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MICHIGAN DEPARTMENT OF STATE HIGHWAYS AND TRANSPORTATION

CAPACITY AND LEVEL

OF SERVICE ANALYSIS

US-23 BYPASS
SOUTH OF STANDISH

August 25, 1976

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TRANSPORTATION LIBRARY
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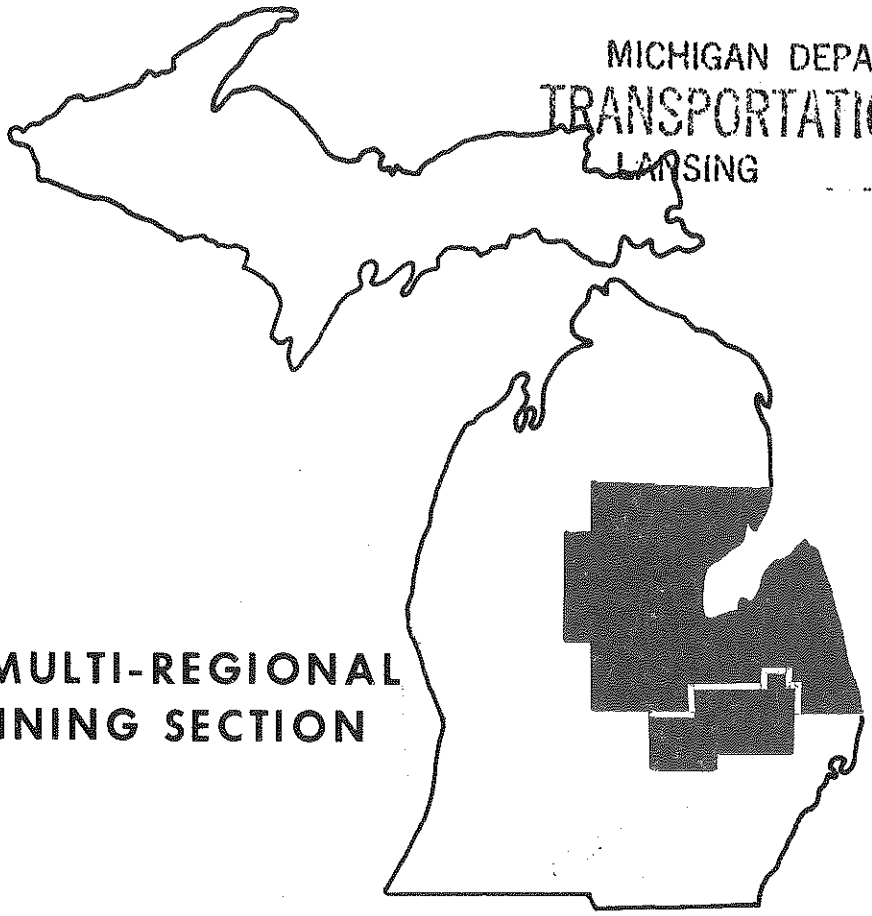

EAST MULTI-REGIONAL
PLANNING SECTION

MICHIGAN DEPARTMENT
OF
STATE HIGHWAYS AND TRANSPORTATION

CAPACITY AND LEVEL

OF SERVICE ANALYSIS

US-23 BYPASS
SOUTH OF STANDISH

August 25, 1976

This report represents the findings and/or professional opinions of the Michigan Department of State Highways and Transportation staff and not an official opinion of the State Highway Commission.

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DEPARTMENT OF STATE HIGHWAYS AND TRANSPORTATION

STATE HIGHWAYS BUILDING, 425 WEST OTTAWA PHONE 517-373-2090
POST OFFICE BOX 30050, LANSING, MICHIGAN 48909

JOHN P. WOODFORD, DIRECTOR

August 25, 1976

Mr. Sam F. Cryderman, Deputy Director
Bureau of Transportation Planning
P. O. Box 30050
Highway Building
Lansing, Michigan 48909

Dear Mr. Cryderman:

Documented in this report are the results of a capacity and level of service analysis for US-23 south of Standish to M-65. Included are tables, maps and summaries of data obtained to supplement previous traffic analysis conducted as part of a Corridor Location Study.

This report was prepared by Transportation Planner Joseph F. Valente, under the supervision of Robert M. Kirkbride. Both are under the supervision of Maynard A. Christensen of the East Central Multi-Regional Section.

Sincerely,

William C. Hartwig for

Keith E. Bushnell, Administrator
Multi-Regional Planning Division

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

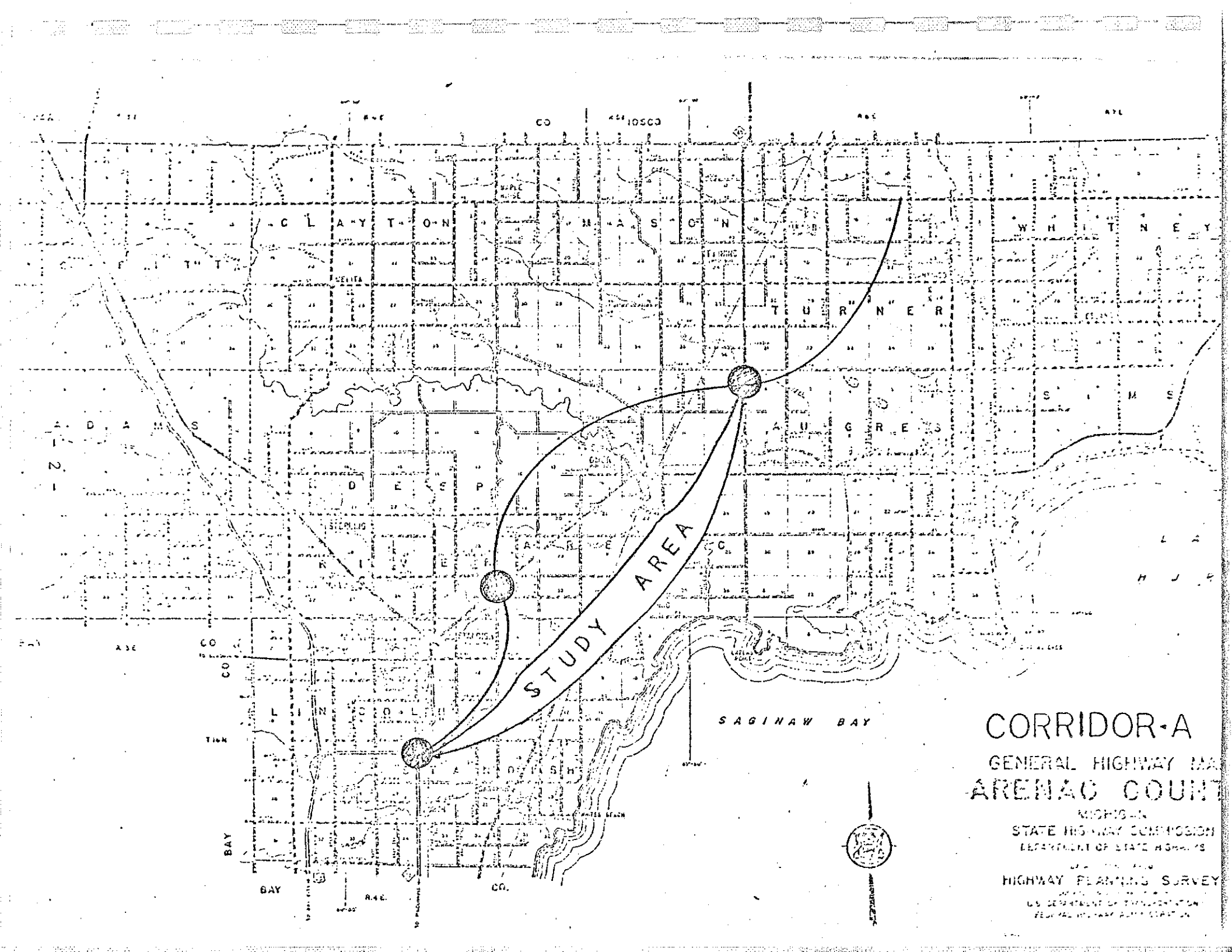
MICHIGAN The Great Lake State

TABLE OF CONTENTS

INTRODUCTION

This report presents the results of a capacity and level of service analysis for US-23 south of Standish to M-65. Data furnished is intended to supplement previous traffic analysis conducted as part of a corridor location study.

Alternatives considered were Do-Nothing, Corridor "A", and Corridor "B". The three alternatives were also analyzed with parking and without parking, as parking is a critical element requiring consideration in order to establish capacity. Other elements required, and which were used to determine capacity and level of service, were lane, width, percent commercial vehicle traffic, percent sight restriction, practical hourly capacity, urban and rural segments of US-23, population and terrain. One element limiting, and often interrupting the flow of traffic on a highway, especially one in an urban area, is the intersection at grade. Because so many factors influence interrupted flow through intersections, it is not feasible to define "ideal conditions" as was done in the above mentioned corridors. Rather, interrupted flow criteria was developed around typical or average conditions. Factors used to adjust hourly capacity on rural roads were obtained by using level of service "C" for ideal conditions and level of service "D" was used for urban segments.


