

AN IN-DEPTH ANALYSIS OF SIXTH STREET BETWEEN ELM STREET AND CONLEY AVENUE
(And other adjacent streets)

APRIL 14, 1986

MICHAEL H. SCHRADER

CE 212 (Writing Assignment 3)

TABLE OF CONTENTS

PART I. INTRODUCTION	P. 1
PART II. PHYSICAL CHARACTERISTICS	1
Figure 1: Adjusted values-Avg. Hourly Flow	1A
Table I: General Street Characteristics	1B
Table II: Gen. Intersection Char..	1C
PART III. OPERATING CHARACTERISTICS	2
Sixth St. And Elm St. Inter. Analysis	2A-2C
Fifth St. and Elm St. Inter. Analysis	3A-3C
Sixth and Stewart Rd. Inter. Anal.	4A-4C
Fifth and Stewart Inter. Anal.	5A-5C
PART IV. EVALUATION	5
Directions of Flow	6A
PART V. RECOMMENDATION	6
Figure 3: Recommendation	6B
PART VI. INDEX OF FOOTNOTES	8

I. Introduction

Several years ago, in an attempt to reduce pedestrian-vehicle and bicycle-vehicle confrontations at major crosswalks, the University of Missouri-Columbia initiated a program to turn its campus into a pedestrian campus. There are several different aspects to the program. One aspect calls for the permanent barricading of several streets on the University campus, with the notion of turning those streets into pedestrian malls, the prime example of this aspect being the conversion of Lowry Street into Lowry Plaza. The other aspect of the plan calls for prohibiting vehicular traffic down several streets on campus during periods of high pedestrian traffic. Examples of this aspect of the plan are Ninth Street, between University and Conley Avenues; Conley, between Missouri Avenue and Ninth St.; and Hitt Street, between University Av. and the south end of Memorial Union, all of which have prohibited vehicular traffic between 7:45 AM and 3:45 PM.

Because of these prohibitions, traffic that had used these streets as thoroughfares were forced to find alternate routes around the circumference of the campus, increasing the volume^{on} many already congested streets. As the University has grown, these routes no longer go along the fringes of campus; rather, they traverse the campus. Major pedestrian-vehicle confrontation problems have arisen along some of these streets. One of these problem areas is Sixth Street between Elm Street and Conley Av.

II. Physical Characteristics

When evaluating a street or road, it is helpful to study roads in the vicinity of the "trouble spot," so that the best alter-

EVALUATION AREA

Scale 1"=200'

○ - Southbound adj. flow
Westbound

□ - Northbound adj. flow
Eastbound

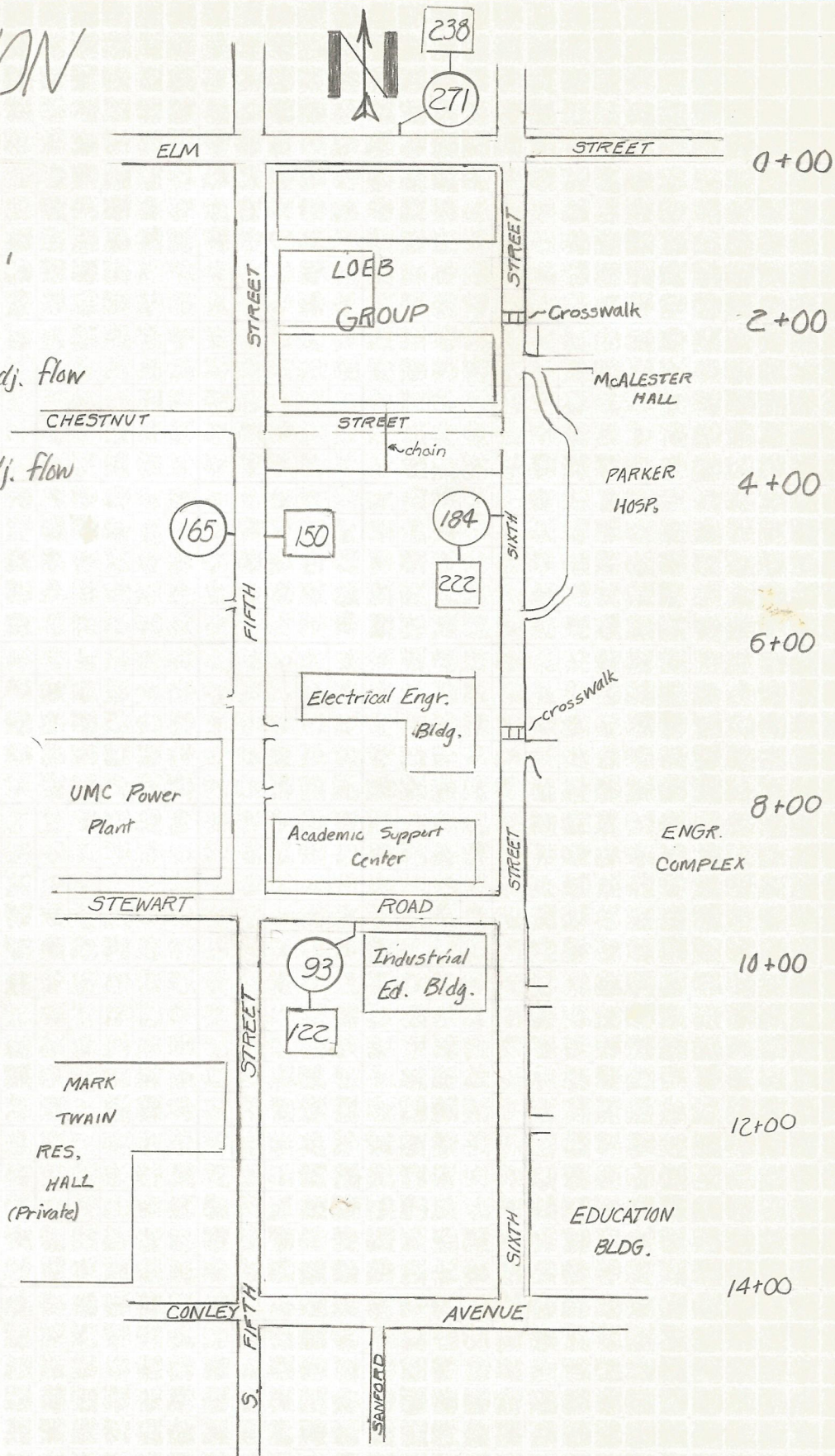


TABLE I: GENERAL PHYSICAL CHARACTERISTICS OF EVALUATION AREA STREETS

	5TH ST.	6TH ST.	CONLEY AV.	STEWART RD.	ELM ST.	CHESTNUT ST. (ALLEY)	SANFORD ST.
Total Width	38'-N of Stewart 24'-S of Stewart	35'-N of Elm 30'-Elm to Stewart 35'-S of Stewart	40'-E of 6th 36'-6th to 5th 20'-W of 5th	33'-6th to 5th 30'-W of 5th	25'-E of 6th 36'-6th to 5th 38'-W of 5th	Parking Lot -6th to 5th 20'-W of 5th	15'
Lane Width* (All streets have one lane in each direction)	12'	14'-N of Elm 11.5'-Elm to Chestnut 15'-Chestnut to Stewart 14'-S of Stewart	16.5'-E of 6th 14.5'-6th to 5th 10'-W of 5th	13'-6th of 5th 11.5'-W of 5th	12.5'-E of 6th 18'-6th to 5th 19'-W of 5th	10'	7.5'
Parking (Parallel)	WS-N of Stewart None-S of Stewart	WS-N of Chestnut None-Chestnut to Stewart ES-S of Stewart	SS-E of 5th None-W of 5th	NS-6th to 5th SS-W of 5th	None	Parking Lot -5th to 6th None-W of 5th	None
Speed Limit	20	20	20	20	20	20	20
N-North S-South E-East W-West	NS-North side (of street) SS-South side ES-East side WS-West side						

* Parking lane width = 7'

TABLE II: CHARACTERISTICS OF INTERSECTIONS IN E.A.

<u>Intersections with All- Directional (4-way) stops</u>	<u>Intersections where one street has right-of- way, and street with right-of-way</u>
5th St. & Elm St.	6th St. & Elm St., Elm St.
5th St. & Stewart Rd.	6th St. & Stewart Rd., 6th St.
5th St. & Conley Ave.	6th St. & Conley Av., Conley Av.
	5th St. & Chestnut St., 5th St.
	6th St. & Chestnut St., 6th St.
	Conley Ave. & Sanford St., Conley Av.

native to solving the existing problems and not creating new problems on other streets in the vicinity can be chosen. While the focus of this evaluation is on Sixth St., other streets in the general area have been included in this evaluation. The general area in which the evaluation was done is hereafter referred to as the Evaluation Area (EA). (FIG 1)

The general physical characteristics of EA streets are given in TABLE I. The physical characteristics of EA intersections are given in TABLE II.

