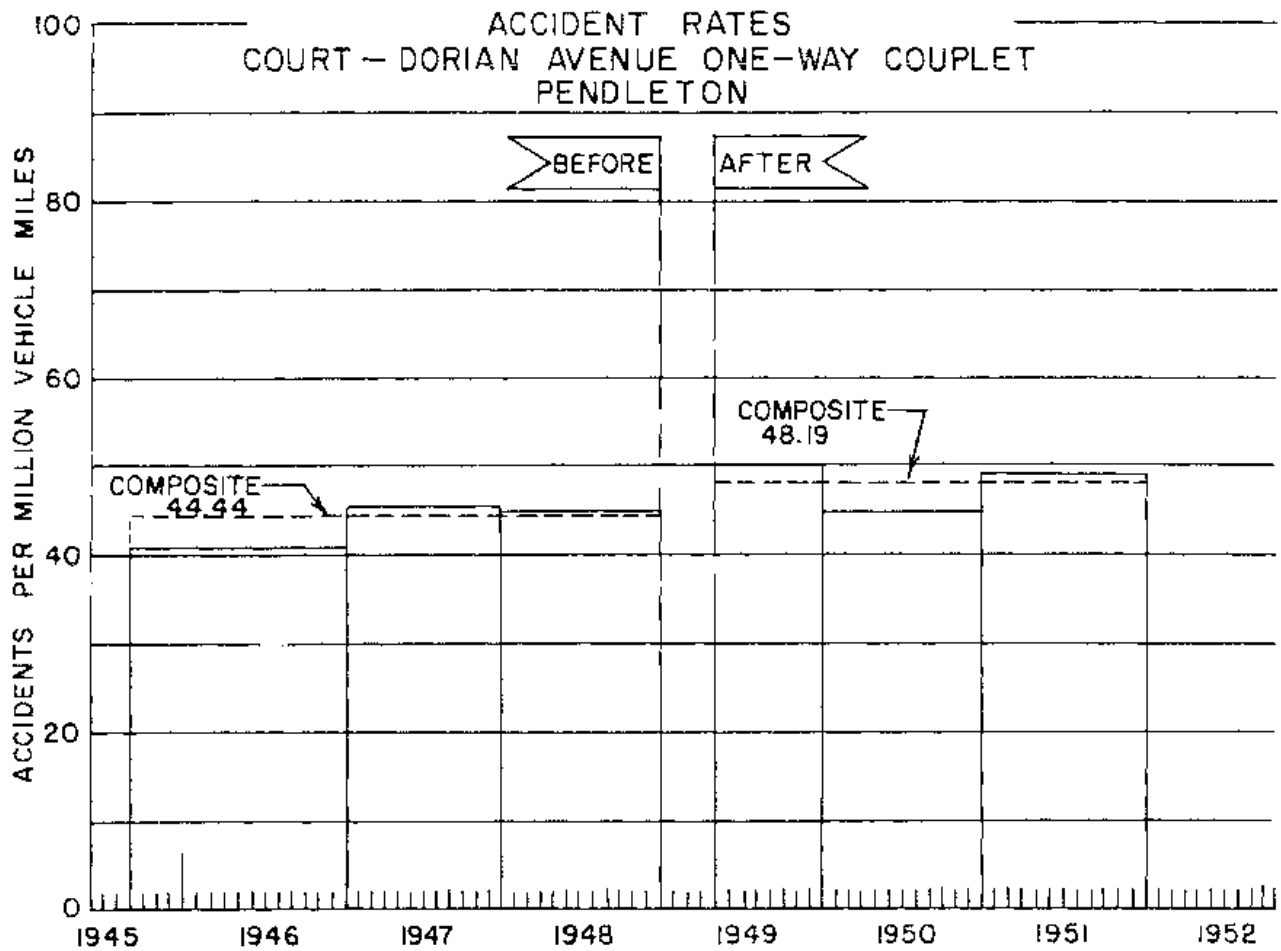


Figure 23

Summary

The Court-Dorian Avenue One-Way Couplet provided a certain amount of relief from congestion. On the other hand, the increase of traffic accidents resulted in a monetary loss to the vehicle user of slightly less than \$15,000 per year. The statistical analysis indicated that the increase in the accident rate was not large enough to be significant, therefore, it can be concluded that from a safety standpoint the one-way couplet did not change the situation existing during the "before" period.

TABLE XVII

ACCIDENT LISTING

Court-Dorian Avenue One-Way Couplet
Pendleton

LOCATION City Pendleton	COLLISION TYPE													CLASSIF.			Persons Killed	Persons Injured	REMARKS
	Angle	Head-on	Rear-end	Sideswipe Meeting	Sideswipe Overtaking	Turning	Parking	Non-Collision	Fixed Object	Pedestrian	Backing	Miscellaneous	ALL COLLISIONS	Fatal	Non-Fatal	Prop. Damage			
INTERSECTIONAL																			
Before	111	-	14	-	2	54	9	3	2	12	4	-	211	-	23	188	-	30	
After	59	3	39	-	2	115	37	-	4	14	12	-	285	-	25	260	-	32	
NON-INTERSECTIONAL																			
Before	-	1	28	4	24	7	95	-	6	2	6	1	174	-	6	168	-	9	
After	-	-	29	4	54	13	89	1	5	2	8	-	205	1	11	193	1	11	
ALL ACCIDENTS																			
Before	111	1	42	4	26	61	104	3	8	14	10	1	385	-	29	356	-	39	
After	59	3	68	4	56	128	126	1	9	16	20	-	490	1	36	453	1	43	

The before period includes all accidents which occurred during the period from September 1, 1945 to August 31, 1948 between the termini of the one-way couplet on US30 before the establishment of the one-way couplet and on the flanking street which later became a part of the one-way couplet. The after period includes all accidents which occurred after the establishment of the one-way couplet during the period from January 1, 1949 to December 31, 1951 on the foregoing sections and on newly constructed extensions.

REDMOND

General

US99 was routed on Sixth Street as shown in Figure 24, prior to the establishment of the Fifth-Sixth Street One-Way Couplet. The section of Sixth Street involved in this study was 1.13 miles in length. The frontage on the three-block section between Evergreen and Highland Avenue was mainly occupied by business establishments. This section of Sixth Street was 40 feet in width and there was parallel parking on both sides of the street. Fifth Street, later to become a part of the one-way couplet, was a local service street terminated on the north near Greenwood Avenue and on the south by Highland Avenue. The over-all length of this street was 0.94 miles. There were no traffic signals on either street.

On June 30, 1951 the Fifth-Sixth Street One-Way Couplet was opened to traffic. As illustrated in Figures 24 and 25, northbound traffic was routed via Fifth Street and southbound traffic was routed over Sixth Street. The establishment of this one-way couplet required the construction of connections between Fifth and Sixth Streets at both ends of the couplet. The length of the northbound leg of the one-way couplet was 1.19 miles, and the southbound leg was 1.13 miles in length.

For comparison, the 36-month period July 1, 1948 to June 30, 1951 was chosen for the "before" period, and the 36-month period July 1, 1952 to June 30, 1955 was selected for the "after" period. In this case, the "after" period of study started one year after the one-way couplet was established.

Traffic Data

Traffic volumes on Fifth Street during the "before" period averaged 235 vehicles per day and varied from a high of 400 near Evergreen Avenue, to a low of 100 near Glacier Avenue. On Sixth Street, traffic volumes were considerably higher. The average daily traffic was 3,920 vehicles, and traffic volumes ranged from a high of 6,000 south of Evergreen Avenue to a low of 3,000 near the north city limits. These two streets combined had an average daily traffic of 4,120 vehicles during the "before" period and a vehicle mileage total of 5,097,243.

During the "after" period traffic volumes on Fifth Street averaged 3,545 vehicles per day and ranged from a high of 4,500 near Evergreen Avenue to a low of 2,500 near the north city limits. On Sixth Street, the average daily traffic was 3,690 vehicles, with peak volumes comparable to those on Fifth Street. During the "after" period, the average daily traffic on the one-way couplet was 7,235 vehicles and there were 9,167,678 vehicle miles of travel.

There were no travel time data available.