CLAYTON
MASCON
WHITNEY
TURNER
DEEP
AUGRES
SIMS
ADAMS
STUDY AREA
SAGINAW BAY
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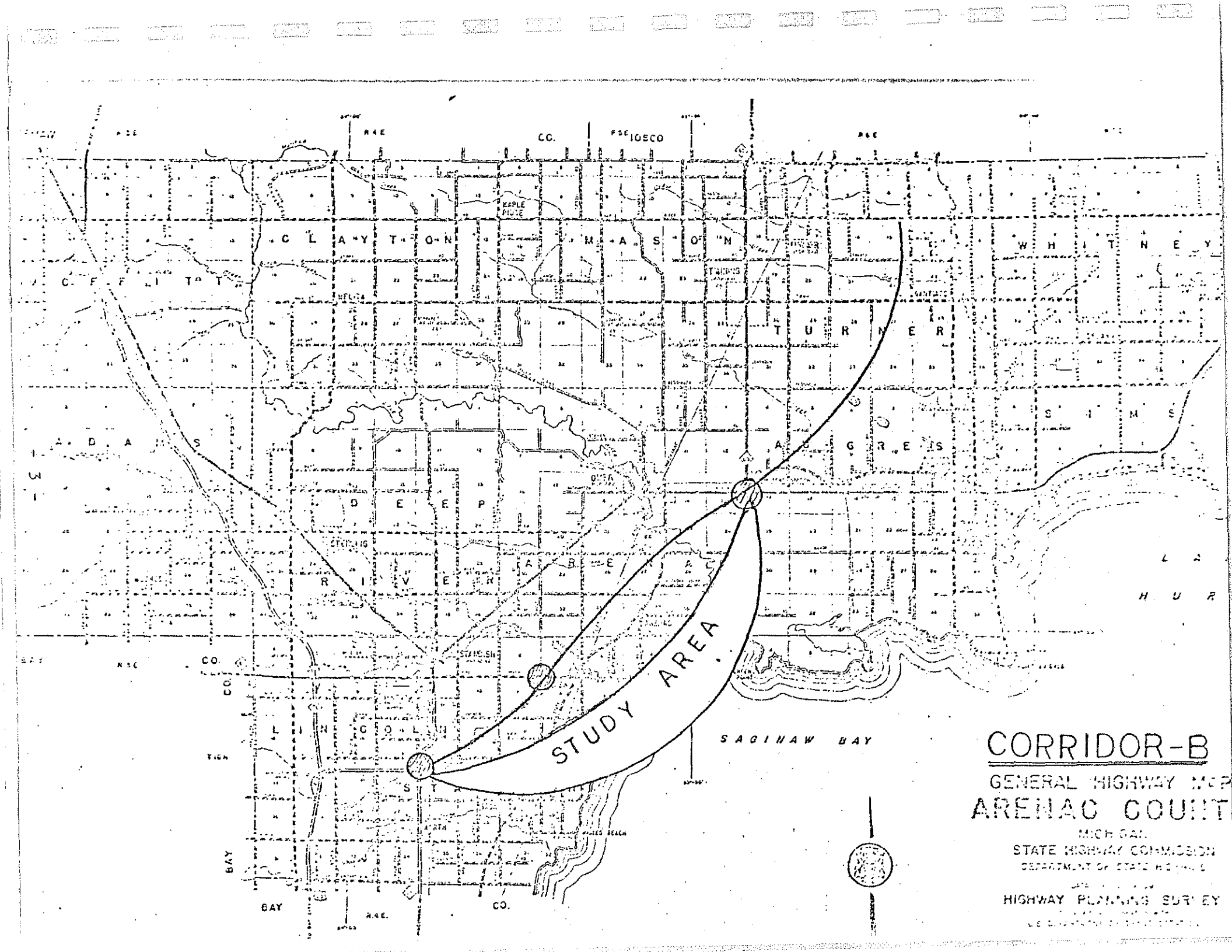
CO.
R4E.
CORRIDOR-A
GENERAL HIGHWAY MA
ARENAC COUNT
STATE HIGHWAY COMMISSION
HIGHWAY PLANNING SURVEY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ADAMS
DEEP
RIVER
AUGRES
SAGINAW BAY
STUDY AREA
BAY
CO.
CORRIDOR-B
GENERAL HIGHWAY MAP
ARENAC COUNTY
MICHIGAN
STATE HIGHWAY COMMISSION
HIGHWAY PLANNING SURVEY

PROCEDURES FOR DETERMIND CAPACITY AND LEVEL OF SERVICE

Capacity Analysis

Separate procedures are required for rural and urban capacity determinations.

Rural Highway sections capacity is determined as CXWXAXT = Capacity C = Practical hourly capacity based upon a highway, which has 12-foot lanes, perfect alignment and no truck traffic. "C" is bi-directional for undivided highways and directional for divided highways.

W = Factor for lane width less than 12 feet.

A = Factor based upon percent sight restriction.

T = Factor based on percent commercial vehicle traffic.

The capacity value "C" is taken from Table 10.7 page 302 of the Highway Capacity Manual 1965. The alignment factor "A" is based on the percent of passing sight distance restriction by the total section length. The values for the alignment factors were taken from the Highway Capacity Manual 1965 and the percents from the Michigan Highways 1974 Sufficiency Rating.

The width factor "W" is based on the average lane width with 12-foot lanes considered as the maximum. These factors are shown in the Highway Capacity Manual 1965. The truck factor "T", including Terrain, were taken from the Highway Capacity Manual 1965,

the percent of commercial vehicles was taken from the Standish External O&D Survey 1973.

Urban Capacity Determination

For an urban section of highway, capacity is first determined on the basis of an urban intermediate area with a population of 1,000,000 and then factored, based on population of the urban area. Capacities represent conditions at level of service "D" with a peak hour factor of 0.85. Capacity is adjusted based on type of parking. Practical hourly capacities for two-way urban streets, based on surface width and type of parking, were taken from Highway Capacity Manual 1965. These capacities properly factored based on population are for intermediate areas which include the fringe areas, the outlying business districts, and residential areas as defined on page 19 of the Highway Capacity Manual 1965. For the central business district a land use factor is used.

Level of Service

Once the capacity has been determined for the appropriate roadway segment it is divided into the 30th high hour. The result being the V/C ratio or level of service. Level of service is a qualitative measure of the effect of a number of factors, which includes speed and travel time, traffic interruptions, freedom to maneuver, safety, driving comfort and convenience, and operating costs. The V/C ratios once known are converted to levels of service by use of the chart on page 6 of Michigan's Statewide Traffic Forecasting Model Volume 1-H 1973. A ratio of 1.00, equivalent to level "C", or less indicates the level of service is adequate, a ratio greater than 1.00 indicates a capacity deficiency.

Average Daily Traffic (ADT) and Design Hour Volume DHV (30th High Hour) were used on the data compiled in T.A.R. #276-B. ADT's and DHV's were projected for the years 1982, 1985, 1990, 1995 and 2000 with the base year being 1971. In addition to the data given traffic was forecasted, for the mentioned years, for the urban segments of US-23 in Standish and Omer. These predictions will follow in this report.

RESEARCH MATERIAL USED TO DETERMINE CAPACITY AND LEVEL OF SERVICE

1. Field Review
2. T.A.R. #276-B, February, 1976.
3. Highway Capacity Manual 1965.
4. Standish External Origin-Destination Survey 1974.
5. Michigan Highway 1974 Sufficiency Rating.
6. Michigan Statewide Traffic Forecasting Model Vol. 1-H 1973.
7. "Population Projections of the Counties of Michigan" State of Michigan Research Division, Bureau of Programs and Budget

MAJOR FACTORS INFLUENCING FUTURE DEVELOPMENT ALONG CORRIDORS A AND B

Existing US-23 will continue to provide services where productions are confined to the local areas. It will further serve as a primary collector of traffic destined for freeway travel. Owing to the various recreational attractors, the predominance of volumes on US-23 relocated will be through trips with design hours occuring during the peak recreational season. The bypassing of many of these coastal towns will eliminate the congestion of recreational traffic in those communities.

Based upon the proposed alignments, US-23 will bypass the city of Standish, the following assumptions are made:

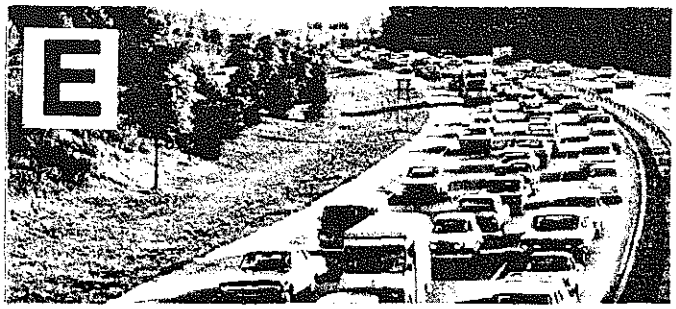
1. Provision of a more direct and efficient route north from Saginaw, Bay City area to existing US-23 northeast of Standish.
2. Trips with origins and destinations in the immediate area will continue to utilize existing facilities.
3. In view of the fact that US-23 is one of the major north-south corridors and the relation of its alignment west of the lakeshore facilities from Standish, traffic will primarily be recreational with through trips attracted to the limited access facilities.
4. Projected data indicates a sizeable increase in volumes and resultant high design hours during peak recreational activity.

LEVEL OF SERVICE

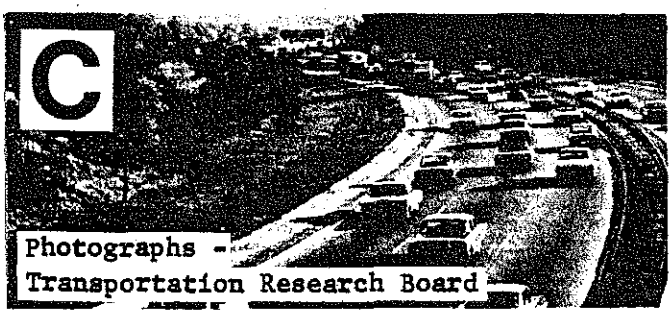
NO RESTRICTION ON OPERATING SPEED

APPROACHING UNSTABLE FLOW - LITTLE FREEDOM TO MANEUVER

STABLE FLOW - FEW SPEED RESTRICTIONS



UNSTABLE FLOW - LOWER SPEED - SOME STOPS



STABLE FLOW - HIGHER VOLUMES - RESTRICTED SPEED and LANE CHANGING

FORCED FLOW OPERATION AT LOW SPEEDS - MANY STOPS

V/C RATIOS AND LEVEL OF SERVICE/US-23

PARKING	DO-NOTHING 1971	DO-NOTHING 1995	CORRIDOR "A" 1982	1985	1990	1995	2000
US-23 From M-65 to Omer	.947 C	1.774 F	1.220 D	1.236 D	1.292 D	1.348 E	1.404 E
Omer Business District	1.076 C	1.960 F	1.216 D	1.314 D	1.407 E	1.514 F	1.606 F
US-23 From Omer to Standish City Limits	1.071 C	2.011 F	.365 A	.365 A	.373 A	.397 A	.414 A
US-23 From C.L. S. to main St./Standish	1.199 D	2.092 F	.426 A	.402 A	.426 A	.484 B	.476 B
Main St. From River St., S. to Beaver St.*	.998 C	1.766 F	.428 A	.450 A	.477 A	.554 B	.570 B
Main St. From Beaver S. to Cedar St.*	1.081 C	1.898 F	.450 A	.472 A	.538 B	.592 B	.636 B
Main St. From Cedar S. to City Limits*	1.152 D	2.019 F	.472 A	.505 A	.581 B	.647 B	.675 B
US-23 From City Limits, S. to By-Pass*	.625	1.218 D	.294 A	.315 A	.347 A	.395 A	.403 A