III. OPERATING CHARACTERISTICS

By far, the busiest intersection in the EA is the intersection of Sixth and Elm Sts. FIG. I shows the average hourly flow (taken from traffic counts) for the peak travel period for all turns and directions at this intersection. As can be seen from the figure, there is a sizable difference in the hourly flow on 6th on both sides of Elm. On the north side of Elm, the hourly flow (in both directions) on 6th is 188 vehicles¹; on the south side of Elm, the hourly flow (in both directions) jumps to 438 vehicles². The jump in flow on 6th from the north side of Elm to the south side of Elm is even more severe for just the southbound traffic. On the north side of Elm, the southbound flow on 6th is 38 vehicle per hour (vph); on the south side, it's 212 vph. Of these 212 vehicles, 64%³ comes from westbound Elm St. (i.e., traffic heading towards Providence Road). Only 10% of the southbound traffic on 6th south of Elm comes from 6th north of Elm (FIG II).

For northbound traffic, the change is not as severe, going from a flow of 226 vph on the south side of Elm to a flow of 150 vph on the north side. However, 47% of the northbound traffic on 6th turns right onto Elm St. eastbound (towards Ninth St.), while only 42%

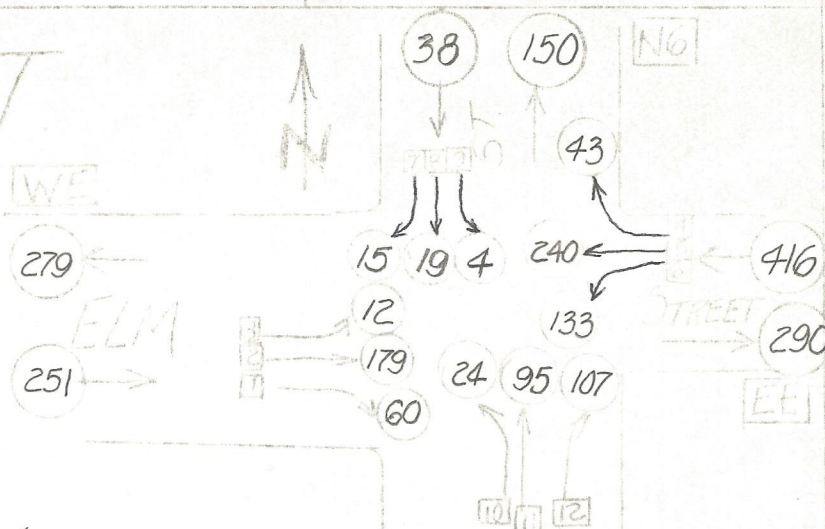
Avg. hourly flow

--2A--

SIXTH STREET

EVALUATION AREA

NORTH SECTOR



DATE: MARCH 12-13, 1986 (WEDNESDAY-THURSDAY)

TIME: 7:50 AM - 4:40 PM

WEATHER CONDITIONS:

NOTE: all numbers are hourly flow

ADDITIONAL COMMENTS:

PEDESTRIAN TRAFFIC:

>At CWL: 67

>NB at ELM & SIXTH: 18

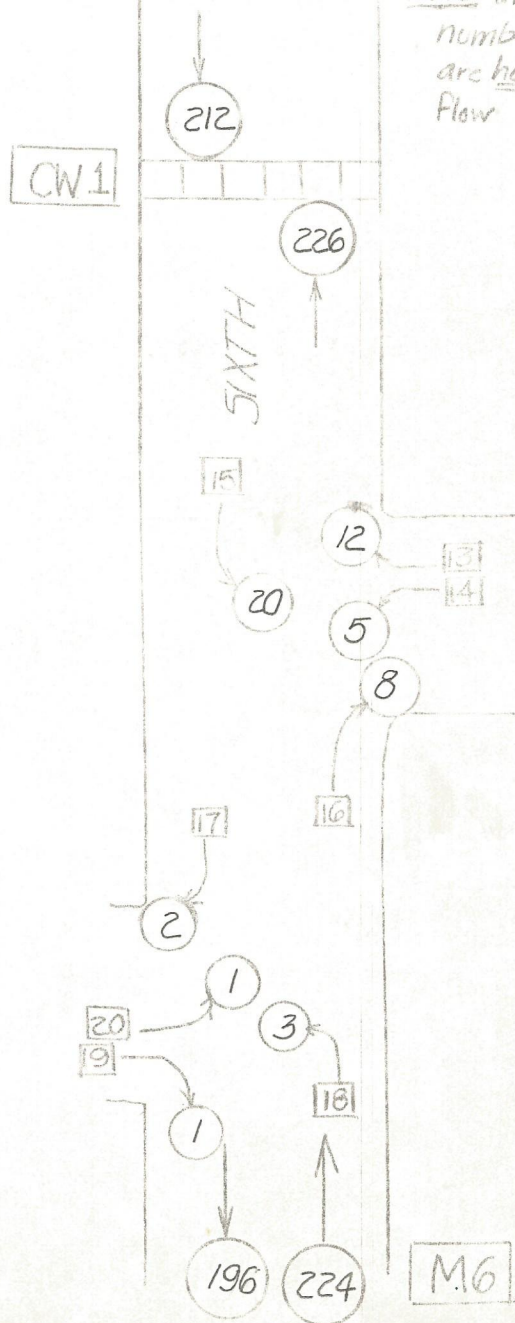
>SB at ELM & SIXTH: 15

>EB at ELM & SIXTH: 21

>WB at ELM & SIXTH: 25

BICYCLES (give directions & quantities)

8-3



WHERE THEY COME FROM ... (all figures are average percentages)

SIXTH STREET EVALUATION AREA - NORTH SECTOR

DATE: MARCH 12-13, 1986

TIME: 7:50 AM - 4:40 PM

WEATHER CONDITIONS:

ADDITIONAL COMMENTS:

PEDESTRIAN TRAFFIC:

> At CW1:

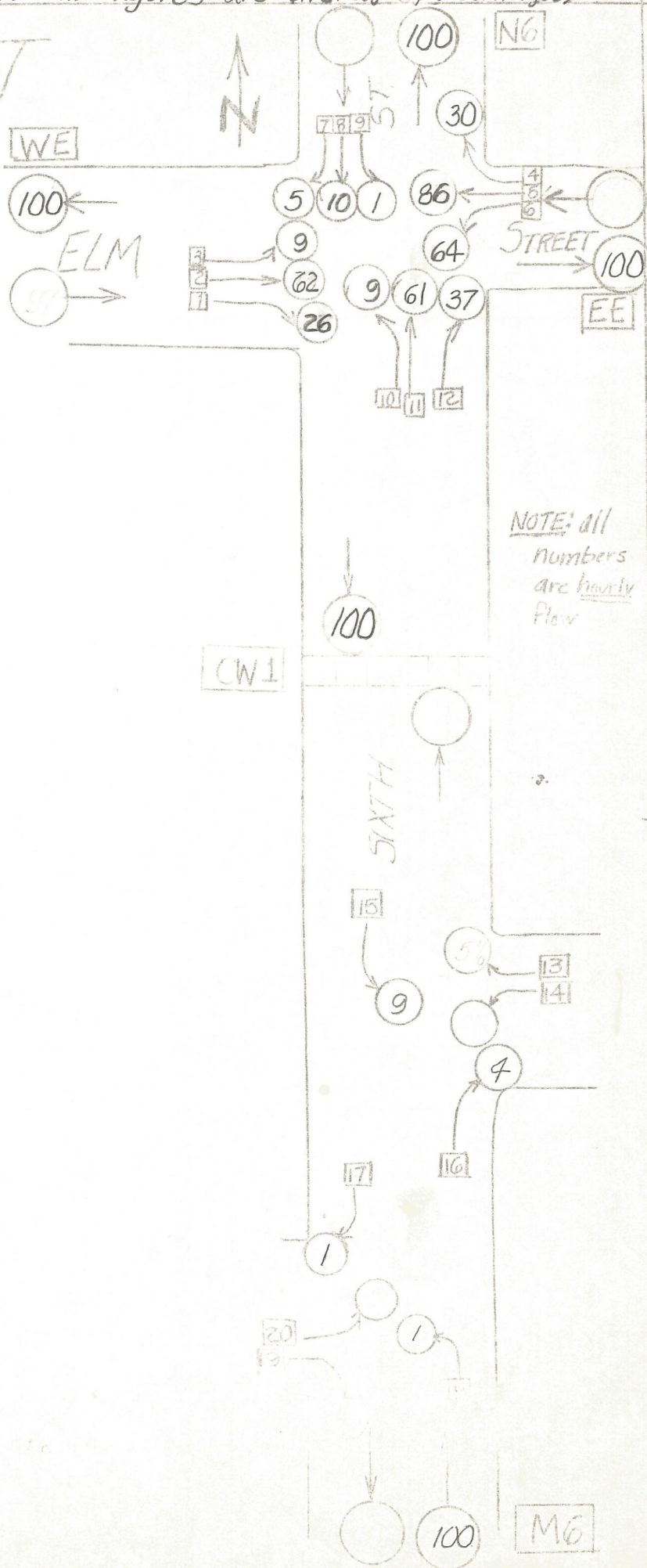
> NB at ELM & SIXTH:

