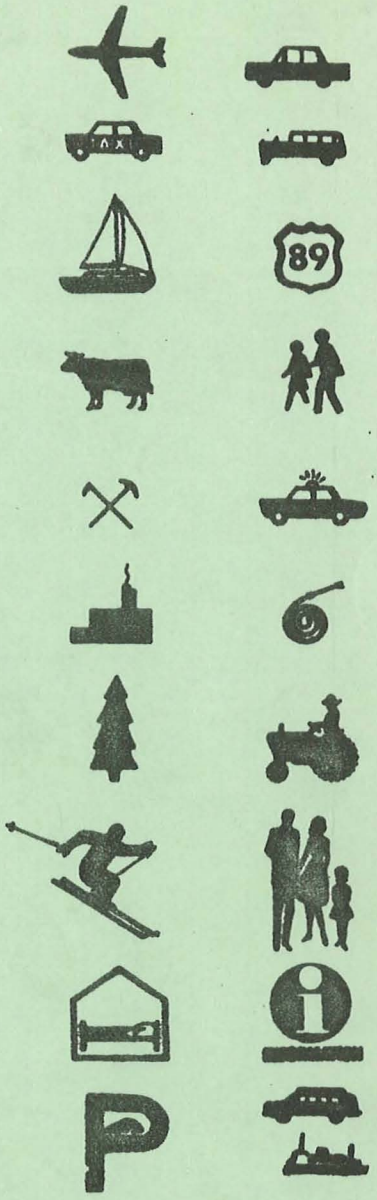
STD 199

BOLTON
BURLINGTON
CHARLOTTE
COLCHESTER
ESSEX JUNCTION
ESSEX TOWN
HINESBURG
HUNTINGTON
JERICHO
MILTON
RICHMOND
ST. GEORGE
SHELBURNE
SO. BURLINGTON
UNDERHILL
WESTFORD
WILLISTON
WINOOSKI
BUEL'S GORE

CHITTENDEN COUNTY



CHITTENDEN COUNTY

Williston / Taft Corners

Transportation Study

Prepared by
Chittenden County Regional Planning Commission

December 1987

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ABSTRACT

TITLE:	WILLISTON-TAFT CORNERS TRANSPORTATION STUDY
AUTHOR:	STAFF CHITTENDEN COUNTY REGIONAL PLANNING COMMISSION
SUBJECT:	To study the cumulative traffic impacts of commercial and residential growth in the Town of Williston, Vermont
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CONTRACT:	CCMPO FY87
NUMBER OF PAGES:	57

ABSTRACT: Analysis of the traffic impacts of growth in the Taft Corners area of the Town of Williston. The study analyzes existing and future conditions, and presents detailed recommendations for upgrading the area's transportation system through a combination of public and private resources.

WILLISTON - TAFT CORNERS TRANSPORTATION STUDY

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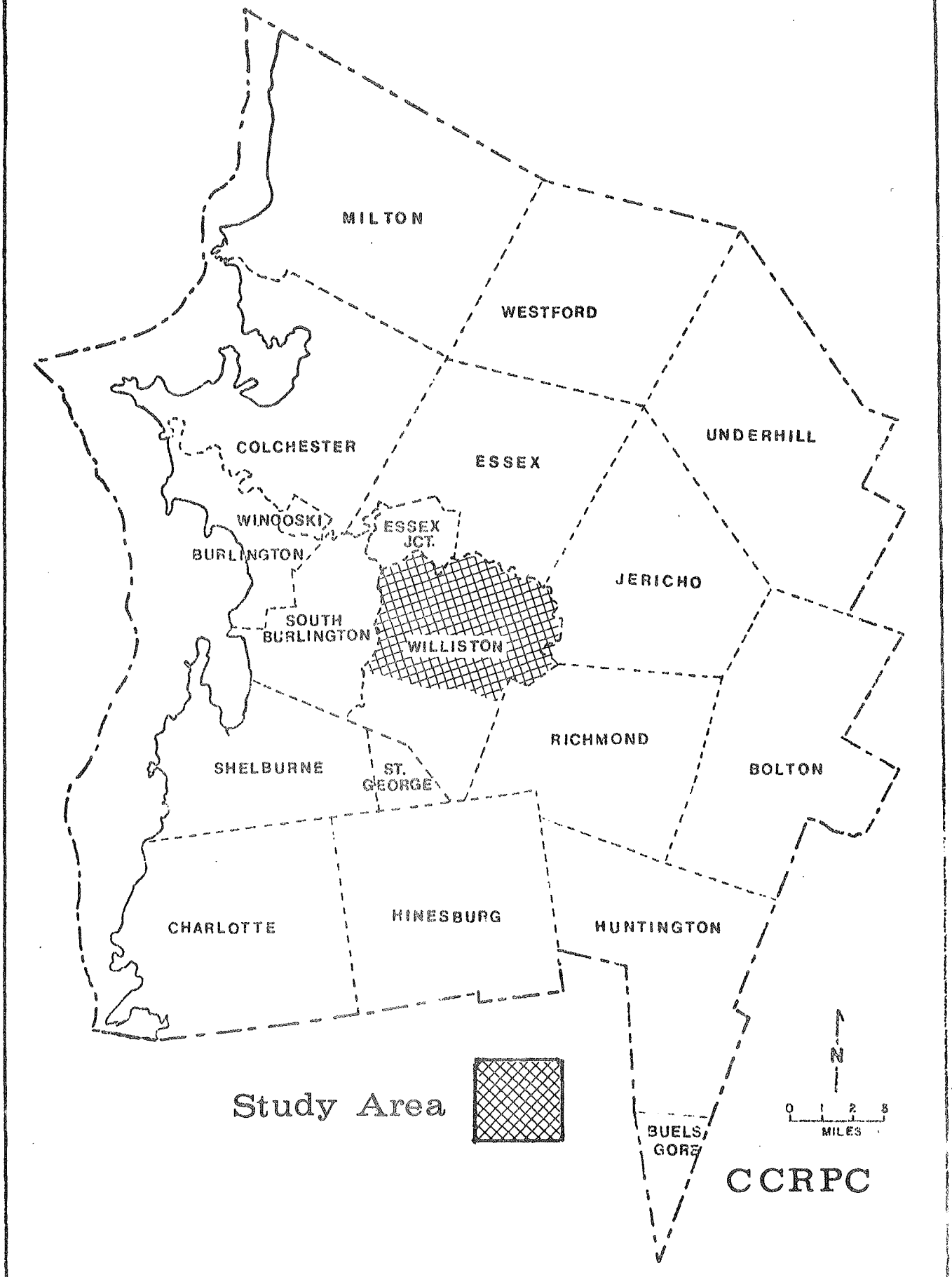
Executive Summary

The Chittenden County Regional Planning Commission (CCRPC), in cooperation with the Town of Williston and the Vermont Agency of Transportation (VAOT), performed an analysis of the traffic impacts of anticipated growth in the Taft Corners area. A general location map is shown on page 2. The study evaluates existing conditions and uses a traffic simulation model to estimate traffic for 1992, 1997 and 2007. It is estimated that 18,880 new p.m. peak hour trips will be generated by 2007. Included in the study are recommendations for improved transportation facilities, and methods for financing improvements, including the uniform application of trip generation fees. These fees are intended to supplement local and state resources for construction of off-site road improvements. On-site improvements (that is, those actions necessary for driveway permit approval) remain 100% privately funded. Over a twenty year period (1987 - 2007) most major roads and key intersections in the Taft Corners area are recommended for upgrading. Moreover, two new roads, the Shunpike Road extension and the Circumferential Highway, should be constructed within this time frame. The twenty year staging program is shown on page 48.

The Williston Town officials, the Vermont Agency of Transportation and the development community made significant positive contributions to the study process and their participation is hereby acknowledged. Final recommendations, however, are the responsibility of CCRPC.

LOCATION MAP



1. Introduction

Over the past several years, the Taft Corners area has become the locus of development in the Town of Williston. This growth is comprised of both residential and commercial uses. The scale of commercial development varies from small expansions of existing uses to potential major developments encompassing up to 500,000 square feet of commercial space. The Town has required traffic studies for individual developments, but for the most part such studies only attempted to address traffic impacts of a single site. Typically, these studies evaluated localized impacts, including the need for frontage improvements such as acceleration/ deceleration lanes, whether adequate sight distance was available for a new driveway, the need for a traffic signal and, in some cases, a level of service analysis at a nearby major intersection. A growing awareness by Williston officials that this case by case review had serious shortcomings led to a work session with the town selectmen and planning commissioners in early October 1986. With the assistance of the town planner, CCRPC staff contrasted the case by case review with a cumulative analysis, thus demonstrating the drawbacks of an incremental analysis of traffic in a high growth area.

Consequently, CCRPC agreed to perform a quick-response comprehensive analysis of the cumulative traffic impact of anticipated development. After several coordinating meetings with the AOT and approval of a Scope of Services by the Chittenden County Metropolitan Planning Organization (CCMPO), staff began work on the study. An outline of the specific work elements in this study is shown on page 2, Table 1.A. The balance of this section presents the modeling methodology and analytical procedures used to evaluate traffic conditions.

Given the complexity of the analysis and the desirability of evaluating several transportation-land use scenarios, the CCRPC microcomputer-based transportation simulation model was used. The software package, "TMODEL" is a system of programs designed to model travel in urbanized areas. The system features a series of menu driven modules consisting of trip generation, trip distribution (using a gravity model formulation) and trip assignment. The software is used nationally, by the New York State Department of Transportation, by local governments and by transportation engineering consultants.

The basic inputs of the trip generation module are single family and multi-family dwelling units and retail and non-retail employment for each transportation analysis zone. Peak hour directional trips for three trip types are calculated for each analysis zone. The three trip types are: home-based work (HBW), home-based non-work (HBNW), and non home based (NHB).

The trip distribution module applies the gravity model for each of the three different trip purposes. This distributes travel to the various zones in the region.

TABLE 1.A

WILLISTON TRANSPORTATION STUDY METHODOLOGY

Assemble Existing Traffic Volumes
Code 1987 Link File
Code 1987 Node File
Enter 1987 Land Use
Calibrate model
Estimate Current LOS

Code 1992 Link File with and without partial Circumferential Highway
Code 1992 Node File
Develop/enter 1992 land use
Simulate 1992 Traffic
Estimate LOS-1992

Code 1997 Link File
Code 1997 Node File
Develop/enter 1997 land use
Simulate 1997 Traffic
Estimate LOS-1997

Code 2007 Link File
Code 2007 Node File
Develop/enter 2007 land use
Simulate 2007 Traffic

Identify cumulative traffic impacts and
Determine necessary improvements

Estimate cost of improvements

Apportion costs to sites based on respective contribution of traffic

Propose fee structure and administration

Zone to zone trip interchanges are then assigned to the network using either an incremental or iterative procedure. Previous aplications of both procedures led to the conclusion that the incremental procedure is more appropriate for this region. The regional zone and link structures were modified to provide additional zone and network detail in the Taft Corners area of Williston. The map on page 4 (Figure 1.A) illustrates the analysis zones for this study. Areas outside the Taft Corners area were modeled at a broad scale, with zones 16 through 59 focussing on Williston. In some cases, the Williston transportation analysis zones were identical with parcel boundaries. In effect, a completely new model was developed for this study. A chart showing zone equivalencies between the regional model and Williston model is shown on page 5, Table 1.B.

In addition to geographic adjustments, CCRPC land use information was modified to create three new files for the years 1992, 1997, 2007. This provides the data for 5, 10 and 20 year traffic forecasts. Outside of the Williston study area, land use forecasts were developed from growth rates presented in the updated regional plan. Within Williston, each zone, 16-58, was examined by the town planner for existing pending and approved development, as well as for development potential. Where necessary, telephone contact was made to verify employment at work sites; the CCRPC windshield survey, conducted in the summer of 1986 was also used as a reference. In the case of certain proposed large developments, town and regional staff worked with the private sector to estimate land use. Consequently, the 1986 land use file was validated, and land use estimates for 1992 were based on actual anticipated development within the next five years. Staff believes this approach yields a more realistic estimate than the application of a historical growth rate. For estimating land use in 1997 and 2007, growth rates from the regional plan were applied to all zones, 1-59, in the modeling system. Summaries of the land use estimates are presented in Appendix A. The 5 year assignment (1992) is for a highway network both with and without a partial Circumferential Highway; the 10 year assignment (1997) is for a highway network with a completed Circumferential Highway; and the 20 year assignment (2007) assumes a completed Circumferential Highway.

Before the model was applied to the future year scenarios, a calibration effort was necessary to ensure that the model was capable of accurately assigning traffic to the study area network. Existing (1987) Design Hour Volumes (DHV's) are displayed on Figure 1.C.

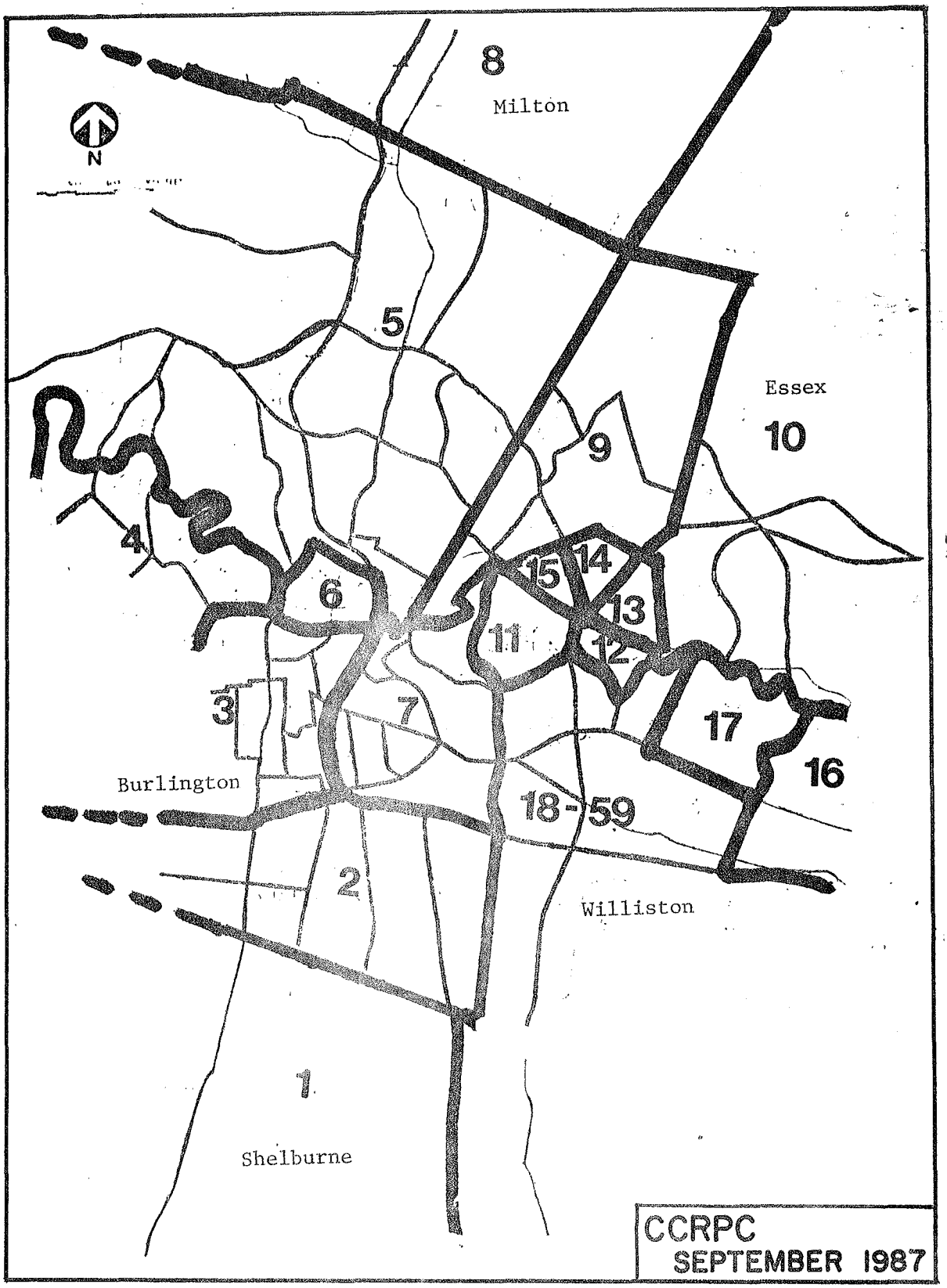


FIGURE I-A, TRANSPORTATION ANALYSIS ZONES

TABLE 1.B

WILLISTON AREA TRANSPORTATION STUDY
ZONE EQUIVALENCY TABLE*

	Regional Transportation Analysis Zones	Williston Study Trans. Analysis Zones
Burlington	1, 2, 3, 4, 5, 6, 7, 8	3 Burl. CBD
Burlington	31, 32, 33, 34, 35 North End	4 Burl. new
So. Burl.	9, 10, 11, 12, 13 19, 20, 21	7 Williston Rd/ Muddy Brook
So. Burl.	14, 15, 16, 17, part of 18	2 Shelburne Rd.
Winooski	43	6 Winooski
Colchester	36, 37, 38, 39, 40, 41, 42, 57, 58, 59, 60, 61, 62, 63, 64	5 Colchester
Essex	44, 55, 56 65, 66, 67	9 West Essex
Essex	47, 48, 49, 50, 51, 68	10 East Essex, Westford, Underhill, Jericho
Essex Jct.	45	11 West St.
	46	12 I.B.M.
	52	13 Brickyard
	53	14 High School
	54	15 Fairgrounds
Milton	69, 70	8 Milton
Shelburne	71	1 Shelburne/ Charlotte
Williston	30	16 E. Williston Richmond, Bolton, Huntington
	29	17 Old Stage Road north

* For zones 1 through 17, reference Figure 1.A; for zones 18-59 reference Figure 1.B.