PARKING	CORRIDOR "B" 1982	1985	1990	1995	2000
US-23 From M-65 to Omer	.225 A	.225 A	.249 A	.265 A	.281 A
Omer Business District	.254 A	.269 A	.300 A	.323 A	.354 A
US-23 From Omer to Standish City Limits	.243 A	.251 A	.276 A	.292 A	.308 A
US-23 From C.L. S. to Main St./Standish	.296 A	.304 A	.328 A	.353 A	.378 A
Main St. From River St. S. to Beaver St.*	.362 A	.373 A	.411 A	.439 A	.477 A
Main St. From Beaver, S. to Cedar St.*	.417 A	.433 A	.488 A	.538 B	.576 B
Main St. From Cedar S. to City Limits*	.527 A	.538 B	.598 B	.636 B	.680 B
US-23 From City Limits, S. to By-Pass*	.307 A	.323 A	.355 A	.379 A	.407 A

V/C RATIOS

LEVEL OF SERVICE	2 LANES	4 LANES
A	0.286	0.400
B	0.643	0.667
C	1.000	1.000
D	1.214	1.200
E	1.428	1.333

*4 LANES

V/C RATIOS AND LEVEL OF SERVICE/US-23

NO PARKING

DO-NOTHING

	1971	1995
US-23, From M-65 to Omer	.947 C	1.774 F
Omer Business District	.947 C	1.724 F
US-23, From Omer to Standish City Limits	1.071 C	2.011 F
US-23, From C.L. S. to Main St./Standish	1.199 D	2.092 F
Main St., From River St., S. to Beaver St.*	.919 C	1.626 F
Main St., From Beaver, S. to Cedar St. *	.995 C	1.754 F
Main St., From Cedar, S. to City Limits*	1.061 C	1.863 F
US-23, From City Limits, S. to By-Pass *	.625 B	1.218 D

CORRIDOR "A"

	1982	1985	1990	1995	2000
US-23, From M-65 to Omer	1.220 D	1.236 D	1.292 D	1.348 E	1.404 E
Omer Business District	1.116 C	1.156 D	1.237 D	1.332 D	1.413 E
US-23, From Omer to Standish City Limits	.365 A	.365 A	.373 A	.397 A	.414 A
US-23, From C.L. S. to Main St./Standish	.426 A	.402 A	.426 A	.484 B	.476 B
Main St., From River St., S. to Beaver St.*	.394 A	.414 A	.439 A	.510 A	.525 A
Main St., From Beaver, S. to Cedar St. *	.414 A	.434 A	.494 A	.545 A	.585 B
Main St., From Cedar, S. to City Limits*	.434 A	.464 A	.535 A	.595 B	.621 B
US-23, From City Limits, S. to By-Pass *	.294 A	.315 A	.347 A	.395 A	.403 A

NO PARKING

CORRIDOR "B"

	1982	1985	1990	1995	2000
US-23, From M-65 to Omer	.225 A	.225 A	.249 A	.265 A	.281 A
Omer Business District	.223 A	.237 A	.264 A	.284 A	.311 A
US-23, From Omer to Standish City Limits	.243 A	.251 A	.276 A	.292 A	.308 A
US-23, From C.L. S. to Main St./Standish	.296 A	.304 A	.328 A	.353 A	.378 A
Main St. From River St. S. to Beaver St.*	.333 A	.343 A	.397 A	.404 A	.439 A
Main St. From Beaver, S. to Cedar St.*	.384 A	.399 A	.449 A	.495 A	.530 A
Main St., From Cedar, S. to City Limits*	.485 A	.495 A	.551 B	.586 B	.626 B
US -23, From City Limits, S. to By-Pass*	.307 A	.323 A	.355 A	.379 A	.407 A

LEVEL OF SERVICE	2 LANES	4 LANES
A	0.286	0.400
B	0.643	0.667
C	1.000	1.000
D	1.214	1.200
E	1.428	1.333

* 4 LANES

V/C RATIOS AND LEVEL OF SERVICE
US-23 FREEWAY BYPASS AROUND STANDISH

CORRIDOR "A"

	1982	1985	1990	1995	2000
EXTENSION FROM M-13 TO US-23	.518 B	.593 B	.939 B	1,098 C	1.304 D
EXTENSION FROM US-23 TO M-65	.355 A	.383 A	.472 B	.537 B	.598 B

CORRIDOR "B"

	1982	1985	1990	1995	2000
EXTENSION FROM M-13 TO PINE RIVER EXIT	.486 B	.556 B	.701 B	.832 B	.981 B
EXTENSION FROM PINE RIVER EXIT TO M-65	.738 B	.869 B	.949 B	1.108 C	1.313 D

BASE AND FUTURE YEAR

TRAFFIC FORECASTS

1971

1982

1985

1990

1995

2000

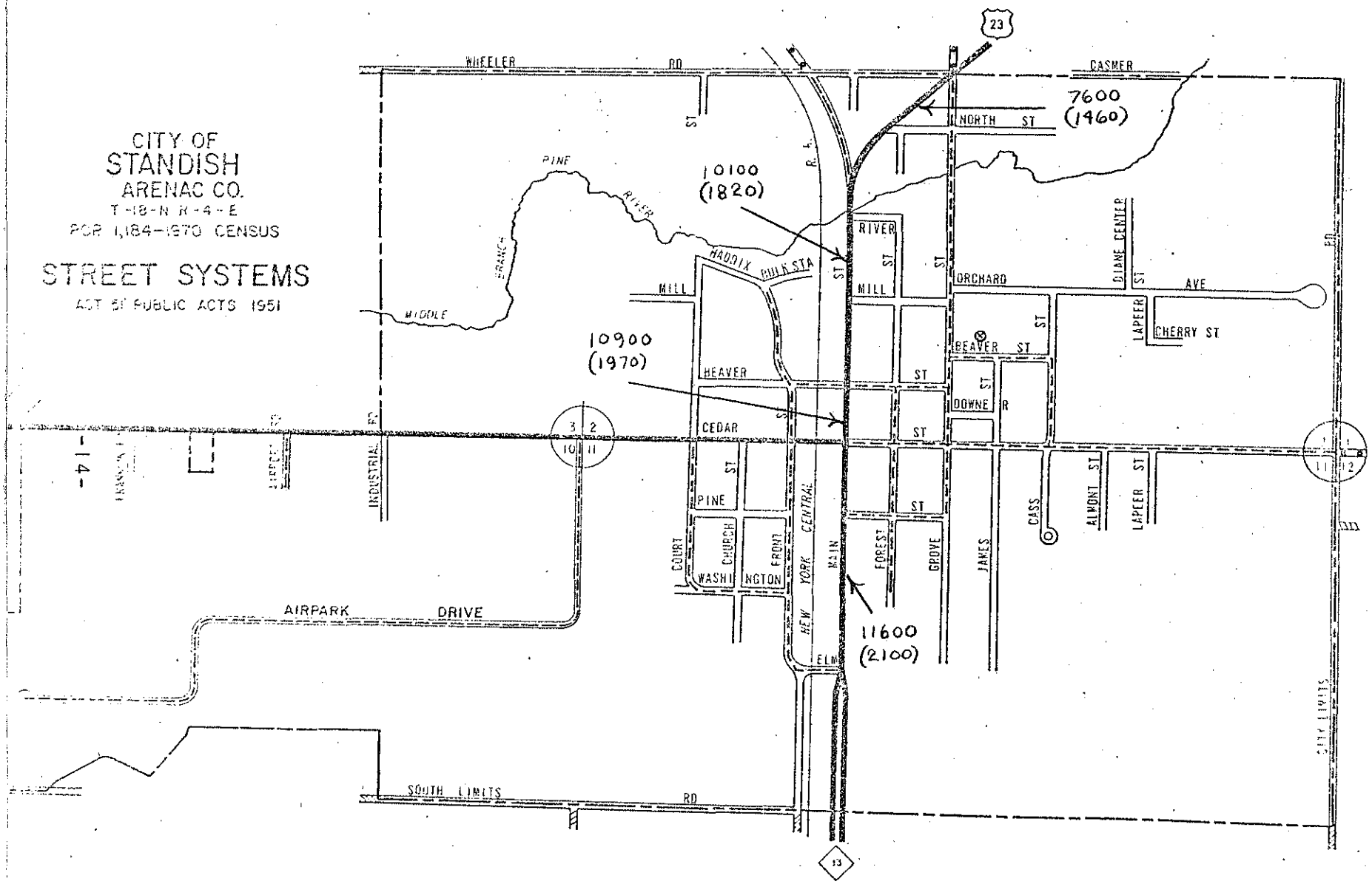
STANDISH/OMER

(BUSINESS DISTRICT)

CITY OF
STANDISH
ARENAC CO.
T-18-N R-4-E
POP 1,184-1970 CENSUS

STREET SYSTEMS

ACT 51 PUBLIC ACTS 1951



1971
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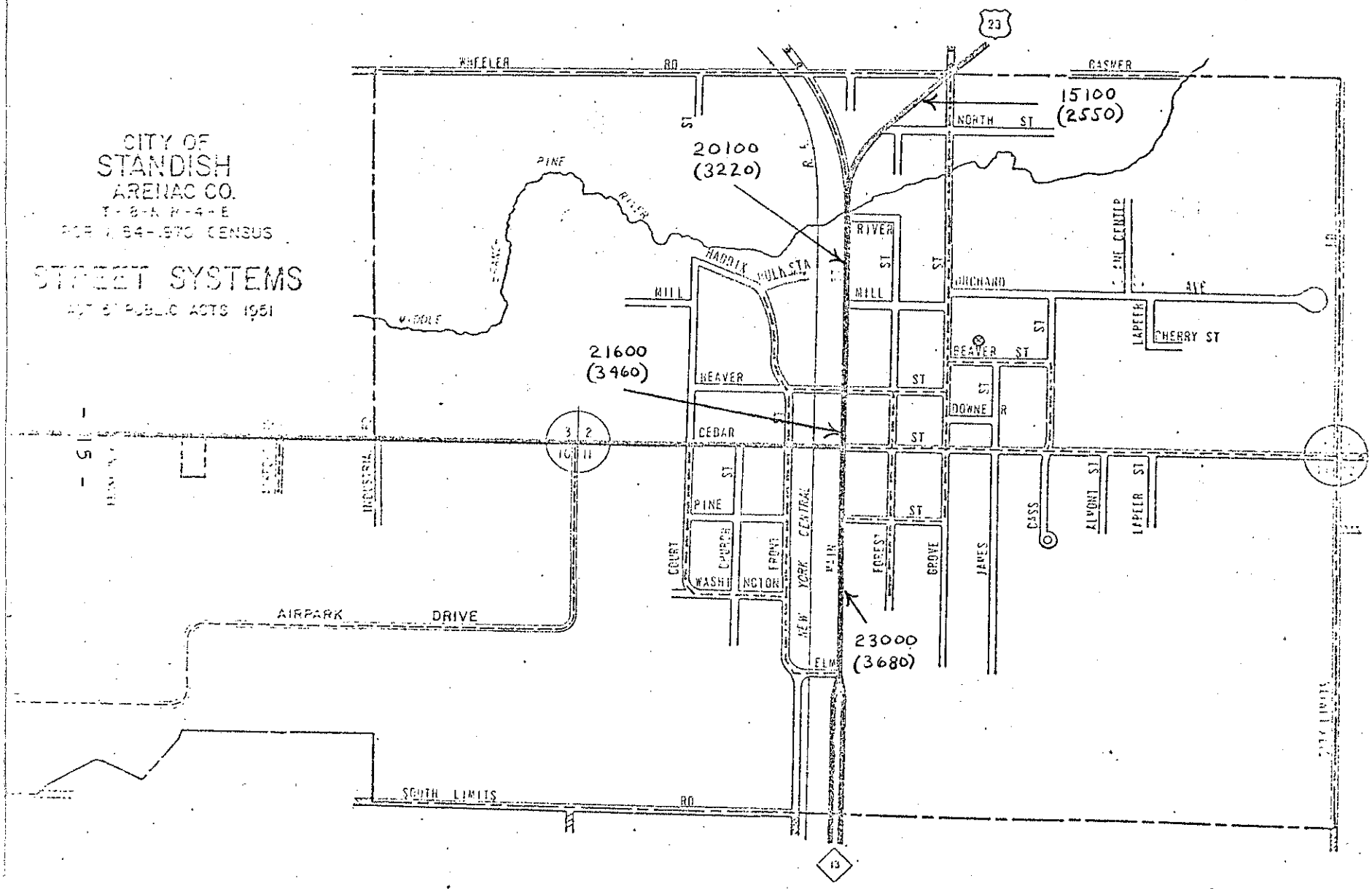