HIGHWAY ROUTE BEFORE AND AFTER ESTABLISHMENT OF ONE WAY COUPLET

City of Redmond

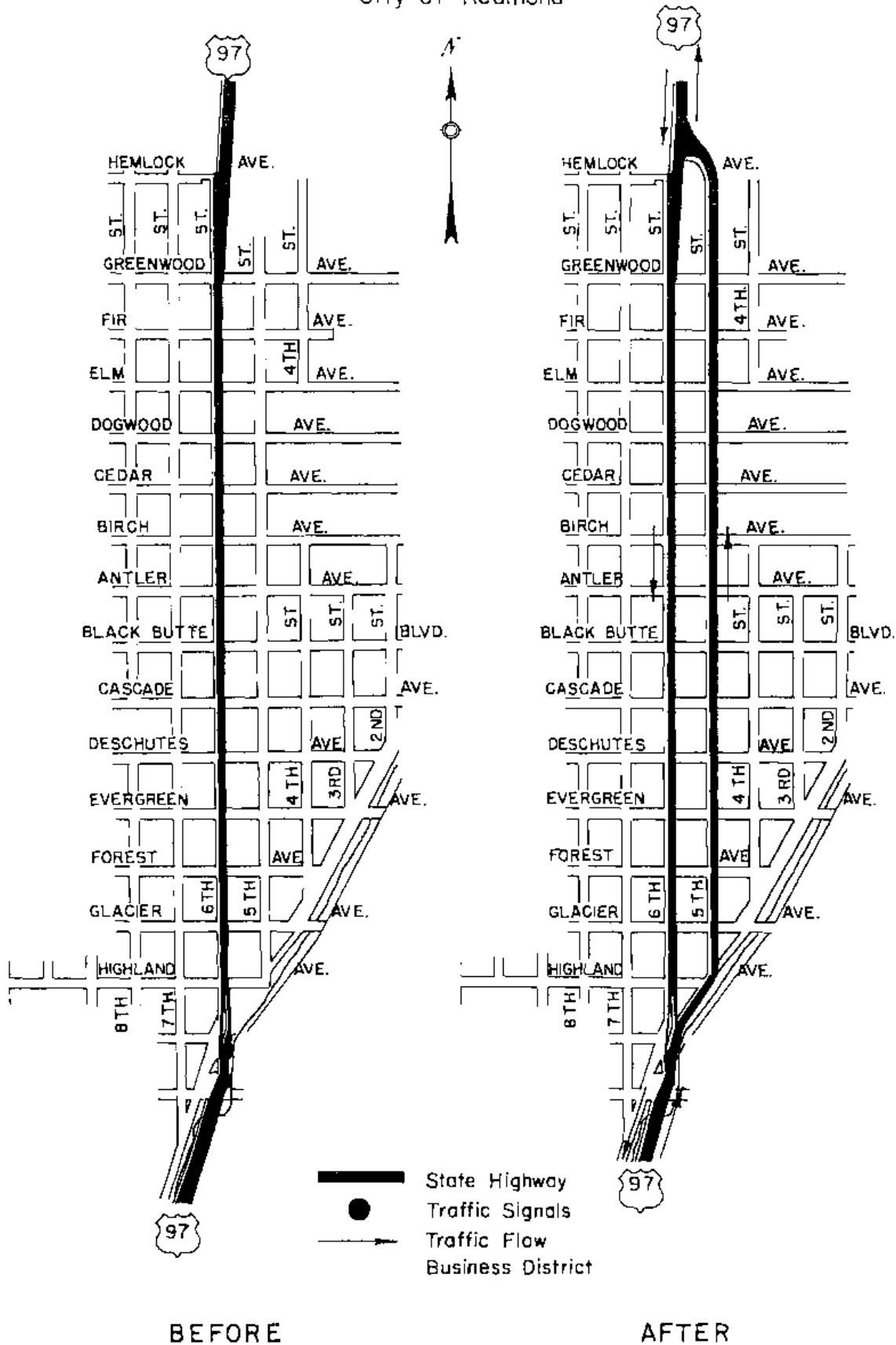


Figure 24

TABLE XIX

ACCIDENT LISTING

Fifth-Sixth Street One-way Couplet
Redmond

LOCATION		COLLISION TYPE												CLASSIF.					REMARKS
		Angle	Head-on	Rear-end	Sideswipe Meeting	Sideswipe Overtaking	Turning	Parking	Non-Collision	Fixed Object	Pedestrian	Backing	Miscellaneous	ALL COLLISIONS	Fatal	Non-Fatal	Prop. Damage	Persons Killed		Persons Injured
City Redmond	INTERSECTIONAL																		
	Before	20	-	9	-	1	43	1	-	2	3	5	-	84	-	7	77	-	11
	After	35	-	9	-	-	46	1	-	3	2	3	-	99	1	12	86	1	15
	NON-INTERSECTIONAL																		
	Before	-	1	16	2	5	2	39	-	1	2	3	-	71	-	4	67	-	4
	After	1	1	2	-	10	12	31	-	5	-	3	-	65	-	3	62	-	6
ALL ACCIDENTS																			
Before	20	1	25	2	6	45	40	-	3	5	8	-	155	-	11	144	-	15	
After	36	1	11	-	10	58	32	-	8	2	6	-	164	1	15	148	1	21	

The before period includes all accidents which occurred during the period from July 1, 1948 to June 30, 1951 between the termini of the one-way couplet on US97 before the establishment of the one-way couplet and on the flanking street which later became a part of the one-way couplet. The after period includes all accidents which occurred after the establishment of the one-way couplet during the period from July 1, 1952 to June 30, 1955 on the foregoing sections and on newly constructed extensions..

SALEM

General

Before the existence of the one-way couplet in the City of Salem, US99E was routed over Commercial, Court, and Capitol Streets as illustrated in Figure 27. There were nine traffic signals along this routing. All other streets destined to become a part of the one-way couplet were open to travel in their entirety, with the exception of Liberty Street which was closed south of Superior Street.

The one-way couplet was established on October 6, 1951. As shown in Figures 27 and 28, northbound traffic was routed via Liberty, Center, and Capitol Streets. Southbound traffic was routed down Fairgrounds Road to Summer Street and thence on Summer, Marion, and Commercial Streets. Court Street and a portion of Capitol Street, previously a part of the route of US99E, then assumed the status of local service streets.

During the following two years, traffic signals were installed at key intersections on the one-way couplet. Each leg of the couplet was 3.18 miles in length.

The 12-month period from October 7, 1950 to October 6, 1951 was chosen for the "before" period, and the 12-month period from October 1, 1953 to September 30, 1954 was selected for the "after" period. It will be noted that the "after" period of study started about two years after the one-way couplet was established.

Traffic Data

During the "before" period, the average daily traffic on the highway ranged from 9,000 vehicles on Court Street to 17,000 on Capitol Street. On city streets that were later to become part of the one-way couplet, the average daily traffic varied from 2,000 vehicles on Marion Street to 12,000 on Center Street. Considering all streets in question as one corridor of travel, the average daily traffic was 19,600 vehicles, and the vehicle miles of travel totaled 22,800,705.

The average daily traffic during the "after" period on the streets in question was more balanced. Capitol and Commercial Streets each carried approximately 10,000 vehicles per day, and Court, Marion, and Summer Streets each accommodated about 8,000 vehicles per day. Vehicle miles of travel amounted to 23,766,293 during this period, and the average daily traffic for the traffic corridor was 20,500 vehicles.

There were no travel time data available.