	Regional Transportation Analysis Zones	Williston Study Trans. Analysis Zones
Williston		18 Redmond Road
		19 Mt. View East A
		20 Colony Park
		21 Morgan Pkwy.
		22 James Brown Dr.
		23 River Cove Rd.
		24 Hillside Dr.
		25 Industrial Ave.
	Part of 18	26 No. Brownell Rd.
	22	27 Pinecrest Circle
	23	28 U.S. 2 West
	24	29 Munson
	25	30 Shunpike West A
	26	31 Shunpike West B
	27	32 Blair Park
	28	33 Meadow Run
		34 VT. 2A East A
		35 VT. 2A East B
		36 Mt.View East B
		37 Mt.View East C
		38 Central
		39 U.S. 2 East C
		40 U.S. 2 East B
		41 U.S. 2 East A
		42 Pecor Horse Farm
		43 Vt. 2A East C
		44 Vt. 2A East D
		45 Taft Corners Shopping Center
		46 US 2 South
		47 Maple Tree Place (Pyramid)
		48 Howard Bank/Judge
		49 Taft Corners Assoc
		50 Commerce St.
		51 So. Brownell Rd.
		52 Shunpike East
		53 O'Brien
		54 Adams
		55 VT 2A South
		56
		57 Anchorage
		58 Hillside East
		59 South Williston, Hinesburg, St. George

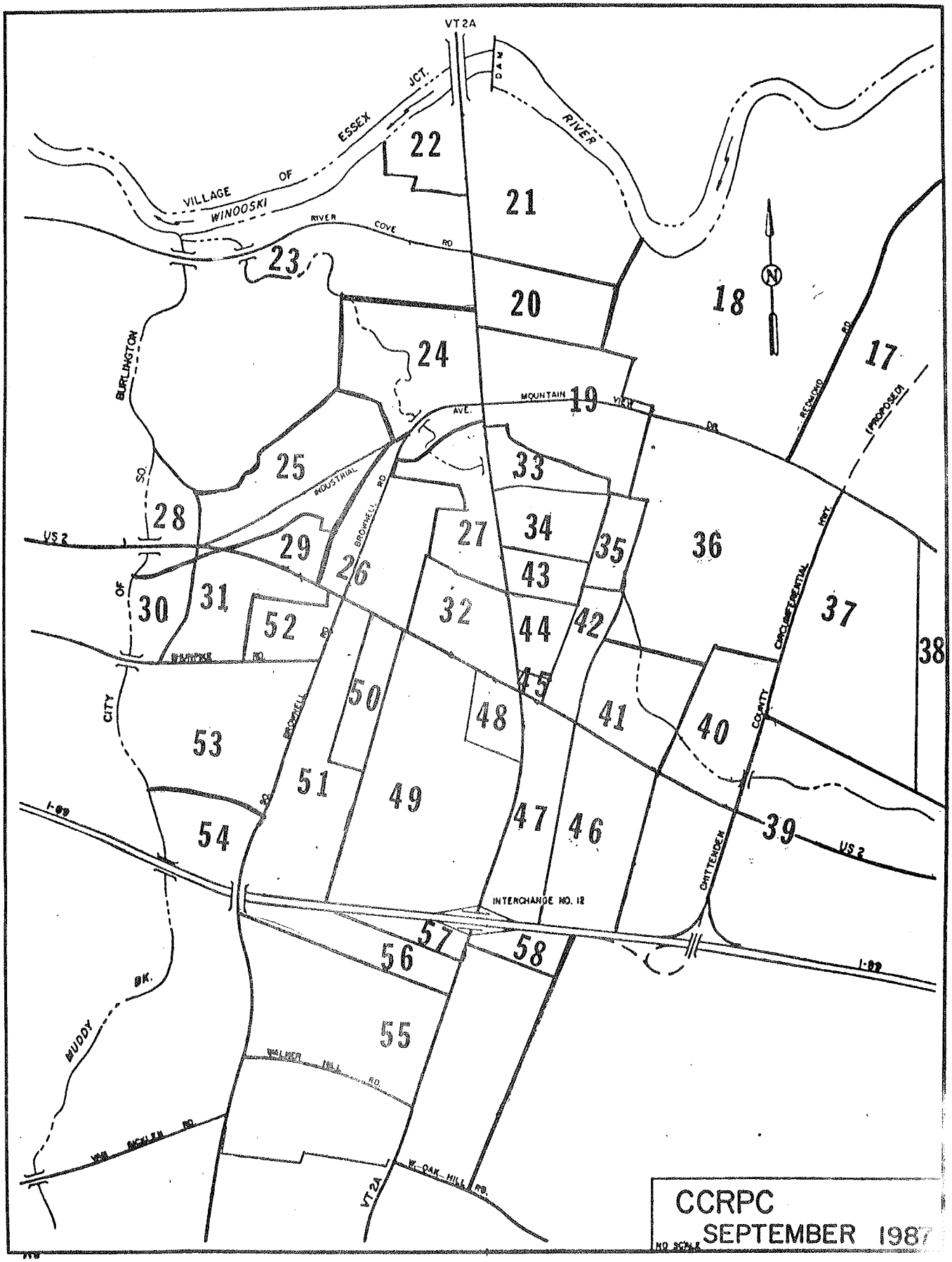


FIGURE I-B, WILLISTON STUDY AREA ZONES

The calibration process consists of making a series of adjustments to the TMODEL modules such that base year simulated link volumes approximate base year observed link volumes at a level of accuracy consistent with the purposes of the analysis. Inasmuch as the focus of this study is on the Williston sub-area, staff concentrated on accurate assigments for US 2, VT 2A, I-89 and Interchange #12 ramps, Industrial Avenue, Mountain View Road and Brownell Road.

Calibration of the model requires application of an iterative procedure. At each successive model run, appropriate modifications are made to various elements of the modeling system, including trip rates, network characteristics (i.e. the node and link file) and the gravity model factors. Trip rates used in this study are:

11 trips/single family dwelling unit/day
6 trips/multi family dwelling unit/day
25 trips/retail employee/day
6 trips/non-retail employee/day

The results of calibration are displayed on Figure 1.D and Table 1.C. The simulated assignments provide a desirable degree of accuracy. The underassignments on I-89, particularly in the eastbound direction are the probable result of travel with origins and/or destinations outside of the region. The percent error on Brownell Road appears large, but is within tolerable limits for low volume roads. The simulated directional assignments are consistent with ground counts. In summary, the simulated assignments for the base year are accurate enough to provide the necessary confidence for the 1992, 1997 and 2007 traffic assignments.

With regard to other elements of this study, standard references and evaluation methods were used. Staff sources included: the 1985 Highway Capacity Manual and companion software; the NCAP intersection analysis software; the AASHTO Green Book; VAOT unit cost estimates, route logs and traffic counts; and turning movements collected by CCRPC.

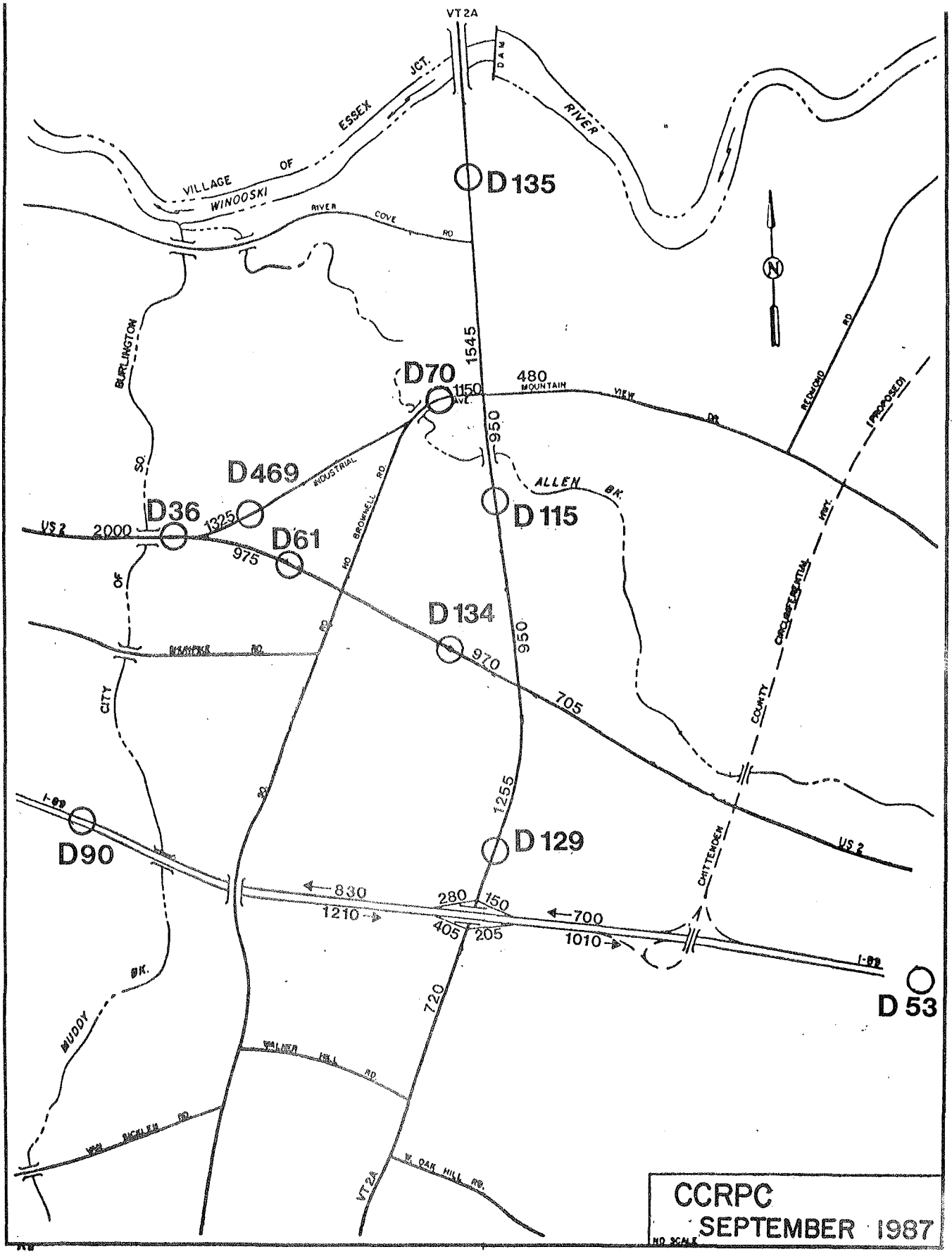


FIGURE I-C

ϕ D129 LOCATION and STATION NUMBER of AUTOMATIC TRAFFIC COUNTER

705 DESIGN HOURLY VOLUME (DHV)

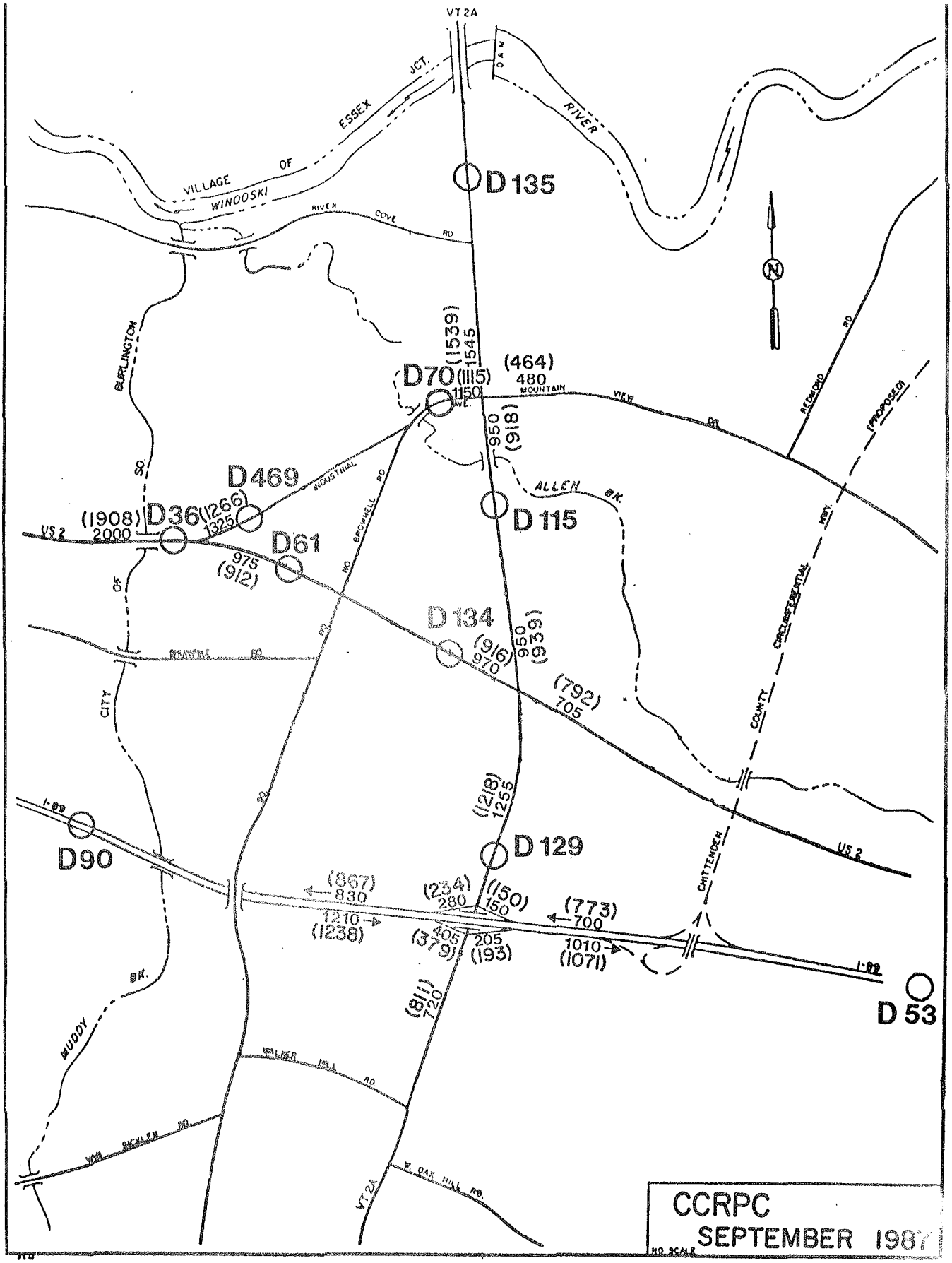


FIGURE I-D, CALIBRATION ASSIGNMENTS

RUN # 5/28/87/01

(867) CALIBRATION ASSIGNMENT

TABLE 1.C

CALIBRATION RESULTS

PEAK HOUR LINK STATISTICS

Route	DHV	Simulated Volume	+/-	Percent Difference
US 2 east of Taft Corners	705	792	+87	+11%
US 2 west of Taft Corners	970	916	-54	-6%
VT 2A north of Taft Corners	950	939	-11	-1%
VT 2A south of Taft Corners	1255	1218	-37	-3%
I-89 Interchange Ramps				
A	150	150	0	0
B	205	193	-12	-6%
C	405	379	-26	-6%
D	280	234	-46	-20%
Industrial Avenue	1325	1266	-59	-4%
Mt. View Road	480	464	-16	-3%
North Brownell Rd.	291	194	-97	-50%
South Brownell Rd.	100	91	-9	-10%
I-89 east of Interchange 12 - WB	700	773	+73	+10%
- EB	1010	1071	+61	+6%
I-89 west of Interchange 12 - WB	830	867	+37	+5%
- EB	1210	1238	+28	+2%
TOTALS	10,866	10,785	-81	-1%

2. Existing Conditions

Traffic operations in the study area are generally satisfactory in terms of level of service. There are, however, several high accident locations and segments with excessive horizontal curves.

US 2, serving east-west travel, is a two lane road on 24 feet of pavement, except at milemarker 2.7 to 3.05 where there is an eastbound climbing lane on an 8% grade, and at the westbound approach to the US 2/VT 2A intersection where the pavement width is 58 feet curb to curb. US 2 in the vicinity of the VT 2A intersection is on a good alignment; however, at many other locations in the study area there are significant grades and sharp curves. Structural condition is fair. Sufficiency ratings for US 2 in Williston range from 37.9 to 61.8; ratings for specific sections are shown in Appendix C.