> SB at ELM & SIXTH:

> EB at ELM & SIXTH:

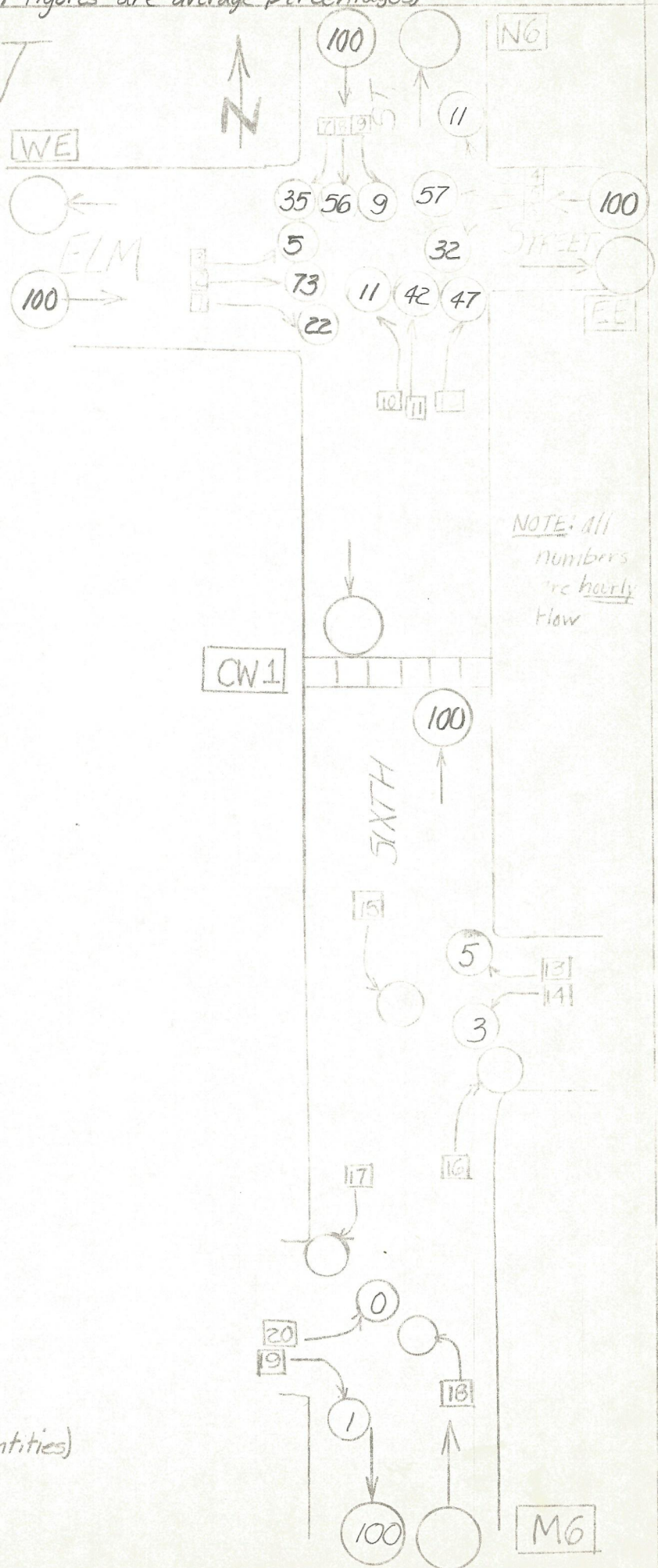
> WB at ELM & SIXTH:

BICYCLES give direction & percentage



...AND WHERE THEY GO (all figures are average percentages)

SIXTH STREET EVALUATION AREA - NORTH SECTOR



DATE: MARCH 12-13, 1986

TIME: 7:50 AM - 4:40 PM

WEATHER CONDITIONS:

ADDITIONAL COMMENTS:

PEDESTRIAN TRAFFIC:

- > At CW1:
- > NB at ELM & SIXTH:
- > SB at ELM & SIXTH:
- > EB at ELM & SIXTH:
- > WB at ELM & SIXTH:

BICYCLES (give directions & quantities)

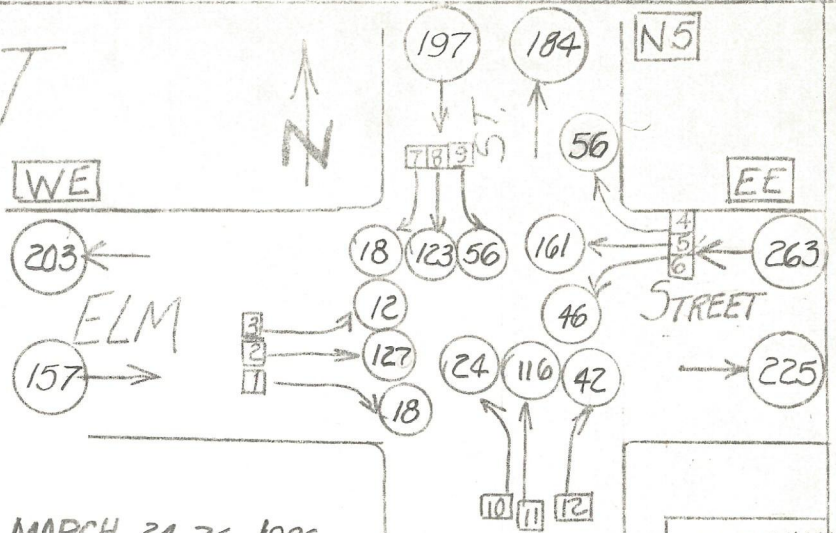
continue northbound through the intersection (FIG III).

Despite the traffic back-ups on 6th St., the decision to reverse the stop signs at 6th and Elm and give Elm the right-of-way was a good one for two reasons. First, the traffic flow on Elm is significantly higher, as it ranges from 530 vph on the west side of 6th to 706 vph on the east side of 6th (FIG I). Second, there is a high volume of left turn traffic from Elm to 6th at the intersection, as 32% of westbound Elm St. turns left to go southbound on 6th St. (FIG III).

Not only is there high vehicular traffic in the vicinity of Elm and 6th, there is also high pedestrian traffic in the area. At the immediate intersection, there is an average flow of 19 pedestrians per hour per approach (pphpa) (there are four approaches to the intersection). Along with this, 67 pedestrians per hour (pph) cross 6th at a crosswalk 200' south of Elm St. (CW 1) at Loeb Residence Hall Group (FIG 1, FIG I).

As noted earlier, for the sake of aiding analysis, additional streets besides 6th have been included in the evaluation area. The street which would probably be most affected by any changes to 6th St. is 5th St., since it is parallel to 6th. As can be seen from FIG IV, most of the traffic at 5th and Elm is through traffic, that is, it is going straight on through the intersection instead of making any turns at the intersection. For 5th, the flow changes from 369⁴ vph south of Elm to 381 vph north of Elm, with 62% of the southbound and 64% of the northbound 5th St. traffic continuing in the same direction (going straight through the intersection) (FIGS IV & VI)⁵. For Elm, the values are 360 vph west of 5th and 488⁶ vph east of 5th, with 81% of the eastbound and 61%

FIFTH STREET EVALUATION AREA - NORTH SECTOR



DATE: MONDAY-WEDNESDAY, MARCH 24-26, 1986

TIME: 7:58AM - 5:18PM

WEATHER CONDITIONS:

McREYNOLDS
HALL

NOTE: all
numbers
are hourly
flow

ADDITIONAL COMMENTS:

Figures for Fifth Street could be slightly altered by construction at the UMC Power Plant.