HIGHWAY ROUTE BEFORE AND AFTER ESTABLISHMENT OF ONE WAY COUPLET

City of Salem

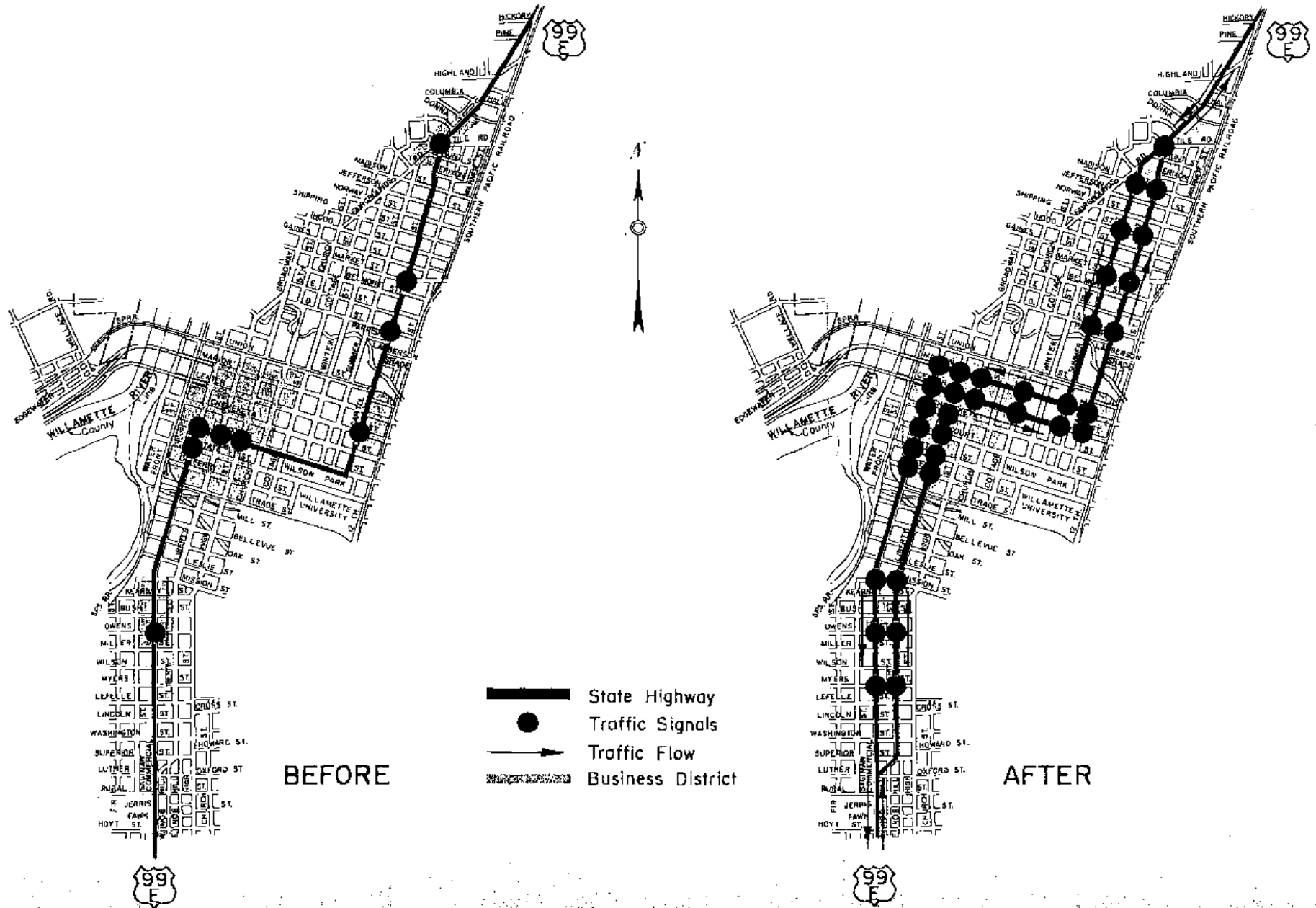


Figure 27

Accident Data

The salient accident data for each period of study are presented in Table XX.

TABLE XX

SUMMARY OF ACCIDENT DATA

Summer, Marion, Commercial-Capitol, Center, Liberty Street One-Way Couplet
Salem

Item	Before Period 10/7/50-10/6/51	After Period 10/1/53-9/30/54	Percent Change
Total Accidents	1,005	1,000	- 0.5
Accident Rate ^①	44.08	42.08	- 4.5
Persons Injured	130	99	-23.8
Persons Killed	0	0	- 0
Accident Severity Rate ^②	570.16	417.90	-26.7
Accident Cost	\$286,040	\$260,370	- 9.0
Accident Cost Rate ^③	12,545	10,991	-12.4

① Accidents per million vehicle miles.

② Injuries and fatalities per hundred million vehicle miles.

③ Cost of accidents per million vehicle miles.

This tabulation shows that there was a slight reduction in the accident rate after the one-way couplet was established. However, this reduction was not significant. Analysis of the accident severity rate shows that the 26.7 percent reduction was significant.

The accident rates for the "before" and "after" periods of study are graphically shown in Figure 29.

Table XXI shows the accident data for each period of study arranged by collision type. This listing discloses that after the one-way couplet was established, rear-end collisions were reduced in number from 248 to 161. Normally, an increase in the frequency of rear-end collisions can be expected after traffic signals are installed, thus this reduction was particularly noteworthy inasmuch as signalized intersections numbered 35 during the "after" period as compared to nine during the "before" period. In addition, there was an appreciable reduction of sideswipe meeting and angle collisions. On the other hand, sideswipe overtaking and turning movement accidents increased considerably in number.

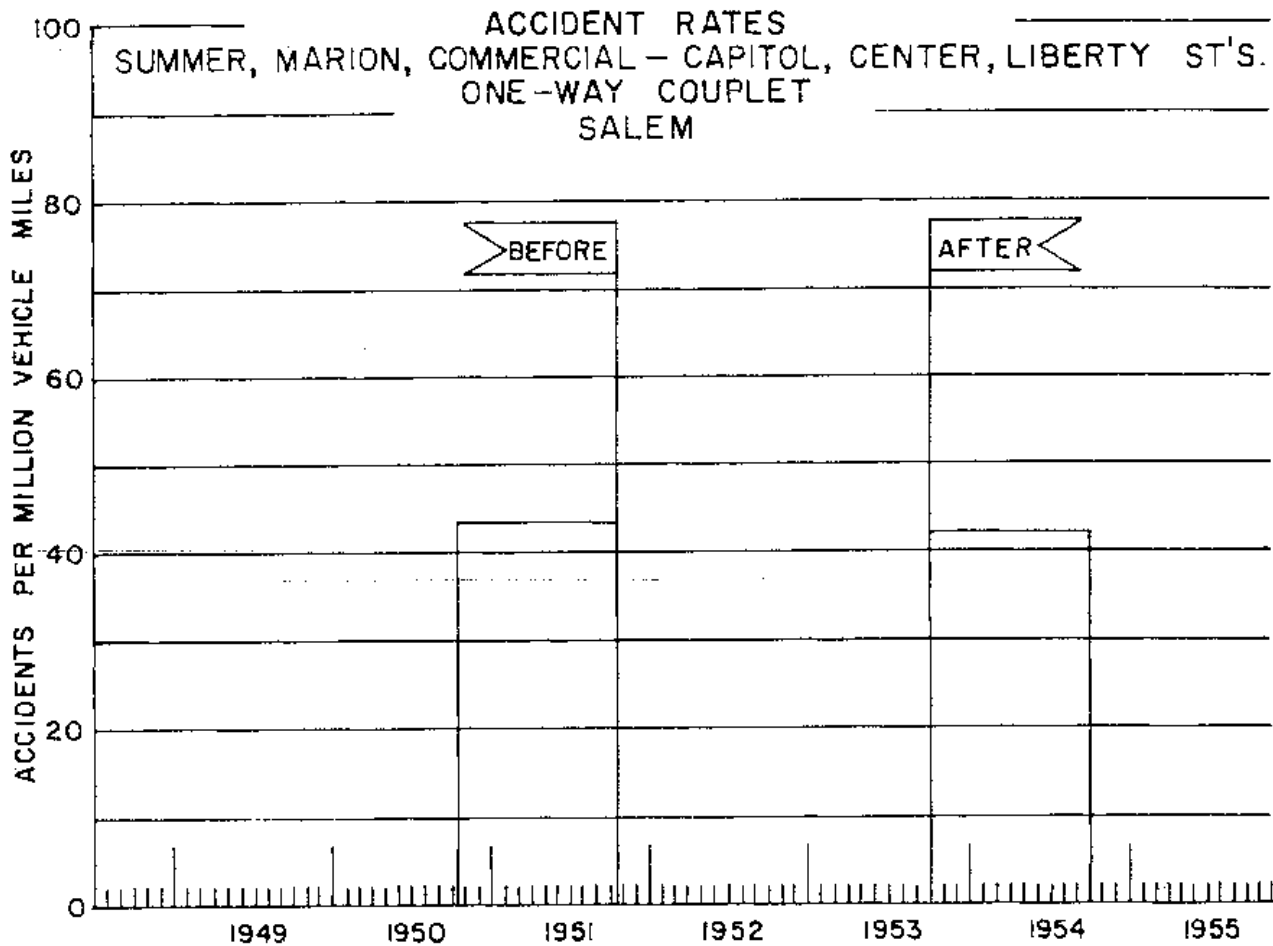


Figure 29

Summary

Prior to the establishment of the one-way couplet, Commercial Street and Capitol Street were carrying 13,000 and 17,000 vehicles per day, respectively. The practical capacity for each street was in the neighborhood of 8,000 vehicles per day. This excess traffic was causing unreasonable delay and restriction to the drivers' freedom to maneuver. The one-way couplet provided additional lanes of travel for US99E traffic, and as a result, traffic moves through the city with less conflicts and fewer interruptions. In view of these accomplishments, coupled with the reduced severity of accidents, the one-way couplet in the City of Salem proved itself to be a highly effective facility