VT 2A serves north-south travel, and is a two lane road on 24 feet of pavement. Right turn lanes are provided on the approaches to US 2. Horizontal alignment is good, but severe grades are present at the perimeter of the study area at milemarker 2.1 - 3.0 and at milemarker 5.8 on the approach to the Winooski River. Structural condition is fair to good. The 1983 sufficiency ratings vary from 36.9 to 77.5; ratings by section are shown in Appendix B.

In addition to links (i.e. highway segments) staff analyzed traffic operations at the following key intersections:

1. VT 2A/US 2
2. VT 2A/ Mountain View Road/Industrial Avenue
3. US2/Industrial Avenue
4. VT 2A/I-89 Ramp Terminals North End - unsignalized
5. VT 2A/I-89 South End
6. US2/Brownell Road-unsignalized

Each location is discussed below.

1. The VT 2A/US 2 intersection is arguably the most important one in the study area. Level of service for existing conditions (1986) is estimated at "E". The operational analysis is complicated by two factors. First, on the northbound and southbound approaches there are exclusive right turn lanes. However, the point at which the lanes begin is quite close to the intersection. Consequently, when more than four or five vehicles are queued, the right turn lane can be partially obstructed, and does not effectively function. This means the right turn lane works well when not blocked, but breaks down quickly if there is interference. Second, through and left turning vehicles share a lane. However, many left turning vehicles are observed to encroach on the middle of the intersection, thus allowing through vehicles to bypass them on the right. This maneuver works if

there are no more than two to three left-turning vehicles. The creation of a de facto left turn lane is difficult to handle in the LOS methodology, and also leads to safety concerns. The left turn vehicles obstruct the view of drivers of through vehicles. This leads to conflicts between a through vehicle and an opposing left turn. Moreover, the left turn vehicle at the mid point of the intersection encroaches on the path of the opposing through vehicle. A review of accident data (1981-85) for this location shows numerous right angle accidents with vehicles turning the opposite direction. A tally of all reported accidents for the five year period 1981-85 shows 21 accidents on the VT 2A approaches and 20 accidents on the US 2 approaches. In fact, this location was identified as a high accident location by the VAOT (1981-85), with a critical rate of 1.038, an actual rate of 2.167 and an actual to critical ratio of 2.088. The severity index was calculated to be $6,868/accident, placing this intersection sixth on a statewide ranking of intersections on the federal aid urban system.

2. VT 2A/Mountain View Road/Industrial Avenue. Located in the northern portion of the study area, this intersection currently operates at an estimated level of service "C". Accidents are also a concern at this location, with 30 accidents reported for the five year period from 1981-85. This was identified as a high accident location by the VAOT using 1981-85 data; the critical rate was calculated to be 0.981, actual rate at 1.176, with Actual to Critical ratio of 1.199. The severity index is $8,083/accident.

3. US 2/Industrial Avenue. This 3-leg intersection is on the western boundary of the study area. Intersection level of service is estimated to be "F". The EB US 2 and the Industrial Avenue approaches are striped as one lane approaches. However, travelers create de facto lanes on both approaches, using unpaved shoulders. This increases vehicle flow rates beyond what one-lane approaches would typically accommodate. However, the situation is not desirable and should be addressed at an early stage.

4. VT 2A/I-89 Ramp Terminals - North End. The northern ramps (westbound off and westbound on) were evaluated and all movements were found to be at good levels of service.

5. VT 2A/I-89 Ramp Terminals - South End. The southern ramps (eastbound off and eastbound on) were evaluated, with mainline movements providing adequate service; however, the left turn from the eastbound off ramp was estimated at level of service "F".

One issue, however, is the spacing between the piers carrying I-89 over 2A; that is, if VT 2A is to be improved between the ramps, there is limited space for widening under I-89. The distance between the piers is approximately 52 feet,

which will affect the widening proposed for 1992-1997 (see illustration, p. 38)

6. US 2/Brownell Road. This is a four-way unsignalized intersection in the western portion of the study area. From 1981-85 there were seven reported accidents at this location; this is not excessive and it does not appear to be an accident prone location. Level of service is adequate for all movements.

Table 2.A summarizes level of service information for the six intersections.

TABLE 2.A

1986 P.M. PEAK
LEVEL OF SERVICE ESTIMATES

LOCATION		LEVEL OF SERVICE	STOPPED DELAY PER VEHICLE (Seconds)
1.	VT 2A/US 2	E*	45.5
2.	VT 2A/MT.VIEW/ INDUSTRIAL AVE.	C	16
3.	US 2/INDUSTRIAL AVE	F	67
4.	VT 2A/I-89 NORTH END	Unsignalized; all movements satisfactory.	
5.	VT 2A/I-89 SOUTH END	Unsignalized; off ramp unsatisfactory.	
6.	US 2/BROWNELL ROAD	Unsignalized; all movements satisfactory	

* This intersection was evaluated without the northbound and southbound right turn lanes. Field inspection suggests that these right turn lanes are effective for part of the peak hour.

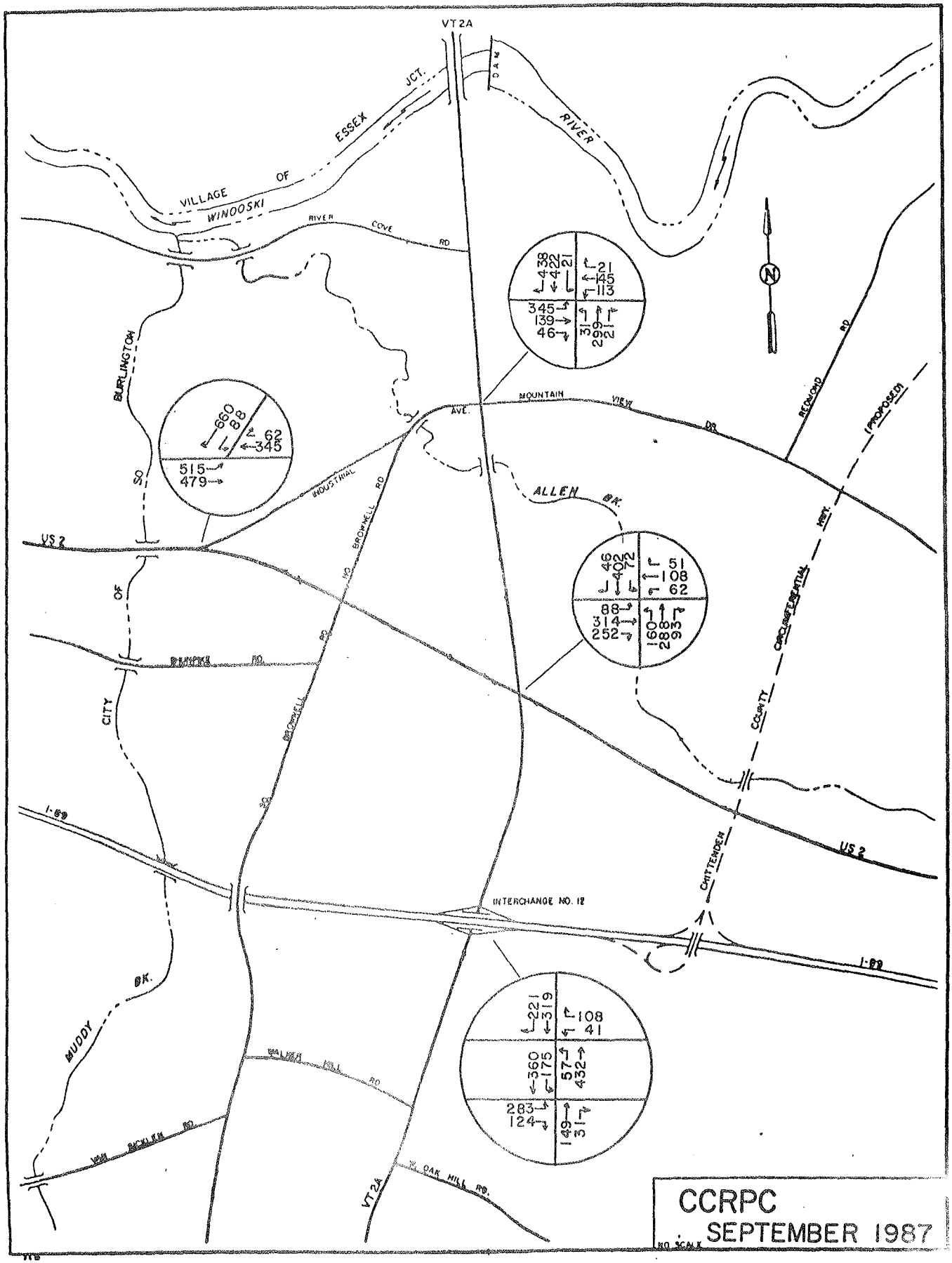


FIGURE 2-A, 1987 DHV TURNING MOVEMENTS

3. Future Conditions

Staff analyzed the transportation impact of land development for three future years: 1992, 1997 and 2007. Five, ten and twenty year forecasts of land use were prepared for use in generating 1992, 1997 and 2007 traffic forecasts; in all, eleven scenarios were evaluated, as shown on Table 3.A. Details on each land use scenario and transportation network are provided below and in Appendix A. It is useful to note that estimating future land use is a difficult exercise, both in terms of the magnitude of changes, as well as the location of those changes. The general methodology, as discussed on pages 6-9 of this report, produced highly reliable estimates of 1992 land use. The ten year (1997) land use estimates introduce greater uncertainty, and the twenty year estimates (2007) approach the limits of accurate land use forecasting.

A. 1992

Traffic forecasts were prepared for four highway network alternatives. The first network assumed no improvements (i.e. 1987 highway network); the second assumes no major changes to the transportation network, except for construction of the Shunpike Road extension from Brownell Road to VT 2A. The third network alternative includes partial construction of a two-lane Circumferential Highway, beginning at a new I-89 interchange in Williston and extending as far as VT 15 in Essex. The fourth network assumed a partial Circumferential Highway and no Shunpike Road Extension. All four highway networks were tested with and without the Taft Corners Associates Development which is expected to exceed 1 million square feet of commercial space. The 1992 land use is shown below:

1992 LAND USE

	SFDU*	MFDU*	RETAIL	NON-RETAIL
Williston	1,637	556	807	7,245
Balance of Chittenden County	35,001	12,992	13,983	50,013
TOTAL	36,638	13,548	14,790	57,258

* SFDU = Single family dwelling units
MFDU = Multi-family dwelling units

TABLE 3.A.
HIGHWAY NETWORK/LAND USE SCENARIOS

HIGHWAY NETWORK	LAND USE	
Existing	1987	
Existing.....1992 w/o TCA*		1992 w/TCA
Existing w/Shunpike Extension.....1992 w/o TCA		1992 w/TCA
Existing w/Shunpike & w/partial Circ. Hwy.....1992 w/o TCA		1992 w/TCA
Existing w/o Shunpike & w/partial Circ. Hwy.....1992 w/o TCA		1992 w/TCA
Existing w/Shunpike and w/full Circ. Hwy	1997	
Existing w/Shunpike & w/ full Circ. Hwy	2007	