1995
DO NOTHING
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CITY OF
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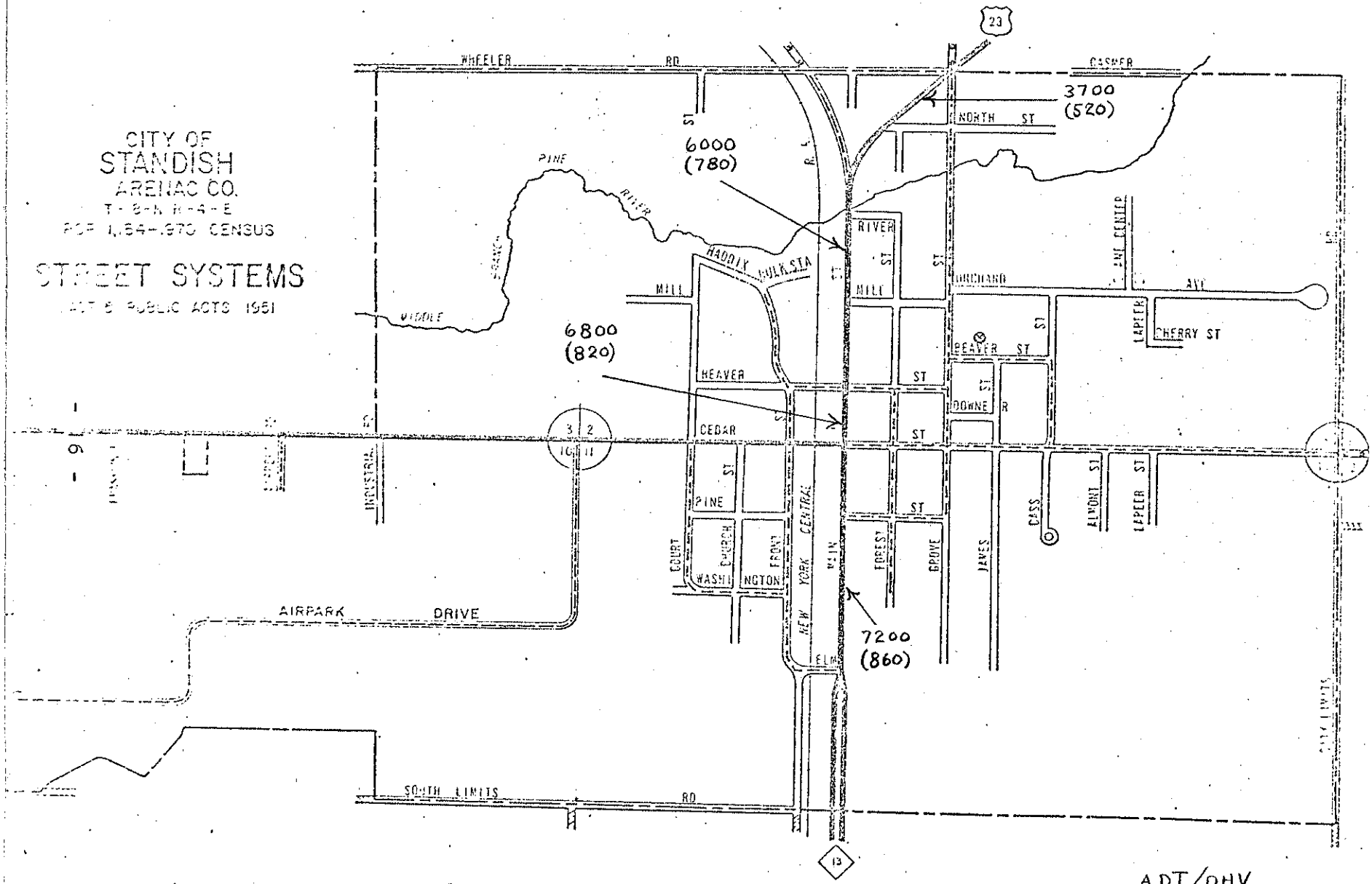
FOR 1964-1970 CENSUS

STREET SYSTEMS

ACT 51 PUBLIC ACTS 1951



ADT/DHV

CORRIDOR A 1982

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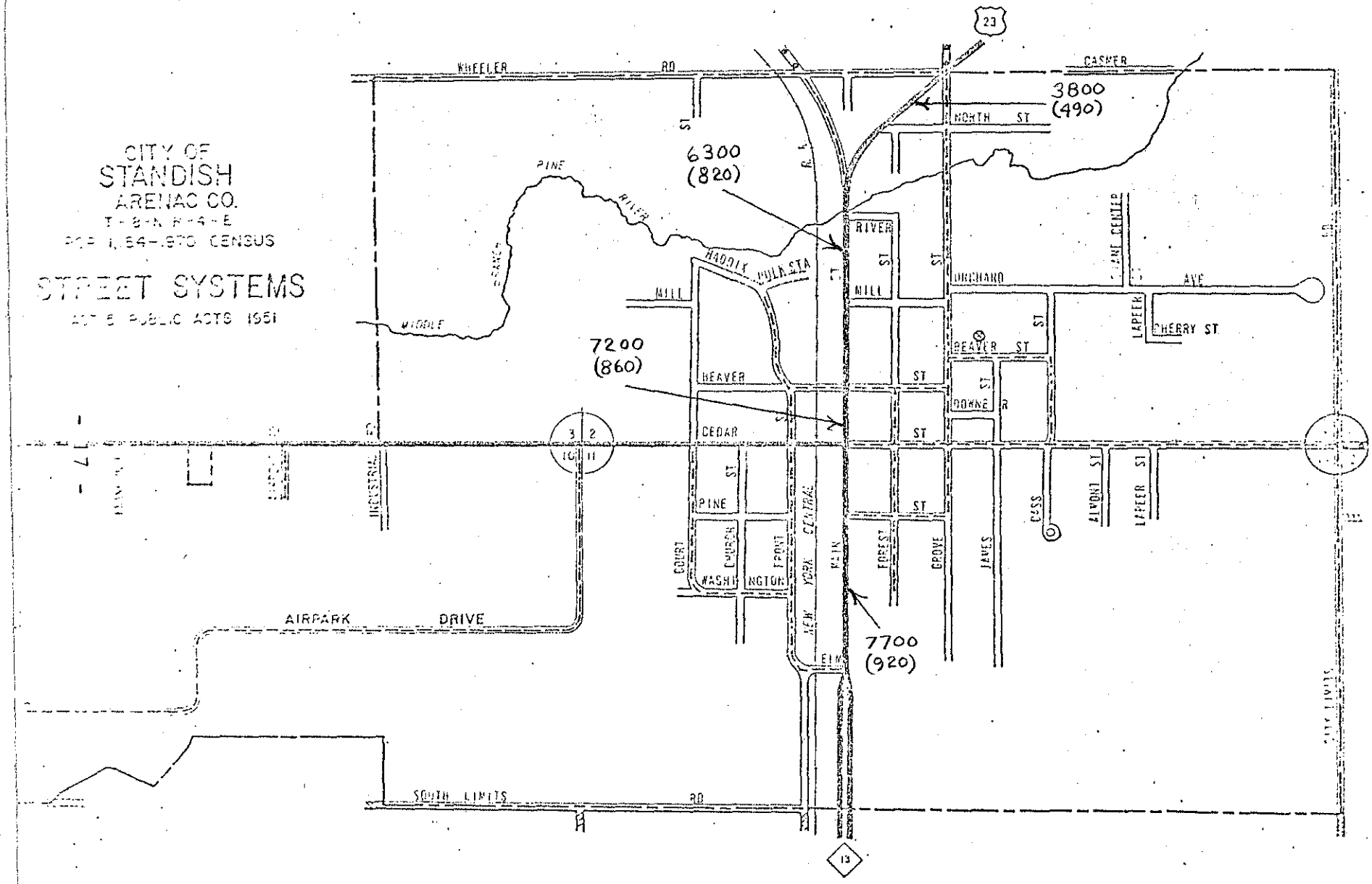