PARKING

LOT

M5 is the location of the "imaginary" crosswalk

M5

McDAVID
HALL

PEDESTRIAN TRAFFIC:

> At M5: 40

> NB at ELM & FIFTH: 19

> SB at ELM & FIFTH: 24

> EB at ELM & FIFTH: 6

> WB at ELM & FIFTH: 9

BICYCLES (give directions & quantities)

3 - 1; 4 - 2; 5 - 2; 8 - 3; 9 - 1; 11 - 1

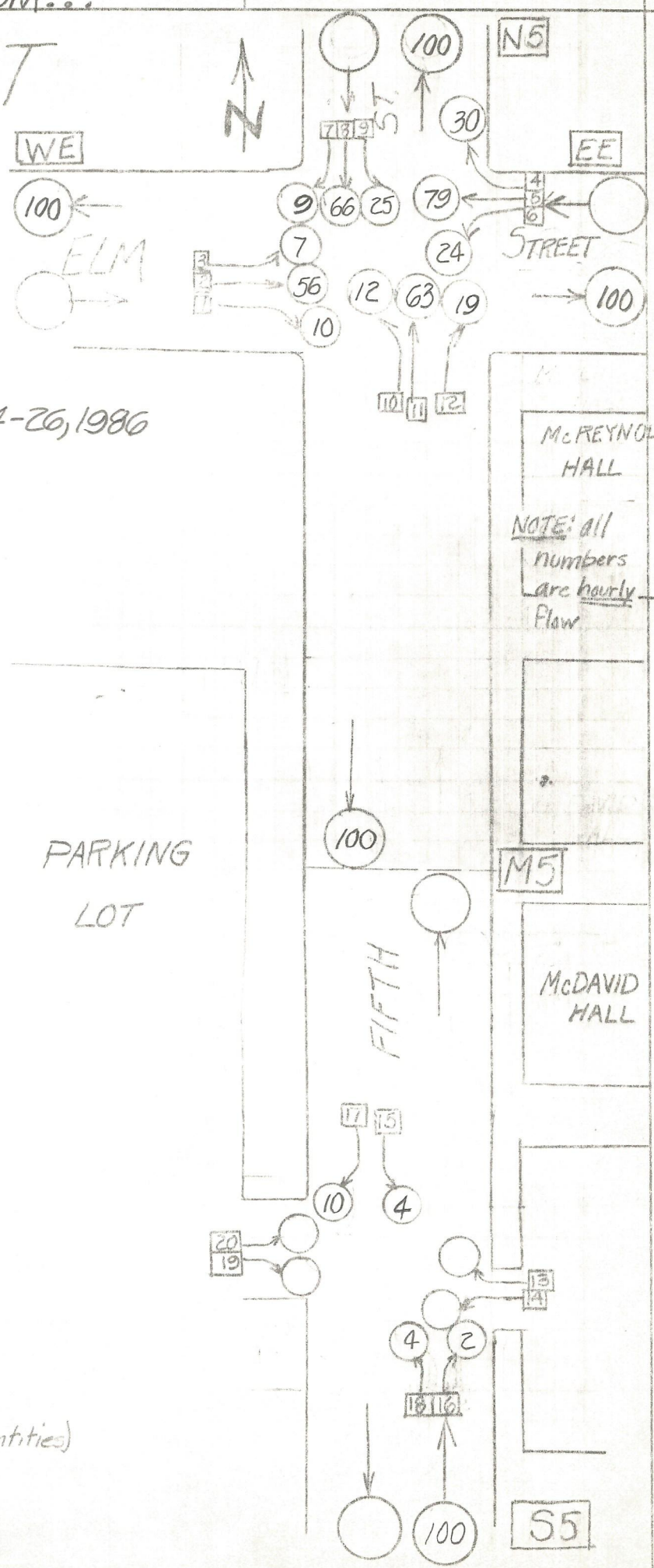
FIFTH

55

WHERE THEY COME FROM...

FIFTH STREET EVALUATION AREA

NORTH SECTOR



DATE: Mon. - Wed., March 24-26, 1986

TIME: 7:50 AM - 5:20 PM

WEATHER CONDITIONS:

ADDITIONAL COMMENTS:

PARKING
LOT

McREYNOLDS
HALL

NOTE: all
numbers
are hourly
flow

M5

McDAVID
HALL

PEDESTRIAN TRAFFIC:

> At M5:

> NB at ELM & FIFTH:

> SB at ELM & FIFTH:

> EB at ELM & FIFTH:

> WB at ELM & FIFTH:

BICYCLES (give directions & quantities)

FIFTH STREET EVALUATION AREA - NORTH SECTOR

DATE: Monday - Wednesday, March 24-26, 1986

TIME: 7:50 AM - 5:20 PM

WEATHER CONDITIONS:

ADDITIONAL COMMENTS:

PARKING
LOT

PEDESTRIAN TRAFFIC:

> At M5:

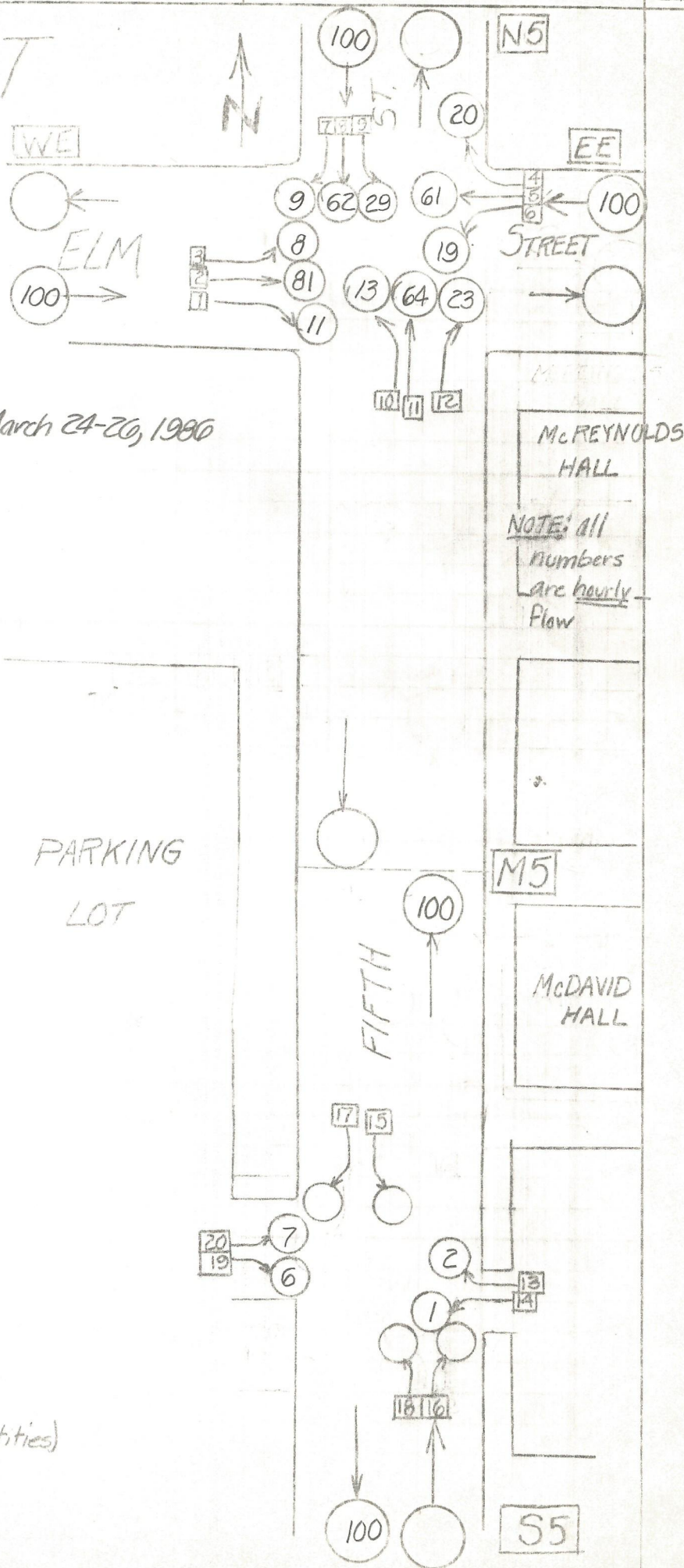
> NB at ELM & FIFTH:

> SB at ELM & FIFTH:

> EB at ELM & FIFTH:

> WB at ELM & FIFTH:

BICYCLES (give directions & quantities)