* TCA = Taft Corners Associates

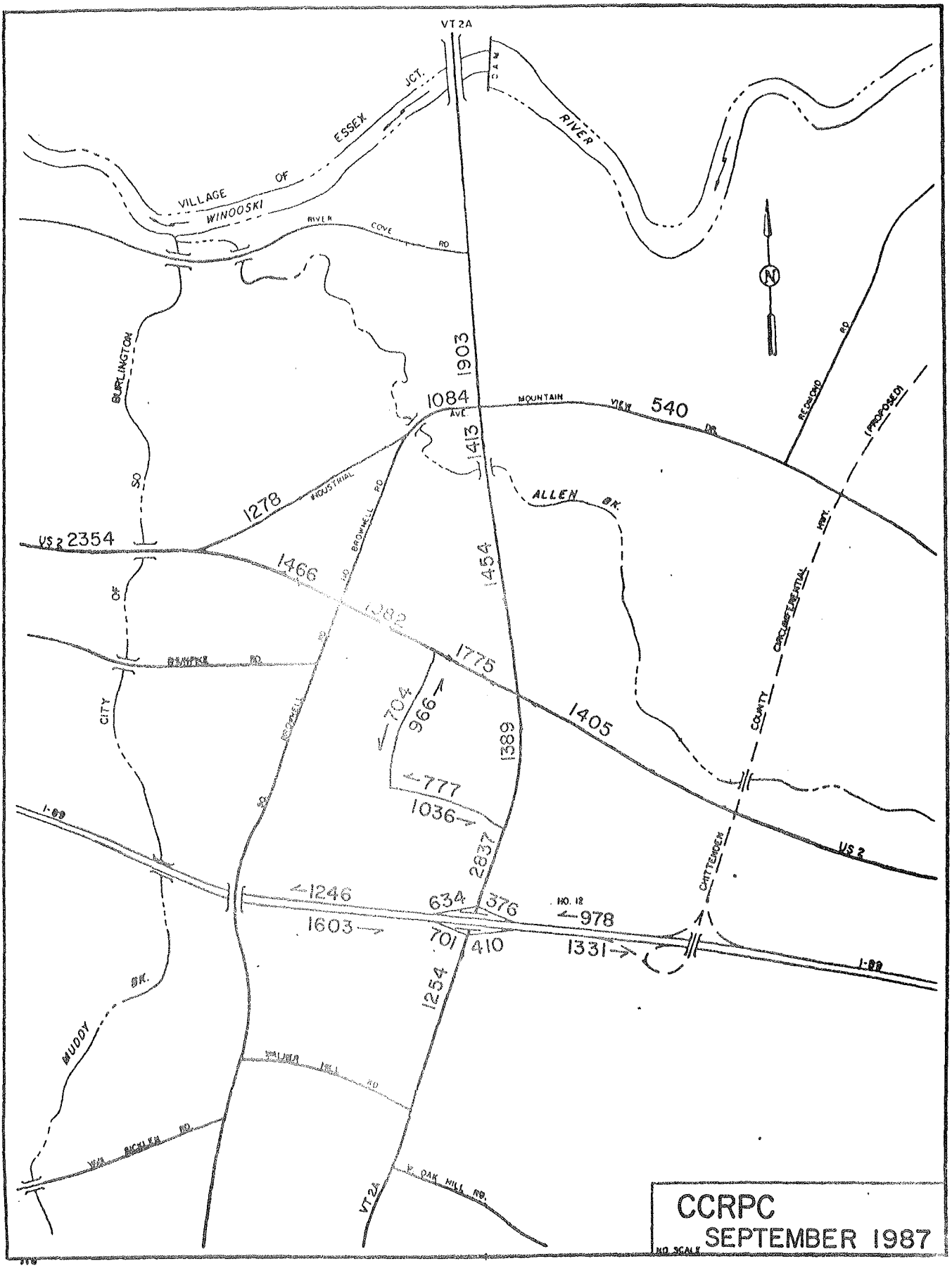


FIGURE 3-A, 1992 TRAFFIC PROJECTIONS
WITH TCA ON EXISTING NETWORK WITHOUT SHUNPIKE RD. EXT.
RUN # 6158701

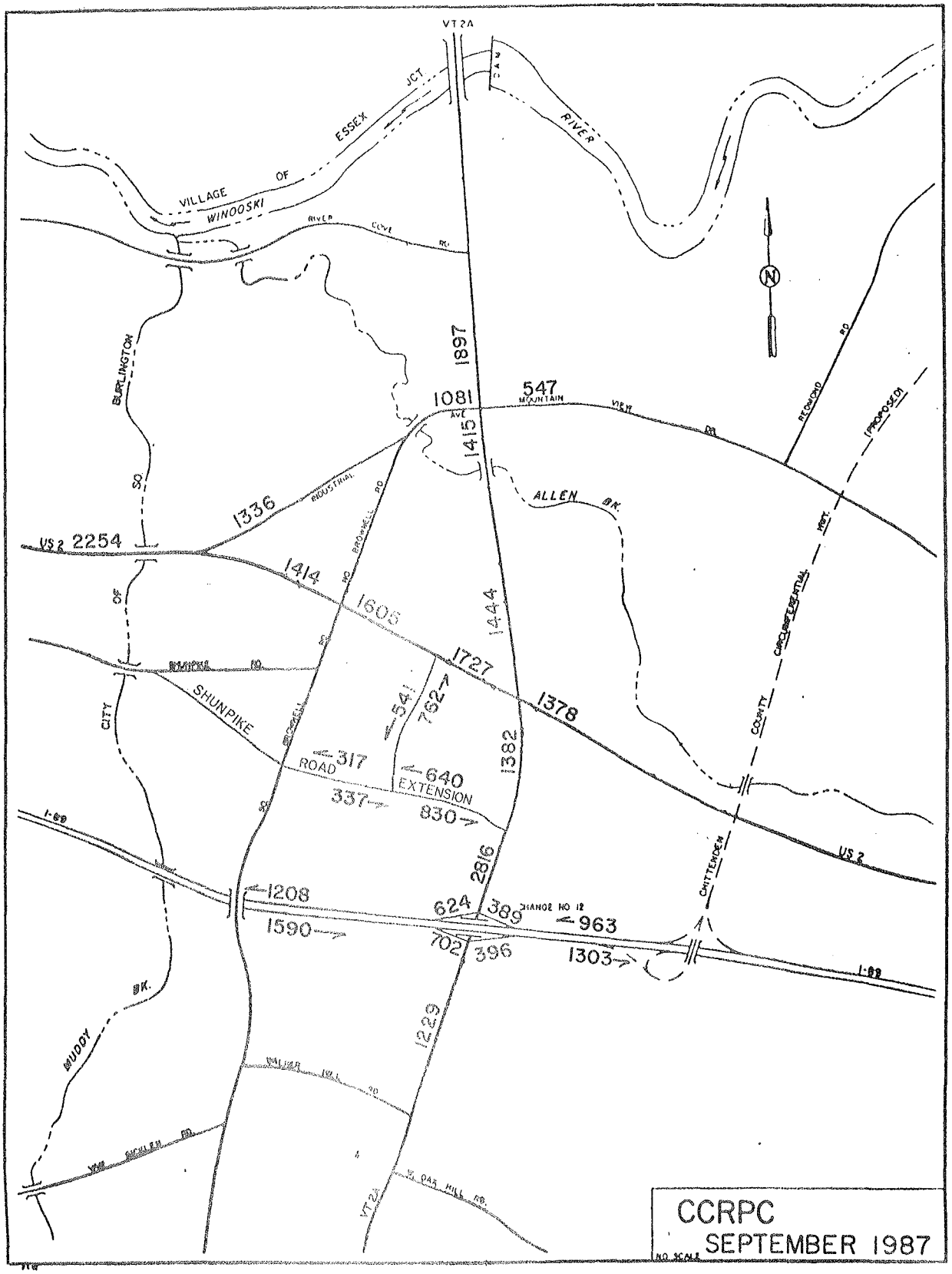


FIGURE 3-B, 1992 TRAFFIC PROJECTIONS
WITH TCA, WITH SHUNPIKE RD. EXT.
RUN # 6168701

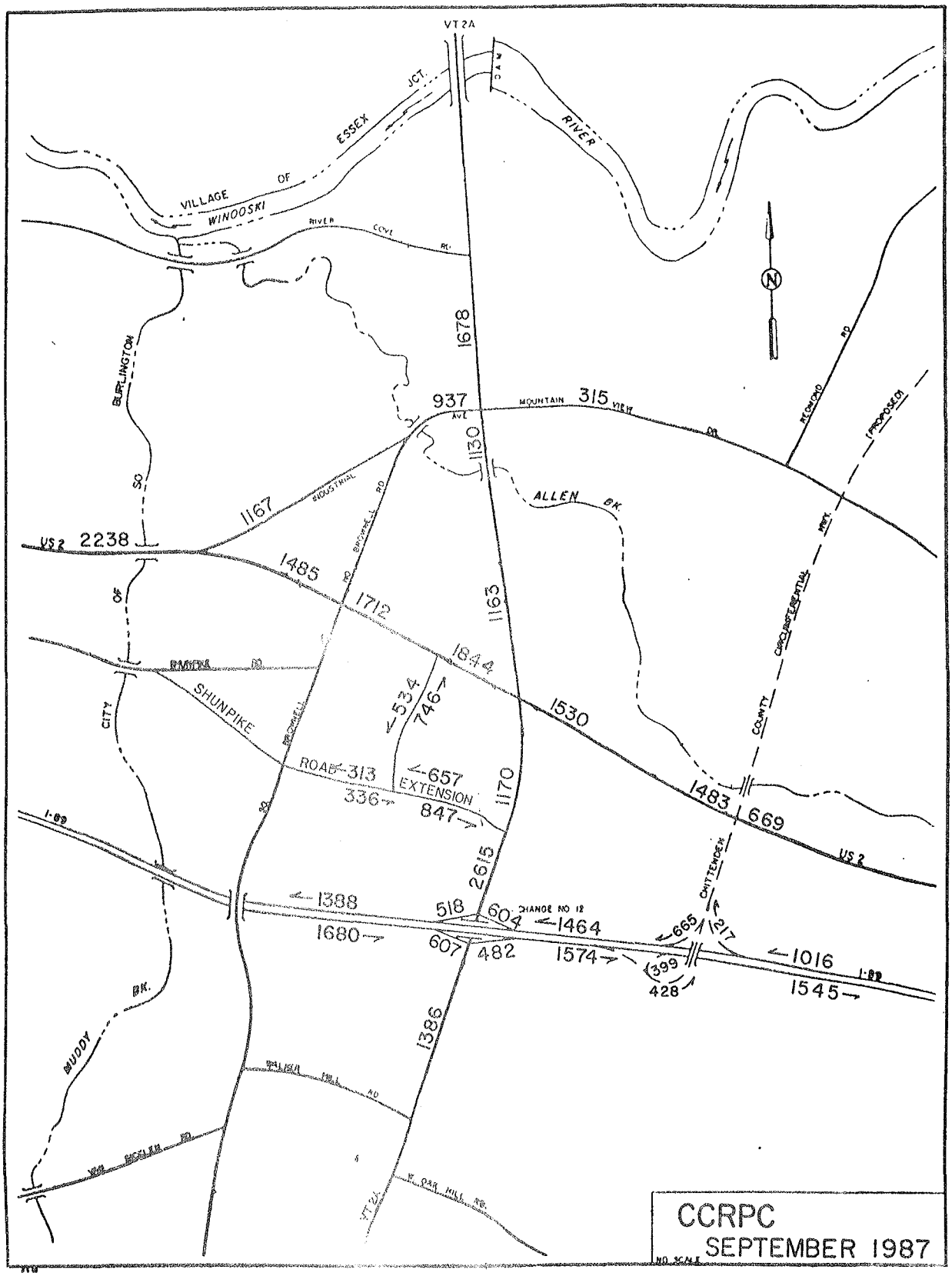


FIGURE 3-C, 1992 TRAFFIC PROJECTIONS WITH TCA, WITH SHUNPIKE RD. EXT., WITH PARTIAL CIRCUMFERENTIAL HWY. TO VT 15. RUN~~#~~ 6168702

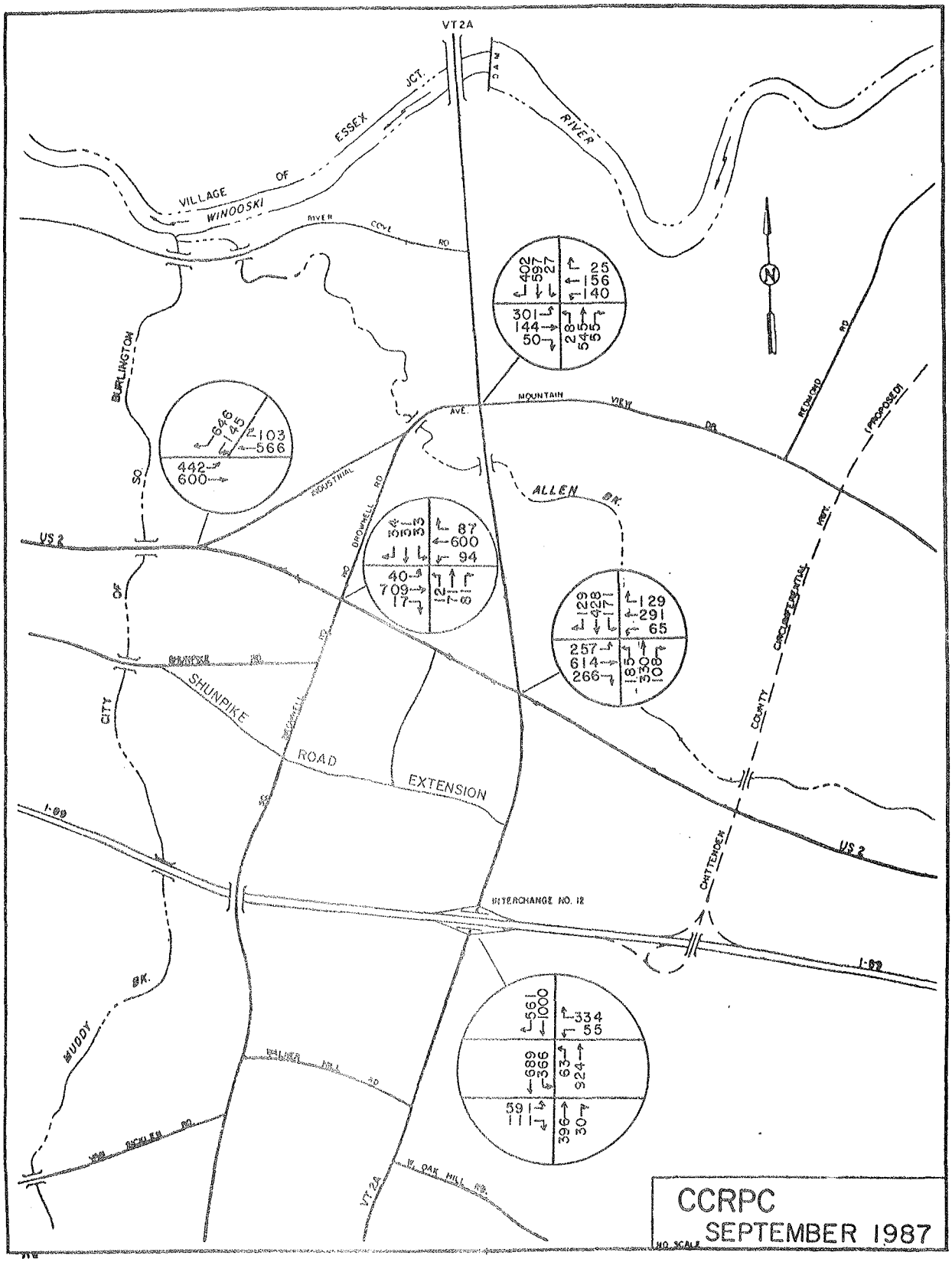


FIGURE 3-D, 1992 DHV TURNING MOVEMENTS WITH TCA, WITH SHUNPIKE RD. EXT., WITHOUT CIRCUMFERENTIAL HWY.

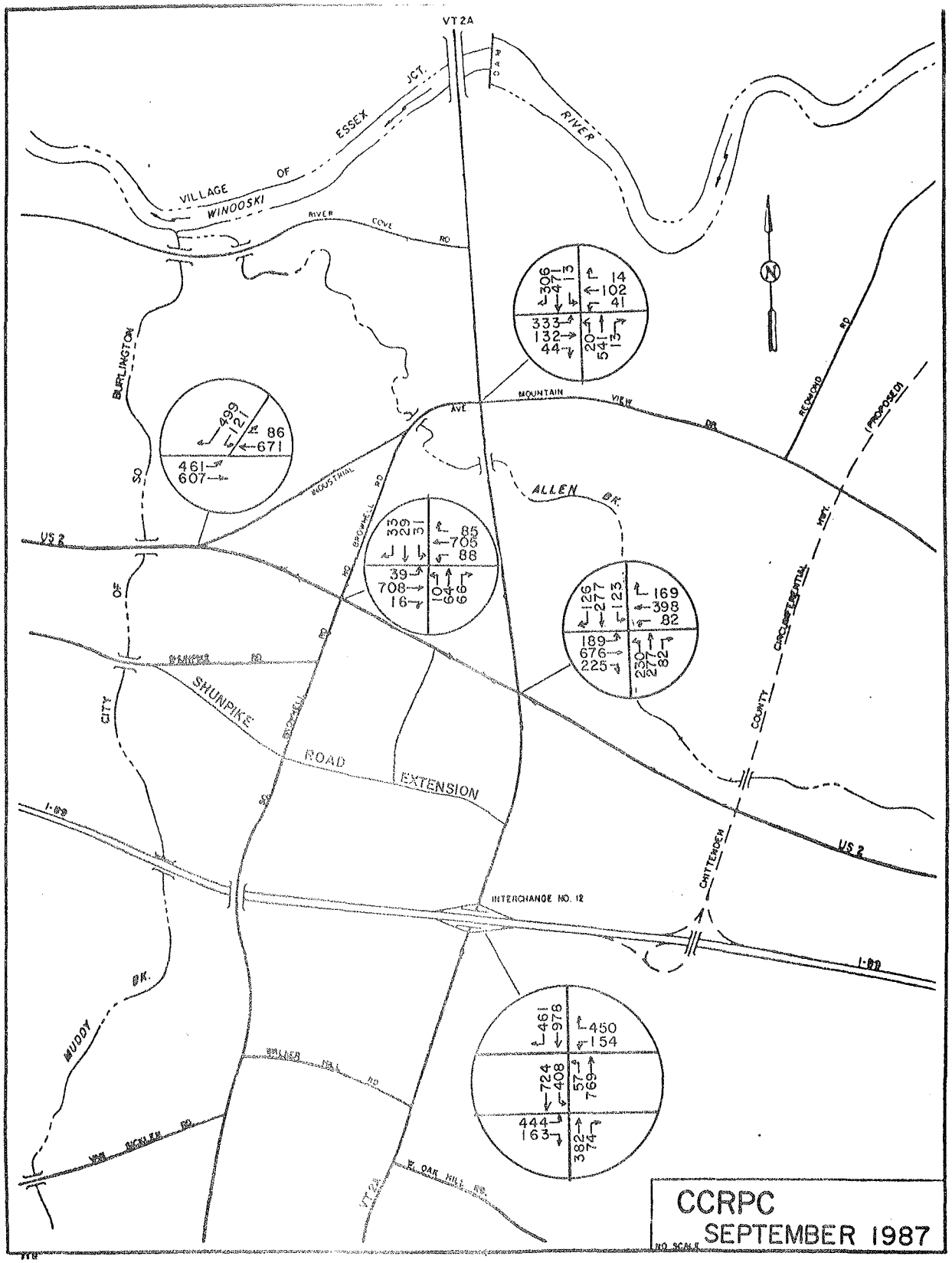


FIGURE 3-E, 1992 DHV TURNING MOVEMENTS WITH SHUNPIKE RD. EXT., WITH TCA, WITH PARTIAL CIRCUMFERENTIAL HWY. TO VT 15

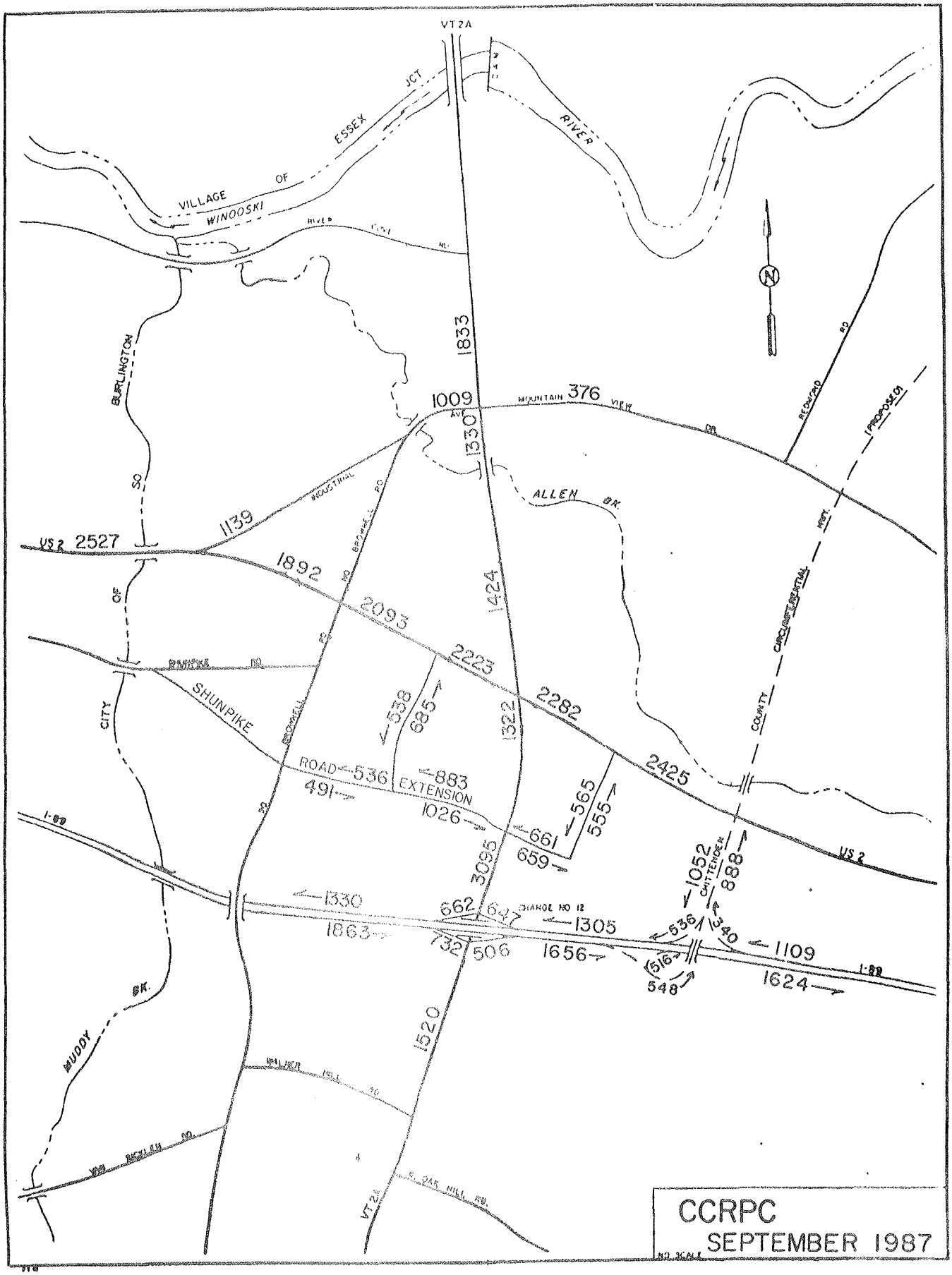


FIGURE 3-F, 1997 TRAFFIC PROJECTIONS

RUN # 6178701

Compared to 1986, the traffic assignments for 1992 reflect a 23% increase on a system-wide basis. Within the Williston study area, the changes in traffic are more complex. Some roads, such as Industrial Avenue show small increases in volumes. Others, such as VT 2A, US 2 and I-89 ramps at interchange 12 show significant increases in volume. Table 3.B compares the results of three simulations for selected links in the study area.