CORRIDOR A 1985

ADT /DHV

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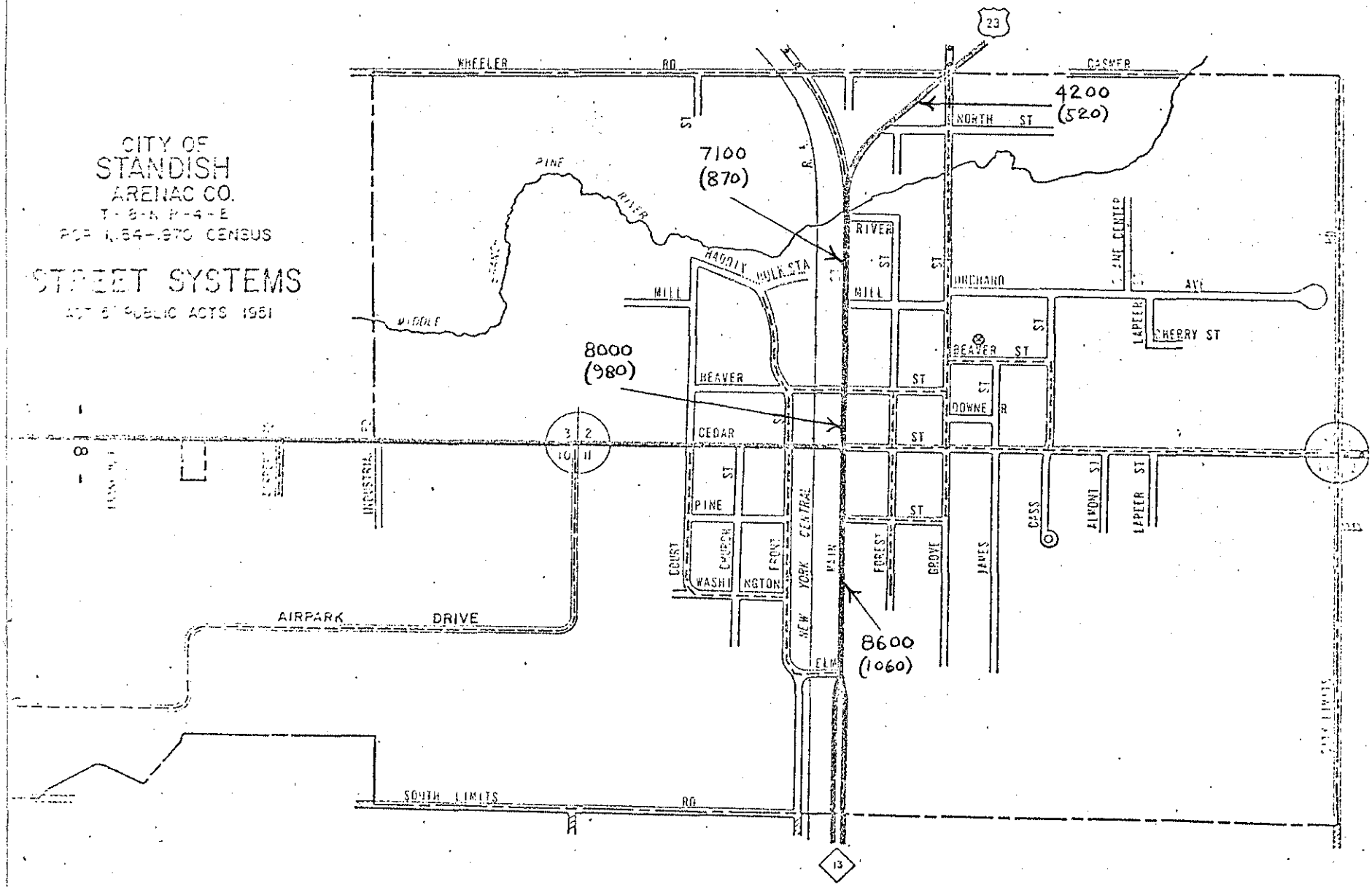
T-18-N R-4-E
PER 1964-1970 CENSUS

STREET SYSTEMS
ACT 51 PUBLIC ACTS 1951



CORRIDOR A 1990

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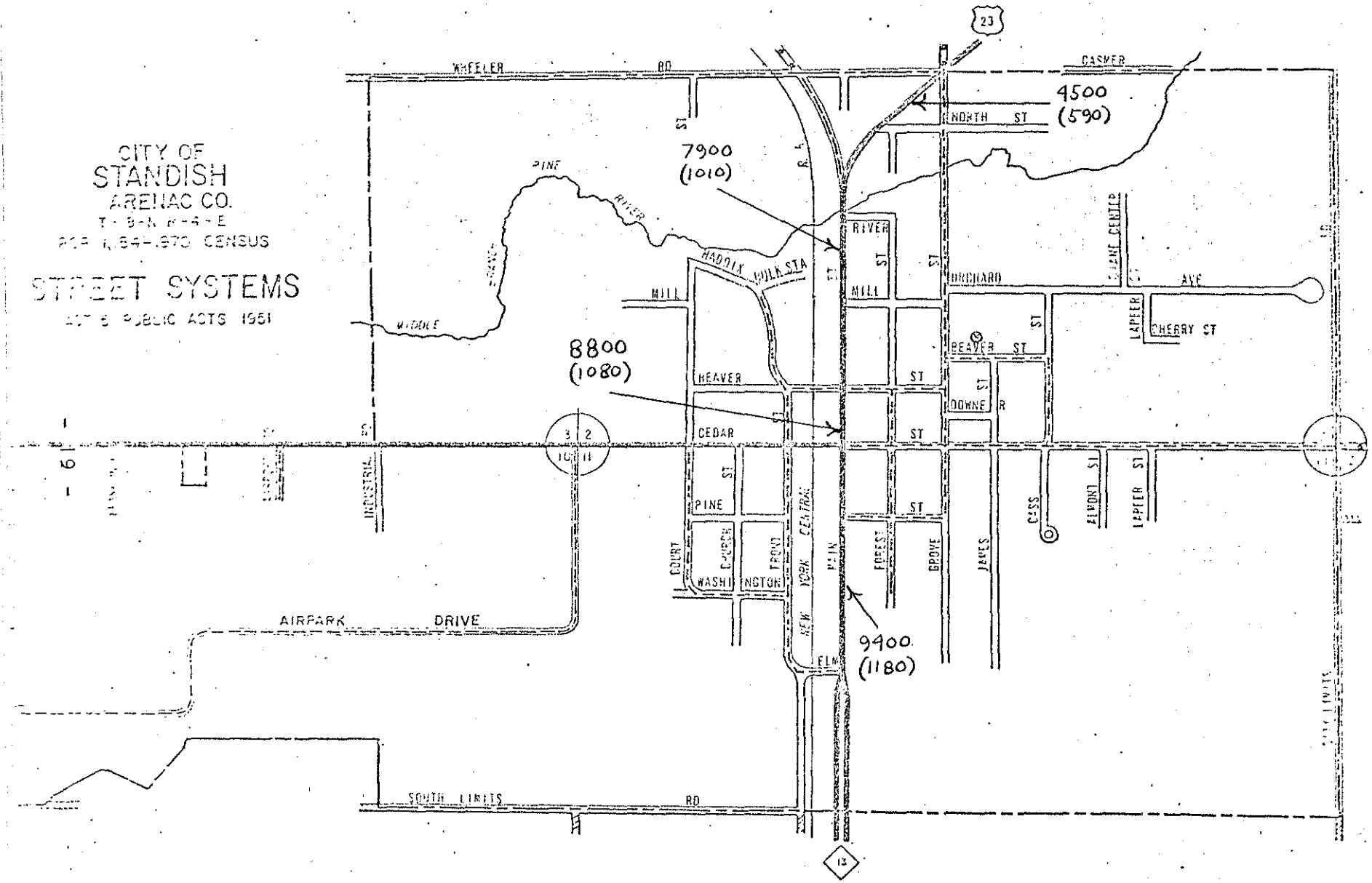

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APT / DHV

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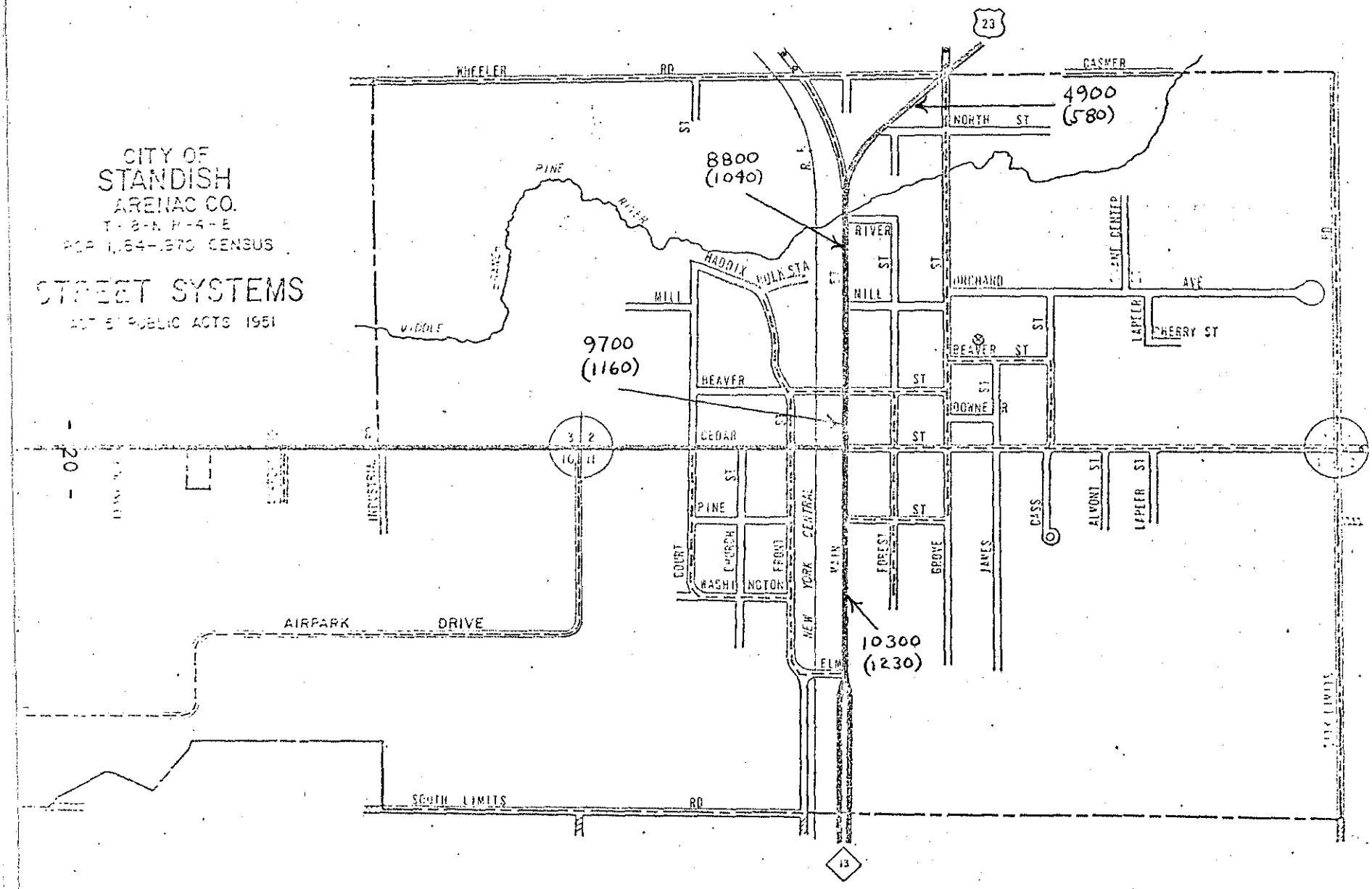