TABLE XXI

ACCIDENT LISTING

Summer, Marion, Commercial-Capitol, Center, Liberty Street One-Way Couplet
Salem

LOCATION		COLLISION TYPE												CLASSIF.					REMARKS
City	Salem	Angle	Head-on	Rear-end	Sideswipe Meeting	Sideswipe Overtaking	Turning	Parking	Non-Collision	Fixed Object	Pedestrian	Backing	Miscellaneous	ALL COLLISIONS	Fatal	Non-Fatal	Prop. Damage	Persons Killed		Persons Injured
INTERSECTIONAL																			
	Before	154	-	158	14	14	183	43	-	5	22	9	1	603	-	81	522	-	106
	After	129	-	119	2	18	273	53	1	3	25	20	1	644	-	68	576	-	90
NON-INTERSECTIONAL																			
	Before	-	3	90	45	39	15	191	-	3	5	11	-	402	-	21	381	-	24
	After	-	-	42	2	117	15	163	1	-	2	14	-	356	-	8	348	-	9
ALL ACCIDENTS																			
	Before	154	3	248	59	53	198	234	-	8	27	20	1	1005	-	102	903	-	130
	After	129	-	161	4	135	288	216	2	3	27	34	1	1000	-	76	924	-	99

The before period includes all accidents which occurred during the period from October 7, 1950 to October 6, 1951 between the termini of the one-way couplet on those streets which were a part of US99E before the establishment of the one-way couplet and on those streets which later became a part of the one-way couplet. The after period includes all accidents which occurred after the establishment of the one-way couplet during the period from October 1, 1953 to September 30, 1954 on the foregoing sections and on newly constructed extensions.

SPRINGFIELD

General

Prior to the establishment of the one-way couplet in the City of Springfield, US126 was routed over Main Street as shown in Figure 30. Main Street was 46 feet in width from the Willamette River Bridge to Tenth Street and 20 feet in width east of Tenth Street. The section of Main Street involved in this study was 1.42 miles in length, and it passed through the Central Business District. There was one traffic signal, and parallel parking was in force.

The Main-South "A" Street One-Way Couplet was established November 6, 1953. As illustrated in Figures 30 and 31, westbound traffic was routed over Main Street, and eastbound traffic was routed over South "A" Street. The establishment of this one-way couplet initially required the construction of South "A" Street, and later, the installation of seven additional traffic signals. South "A" Street was 1.52 miles in length and 40 feet in width. Parallel parking was allowed throughout its entirety.

For comparative purposes, the 36-month period November 1, 1950 to October 31, 1953 was chosen for the "before" period and the 36-month period June 1, 1954 to May 31, 1957 was selected for the "after" period. It will be noted that the "after" period of study began approximately seven months after the one-way couplet was established. During this period, the new traffic signals were put in operation and motorists familiarized themselves with the new routing. For these reasons, the data for this period were not expected to reflect a normal situation, and therefore this seven-month period was omitted from the study.

Traffic Data

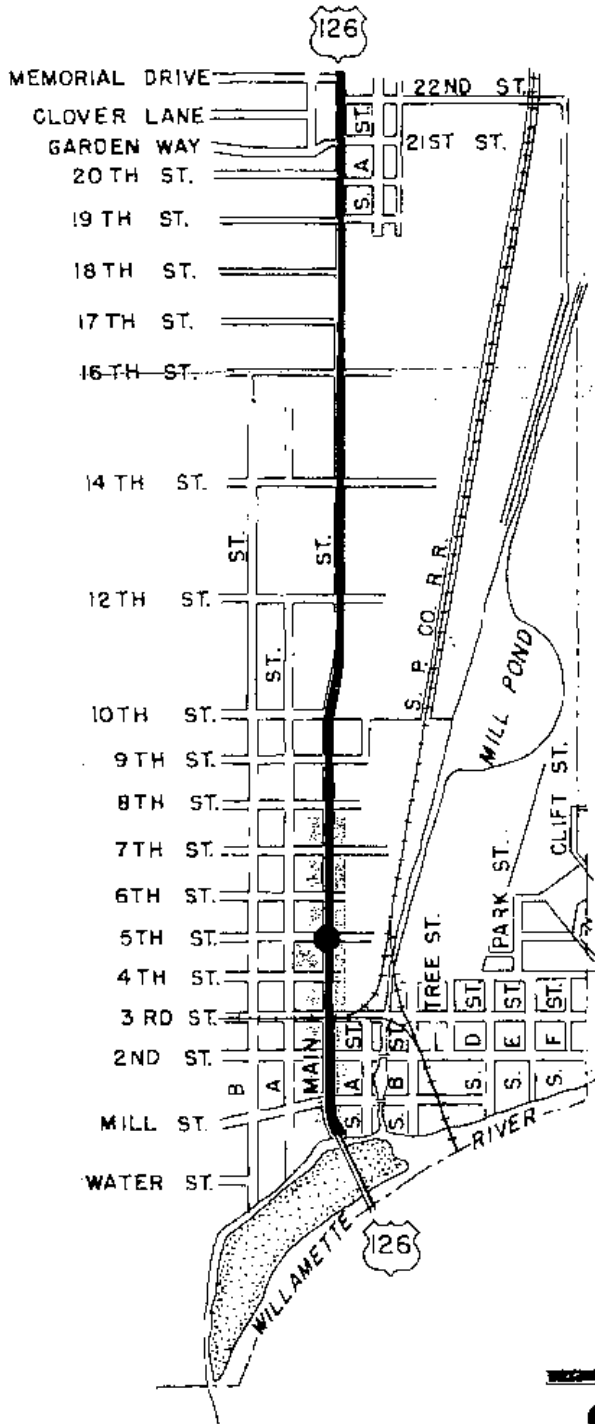
Traffic volumes on Main Street during the "before" period averaged 14,530 vehicles per day and ranged from a high of 18,000 near the Willamette River Bridge to a low of 13,000 near 19th Street. The total vehicle miles for the "before" period amounted to 22,597,880. As mentioned hereinbefore, South "A" Street was nonexistent during the "before" period, thus the foregoing data represent total "before" data.

During the "after" period, traffic volumes on Main Street averaged 8,520 vehicles per day and ranged from 11,000 near Fifth Street to 7,000 near 19th Street, the eastern terminus of the one-way couplet. On South "A" Street traffic volumes were generally lower, averaging 8,280 vehicles per day and varying from 9,000 near the western terminus to 7,000 near the eastern terminus. The average daily traffic during the "after" period on the couplet was 16,800 vehicles, and there were 27,023,505 vehicle miles of travel.

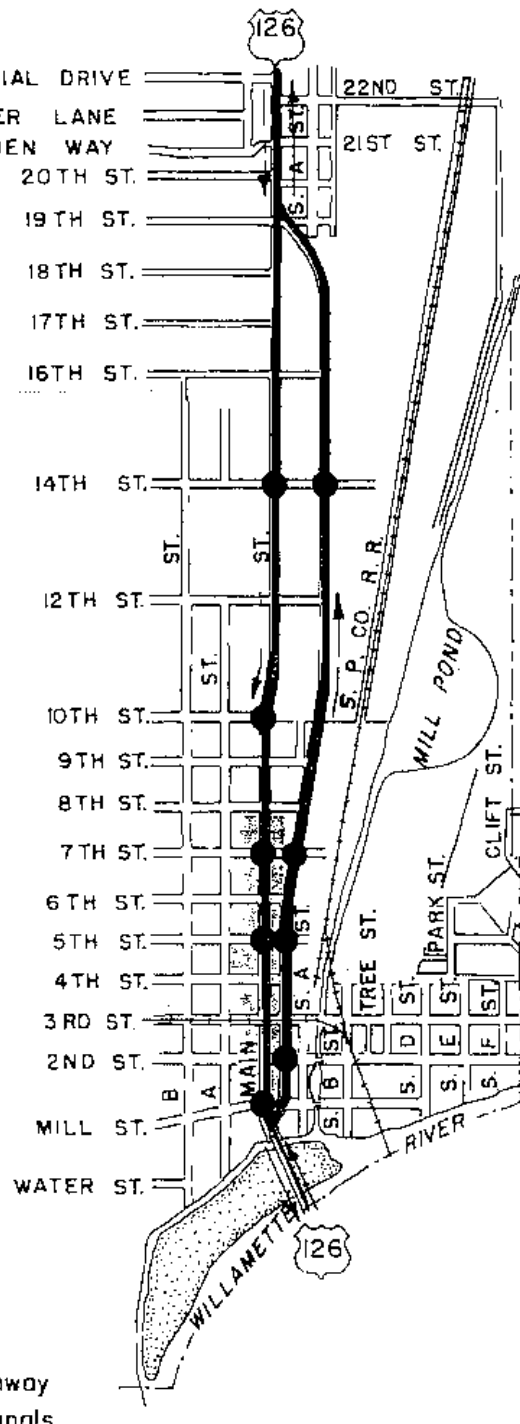
There were no travel time data available.