TABLE 3.B
COMPARATIVE LINK ASSIGNMENTS: 1987, 1992 SCENARIOS

LINK	1987	1992 w/o circ.hwy.	1992 w/partial circ.hwy.
US 2 East of Taft Corners	792	1378	1530
US 2 West of Taft Corners	916	1727	1844
VT 2A North of Taft Corners	939	1444	1163
VT 2A South of Taft Corners	1218	2816/1382	2615/1170
Industrial Ave.	1266	1336	1167

These link volumes were used to estimate levels of service at key intersections and on selected highway links. This is displayed on Table 3.C.

TABLE 3.C
1992 INTERSECTION PERFORMANCE*

	1992 w/o Circ.Hwy.	1992 w/Partial Circ.	Recommended w/intersection improvements
1. VT 2A/ US 2	F	F Overcapacity	w/partial circ. Two lanes on EB & WB US 2; three lanes NB & SB on VT 2A. w/o partial circ. Three lanes on EB US 2; two lanes on WB US 2; modify signal, use protected/ permitted phasing; three lanes on SB & NB VT 2A.

Table 3.C (Cont'd)

	1992 w/o circ.hwy	1992 with partial circ.	Recommended Intersection Improvements
2. VT 2A/ Mtn.View/ Industrial Avenue	D	C	Widen EB & WB approaches to 2 lanes to allow exclusive left turn lanes; improve sight distance; revise signal timing (75 second cycle).
3. US 2/ Industrial Ave.	F	F	Widen EB US 2 approach to 2 lanes, widen Industrial Ave. approach to 2 lanes
4. VT 2A/ I-89 ramps	left turns from off ramps at "F", major street left turns at "B" (south end & "E" (north end)	left turns from off ramps at "F" major street left turns at "C" (south end) & "D" (north end)	Phase one: Widen off ramps to 2 lanes, construct deceleration lanes for right turns onto on ramps (see illustration on p. 38.)
5. US 2/ Brownell Road	Minor street lefts and thrus "F"	Minor street lefts and thrus "F"	Widen Brownell Road approaches to US 2;signalize intersection
6. US 2/ Taft Corners Assoc. access	E	E	Construct EB deceleration lane; construct WB left turn lane;signalize intersection.
7. VT 2A/ Taft Corners Assoc. access	E	D	Construct southbound deceleration lane; construct northbound left turn lane; two lane exit; signalize intersection.

* Both 1992 scenarios assume full development by Taft Corners Associates.

B. 1997

For 1997, one highway network was used, which assumes a full build of the Circumferential Highway as a two lane facility, except for those segments that will be 3 or 4 lane cross-sections. Land use for 1997 assumes build out of the Taft Corners Associates site, as well as approximately 400,000 square feet of retail uses in the southeast quadrant of Routes US2/VT 2A. Land use estimates for 1997 are shown below:

1997 LAND USE

	SFDU	MFDU	RETAIL	NON-RETAIL
Williston	2,261	890	3,024	12,729
Balance of Chittenden County	36,210	14,089	16,251	54,091
TOTAL:	38,471	17,979	19,275	66,811

The Circumferential Highway appears to divert significant volumes from Mt. View Road and most sections of VT 2A. However, the build out in the southwest quadrant of US 2/VT 2A, accompanied by retail development in the southeast quadrant, affects VT 2A (between I-89 and US 2) and US 2. These roads begin to function as local access roads, particularly VT 2A. Compared to 1986, the traffic assignments for 1997 reflect a 31% increase on a system-wide basis. The traffic forecasts were used to develop turning movements at key intersections. Table 3.C presents anticipated intersection performance for 1997.

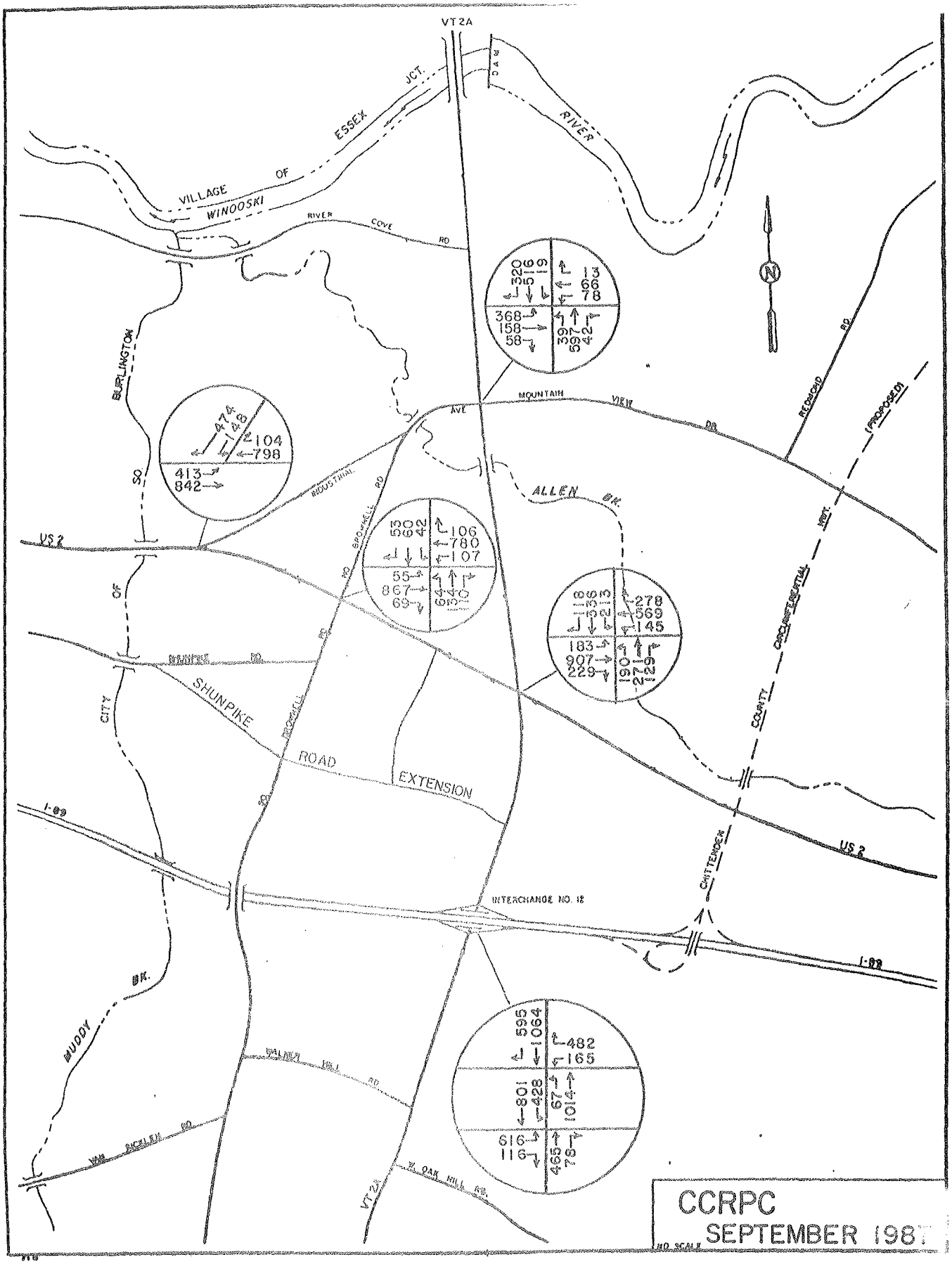


FIGURE 3-G, 1997 DHV TURNING MOVEMENTS

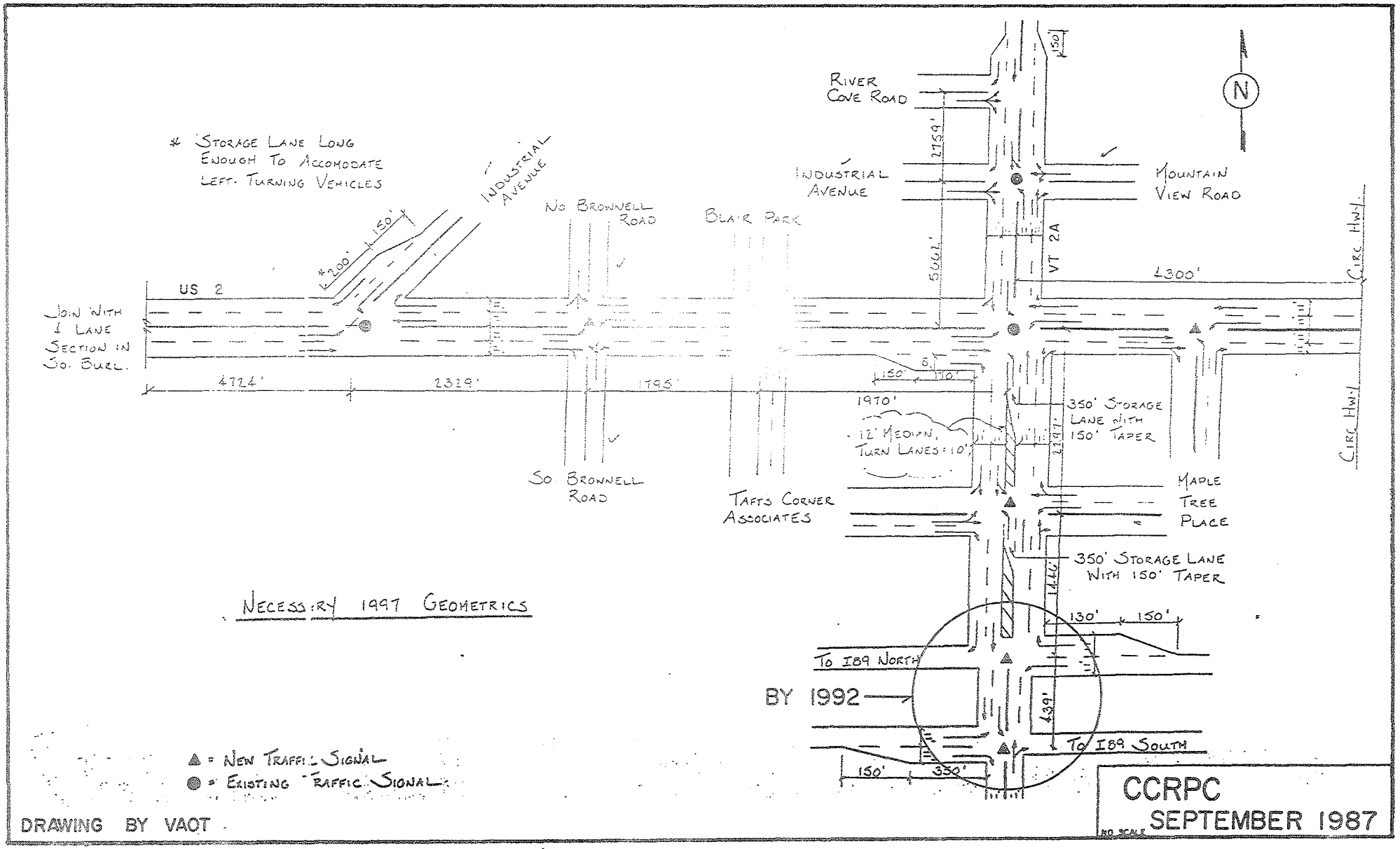


FIGURE 3-H, RECOMMENDED IMPROVEMENTS 1987 – 1997

TABLE 3.D
1997 Intersection Performance

	1997 w/complete Circ. Hwy.	1997 w/intersection improvements*
1. VT 2A/ US 2	LOS F w/no improvements.	LOS C
2. VT 2A/ Mt.View/ Industrial Avenue	LOS F	LOS C
3. US 2/ Industrial Avenue	LOS F	LOS B
4. VT 2A/ I-89 Ramps	------	LOS B (South end); (Signalized) LOS B (North end). (Signalized)
5. US 2/ Brownell Rd.	------	LOS B (Signalized)
6. US 2/ Taft Corners Assoc. Access	LOS F	LOS C
7. VT 2A/Taft Corners Access	LOS F	LOS B
8. US 2/ TAZ 47 (Maple Tree Place)	LOS F	LOS B

* Recommended geometrics are shown on Figure 3.H, Page 28.

C. 2007

The last in the series of forecasts is for the year 2007. Although twenty year land use estimates are speculative, it is important for design purposes to have an understanding of travel patterns for 2007. Compared to 1986, travel is expected to increase 57% on a system basis. The Circumferential Highway carries 2,561 vph between I-89 and US 2, 2,419 vph between US 2 and Mountain View Road and 1,527 vph north of the Redmond Road interchange. These assignments appear consistent with those presented for the year 2004 (Figure 3.b-3) in the Circumferential Highway Final Environmental Impact Statement (EIS). However, for the balance of the road network (VT 2A, US 2, Industrial Avenue, Mountain View Road and Brownell Road) the traffic assignments developed for the year 2007 for this report are significantly higher than those in the Circumferential Highway EIS. At least three factors contribute to these variations. First, different transportation software was used for each study. The inherent differences in the structure of each model can lead to differences in assignments. Second, more detailed and higher land use densities were assumed. Third, a different forecast year was used. The primary contributing factor is in the area of land use. This study produced refined land use estimates that, in effect, drive the traffic forecasts. Land use estimates for 2007 are shown in the Appendix.