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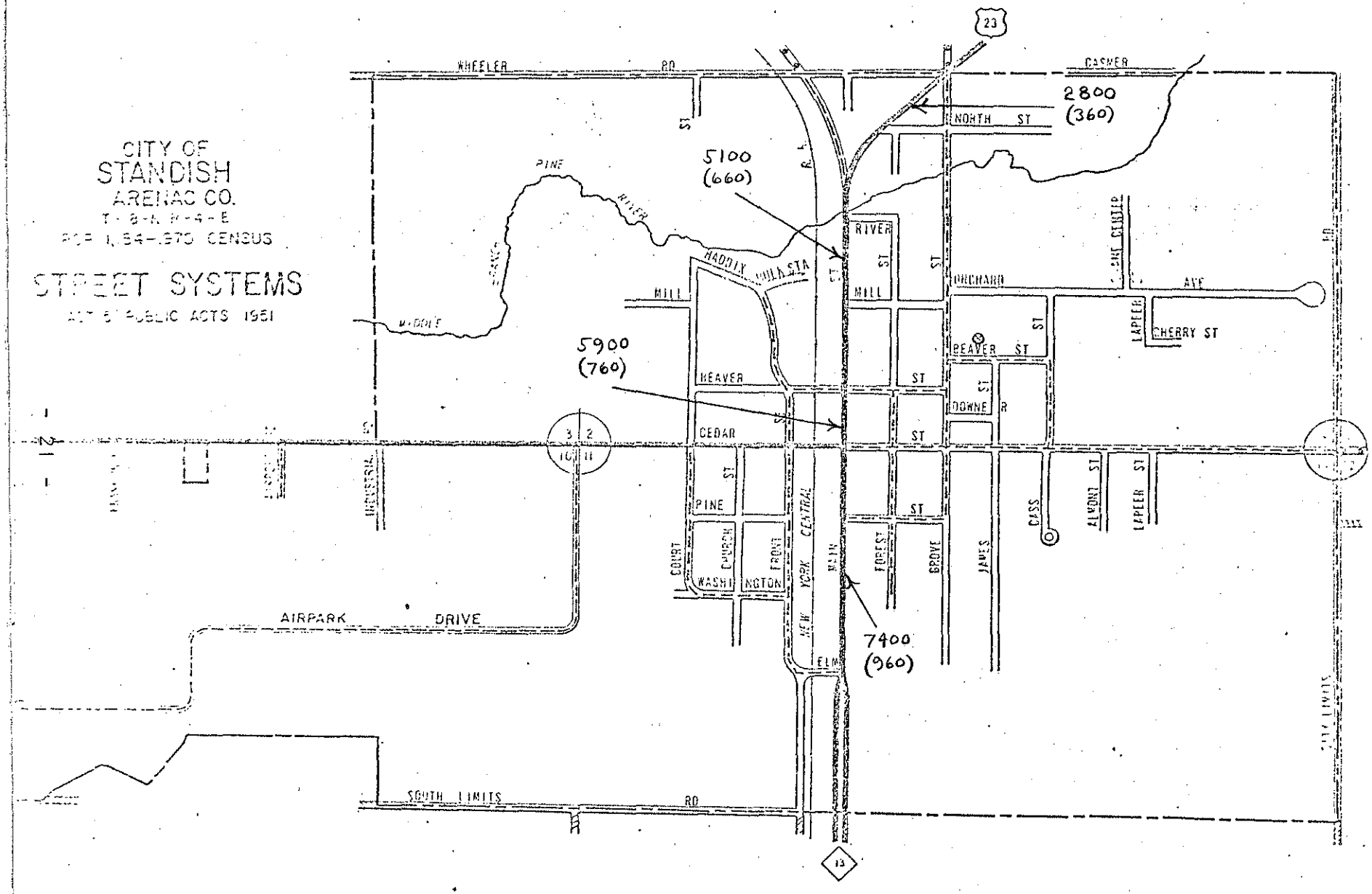

CORRIDOR B 1982

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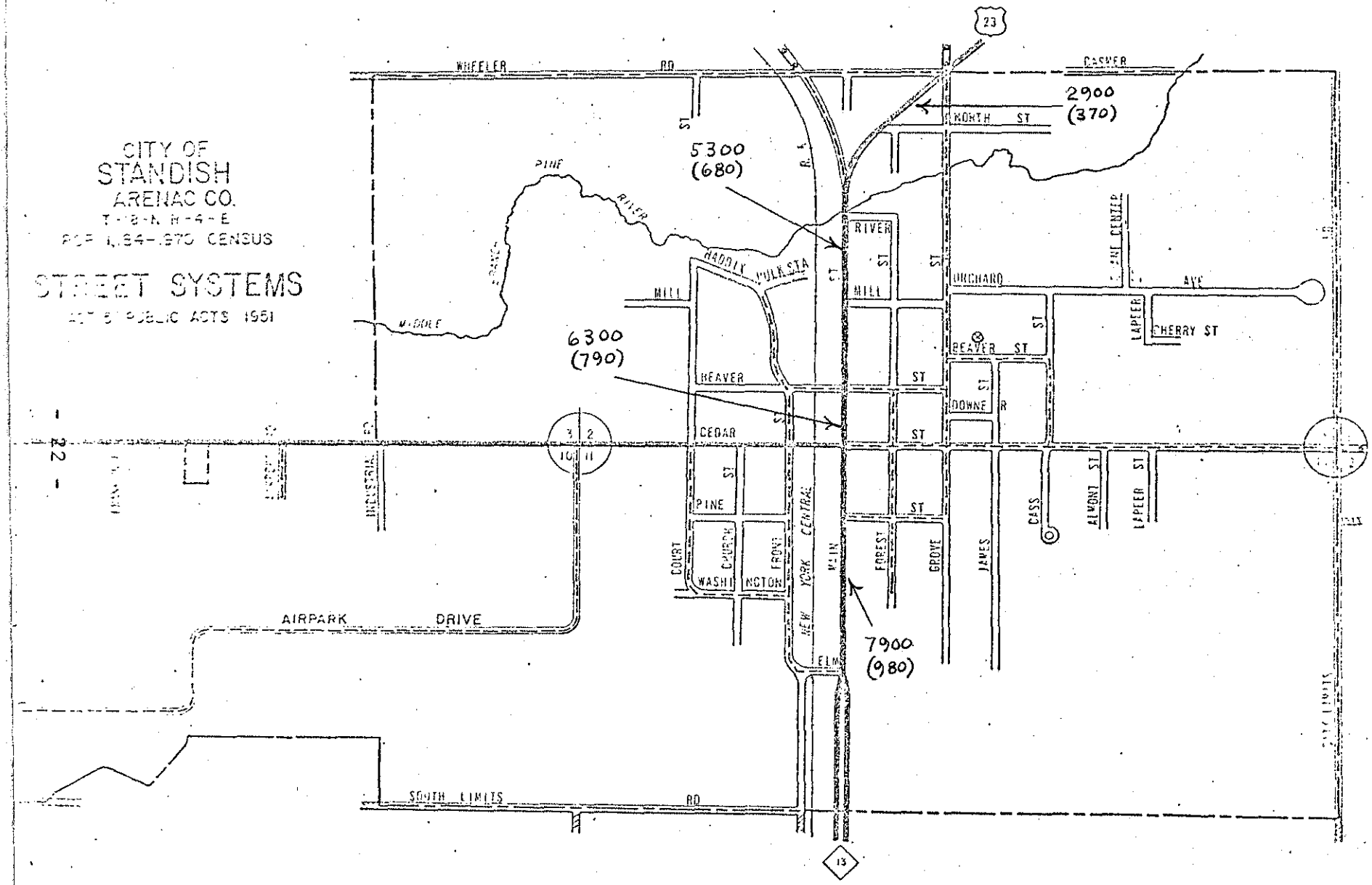

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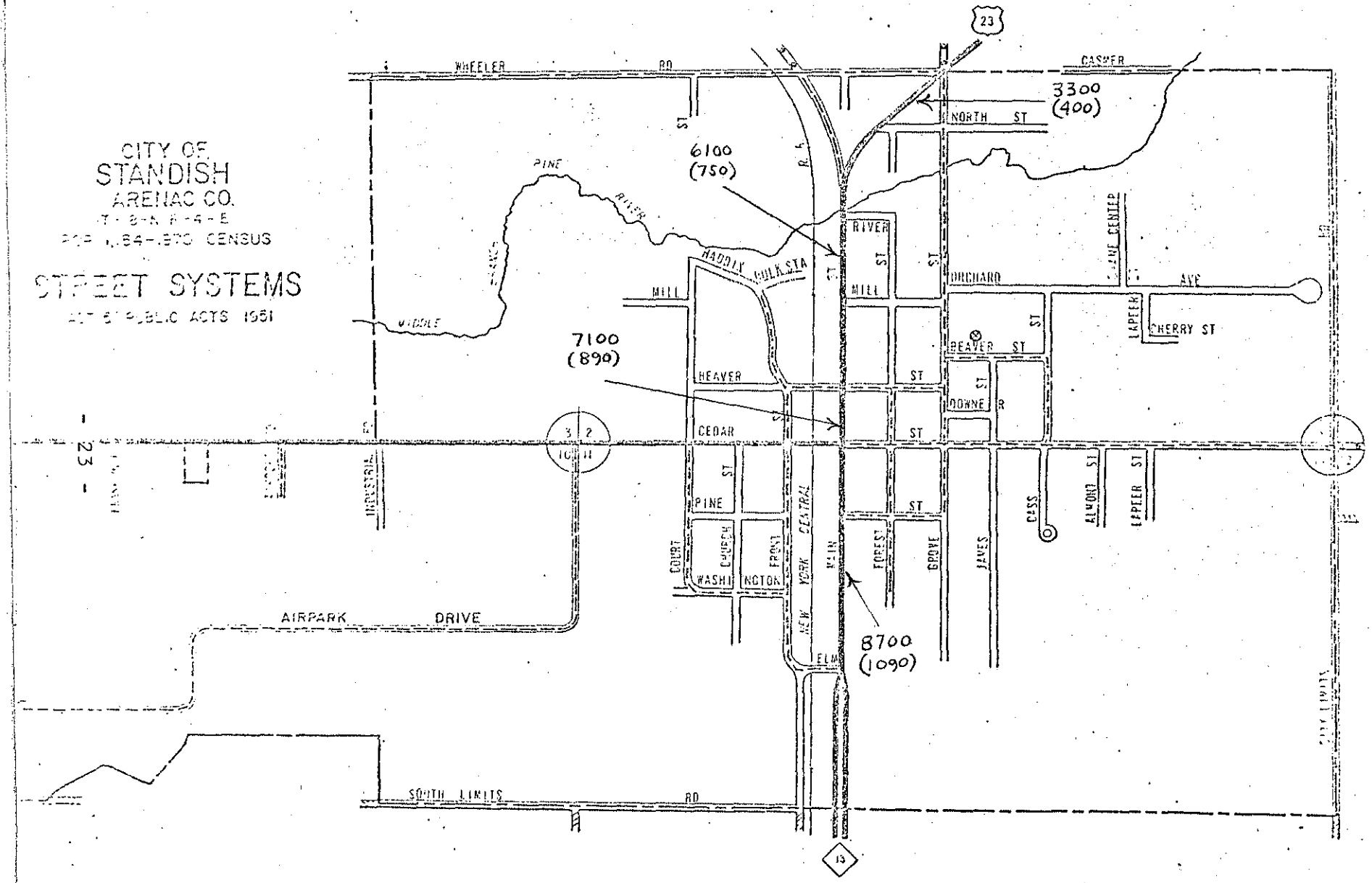