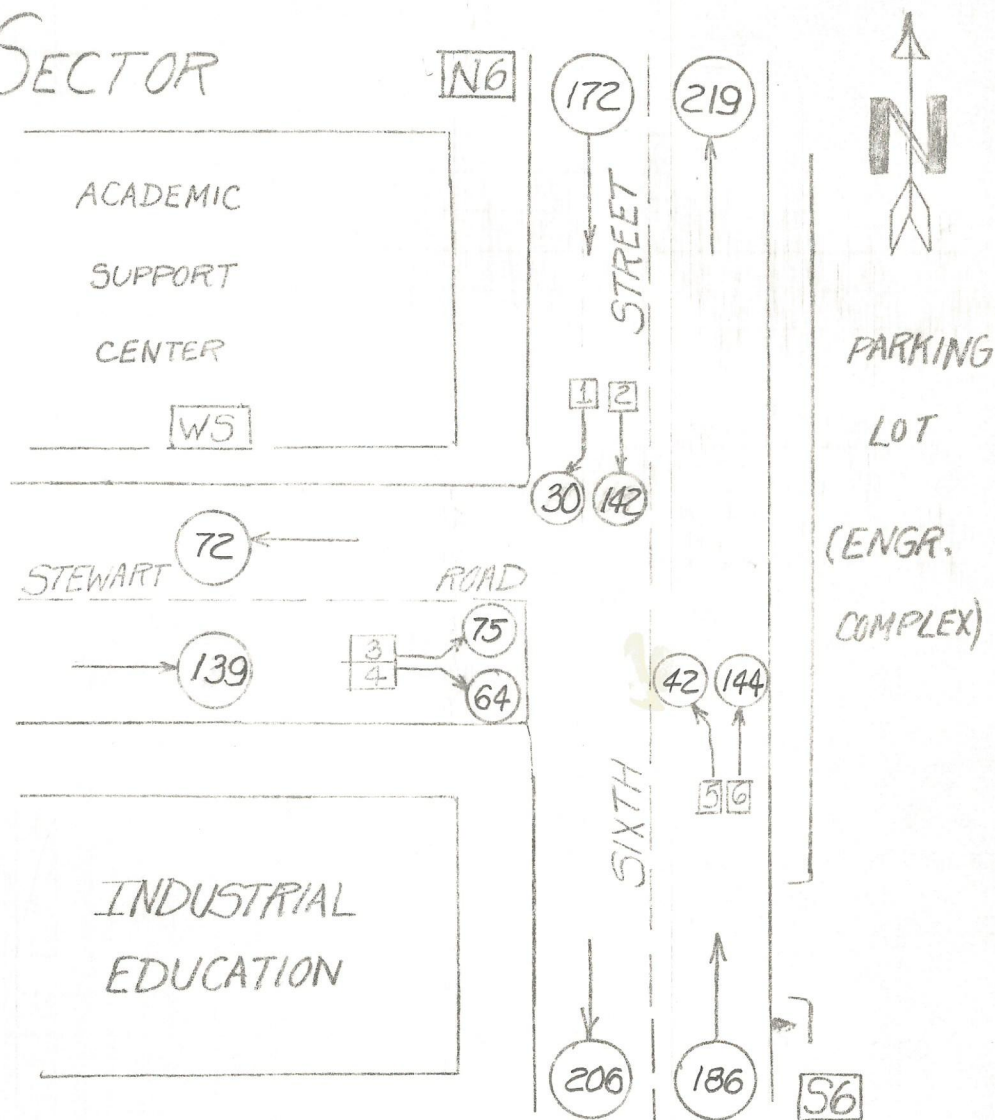
of the westbound traffic continuing in the same direction.

The total volume of traffic on 5th south of Chestnut St., 315 vph, is approximately 80% of the 406 vph for 6th St. at an analogous location (FIG 1)⁶. Similarly, the pedestrian traffic at the intersection of 5th and Elm is approximately 80% of the pedestrian traffic at 6th and Elm, or 15 pphpa. Moving 200' south of Elm on 5th, there is no marked crosswalk on 5th like there is on 6th. However, there is an "imaginary" crosswalk, that is although there is no marked crosswalk, the volume is high enough that it is as if a crosswalk exists. The flow of 40 pph at the "imaginary" crosswalk is partially due to the fact that the "imaginary" crosswalk connects a sidewalk from Loeb Group to the parking lot across the street.

Moving south to 6th and Stewart, the flow on 6th St. north of Stewart (391 vph)⁷ is approximately equal to the flow on 6th south of Stewart (392 vph)⁸ (FIG VII). There are several factors involved in this equality. First, the traffic on Stewart is distributing fairly evenly, as 54% of the traffic on eastbound Stewart turns north onto 6th, while the remaining 46% turns south onto 6th (FIG IX). Second, the compositions of traffic for 6th southbound south of Stewart and 6th northbound north of Stewart are approximately equal. That is, for southbound 6th south of Stewart, 69% of the traffic is 6th St. traffic continuing on in the same direction, and 31% comes from Stewart. For 6th northbound north of Stewart, 66% comes from 6th and 34% from Stewart. For 6th northbound north of Stewart and 6th southbound south of Stewart, the percentages of traffic that come from 6th and Stewart are approximately equal (FIG VIII).

SIXTH STREET EVALUATION AREA

- SOUTH SECTOR



DATE:

TIME:

WEATHER CONDITIONS:

ADDITIONAL COMMENTS: All numbers (~~except for bicycles~~) adjusted for hourly flow.

PEDESTRIAN TRAFFIC

- > N. side Stewart Road (crossing Sixth Street): 34
- > S. side Stewart (crossing 6th): 78
- > W. side 6th (crossing Stewart): 71

BICYCLES (dir. & quantity)

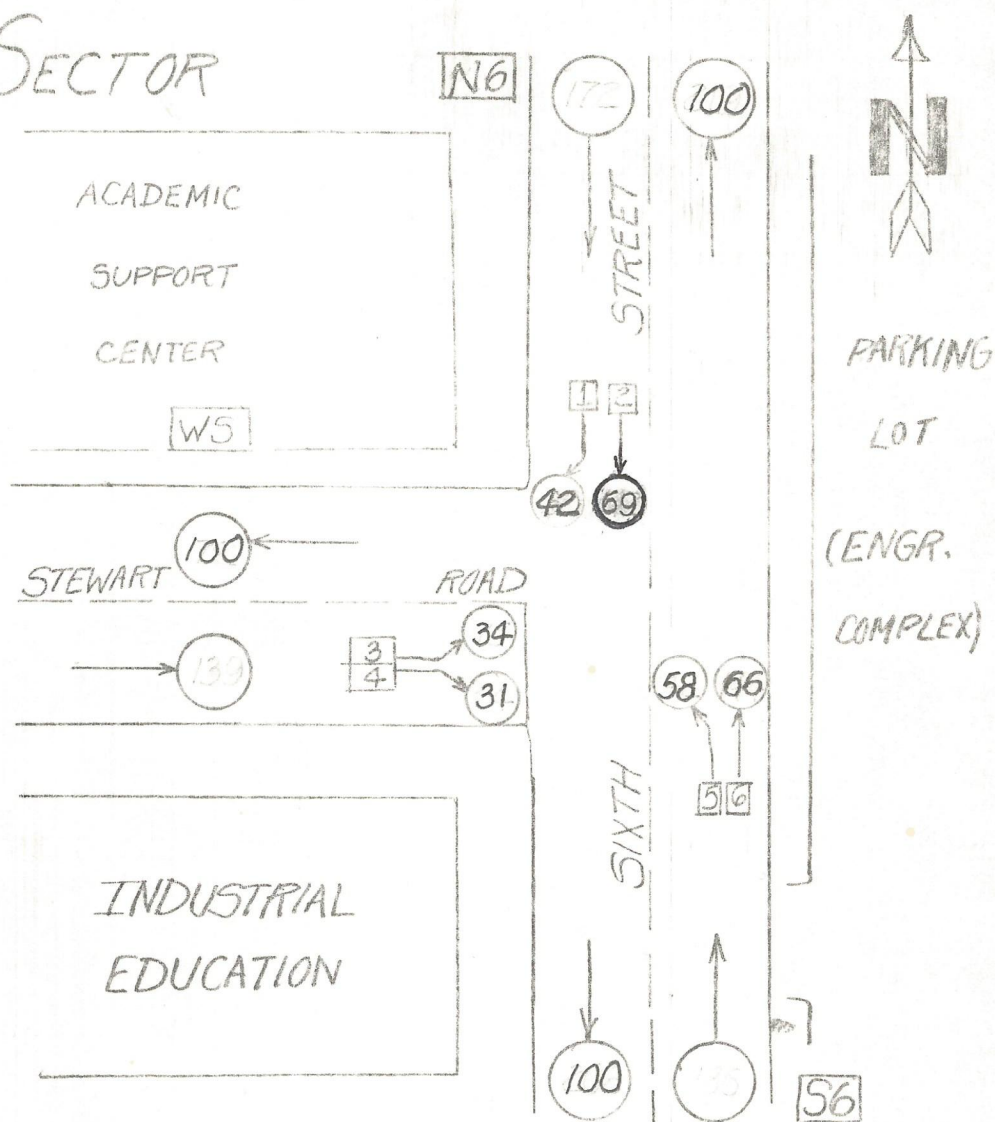
- 1-2; 2-2; 3-4;
- 4-1; 5-3; 6-3

WHERE THEY COME FROM...

--4B--

SIXTH STREET EVALUATION AREA

- SOUTH SECTOR



DATE:

TIME:

WEATHER CONDITIONS:

ADDITIONAL COMMENTS: All numbers (except for bicycles) adjusted for hourly flow.