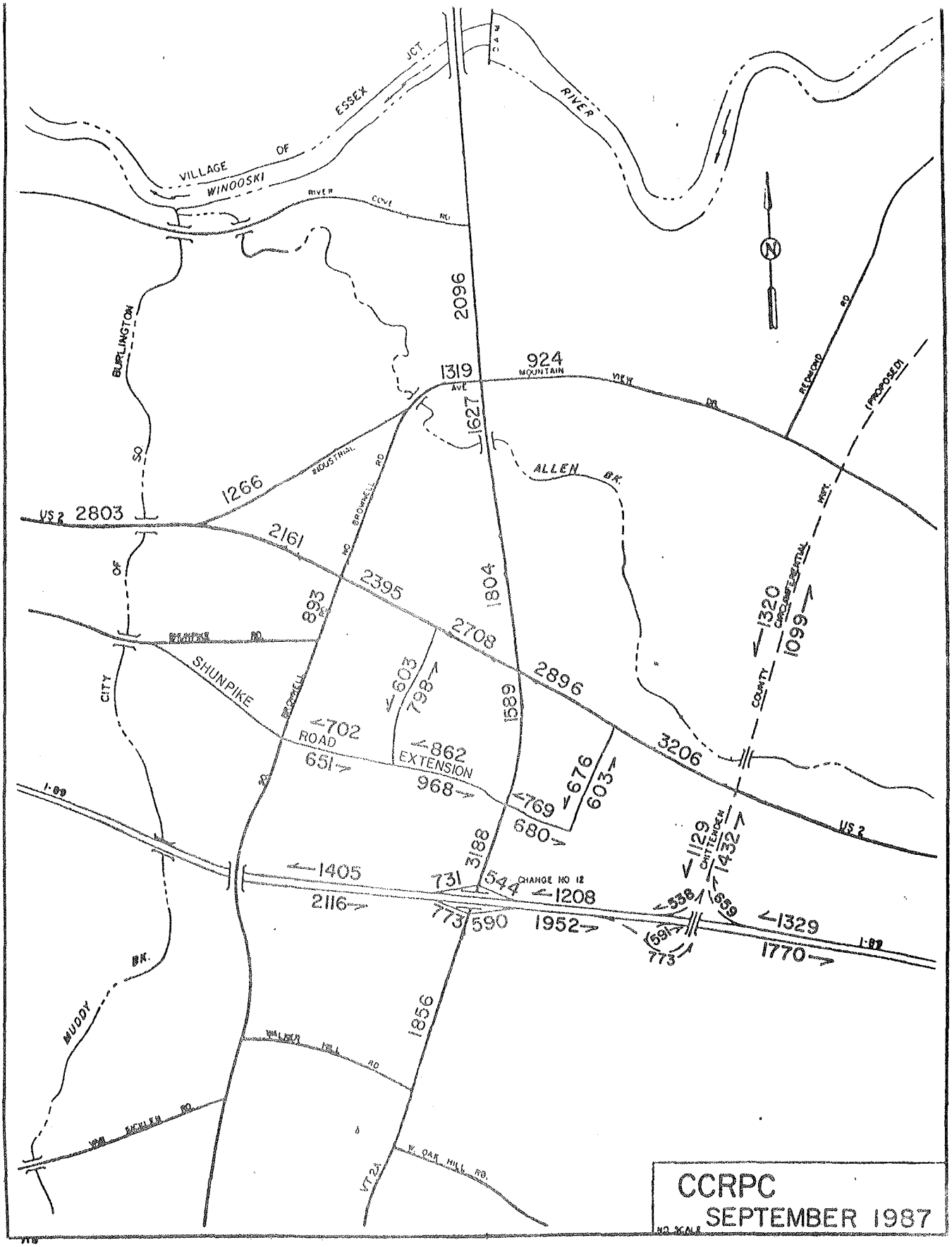


FIGURE 3-1, 2007 TRAFFIC PROJECTIONS

RUN # 6188701

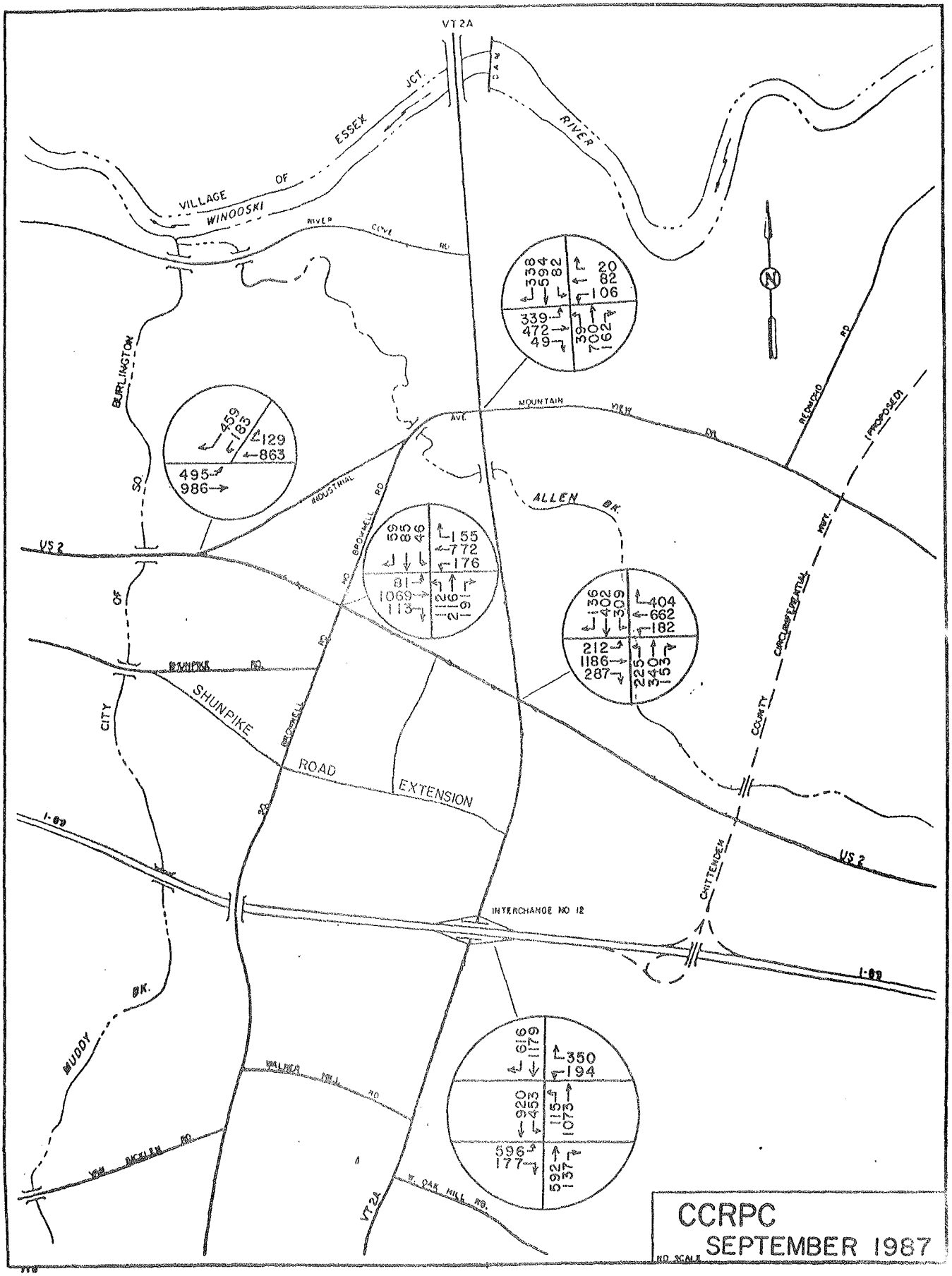


FIGURE 3-J, 2007 DHV TURNING MOVEMENTS

Discussion of Forecasts

The results of the forecasts are displayed, by link, in Table 3.E. Travel in Williston is expected to increase dramatically by 1992, with volumes nearly doubling on many links. To a certain extent, the presence of the Circumferential Highway in 1992 limits increases on parallel roads such as VT 2A. However, volumes on VT 2A will be higher in 1992 both with or without the Circumferential Highway. Over the 1997 to 2007 period, VT 2A volumes continue to stabilize, while US 2 volumes increase. This is consistent with traffic pattern changes often associated with freeway openings. Traffic on parallel roads stabilizes or decreases, while substantial traffic growth occurs on arterials perpendicular to and intersecting with freeways. Thus, US 2 east of VT 2A and VT 2A south of US 2 must provide access to adjacent land use, as well as carry movements to and from interchanges, while still carrying at least a portion of previous traffic loads.

TABLE 3.E

SUMMARY OF TRAFFIC ASSIGNMENTS
P.M. PEAK HOUR
Vehicles Per Hour (vph)

Link	1987	1992 w/TCA w/Shunpike w/o circ.hwy.	1992 w/Shunpike w/circ.hwy. w/TCA	1997	2007
US 2 East of Taft Cor.	792	1378	1530	2282	2896
US 2 West of Taft Cor.	916	1727	1844	2223	2708
VT 2A North of Taft Cor.	939	1444	1163	1424	1804
VT 2A South of Taft Cor.	1218	2816/ 1382	2615/ 1170	3095/ 1322	3188/ 1589
I-89 Interchange ramps					
A	150	389	604	647	544
B	193	396	482	506	590
C	379	702	607	732	773
D	234	642	518	662	731
Industrial Avenue	1266	1336	1167	1139	1266
Mt. View Rd.	464	547	315	376	924
I-89 east of inter- change #12	WB 773 EB 1071	963 1303	1464 1574	1305 1656	1208 1952
I-89 west of inter- change #12	WB 867 EB 1238	1208 1590	1388 1680	1330 1863	1405 2116
Circum. Hwy. between I-89 and US 2	n/a	n/a	1709	2040	2561

4. Recommendations

Staff, using the traffic forecasts, performed operational analyses of existing and future conditions and identified anticipated deficiencies in the road network; the timing of proposed development was reviewed in coordination with the development community. This led to development of a staged improvement plan that would result in an orderly implementation of transportation improvements, consistent with the rate and location of expected development. The four stage improvement plan is to occur over a twenty year period, 1987-2007, and is designed to coordinate improvements to the greatest extent possible.

A. 1987 - 1990

- Widen approaches, NB & SB at VT 2A/US 2;
- Begin NB right turn lane on VT 2A at a point south of existing location.
- Upgrade South Brownell Road from US 2 to Shunpike Road extension.
- Remove driveways to Howard Bank and Judge; have access via Taft Corners Associates 2A driveway.
- At Industrial Avenue/Mountain View Road/VT 2A, construct eastbound left turn lane, improve sight distance.
- Widen eastbound US 2 and westbound Industrial Avenue to two lane approaches.

B. 1990 - 1992

- Signals at both access points to Taft Corners Associates;
- Partial circumferential highway
- I-89 ramps phase one (P. 48)

C. 1992 - 1997

- I-89 ramps phase two (P. 48)

D. 1997 - 2007

- Widening of US 2 from Brownell to Circumferential Highway

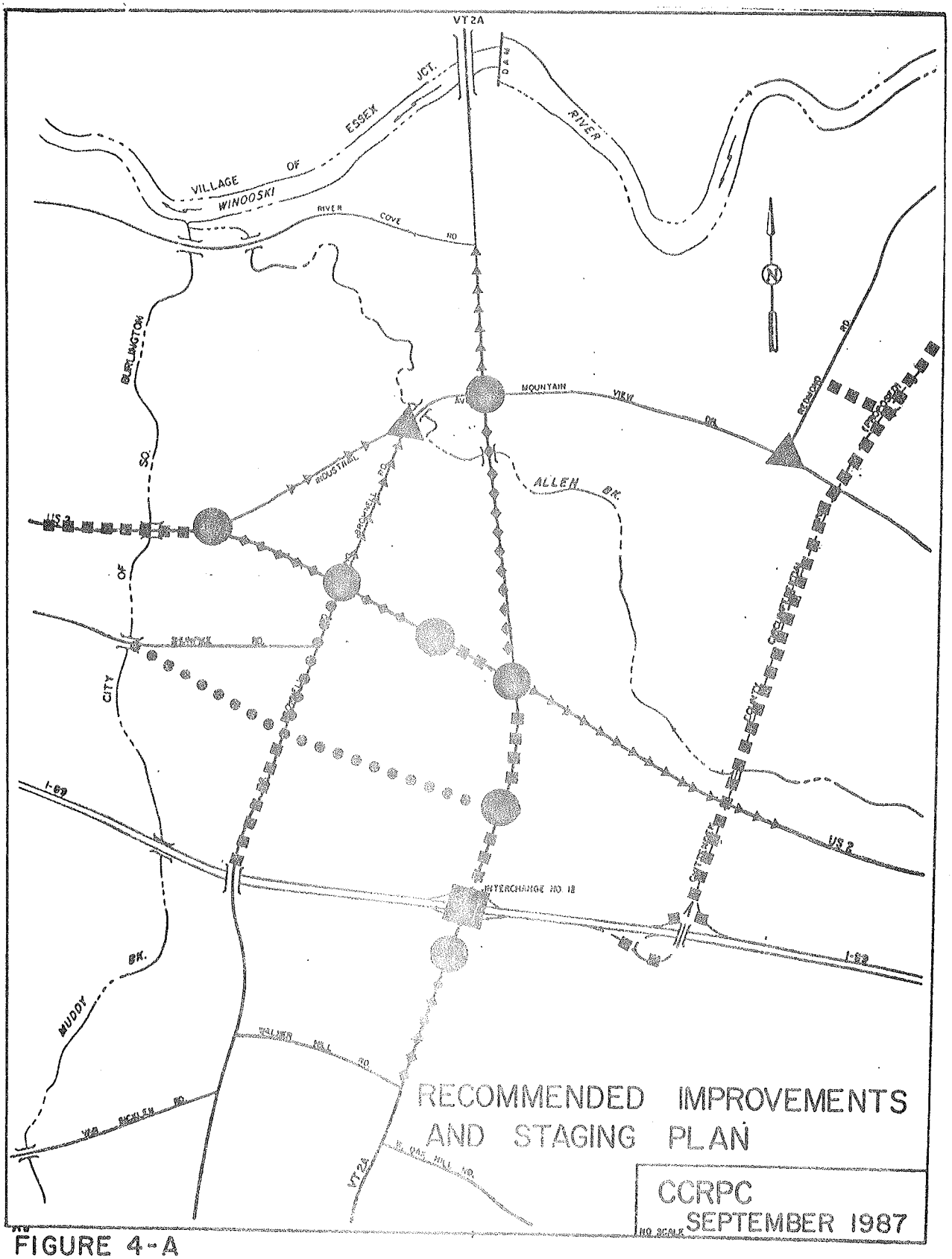


FIGURE 4-A

LINK IMPROVEMENT

- 1987-1990
- 1990-1992
- 1992-1997
- 1997-2007

INTERSECTION IMPROVEMENT

- 1987-1990
- 1990-1992
- 1992-1997

See Fig. 4-B for phases

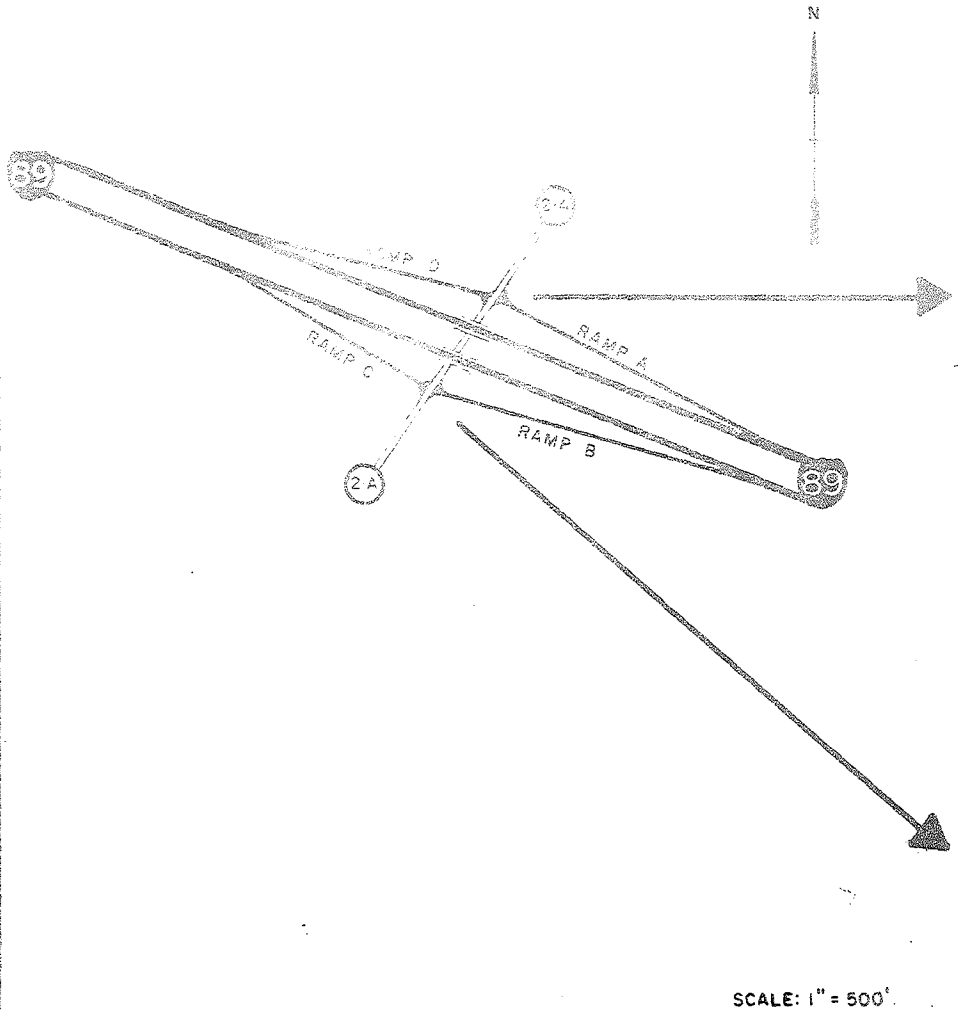
- 1997-2007

E. Alternate Transportation

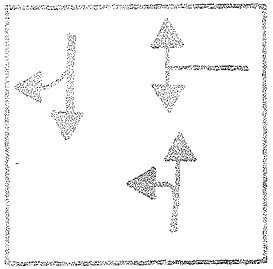
Other methods to accommodate travel should also be considered. Traffic mitigation programs, public transportation, and ridesharing (vanpools, carpools) will play key roles in the mid and long term plan of action. In the short term, over the next five years, remedial improvements and modest increases in highway/ intersection capacity are essential. Buses, carpools and vanpools would be using the same roads as single occupant vehicles and thus be confronted by the same congestion, if no improvements are made in the next five years. However, in the period after 1992, alternate transportation programs should be aggressively pursued to reduce rates of increase in low occupancy vehicles. Consequently, a method will have to be developed to modify the amount of a traffic impact fee if a developer desires to participate in an alternate transportation program. Future versions of this report will detail a mechanism for instituting such programs.