CORRIDOR B 1990

ADT / DHV

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CITY OF
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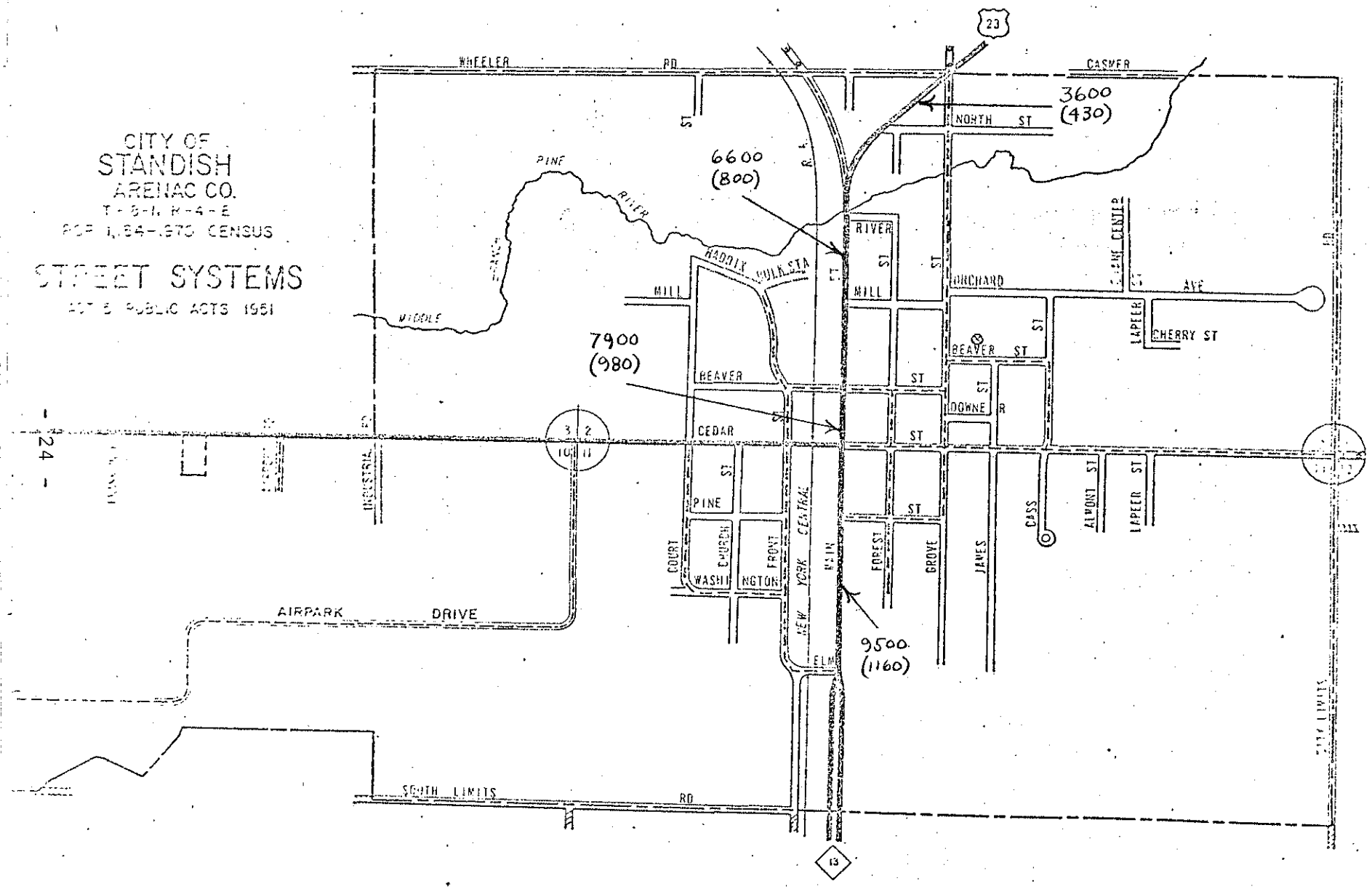
STREET SYSTEMS
ACT 51 PUBLIC ACTS 1951



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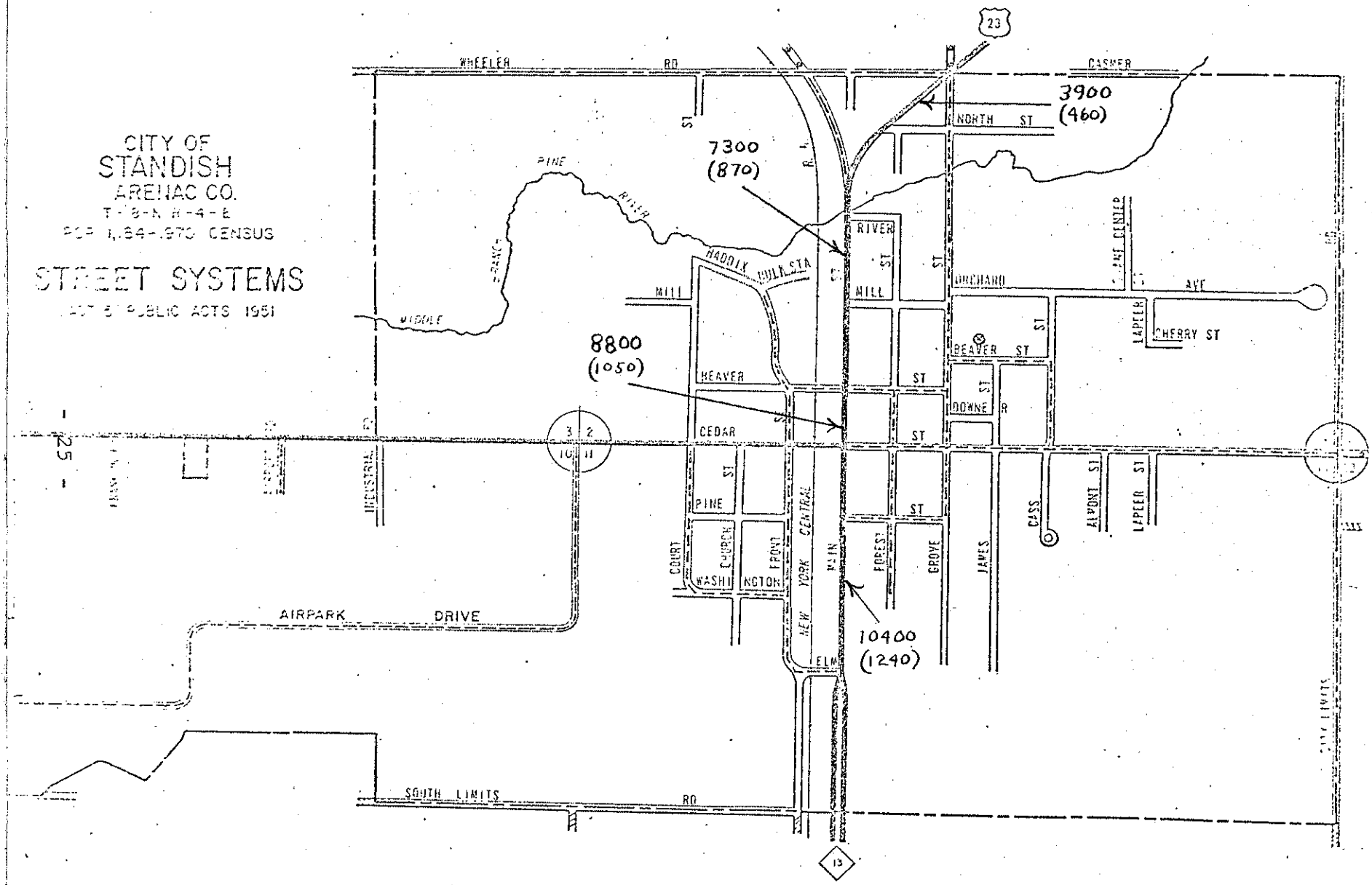