PEDESTRIAN TRAFFIC

> N. side Stewart Road (crossing Sixth Street): 34

> S. side Stewart (crossing 6th): 75

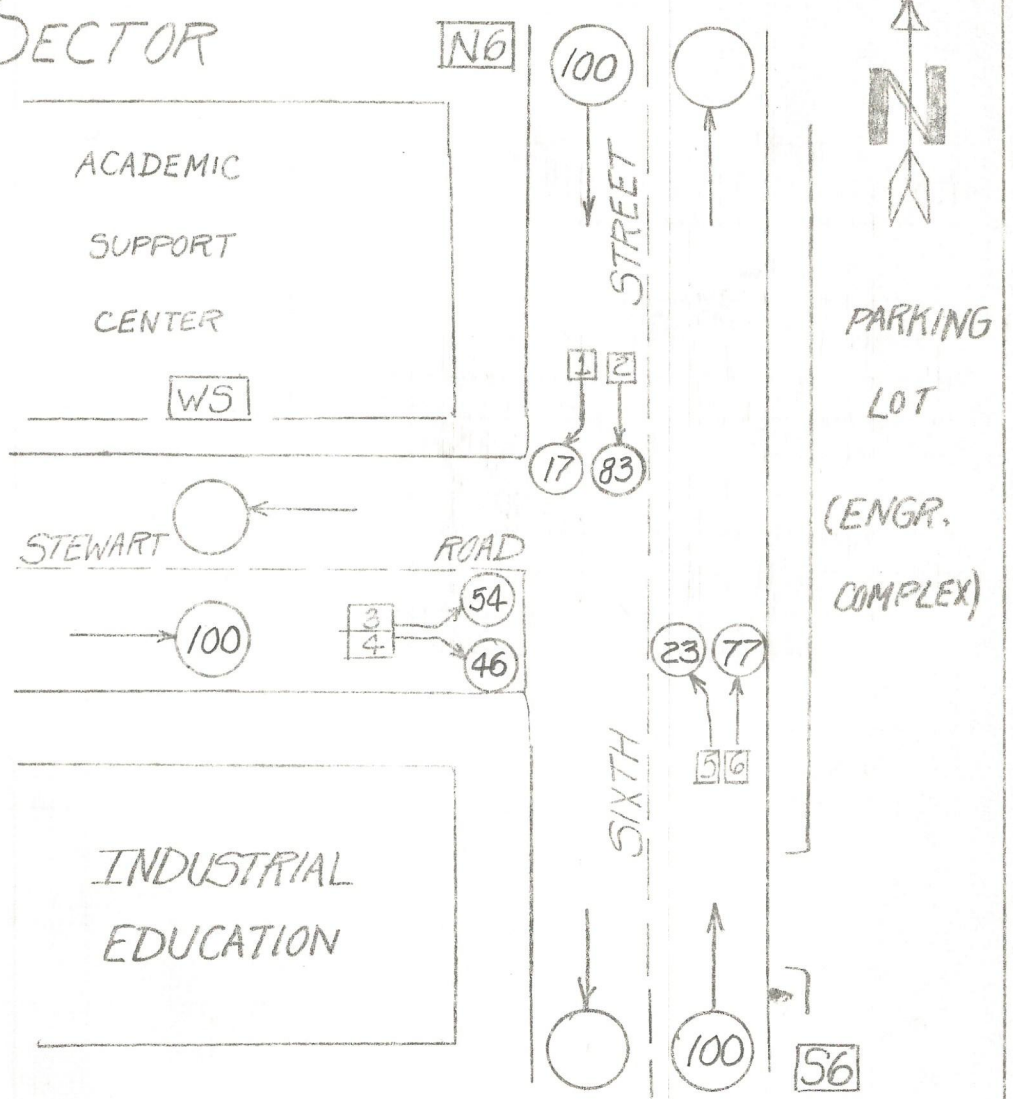
> W. side 6th (crossing Stewart): 75

BICYCLES (dir. & quantity):

... AND WHERE THEY GO

SIXTH STREET EVALUATION AREA

- SOUTH SECTOR



DATE:

TIME:

WEATHER CONDITIONS:

ADDITIONAL COMMENTS: All numbers (except for bicycles) adjusted for hourly flow.

PEDESTRIAN TRAFFIC

- > N. side Stewart Road (crossing Sixth Street):
- > S. side Stewart (crossing 6th):
- > W. side 6th (crossing Stewart):

BICYCLES (dir. & quantity):

The intersection of 6th and Stewart has a relatively high flow of pedestrians and bicycles. The pedestrian flow at the intersection is 61 pphpa (FIG VII), as compared to the 19 pphpa for 6th and Elm and the 15 pphpa for 5th and Elm. The bicycle flow for 6th and Stewart is 5 bicycles per hour per approach (bphpa) (FIG VII), as compared to 3 bphpa for 5th and Elm (FIG IV) and 1 bphpa for 6th and Elm (FIG I). Moving west on Stewart, at the intersection of 5th and Stewart the pedestrian and bicycle flow rates drop to 33 pphpa and 4 bphpa, respectively (FIG X).

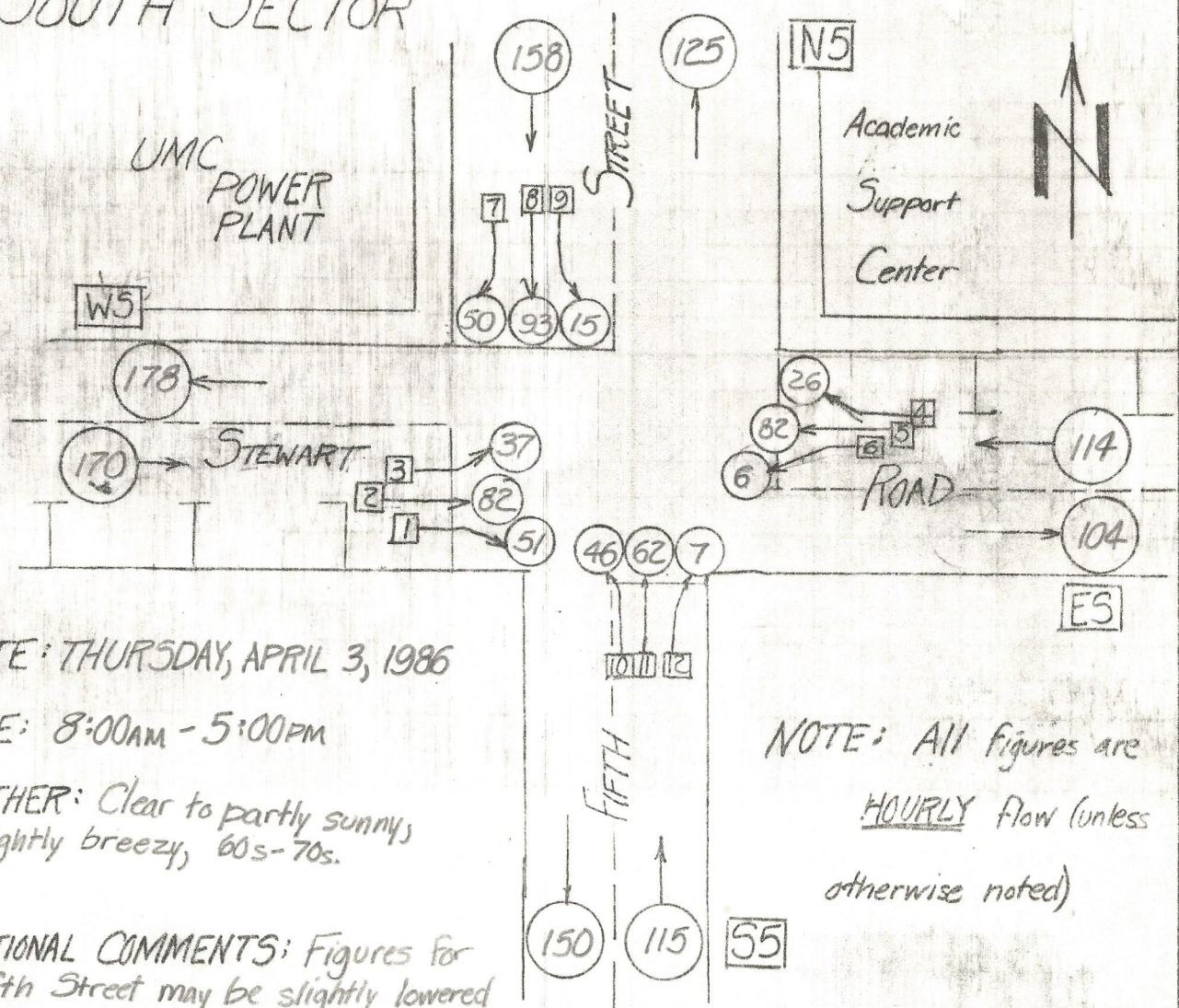
At 5th and Stewart, the flow on 5th changes from 283 vph⁹ north of Stewart to 265 vph south of Stewart, a 6% drop in flow.¹⁰ (FIG X) For Stewart, the change in flow is more severe. The flow on Stewart east of 5th is 218 vph.¹¹ West of 5th, the flow jumps to 348 vph, (FIG X) a 60% increase. There are several reasons for this increase. First, only 46% of the westbound traffic on Stewart west of 5th comes from Stewart east of 5th. 28% of the westbound Stewart traffic comes from southbound 5th St. traffic (north 5th St. approach), with the remaining 26% coming from northbound 5th St. traffic (south 5th St. approach) (FIG XI). Second, only 48% of the eastbound Stewart Rd. traffic west of 5th continue in the same direction, as 30% of the eastbound Stewart traffic west of 5th turns south onto 5th, with the remaining 22% turning north onto 5th.