EXISTING & RECOMMENDED LANE CONFIGURATIONS

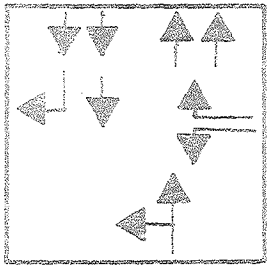
WILLISTON INTERCHANGE NO. 12



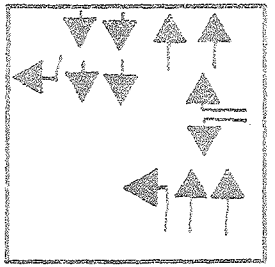
EXISTING LANE USE



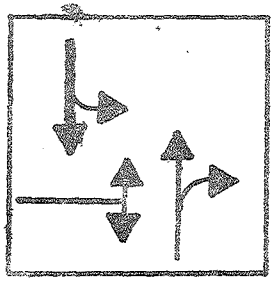
1990-1992



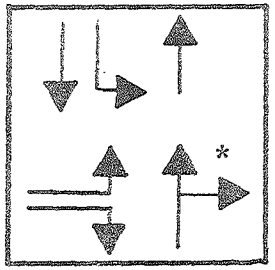
1992-1997



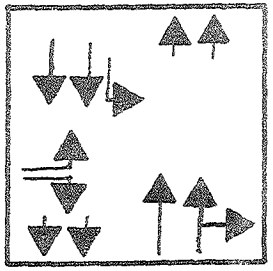
EXISTING LANE USE



1990-1992



1992-1997



* With Circ. Highway

CCRPC
SEPTEMBER 1987

5. Implementation and Financing

It would be difficult to implement the above recommendations using "traditional" funding sources; local, state and federal transportation dollars. Moreover, since much of the need for the improvements described above is directly attributable to private development activity in the Williston area, it is reasonable that some part of the revenues needed to construct the improvements be generated by contributions from the private sector benefitting from the improvements.

One method for establishing private contributions is through the use of standardized traffic impact fees. Traffic impact fees are charges applied by local government against new development for the express purpose of financing traffic improvements needed by that development. Such fees can be applied when building permits are obtained or when occupancy permits are granted. Such fees should be based on a formula which links the amount of fee to the demand for highway capacity generated by the development. Such formulas include a fee per estimated daily trips generated by various uses, a fee per square foot of building construction, or a fee per residential/hotel unit constructed.

Trip generation fees are applied under the police power of local government, and as such must follow certain logical guidelines in their construction:

> Impact fees must bear a reasonable and logical relationship to the benefits received by those who pay the fee. That is, the fees applied to a given development should reflect that development's share of the services provided by the needed facility.
>
> Impact fees should be specifically and exclusively used to construct the facilities and/or services needed by the development on which the fees are assessed, thus establishing a link between payment of fees and benefits from the improvements.
>
> Impact fees should be dedicated to the construction of specific improvements according to a specific time schedule, thus ensuring that developments which pay the fees receive the benefits of the improvements in a timely manner.

There are three other aspects of a traffic impact fee structure which should be considered: a) outside funding; b) credits against the fees; and c) provision for regular monitoring and updating. These will be discussed below.

a) Outside funding. Since impact fees are designed to aid local governments in meeting the costs of traffic improvements needed for anticipated development, it is reasonable that provision be made for the situation where outside funds (eg. state or federal government funds) also become available for

financing the improvements. Assumptions regarding the availability of outside funds can be built into the analysis used to establish the impact fee formula, or provision can be made for the refund of fees equal to outside funds on a pro rated basis (ie. a development which contributes fees equal to five percent of the total cost of an improvement would be refunded five percent of outside funds used for constructing the improvement).

b) Credits against the fees. Several of the improvements described above and indicated in the staging plan are, in part, remedial--that is they are needed to correct existing deficiencies. These projects are actually needed prior to allowing new development to go forward.

Correcting these deficiencies is, appropriately, a public responsibility. Given the constraints on state and local funding, however, the timing of these remedial projects is uncertain. If the development community expedited these remedial improvements (identified in stage I, 1987-1990) their expenditures should be considered as a credit against fees levied for future traffic improvements. This practice would not, however, change the schedule for the future improvements, but shifts the public sector's contribution from remedial projects to future projects.

Credits may also be established for other private sector expenditures which reduce the need for traffic improvements, and should reflect the degree to which the need is reduced. For instance, credits may be established for expenditures in the following areas:

- o Construction of improvements in lieu of payment
- o Donation of needed right-of-way
- o Initiation or participation in ride-sharing programs
- o Investment in traffic system management activities
- o consolidation of curb cuts and access points

c) Provision for regular monitoring and updating. Traffic impact fee systems should include provision for regular monitoring and updating. This provides the capability for mid-course modifications reflecting significant changes in development plans, travel demand, construction schedules or economic conditions. For instance, if development does not materialize at the rate initially anticipated, it must be possible to revise the scope and timing of improvements to be funded by the impact fees. In addition, economic conditions may generate revisions to anticipated costs of planned traffic improvements, suggesting that fees be tied to published construction cost indices such as those in the Engineering News Record or American City and County. Finally, a change of use provision should be employed to address a situation where a low trip generator changes use to a high generator; for example a warehouse changing to an office use.

Impact fees, had they been established for some years, would generally be considered as a cost of using land for various purposes, and would be reflected in the selling price of that land. If impact fees are established in the middle of a development planning process where the price of land has already been determined, an adjustment in the price is not possible and the fees must be carried by developer profit. In such a case, it would be reasonable to phase in the fees, thereby not imposing an unreasonable burden on developments already in the process. If this is done, obviously some other source must be found for needed funds not provided by the impact fees.

The impact fee system proposed for the Tafts Corners area of Williston was developed in the following manner. First, assumptions were made about the amount of traffic to be generated by anticipated new development, and the distribution of that traffic on the roadway network. Second, improvements needed to accommodate that traffic were identified and cost estimates were prepared for their construction. Third, a phasing plan was developed linking the sequence and timing of the improvements to the rate of new development. This has been described in detail in the preceeding sections of this report.

To summarize, it is estimated that approximately 18,880 new p.m. peak vehicle trips will be generated by new development in the study area over the coming twenty years, and that the improvements needed to accommodate this increment in traffic will cost $20 million (roughly $1,059 per p.m. peak hour trip generated).

Since most major roadway improvements in Vermont are funded in large part by State and Federal funds, it was assumed that outside funds for these improvements would amount to fifty percent of total costs, or $10 million, leaving an equal amount to be generated locally.

Ideally, the local share would be generated by traffic impact fees. However, since the establishment of such fees will occur after several development projects have proceeded well along in the planning process, it was felt inappropriate to assess fees of this magnitude at this point. Staff was particularly concerned with maintaining the competitiveness of the Taft Corners Area in relation to other rapidly developing towns in the region. Consequently, other local sources were explored, and the use of a tax increment financing district appeared to be the most promising. Under this approach, a tax increment financing district would be established, coterminous with the area to which the traffic impact fees are being established, and a portion of the tax revenues generated by new development would be specifically earmarked to be used for constructing the identified traffic improvements according to the agreed upon phasing plan. Tax increment financing was assumed to generate $7.5 million of the $10 million local portion of the

total cost of improvements, thus leaving $2.5 million to be generated by traffic impact fees.

With $2.5 million to be raised by traffic impact fees, and with an estimated 18,880 new p.m. peak trip ends being generated by development over the coming twenty years, a traffic impact fee of $133.00 per estimated p.m. peak trip end is indicated. However, it was also desired to phase the mix between traffic impact fees and tax increment financing so that eventually all local costs would be covered by the impact fees. To this end, it is proposed that the traffic impact fee be established at $133.00 per estimated p.m. peak trip end initially.

Implementation of the above described financing system involves careful agreements between the Town, the State and the developers in terms of what fees are applied, when they are due, what improvements are required and when they will be constructed. The system described, along with the agreements should reflect the following concerns expressed by the development community:

1. The fee system should be designed to minimize, to the extent possible, upfront costs to the developer.
2. Each development should pay its fair share.
3. There should be private participation in decisions regarding the timing and location of improvements.
4. The fees should generate sufficient funds while allowing the developer to remain competitive.
5. The fee should be a predictable one time cost.

Accordingly, the trip generation fee payments would be made prior to or at issuance of a use and occupancy permit. This delays payments until firm leasing or sale agreements are in place. Further, any fees payed by the landowner would be placed into the Town's interest-bearing account, with the dollars earmarked for transportation improvements. Lastly, there will be a Memorandum of Agreement which will structure and detail the responsibilities of each party: private, Town and State.

It is recommended that the traffic impact fee system be monitored and reviewed annually, and that the entire system be evaluated and revised if necessary after three years. This evaluation should compare actual and anticipated development, traffic improvements built and needed, traffic generated and anticipated, etc., in order to ensure that the system is effectively supporting the traffic improvements needed to accommodate the development.

It is useful to emphasize that the revenue generated by the payment of trip generation fees is applied to what are typically referred to as "off-site" road improvements, as shown in the staging programs. Included are road links and intersections that must be upgraded as a result of the overall development in the area. This will ensure that the road network as a whole has adequate capacity. "On-site" improvements - auxilliary lanes,

new traffic signals at driveways - are not funded by the trip generation fees. Such on-site improvements are a condition of an access permit, the cost of which is borne completely by the developer of the specific site.

6. Conclusion

This section summarizes three categories of information presented in sections 2, 4 and 5. Table 6.A summarizes recommended improvements for each year. Table 6.B presents the cost estimates for the improvements, Table 6.C is the cost of improvements by stage, and Table 6.D is the trip generation schedule which is to be used to calculate the fees for a particular development.

TABLE 6.A

WILLISTON OFF-SITE IMPROVEMENTS

With any construction staging program, overlap or duplication of construction is a concern. Three options are possible. First, interim improvements can be delayed until the ultimate improvement is needed. This results in congestion and delay in the interim. Second, the ultimate improvement can be made immediately, resulting in excess capacity, over design, and poor use of resources. Third, interim improvements can be made which, in some cases, may have to be removed at a later date. This may make sense if it would produce substantial benefit over a two to five year period. The program recommended in this report attempts to minimize overlap. However, design is often a compromise between needs and resources, and the recommended program attempts to strike a reasonable balance between design needs and financing.

It is clear, however, that the anticipated timing of development is such that phasing of improvements at the same location is necessary. This occurs at two locations only: the US 2/VT 2A intersection and Interchange #12. The widening of northbound and southbound VT 2A to three lanes should be done immediately. A second phase, widening eastbound and westbound US 2 should be done in 1990-1992. Overlap, however, should be minimal, since work will be on different approaches in different years. These improvements, moreover, will be adequate till at least 1997, with signal timing adjustments. For Interchange #12, the first set of improvements deal mainly with the off ramps. The second set of improvements should not result in reconstructing the previous ramp work.

The recommended first stage improvements are shown below:

1987-1990

On VT 2A, widen northbound and southbound approaches to three lanes: exclusive left turn lane, through lane, exclusive right turn lane. Exclusive right turn lanes should be reconstructed to allow for continuous movements.

Consolidate driveways at Howard Bank and access via Taft Corners Associates VT 2A driveway.

Widen eastbound US 2 and westbound Industrial Avenue to two lane approaches.

At Industrial Avenue/ Mountain View Road/VT 2A construct eastbound left turn lane, improve sight distance.

Upgrade South Brownell Road, from US 2 south to Shunpike Road extension.

The recommended second stage improvements are presented below:

1990-1992

Widen VT 2A, from I-89 to US 2. A four lane divided road is the recommended design, with turn lanes at driveways. The design should be consistent with previous improvements made at the US 2/ VT 2A intersection, and at the Taft Corners Associates VT 2A access.

US 2 from Muddy Brook to Industrial Avenue should be widened to four lanes, with consolidation of driveways on the south side of US 2.

The I-89 off ramps (A and C) at Interchange #12 should be widened to two lanes. A southbound right turn lane should be constructed at the southbound VT 2A approach to Ramp D (on ramp to Burlington).

Brownell Road, from the Shunpike Road extension to I-89 should be upgraded to 12 foot lanes and stone stabilized or paved shoulders.

Widen to two lanes the eastbound and westbound approaches of US 2 at VT 2A. This will create exclusive left turn lanes on each approach.

Recommended third stage improvements are:

1992-1997

Widen VT 2A from US 2 to the Industrial Avenue/Mountain View Road intersection. A four lane divided design with channelization at major driveways in recommended.

Reconstruct VT 2A from I-89 to Walker Hill Road to improve sight distance and provide paved shoulders.

Widen VT 2A at Interchange 12 to provide exclusive left turn lanes and two through lanes, northbound and southbound.

Widen US 2 from Industrial Avenue to Commerce Street to a four or five lane section.

Recommended improvements for the fourth stage are:

1997-2007

Widen VT 2A from the Industrial Avenue/Mountain View Road intersection to River Cove Road to a four lane divided or five lane road.

Widen or upgrade US 2 from 2A to the Circumferential Highway intersection. Improvement should include the eastern approaches of the US 2/Circumferential Highway intersection.

TABLE 6.B

COST ESTIMATES

FOR RECOMMENDED IMPROVEMENTS

IN WILLISTON

Route	From	To	Description	Cost		
VT 2A	I-89	US 2	2 to 4 L	$520 X 3520 LF*	=	$ 1,830,400
VT 2A	US 2	Ind Ave	2 to 4 L	520 X 5775 LF	=	3,003,000
VT 2A	Ind Ave	River Cove	2 to 4 L	520 X 2740 LF	=	1,424,800
VT 2A	I-89	Walker Hill	Upgrade	200 X 2970 LF	=	594,000
	VT 2A Subtotal				=	$ 6,852,200
US 2	Muddy Br.	Ind Ave	2 to 4 L	520 X 1400 LF	=	$ 728,000
US 2	Ind Ave	Brownell	2 to 4 L	520 X 2362 LF	=	1,228,240
US 2	Brownell	Commerce Pk	2 to 4 L	520 X 966 LF	=	502,320
US 2	Comrse.Pk	2A	2 to 4 L	520 X 2800 LF	=	1,456,000
US 2	2A	CCCH	2 to 4 L	520 X 4258 LF	=	2,214,160
US 2	CCCH	East	2 to 4 L	520 X 1500 LF	=	780,000
	US 2 Subtotal				=	6,908,720
I-89	Interchange 12		2 phases of improvements			2,000,000
	I 89 Subtotal				=	2,000,000
	State and Federal Routes Total				=	$15,760,920
Brownell	US 2	New Road		200 X 3370	=	674,000
Brownell	US 2	Industrial Ave		200 X 3200	=	640,000
Ind. Ave.	US 2	Brownell		200 X 3550	=	710,000
Ind. Ave.	2A	Brownell		200 X 1850	=	370,000
MT. View	2A	Redmond		200 X 6000	=	1,200,000
Brownell	New Road	I-89		200 X 1950	=	390,000
	Local Roads Total				=	$3,984,000
	All Roads Total				=	$19,744,920
					say	20,000,000

Cost Sharing

50% State/Federal	=	$10,000,000
37.5% Local (TIF)**	=	7,500,000
12.5% Private (Impact Fee)	=	2,500,000
100.0%		$20,000,000

* Linear feet

** Tax increment financing revenues

Williston Transportation
CCRPC
April 22, 1987

TABLE 6.C
20 YEAR STAGING PROGRAM WITH COST OF IMPROVEMENTS BY STAGE

1987 - 1990		
US 2	Commerce Street to VT 2A	1,456,000
	TOTAL STATE/FEDERAL	$1,456,000
Brownell Road	US 2 to new road	674,000
1987-1990	TOTAL STATE/FEDERAL & LOCAL	$2,130,000
1990 - 1992		
VT 2A	I-89 to US 2	1,830,400
US 2	Muddy Brook to Industrial Ave.	728,000
I-89	Int. #12 Phase One	500,000
	TOTAL STATE/FEDERAL	$3,058,400
Brownell Road	new road to I-89	390,000
	TOTAL LOCAL	390,000
1990-1992	STATE/FEDERAL & LOCAL	$3,448,400
1992 - 1997		
VT 2A	US 2 to Industrial Ave.	3,003,000
VT 2A	I-89 to Walker Hill	594,000
I-89	Int. #12 phase two	1,500,000
US 2	Industrial Ave. to Brownell	1,228,240
US 2	Brownell to Commerce St.	502,320
1992-1997	TOTAL STATE/FEDERAL	$6,827,560
1997 - 2007		
VT 2A	Industrial Ave. to River Cove Rd.	1,424,800
US 2	VT 2A to Circumferential Highway	2,214,160
US 2	Circumferential Highwyay to east	780,000
	TOTAL STATE/FEDERAL	$4,418,960
Industrial Ave.	VT 2A to Brownell Rd.	370,000
Brownell Rd.	US 2 to Industrial Ave.	640,000
Industrial Ave.	US 2 to Brownell	710,000
Mt. View Rd.	VT 2A to Redmond	1,200,000
	TOTAL LOCAL	2,920,000
1997-2007	TOTAL STATE/FEDERAL & LOCAL	7,338,960
TOTAL COST OF IMPROVEMENTS - 1987-2007		$19,744,920 ($20,000,000)

WILLISTON TRAFFIC STUDY

TABLE 6.D

May 1987

SUGGESTED TRIP GENERATION RATES BY LAND USE*

The purpose of this table is to provide a guide on trip generation rates for various land uses, i.e., the number of trips which may be generated by a specific building or land use. These rates are used in the calculation of the trip generation impact fee; the initial fee, per p.m. peak trip, is $133.00

Average Weekday Vehicle Trip Ends = Weighted 24-hour total of all vehicle trips counted to and from a study site from Monday through Friday.