HIGHWAY ROUTE BEFORE AND AFTER ESTABLISHMENT OF ONE WAY COUPLET

City of Springfield



BEFORE



AFTER




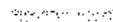
-  State Highway
-  Traffic Signals
-  Traffic Flow
-  Business District

Figure 30

Accident Data

The pertinent accident data for each period of study are shown in Table XXII.

TABLE XXII
SUMMARY OF ACCIDENT DATA
Main-South "A" Street One-Way Couplet
Springfield

Item	<i>Before Period</i> 11/1/50-10/31/53	<i>After Period</i> 6/1/54-5/31/57	<i>Percent</i> <i>Change</i>
Total Accidents	602	431	- 28.4
Accident Rate ^①	26.64	15.95	- 40.1
Persons Injured	91	72	- 20.9
Persons Killed	1	0	-100
Accident Severity Rate ^②	407.12	266.43	- 34.6
Accident Cost	\$203,290	\$135,180	- 33.5
Accident Cost Rate ^③	8,996	5,002	- 44.4

① Accidents per million vehicle miles.

② Injuries and fatalities per hundred million vehicle miles.

③ Cost of accidents per million vehicle miles.

It can be seen that in all accident categories there was a marked improvement after the one-way couplet was established. The 28.4 percent reduction in total accidents was outstanding, particularly since traffic volumes showed a 15.5 percent increase. The accident rate revealed that when traffic volumes were considered in conjunction with total accidents, there was a 40.1 percent decrease in the accident rate. This reduction was highly significant. The reduction in the severity rate was also found to be highly significant.

Figure 32 graphically shows a comparison of the accident rates for three consecutive 12-month periods immediately preceding the establishment of the one-way couplet with the accident rates for three consecutive 12-month periods immediately following the seven-month transition period. In addition, the composite accident rates for the "before" and "after" periods of study are shown.

Table XXIII shows the accident data for each period of study arranged by collision type. This listing discloses that after the one-way couplet was established there was an appreciable reduction of parking, rear-end, turning and pedestrian accidents. On the other hand, angle and sideswipe overtaking accidents increased considerably in number.

TABLE XXIII
ACCIDENT LISTING

Main-S. "A" Street One-Way Couplet
Springfield

LOCATION		COLLISION TYPE												CLASSIF.					REMARKS
City	Springfield	Angle	Head-on	Rear-end	Sideswipe Meeting	Sideswipe Overtaking	Turning	Parking	Non-Collision	Fixed Object	Pedestrian	Hacking	Miscellaneous	ALL COLLISIONS	Fatal	Non-Fatal	Prop. Damage	Persons Killed		Persons Injured
INTERSECTIONAL																			
	Before	14	-	115	-	3	76	4	-	4	14	8	1	239	-	30	209	-	33
	After	32	-	104	-	5	48	4	-	1	4	10	1	209	-	35	174	-	43
NON-INTERSECTIONAL																			
	Before	1	4	186	6	19	21	98	3	3	8	11	3	363	1	43	319	1	58
	After	-	1	106	-	31	11	57	3	7	1	3	2	222	-	25	197	-	29
ALL ACCIDENTS																			
	Before	15	4	301	6	22	97	102	3	7	22	19	4	602	1	73	528	1	91
	After	32	1	210	-	36	59	61	3	8	5	13	3	431	-	60	371	-	72

The before period includes all accidents which occurred during the period from November 1, 1950 to October 31, 1953 between the termini of the one-way couplet on US126 before the establishment of the one-way couplet. The after period includes all accidents which occurred after the establishment of the one-way couplet during the period from June 1, 1954 to May 31, 1957 on the one-way couplet.

THE DALLES

General

Second Street was the designated route of US30 in the City of The Dalles as shown in Figure 33, prior to the existence of the Second-Third Street One-Way Couplet. That portion of Second Street involved in this study was 0.76 miles in length. Those portions of Lincoln and Third Streets, later to become a part of the one-way couplet, had a combined length of 0.72 miles. There were no traffic signals on any of these streets. During the latter part of the "before" period, work was started on The Dalles Dam which was located just north of The Dalles. This generated an increase in the city's population and a consequent increase in the number of road users.

Prior to the opening of the Second-Third Street One-Way Couplet, Third Street was extended eastward to a junction with Second Street, and channelizing islands designed to facilitate traffic movements to and from the one-way couplet were constructed at the intersection of Second and Lincoln Streets.

The one-way couplet was established on November 12, 1952. As shown in Figures 33 and 34, Lincoln and Third Street became the routing for eastbound traffic, and Second Street was designated as the route for westbound traffic. Shortly after the one-way couplet was opened to traffic, traffic signals were installed and put in operation at eight intersections, as illustrated in Figure 33. The eastbound leg of the one-way couplet is 0.83 miles in length, and the westbound leg is 0.76 miles in length.

The 36-month period from November 1, 1949 to October 31, 1952 was selected for the "before" period of study, and the 36-month period from June 1, 1953 to May 31, 1956 was chosen as the "after" period. It will be noted that the "after" period of study started approximately six months after the one-way couplet was established.

Traffic Data

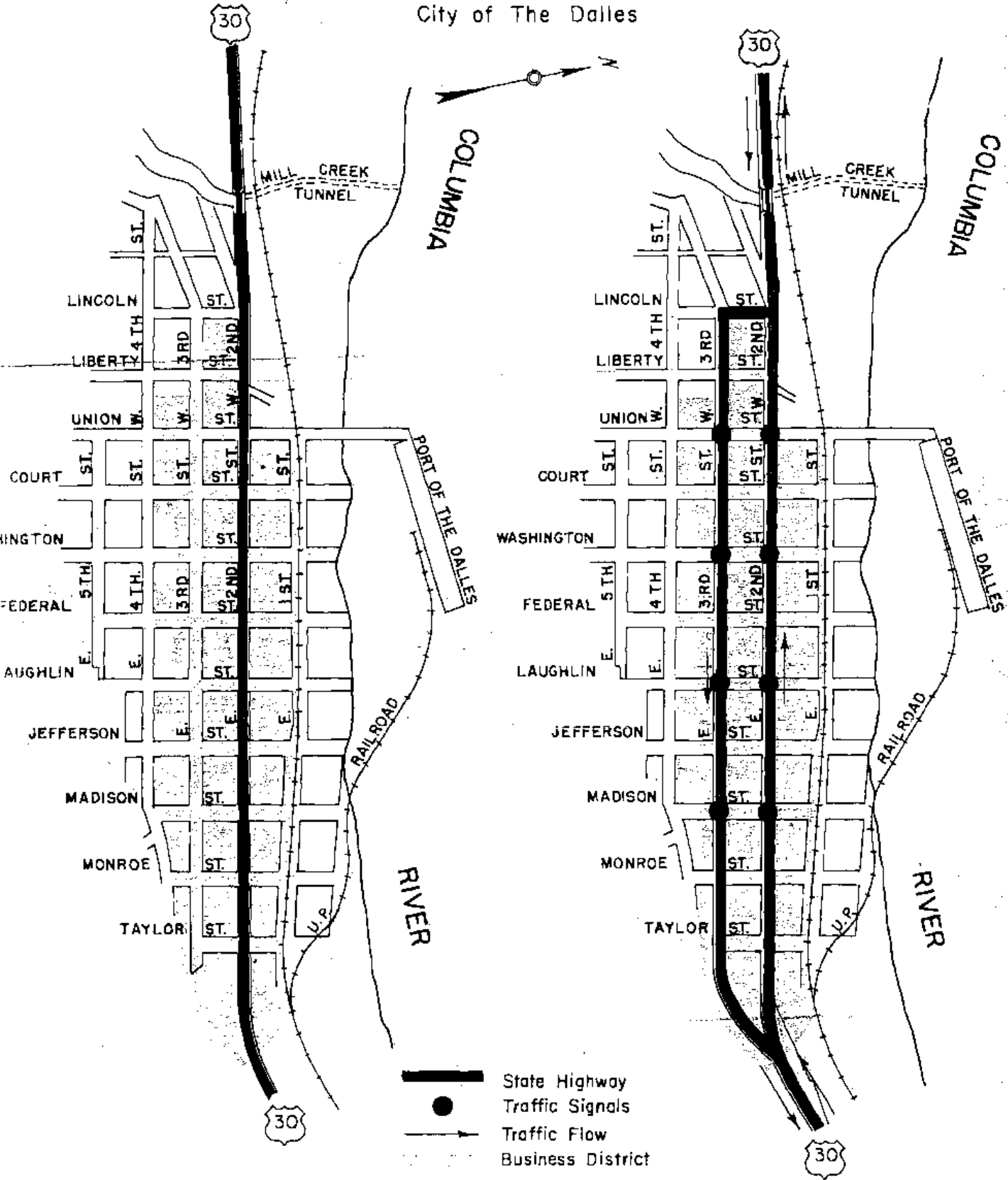
Traffic volumes on Second Street during the "before" period averaged 6,005 vehicles per day and ranged from a high of 7,000 just west of Federal Street to a low of 5,000 immediately east of Taylor Street. On Third Street, traffic volumes were considerably lower. The average daily traffic was 2,925 vehicles and varied from a high of 4,500 near Federal Street to a low of 1,000 near Taylor Street. The composite average daily traffic for both streets was 8,780 vehicles, and the over-all vehicle miles totaled 7,306,380.