IV. EVALUATION OF TRAFFIC PATTERNS IN EA

FIG 2 shows the directions of primary flow within the EA. By studying the figure and the intersection analyses, the following conclusions may be made.

FIFTH STREET EVALUATION AREA

SOUTH SECTOR



DATE: THURSDAY, APRIL 3, 1986

TIME: 8:00AM - 5:00PM

WEATHER: Clear to partly sunny,
slightly breezy, 60s-70s.

ADDITIONAL COMMENTS: Figures for
Fifth Street may be slightly lowered
because of construction at Power Plant.

NOTE: All figures are
HOURLY flow (unless
otherwise noted)

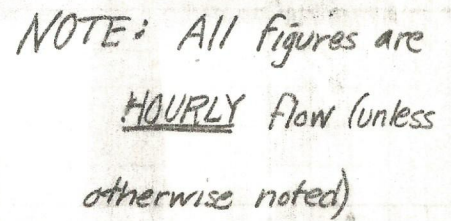
PEDESTRIAN TRAFFIC:

- > NORTH side 5th & Stewart (crossing 5th): 24
- > SOUTH side: 56
- > EAST side (crossing Stewart): 34
- > WEST side: 16

BICYCLES — Give direction & quantity:

1-1 ; 2-6 ; 5-5 ; 10-1

FIFTH STREET EVALUATION AREA
SOUTH SECTOR



ADDITIONAL COMMENTS:

PEDESTRIAN TRAFFIC:

> NORTH side 5th & Stewart (crossing 5th):

> SOUTH side :

→ EAST side (crossing Stewart):

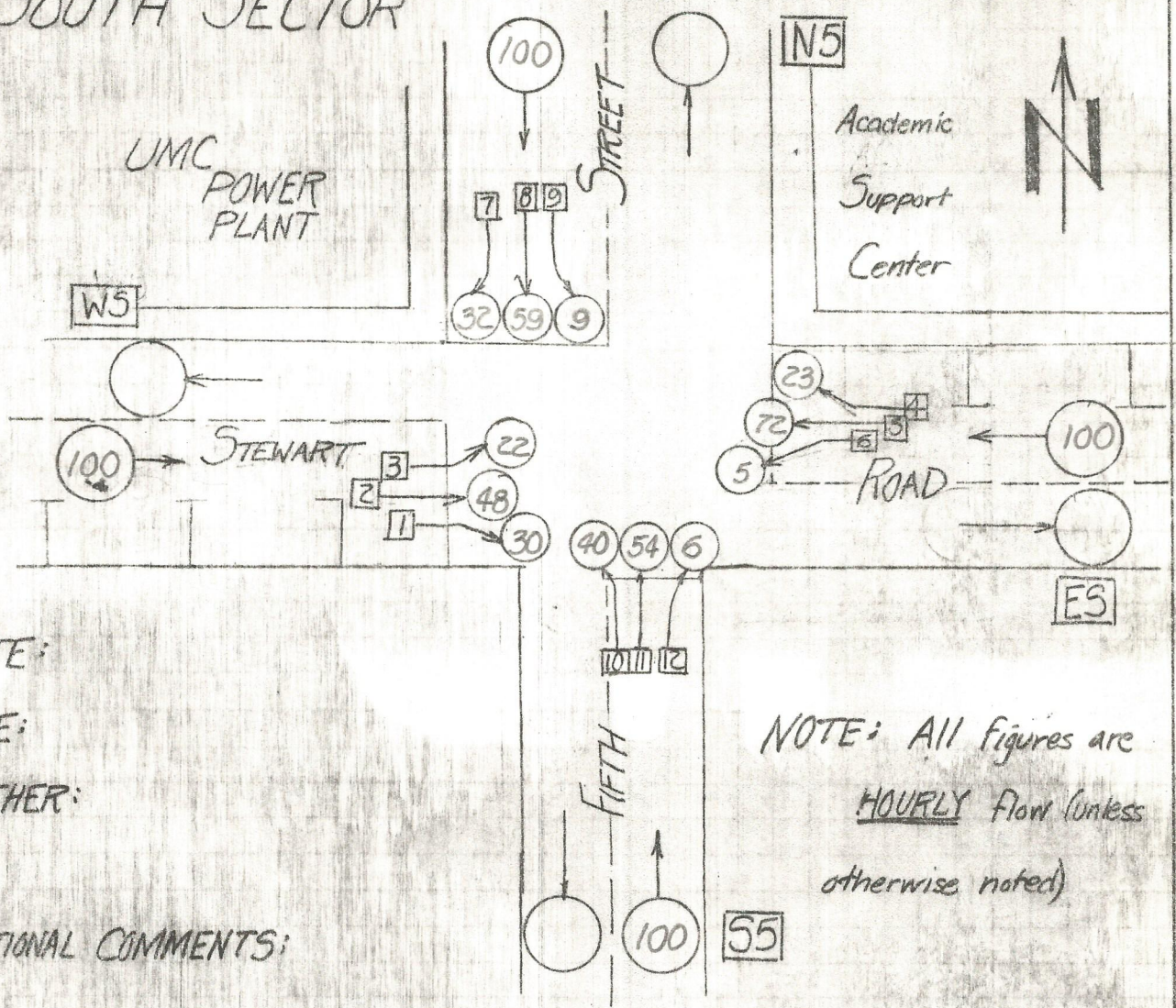
7 WEST side:

BICYCLES — Give direction & quantity.

AND WHERE THEY GO...

FIFTH STREET EVALUATION AREA

SOUTH SECTOR



DATE:

TIME:

WEATHER:

ADDITIONAL COMMENTS:

NOTE: All figures are
HOURLY flow (unless
otherwise noted)

PEDESTRIAN TRAFFIC:

> NORTH side 5th & Stewart (crossing 5th):

> SOUTH side:

> EAST side (crossing Stewart):

> WEST side:

BICYCLES — Give direction & quantity:

- a) The primary flow on Sixth Street is between Elm Street east of Sixth and Conley Avenue east of Sixth Street
- b) The primary flow on Fifth Street is between Stewart Road west of Fifth, Conley Avenue east of Fifth, and downtown (because of the relatively little flow exchanged between 5th and Elm)

Several driving patterns in the EA were observed. First, very few vehicles travel at the posted speed (many in excess of 10 mph over the posted speed). Second, most vehicles refuse to stop for pedestrians in crosswalks, despite the fact that it states in the Missouri Driver Manual that it is state law to stop for all pedestrians in crosswalks. I observed that not only do people drive fast and not stop for pedestrians, I have seen vehicles speed up at the sight of pedestrians, many near-collisions between vehicles and pedestrians, and even two vehicles drag racing down Sixth Street.

Because of this imprudent driving, the high number of vehicles using Sixth St., and the high number of pedestrians crossing Sixth St., the probability of pedestrian-vehicle collision is high. Therefore, something must be done to alter this situation.