	Ave. Weekday Veh. Trip Ends	p.m. Peak Hour Trip Rate
RESIDENTIAL		
Single Family Detached Unit (per unit)	10.0	1.00
Apartment, General	6.1	0.70
Low Rise Apartment	6.6	0.60
High Rise Apartment	4.0	0.40
Condominium (Townhouse)	5.2	0.51
Mobile Home	4.8	0.59
Retirement Community	3.3	0.40
Planned Unit Development	7.8	0.80
COMMERCIAL		
Hotels -		
Per employee	11.3	
Per room	10.5	0.73
Motels -		
Per employee	12.81	
Per occupied room	10.14	0.65
Office Buildings -		
Per employee	3.59	
Per 1,000 gross square feet	12.30	2.20
Per acre	240.10	
General Office under 100,000 gross square feet -		
Per employee	3.7	
Per 1,000 gross square feet	17.7	2.82
Per acre	137.0	
General Office 100,000 to 199,999 gross sq. ft. -		
Per employee	3.8	
Per 1,000 gross square feet	14.3	2.03
Per acre	166.0	

* Institute of Transportation Engineers, June 1983.

Suggested Trip Generation Rates By Land Use May 1987

	Ave. Weekday Veh. Trip Ends	p.m. Peak Hour Trip Rate
General Office over 200,000 gross square feet -		
Per employee	2.9	—
Medical Offices -		
Per 1,000 square feet	54.6	3.94
Government Office Building -		
Per employee	12.0	—
Per 1,000 gross square feet	68.93	
State Motor Vehicle Department -		
Per employee	44.5	
Per 1,000 gross square feet	166.1	17.09
Post Office -		
Per employee	25.1	
Per 1,000 gross square feet	139.7	11.36
Civic Centers -		
Per employee	6.09	
Per 1,000 gross square feet	25.00	2.85
Office Park -		
Per employee	3.33	
Per 1,000 gross square feet	20.65	2.38
Per acre	276.60	
Research Center -		
Per employee	2.4	
Per 1,000 gross square feet	5.3	0.90
Per acre	57.2	
Shopping Centers -		
0-49,999 square feet		
Per 1,000 square feet	117.9	14.42
50,000 - 100,000 square feet		
Per 1,000 square feet	82.0	7.80
100,000 - 200,000 square feet		
Per 1,000 square feet	66.7	5.90
200,000 - 300,000 square feet		
Per 1,000 square feet	50.6	4.80
300,000 - 400,000 square feet		
Per 1,000 square feet	41.9	5.50
400,000 - 500,000 square feet		
Per 1,000 square feet	49.7	4.90
500,000 - 1,000,000 square feet		
Per 1,000 square feet	37.2	3.12
Speciality Retail Centers -		
Per 1,000 gross square feet	40.7	—
Discount Stores -		
Per 1,000 square feet	70.1	3.79
Hardware/Paint Store -		
Per employee	53.2	
Per 1,000 gross square feet	51.3	4.90
Per acre	546.0	
Quality Restaurants -		
Per seat	2.34	
Per 1,000 square feet gross floor area	74.90	6.14
High Turnover - Sit Down Restaurant -		
Per 1,000 gross square feet	164.4	10.50
Drive-In Restaurants -		
Per 1,000 square feet	553.0	31.60

Suggested Trip Generation Rates By Land Use May 1987

	Ave. Weekday Veh. Trip Ends	p.m. Peak Hour Trip Rate
New Car Sales -		
Per employee	24.0	
Per 1,000 gross square feet of building area	47.5	4.58
Service Stations -		
Per station	748.0	25.00
Per pump	133.0	3.63
Car Wash -		
Per site		110.00
Super Markets -		
Per 1,000 gross square feet	125.5	8.82
Convenience Markets -		
Per 1,000 gross square feet (15-16 open hours)	322.6	———
Per 1,000 gross square feet (24 open hours)	625.2	46.70
Wholesale -		
Per employee	8.21	
Per 1,000 gross square feet of building space	6.73	0.21
Per acre	128.00	
Furniture Store -		
Per 1,000 gross square feet of building area	0.70	0.06
Banks, Walk-In -		
Per employee	44.5	
Per 1,000 square feet	169.0	16.70
Banks, Drive-In -		
Per employee	47.4	
Per 1,000 square feet	192.0	25.30
Per window	297.0	
Savings & Loan Walk-In -		
Per employee	30.5	
Per 1,000 square feet	61.0	5.30
Savings & Loan Drive-In -		
Per employee	49.0	
Per 1,000 square feet	74.0	6.80
Per window	445.0	
Insurance -		
Per employee	2.45	
Per 1,000 gross square feet	11.50	2.40
Per acre	91.80	
INDUSTRIAL		
Per employee	3.00	
Per 1,000 gross square feet floor area	5.43	1.05
Per acre	59.90	
General Light Industrial -		
Per employee	3.20	
Per 1,000 gross square feet	5.46	1.
Per acre	52.40	
General Heavy Industrial -		
Per employee	2.05	
Per 1,000 gross square feet	1.50	0.19
Per acre	15.60	

Suggested Trip Generation Rates By Land Use May 1987

	Ave. Weekday Veh. Trip Ends	p.m. Peak Hour Trip Rate
Industrial Park -		
Per employee	3.59	
Per 1,000 square feet	7.00	0.99
Per acre	62.80	
Manufacturing -		
Per employee	2.01	
Per 1,000 gross square feet	3.86	0.75
Per acre	38.90	
Warehousing -		
Per employee	3.89	
Per 1,000 square feet	4.88	1.63
Per acre	56.10	
Mini-Warehouse -		
Per 1,000 gross square feet	2.80	0.29
Per storage unit or vault	0.28	
Per acre	48.60	
Truck Terminals -		
Per employee	6.99	
Per 1,000 square feet	9.86	0.82
Per acre	81.90	
INSTITUTIONAL		
Elementary School -		
Per student	1.02	
Per employee	13.10	0.28
High School -		
Per student	1.39	0.20
Per employee		
Junior-Community College -		
Per student	1.55	0.12
University -		
Per student	2.41	—
Library -		
Per employee	51.0	—
Per 1,000 gross square feet	41.8	
Hospitals -		
Per employee	4.90	
Per bed	11.40	1.17
Per 1,000 square feet	16.70	
Nursing Home -		
Per employee	4.0	
Per bed	2.6	0.21
Medical Clinic -		
Per employee	5.9	1.12
Per 1,000 square feet	23.8	
Commercial Airport -		
Per employee	16.82	2.91
Per commercial flights/day	77.86	

	Ave. Weekday Veh. Trip Ends	p.m. Peak Hour Trip Rate
RECREATION		
Park - Local -		
Per employee	96.2	
Per parking space	7.8	———
Per acre	6.0	
Park - Regional -		
Per employee	26.5	
Per parking space	2.2	———
Per acre	5.1	
Park - State -		
Per employee	29.1	2.20
Per parking space	2.0	
Per acre	.6	
Marinas -		
Per employee	251.5	18.00
Per boat berth	3.0	0.17
Per acre	20.9	
Golf Courses -		
Per employee	20.6	
Per parking space	5.3	0.33
Per acre	6.9	0.39
Racquet Clubs -		
Per employee	40.7	
Per court	44.3	
Per 1,000 square feet building area	11.7	1.50
Per member	.59	

Trip generation data are continually being updated. To confirm current rates or obtain information on land uses not included in this Table, contact the CCRPC transportation staff.

APPENDIX A

WILLISTON-TAFT CORNERS TRANSPORTATION STUDY
LAND USE ESTIMATES

1987

	SFDU*	MFDU*	RETAIL	NON-RETAIL
Williston Study Area	1,292	331	115	2,580
Balance of Chittenden Cty.	33,636	12,446	14,709	51,029
TOTAL	34,928	12,777	14,824	53,609

TOTAL DWELLINGS 47,705

TOTAL EMPLOYMENT 68,433

1992

	SFDU	MFDU	RETAIL	NON-RETAIL
Williston	1,839	556	807	7,245
Balance of Chittenden Cty.	35,462	12,992	13,983	50,013
TOTAL	37,301	13,548	14,790	57,258

TOTAL DWELLINGS 50,186

TOTAL EMPLOYMENT 72,048

* SFDU = Single Family Dwelling Units
MFDU = Multi-Family Dwelling Units

1997

	SFDU	MFDU	RETAIL	NON-RETAIL
Williston	2,267	897	3,111	12,949
Balance of Chittenden Cty.	36,564	14,134	16,835	54,956
TOTAL	38,831	15,031	19,946	67,905

TOTAL DWELLINGS 53,862

TOTAL EMPLOYMENT 87,851

2007

	SFDU	MFDU	RETAIL	NON-RETAIL
Williston	5,678	1,200	4,750	17,288
Balance of Chittenden Cty.	40,919	15.100	17,445	56,706
TOTAL	46,597	16,300	22,195	73,994

TOTAL DWELLINGS 62,897

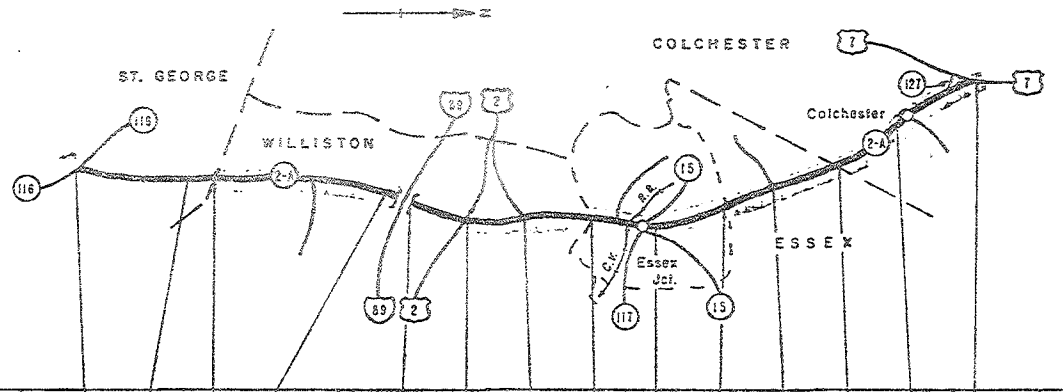
TOTAL EMPLOYMENT 96,189

* SFDU: Single Family Dwelling Unit
MFDU: Multi Family Dwelling Unit

AGENCY OF TRANSPORTATION
PROJECT PLANNING DIVISION

1983 SUFFICIENCY RATING

ROUTE : VT. 2-A

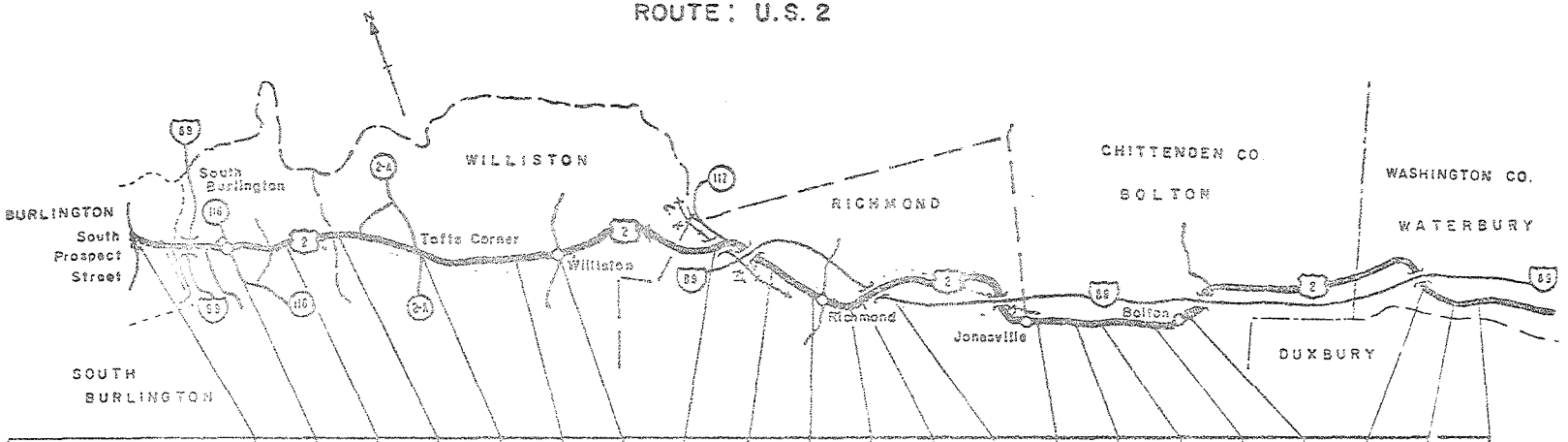


Section Number	1	2	3	4	4A	4B	4C	4D	4E	5	6	7
Length	1.6	0.4	2.8	0.2	0.7	1.1	1.2	0.6	0.9	0.9	1.2	1.3
Average Daily Traffic	2140	2140	2400	4240	6970	4920	12000	5940	4460	5450	5450	4903
Year Constructed	46	46	47	47	64	36,39	39	36	34,36	34	34	33,34,42
Jurisdiction *	S	S	S	S	S	S	S L	S	S	S	S	S
Ave. Surface Width	22.0	22.0	22.4	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	25.4
Ave. Roadway Width	26.0	26.0	25.6	40.0	40.0	29.0	31.0	31.3	30.0	30.0	30.0	31.2
Condition	17.8	17.8	22.4	45.6	45.6	27.5	25.8	30.8	30.8	30.8	22.8	22.8
Safety	14.2	7.5	8.7	16.0	10.0	18.2	7.8	17.7	15.6	10.3	13.7	15.4
Service	18.7	16.7	13.8	21.2	18.5	22.0	12.6	19.4	22.2	19.0	18.0	21.8
Correction	--	--	--	--	--	--	--	--	--	--	--	--
Basic Rating	50.7	42.0	44.9	82.8	74.1	67.7	46.2	67.9	68.6	60.1	54.5	60.0
Traffic Adjustment	-4.5	-4.4	-5.3	-5.3	-4.6	-3.3	-9.3	-4.3	-2.7	-10.7	-11.0	-10.0
Adjusted Rating	46.2	37.6	39.6	77.5	69.5	64.4	36.9	63.6	65.9	49.4	43.5	50.0
System	FAS					FAU				FAS		

* S State L Local FAP Federal Aid Primary FAS Federal Aid Secondary FAU Federal Aid Urban

AGENCY OF TRANSPORTATION
PROJECT PLANNING DIVISION

1983 SUFFICIENCY RATING
ROUTE: U.S. 2



Section Number			24A	24B	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Length			0.9	1.2	1.6	0.7	2.9	0.8	0.9	0.5	0.1	0.3	3.2	0.6	0.4	0.8	0.7	4.4	1.0	0.4
Average Daily Traffic			16530	5500	3980	3980	1630	3060	3900	3080	2180	2180	2130	1750	1750	1750	1750	1320	1320	2620
Year Constructed			25	29 64 25	29	29	17 60 29	30	29	29	64	64	29	64	29	64	29	30	30	61
Jurisdiction *	L	L	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Ave Surface Width			28.0	25.7	24.0	24.0	24.0	29.6	24.0	30.2	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	24.0	22.0
Ave. Roadway Width			34.0	31.4	30.0	30.0	29.5	33.4	28.0	32.2	31.5	34.0	26.2	34.0	28.0	34.0	26.0	34.0	28.0	34.0
Condition			31.7	29.0	29.2	31.2	27.2	44.4	29.2	29.2	48.3	48.3	29.2	48.3	29.2	32.3	29.2	31.1	32.8	40.8
Safety			3.8	16.3	13.5	15.6	11.3	13.4	8.2	16.6	8.1	10.2	5.2	18.0	17.0	17.9	15.2	21.7	18.0	13.4
Service			13.8	20.5	19.4	22.6	14.3	18.1	16.3	19.9	16.6	15.6	13.9	22.6	21.8	22.6	21.8	24.1	24.2	19.5
Correction			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Basic Rating			49.3	65.8	62.1	69.3	52.8	75.9	53.7	65.7	73.0	74.1	48.3	88.9	68.0	72.8	66.2	76.9	75.0	73.7
Traffic Adjustment			-11.4	-4.0	-8.4	-8.6	-2.6	-5.2	-8.7	-6.7	-3.6	-3.6	-4.5	-1.2	-1.7	-2.4	-2.7	-0.8	-0.8	-4.2
Adjusted Rating			37.9	61.8	53.7	61.7	50.2	70.7	45.0	59.0	69.4	70.5	43.8	87.7	65.3	70.4	63.5	76.1	74.2	69.5
System	FAU						FAS													

* S State L Local FAP Federal Aid Primary FAS Federal Aid Secondary FAU Federal Aid Urban