During the "after" period, traffic volumes on Second Street averaged 8,835 vehicles per day and ranged from a high of 11,000 just west of Federal Street to a low of 6,500 near Taylor Street. On Third Street, the average daily traffic was 8,460 vehicles with volume extremes comparable to those on Second Street. During this period of study the average daily traffic on the one-way couplet was 17,295 vehicles, and there were 15,041,989 vehicle miles of travel.

There were no travel time data available.

HIGHWAY ROUTE BEFORE AND AFTER ESTABLISHMENT OF ONE WAY COUPLET

City of The Dalles



BEFORE

AFTER

Figure 33

Accident Data

The pertinent accident data for each period of study are presented in Table XXIV.

TABLE XXIV

SUMMARY OF ACCIDENT DATA

Second-Third Street One-Way Couplet The Dalles

Item	Before Period 11/1/49-10/31/52	After Period 6/1/53-5/31/56	Percent Change
Total Accidents	380	522	+37.4
Accident Rate ^①	52.01	34.70	-33.3
Persons Injured	34	34	0
Persons Killed	1	1	0
Accident Severity Rate ^②	479.03	232.68	-51.4
Accident Cost	\$116,920	\$142,480	+21.9
Accident Cost Rate ^③	16,002	9,472	-40.8

① Accidents per million vehicle miles.

② Injuries and fatalities per hundred million vehicle miles.

③ Cost of accidents per million vehicle miles.

This table reveals that the number of accidents increased 37.4 percent. During the same period, vehicle miles of travel increased 105 percent, and as a consequence the accident rate shows a reduction of 33.3 percent. This reduction was highly significant. The accident severity rate was reduced more than 50 percent, and this too was highly significant.

The accident rates for three consecutive 12-month periods immediately preceding the establishment of the one-way couplet and three consecutive 12-month periods immediately following the transition period are graphed and shown in Figure 35. This graph also shows the composite accident rates for both periods of study. It can be seen that the accident rates for the "after" years were very stable.

Table XXV shows the accident data for each period of study arranged by collision type. This listing reveals that after the one-way couplet was established there was an appreciable reduction of angle collisions. Only five angle type accidents occurred at the eight signalized intersections during the "after" period as against 26 such type accidents at these intersections during the "before" period. In the main, however, there were more accidents during the "after" period, particularly in the sideswipe overtaking, rear-end, turning, parking, and backing accident categories. Except for rear-end accidents which increased 129 percent, none of these types showed a percent increase as high as the vehicle mile increase for the same period.

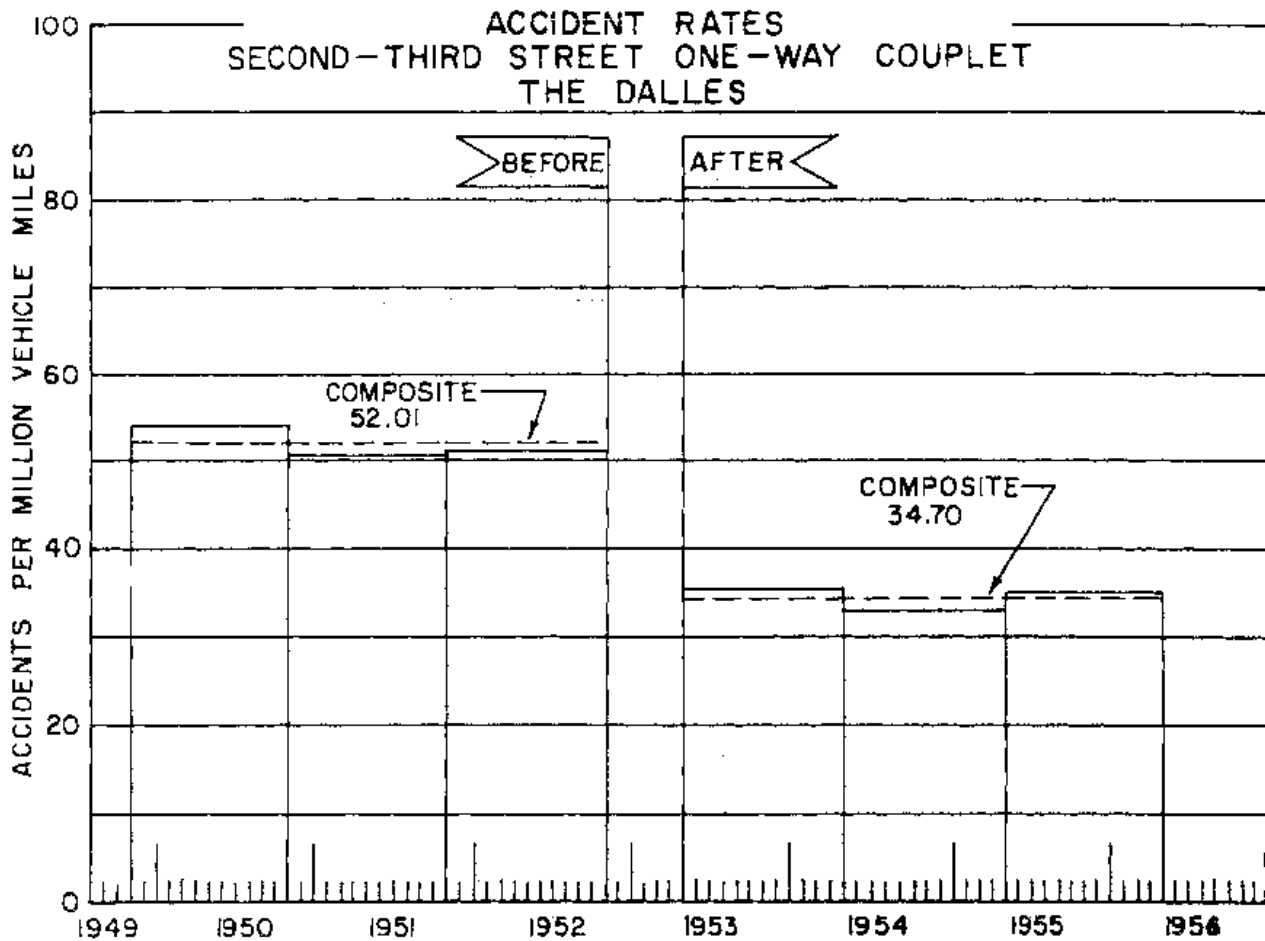


Figure 35

Summary

Because of increased construction activities in connection with The Dalles Dam, traffic growth during the "after" period was unusually high and, as a result, the average daily traffic increased from 8,780 vehicles during the "before" period to 17,295 vehicles during the "after" period. The traffic volumes during the "after" period would have exceeded the capacity of the former highway routing, but the one-way couplet provided the necessary street capacity to care for these high traffic volumes during the "after" period. In addition, the one-way couplet afforded safer driving conditions as evidenced by the lower accident and accident severity rates.