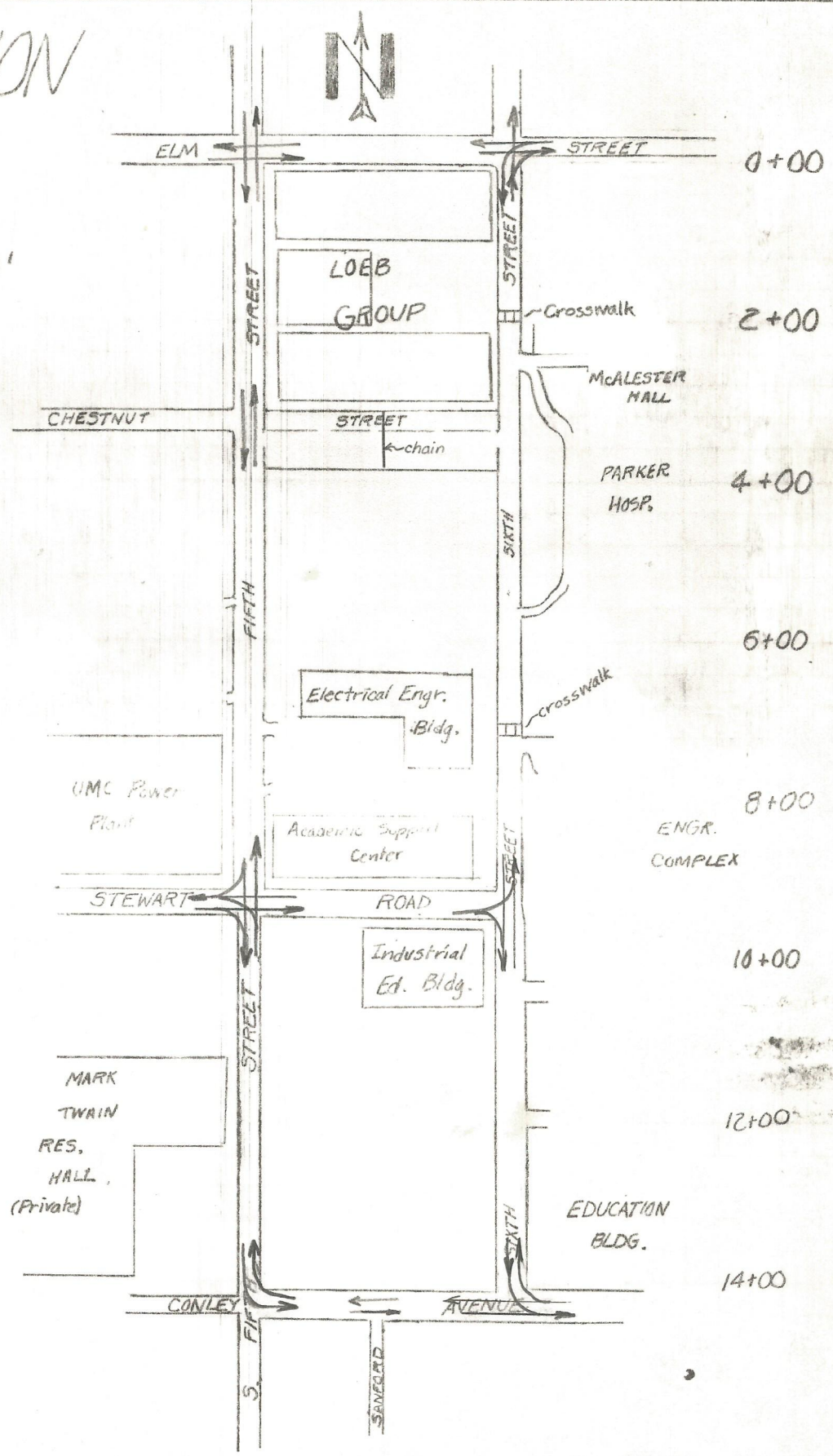
V. RECOMMENDATION FOR IMPROVEMENT

There are several different alternatives to solving this situation. Closing the street is considered by many to be the best alternative. However, closing the street could have grave consequences. First of all, it would close off access to all the buildings served by Sixth St., which are numerous. Second, it would force all of the traffic onto Fifth St., which would just be creating new problems.

DIRECTIONS OF TRAFFIC FLOW AT INTERSECTIONS

EVALUATION
AREA

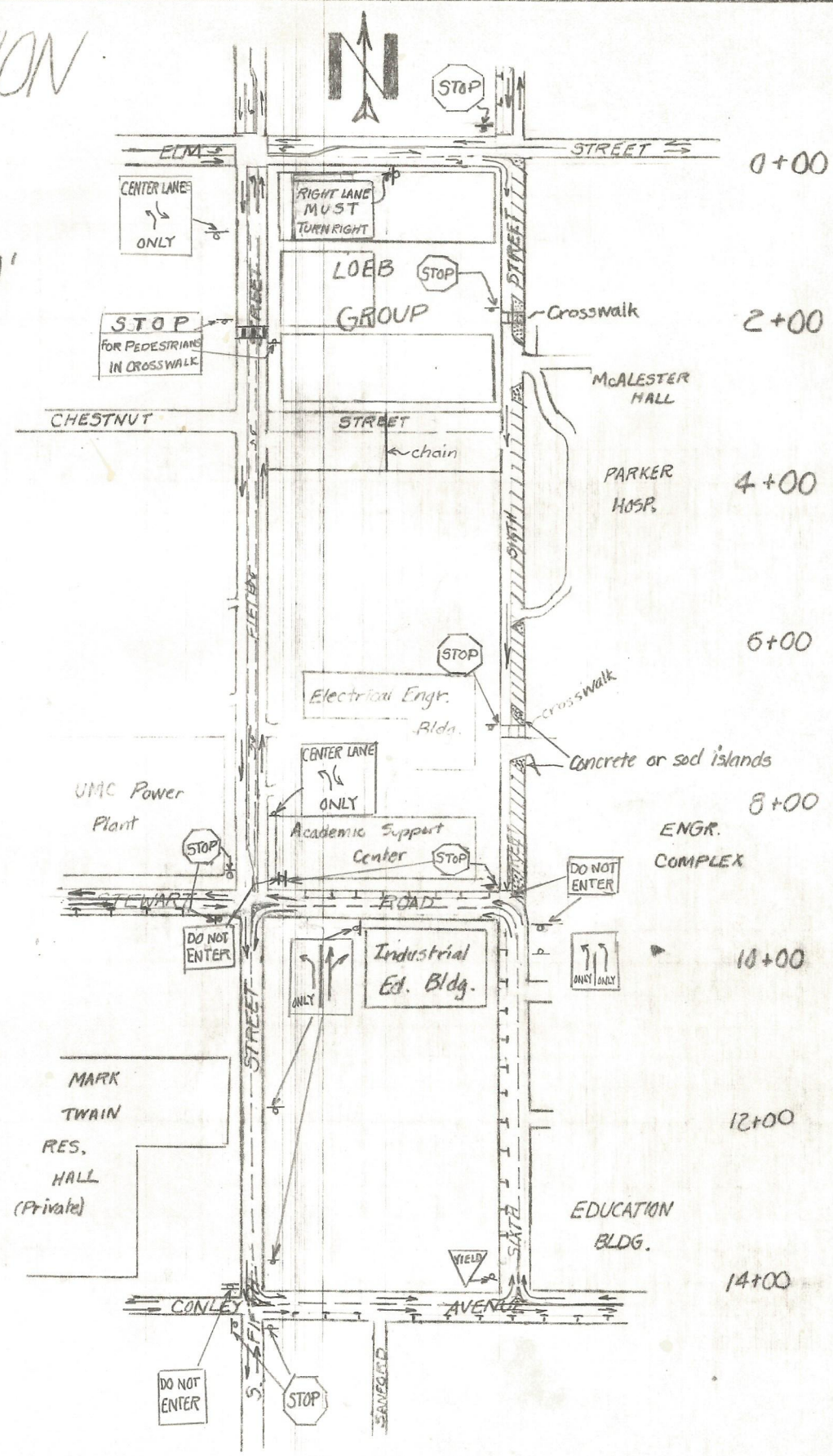
Scale 1"=200'



FADMASTER®
Made in USA

EVALUATION AREA

Scale 1"=200'



MADE IN U.S.A.
PADMASTER®

A second, more viable option is to keep Sixth the way it is and add stop signs at the crosswalks. This would take care of the problem of pedestrian-vehicle confrontations, but would not solve Sixth's traffic problem, such as the back-up of northbound traffic at Sixth and Elm during peak hours.

My recommendation, shown in FIG 3, calls for making Sixth one-way southbound, since this is the direction of least traffic flow (FIG 1). Sixth would consist of one 12' lane on the west-side of the street. The remaining 18' of the street would be used for 45-degree angle parking. Stop signs would be installed at all crosswalks. Sixth would only be accessible to eastbound Elm St., and would empty out onto westbound Stewart Road. This would serve several purposes. First, buildings along Sixth would still be accessible. Second, it would create new parking, which is so desperately needed. Third, it would greatly reduce the flow of traffic, as Sixth would no longer provide an easy through route.

In order to provide for the extra traffic, Fifth between Stewart and Elm would be restriped for three lanes (two 12' through lanes, one 14' turning lane) with parking prohibited. A crosswalk would be striped between Loeb Group and the parking lot, with stop signs for traffic at the crosswalk.

Elm St. would be restriped for three lanes between 5th and 6th, with two 12.5' through lanes and one 11' right turn only lane from eastbound Elm onto Sixth. The block bounded by Sixth, Conley, Fifth and Stewart would be turned into a two lane counterclockwise one-way system, with concrete islands placed at the appropriate intersections. Lane width on this system would be 12'.

INDEX

- 1 Traffic figures taken from traffic counts performed from 7:50 AM to 5:30 PM at the various intersections.
- 2 Non-adjusted flow. (ADJUSTED FLOW at a point common to two different intersection analyses is equal to the average of the separate flows.)
- 3 Percentage based on non-adjusted flow.
- 4 Non-adjusted flow.
- 5 Percentage based on non-adjusted flow.
- 6 Adjusted flow.
- 7 Non-adjusted flow.
- 8 Derived from non-adjusted flows.
- 9 Non-adjusted flow.
- 10 Based on non-adjusted flow.
- 11 Non-adjusted flow.