The facility, therefore, was decidedly effective in the two basic respects for which one-way couplets are designed.

TABLE XXV

ACCIDENT LISTING

Second-Third Street One-Way Couplet
The Dalles

LOCATION		COLLISION TYPE											CLASSIF.					REMARKS	
City	The Dalles	Angle	Head-on	Rear-end	Sideswipe Meeting	Sideswipe Overtaking	Turning	Parking	Non-Collision	Fixed Object	Pedestrian	Backing	Miscellaneous	ALL COLLISIONS	Fatal	Non-Fatal	Prop. Damage		Persons Killed	Persons Injured
INTERSECTIONAL																			
	Before	42	-	15	-	1	80	32	-	2	11	6	1	190	-	20	170	-	24
	After	20	-	60	-	6	119	46	-	2	8	10	-	271	1	24	246	1	28
NON-INTERSECTIONAL																			
	Before	3	-	32	5	27	14	95	1	2	7	4	-	190	1	10	179	1	10
	After	-	1	48	1	65	14	106	-	3	2	10	1	251	-	6	245	-	6
ALL ACCIDENTS																			
	Before	45	-	47	5	28	94	127	1	4	18	10	1	380	1	30	349	1	34
	After	20	1	108	1	71	133	152	-	5	10	20	1	522	1	30	491	1	34

The before period includes all accidents which occurred during the period from November 1, 1949 to October 31, 1952 between the termini of the one-way couplet on US30 before the establishment of the one-way couplet and on those streets which later became a part of the one-way couplet. The after period includes all accidents which occurred after the establishment of the one-way couplet during the period from June 1, 1953 to May 31, 1956 on the foregoing sections and on newly constructed extensions.

TILLAMOOK

General

US101 was routed through the City of Tillamook as shown in Figure 36 before the Main-Pacific Avenue One-Way Couplet was established. The portion of Main Avenue involved in this study was 0.79 miles in length. Pacific Avenue, a parallel street one block to the east which was later to become a part of the one-way couplet, extended from a junction with First Street on the north to a point just south of 12th Street, an over-all distance of 0.55 miles. The one-block section of First Street considered was 0.04 miles in length. There were no traffic signals on any of these streets.

Considerable construction was necessary to provide a southerly terminus for the one-way couplet. This construction involved the extension of Main Avenue south beyond the city limits to the re-located line of the Tillamook-Pleasant Valley Section of US101, and the extension of Pacific Avenue south to an intersection with the Main Avenue extension. On September 29, 1950, the Main-Pacific Avenue One-Way Couplet was opened to traffic. As shown in Figures 36 and 37, northbound traffic traveled over Pacific Avenue and First Street, while southbound traffic was directed over Main Avenue. Each leg of the one-way couplet is 0.79 miles in length. Signals at the intersections of Main and Pacific Avenues with Third Street were not installed until over a year after the one-way couplet was established.

For comparative purposes, the 36-month period from September 1, 1947 to August 31, 1950 was selected for the "before" period, and the 36-month period from October 1, 1951 to September 30, 1954 was chosen for the "after" period. It will be noted that the "after" period of study started one year after the one-way couplet was established.

Traffic Data

Traffic volumes on Main Avenue during the "before" period averaged 4,815 vehicles per day and ranged from a high of 5,500 just north of Third Street to a low of 4,000 near the south city limits. Traffic on First Street and Pacific Avenue was appreciably lighter. The average daily traffic was 1,365 vehicles, ranging from a high of 2,500 on First Street to a low of 50 on Pacific Avenue near 11th Street. The average daily traffic for all streets combined was 5,835 vehicles, and there were 5,047,073 vehicle miles of travel.

During the "after" period, the average daily traffic on Main Avenue was 3,350 vehicles. Traffic volumes on Main Avenue ranged from a high of 6,000 vehicles per day just north of Third Street to a low of 2,000 near the south city limits. On Pacific Avenue, traffic volumes averaged 3,525 vehicles per day and varied from a high of 6,000 north of Third Street to a low of 2,000 near the south city limits. During the "after" period, the average daily traffic on the one-way couplet was 6,875 vehicles, and the vehicle miles of travel totaled 5,947,507.

During the "before" period it required 3.56 minutes to negotiate the section in one direction. This corresponds to a running speed of 13.3 MPH. After the one-way couplet was established travel time was reduced to 2.14 minutes, and the running speed was increased to 22.1 MPH. This was a savings of 1.42 minutes, or a 40 percent reduction in travel time.

HIGHWAY ROUTE BEFORE AND AFTER ESTABLISHMENT OF ONE WAY COUPLET City of Tillamook

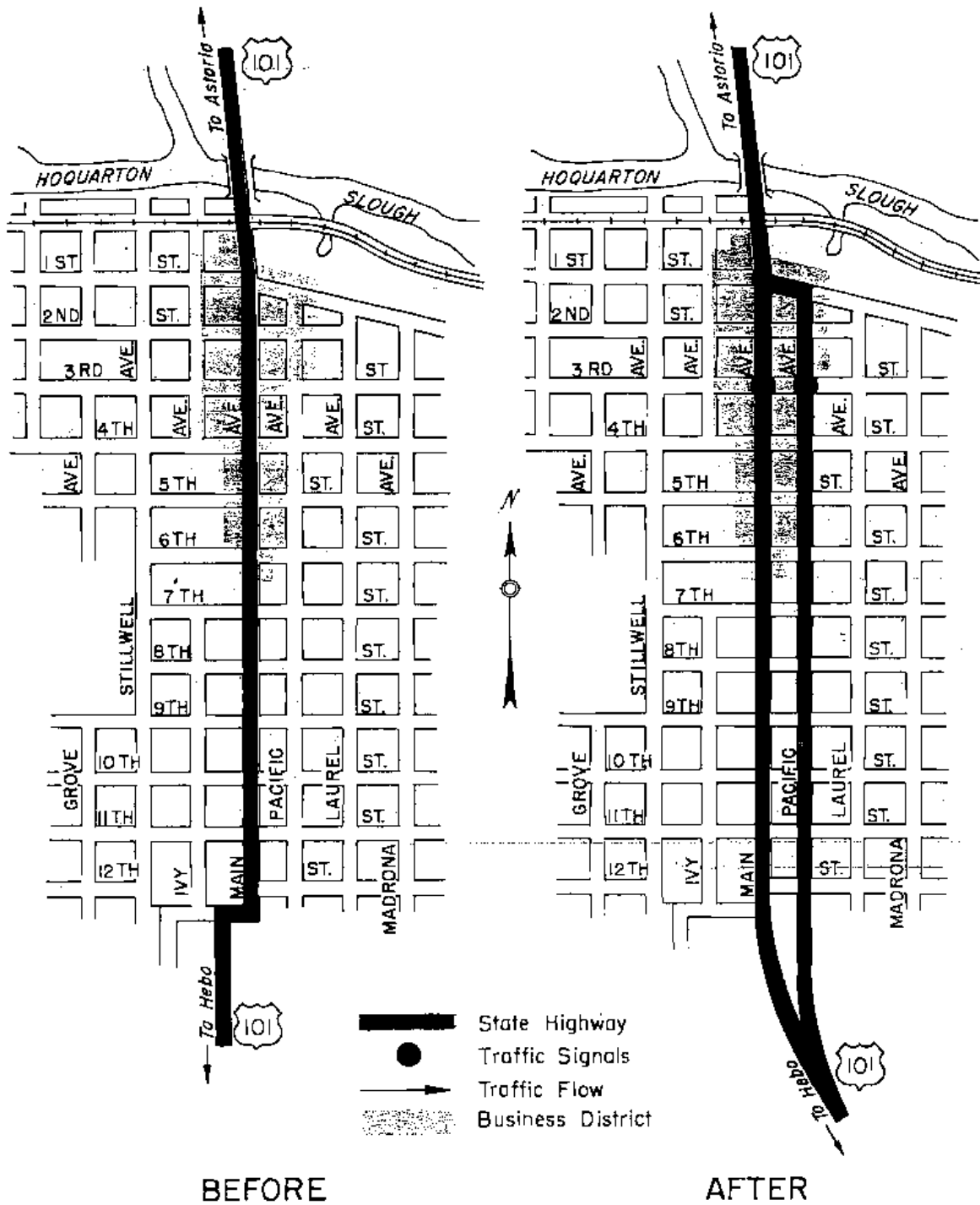


Figure 36

Accident Data

The pertinent accident data for both periods of study are summarized in Table XXVI.

TABLE XXVI
SUMMARY OF ACCIDENT DATA
Main-Pacific Avenue One-Way Couplet
Tillamook

Item	Before Period 9/1/47-8/31/50	After Period 10/1/51-9/30/54	Percent Change
Total Accidents	209	231	+ 10.5
Accident Rate ^①	41.41	38.84	- 6.2
Persons Injured	15	34	+126.7
Persons Killed	0	0	0
Accident Severity Rate ^②	297.20	571.69	+ 92.4
Accident Cost	\$49,170	\$69,740	+ 41.8
Accident Cost Rate ^③	9,742	11,726	- 20.4

① Accidents per million vehicle miles.

② Injuries and fatalities per hundred million vehicle miles.

③ Cost of accidents per million vehicle miles.

Table XXVI shows that after the one-way couplet was established, there were either increases or no change in all accident categories excepting the accident rate which decreased. Analysis revealed that this reduction was not significant. On the surface, it appeared as though the accidents during the "after" period were unusually severe. However, the increase in the accident severity rate was not significant.

A comparison of the accident rates for three consecutive 12-month periods immediately preceding the establishment of the one-way couplet with the accident rates for three consecutive 12-month periods immediately following the transition period are graphically shown in Figure 38. Also shown are the composite accident rates for each period of study. It is interesting to note that the accident rate increased at the outset of one-way operation, and then, started to decline. As a result, the rate for the last year of study was lower than the rate for any of the years prior to one-way operation.

Table XXVII shows the accident data for each period of study arranged by collision type. This listing reveals that after the one-way couplet was established considerably more rear-end, sideswipe overtaking and turning movement accidents occurred. On the other hand, sideswipe meeting and parking accidents were substantially reduced in number.

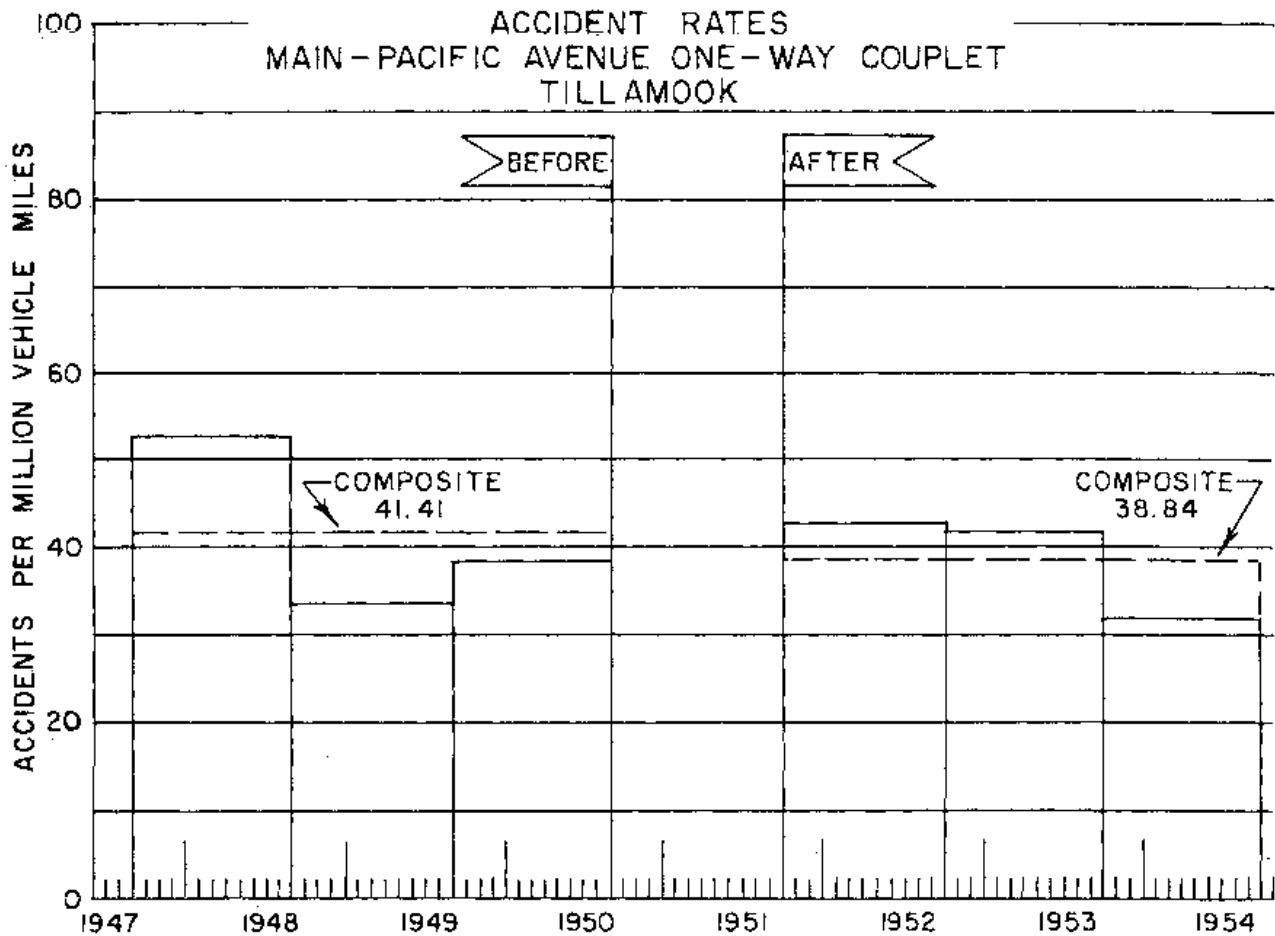


Figure 38

Summary

The Main-Pacific Avenue One-Way Couplet appreciably reduced travel time for US101 traffic through Tillamook. This was an indication that the facility was relatively less congested than the former route of US101. In general, the accident record during the "after" period did not compare favorably with the accident experience for the "before" period. However, trend data indicated that there was a gradual improvement during the "after" period.

In view of the fact that the one-way couplet was operating more safely near the end of the "after" period than the two-way section did during the "before" period, it can be reasoned that the conflicts or unfamiliarity existing during the early part of the "after" period were corrected.

In light of these findings, it was concluded that the establishment of the Main-Pacific Avenue One-Way Couplet improved the operations of traffic.

TABLE XXVII

ACCIDENT LISTING

Main-Pacific Avenue One-Way Couplet
Tillamook

LOCATIONS		COLLISION TYPE											CLASSIF.			REMARKS			
City	Tillamook	Angle	Head-on	Rear-end	Sideswipe Meeting	Sideswipe Overtaking	Turning	Parking	Non-Collision	Fixed Object	Pedestrian	Backing	Miscellaneous	ALL COLLISIONS	Fatal		Non-Fatal	Prop. Damage	Persons Killed	Persons Injured
INTERSECTIONAL																			
	Before	38	-	8	-	1	50	3	-	1	8	1	-	110	-	14	96	-	14
	After	41	-	14	-	5	64	7	1	2	6	6	-	146	-	17	129	-	27
NON-INTERSECTIONAL																			
	Before	-	2	12	9	14	9	48	-	-	-	5	-	99	-	1	98	-	1
	After	-	1	15	1	21	5	34	-	3	1	4	-	85	-	6	79	-	7
ALL ACCIDENTS																			
	Before	38	2	20	9	15	59	51	-	1	8	6	-	209	-	15	194	-	15
	After	41	1	29	1	26	69	41	1	5	7	10	-	231	-	23	208	-	34

The before period includes all accidents which occurred during the period from September 1, 1947 to August 31, 1950 between the termini of the one-way couplet on those streets which were a part of US101 before the establishment of the one-way couplet and on those streets which later became a part of the one-way couplet. The after period includes all accidents which occurred after the establishment of the one-way couplet during the period from October 1, 1951 to September 30, 1954 on the foregoing sections and on newly constructed extensions.