CORRIDOR B 2000

ADT / DHV

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CITY OF

'OMER

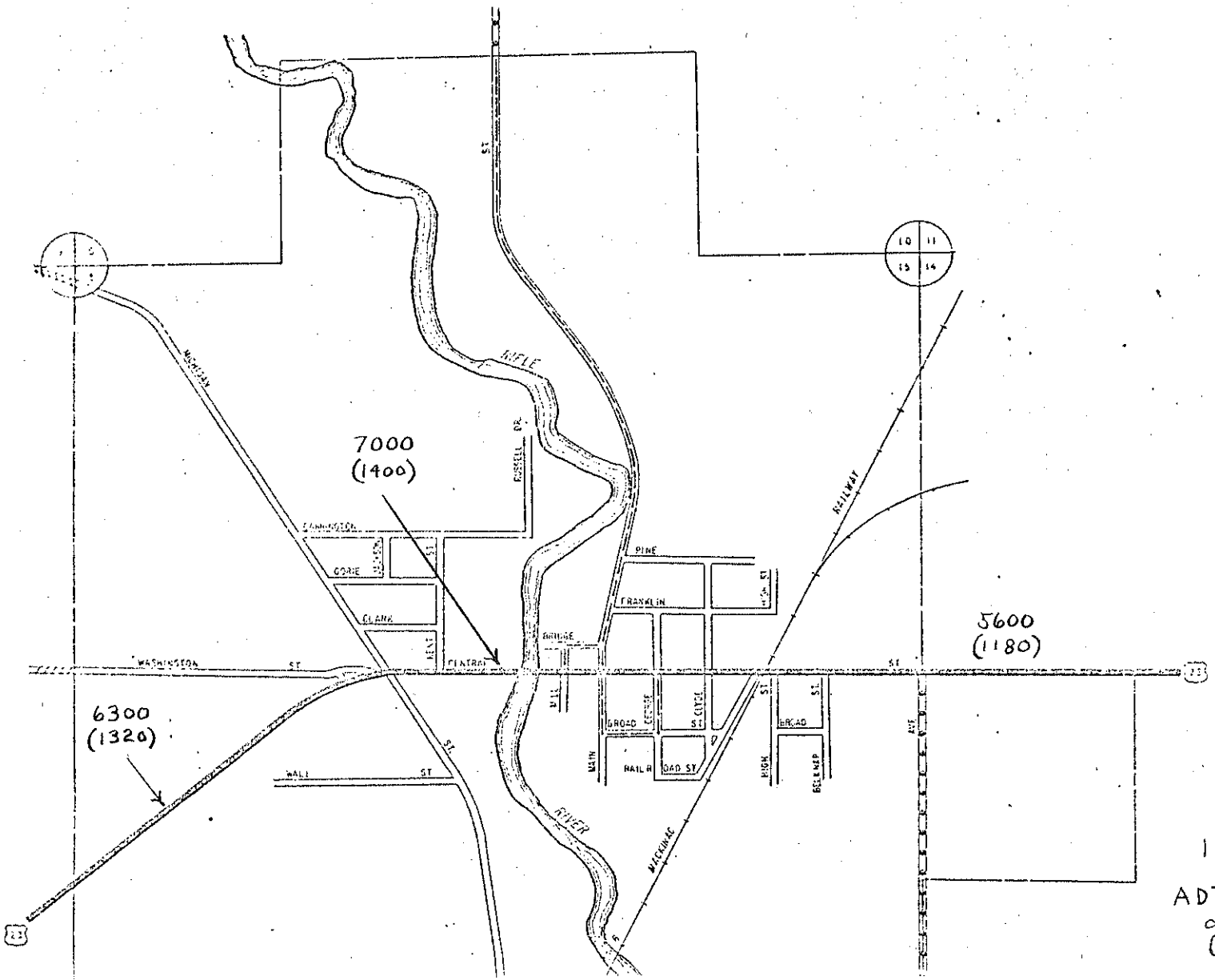
ARENAC CO.

T 19 N R 5 E

POP 366-1970 CENSUS

STREET SYSTEMS

ACT 51 PUBLIC ACTS 1951



1971

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CITY OF

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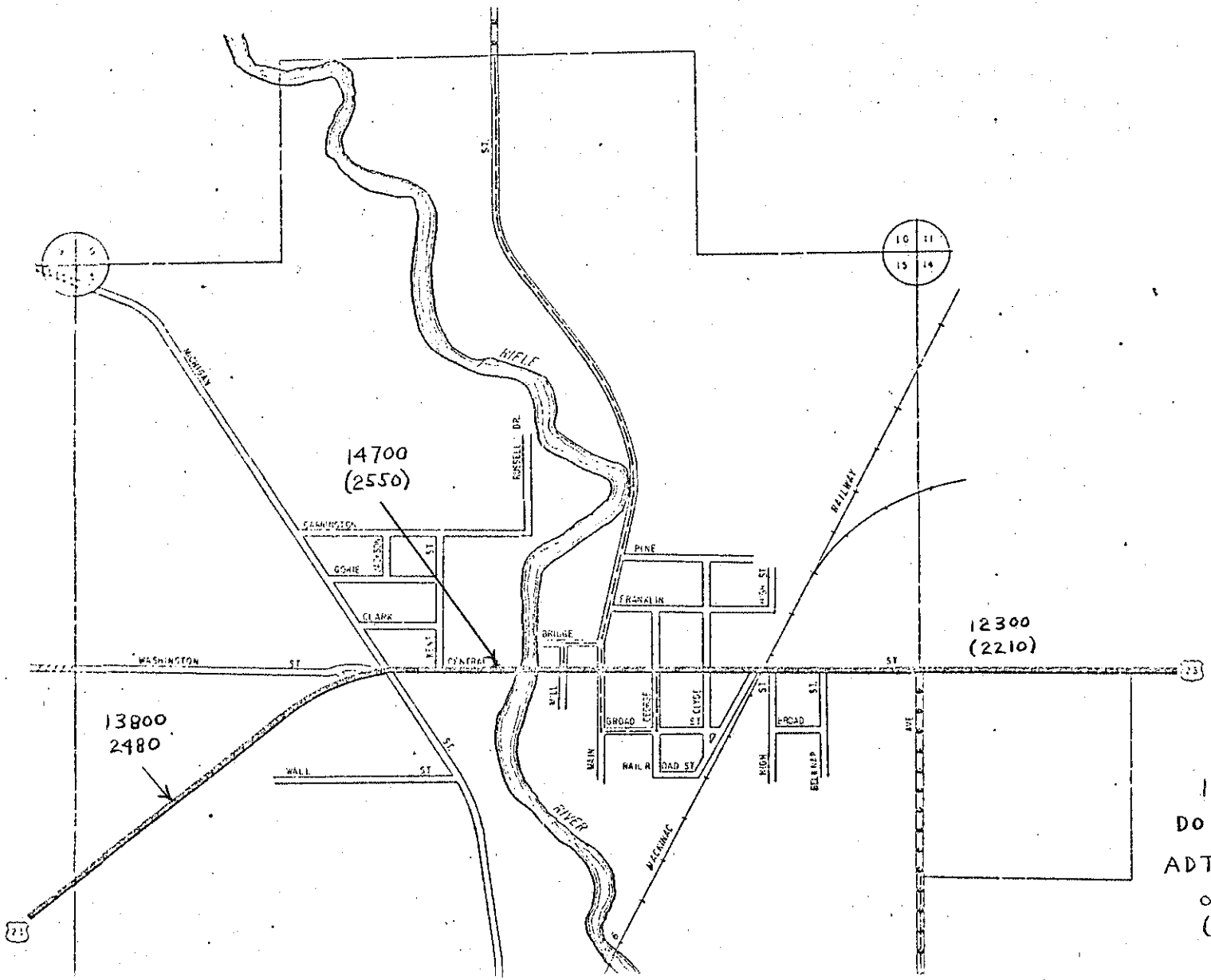
STREET SYSTEMS

ACT 51 PUBLIC ACTS 1951



CITY OF

OMER

ARENAC CO.

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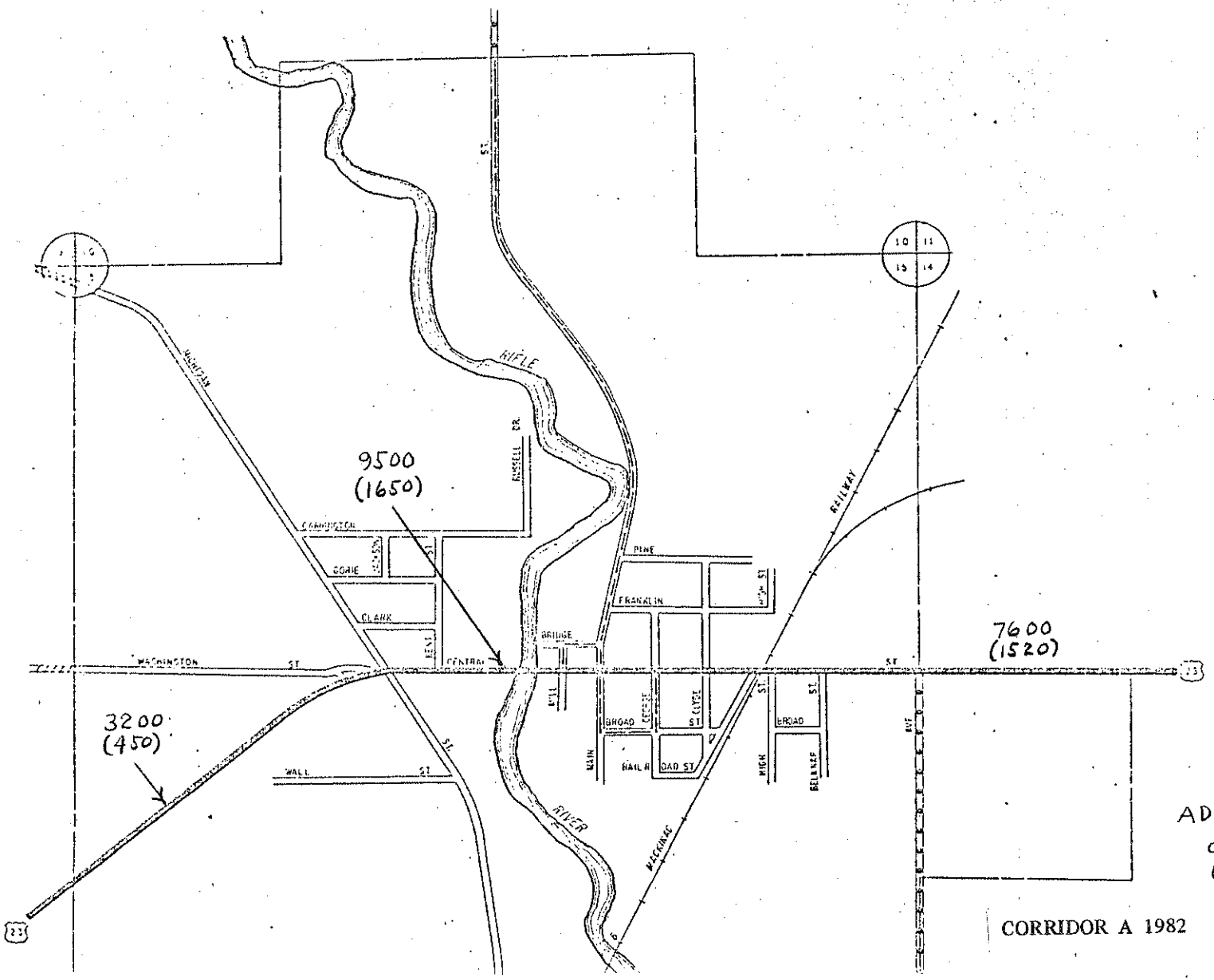
STREET SYSTEMS

ACT 51 PUBLIC ACTS 1951



CORRIDOR A 1982

CITY OF

OMER

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POP 386-1970 CENSUS

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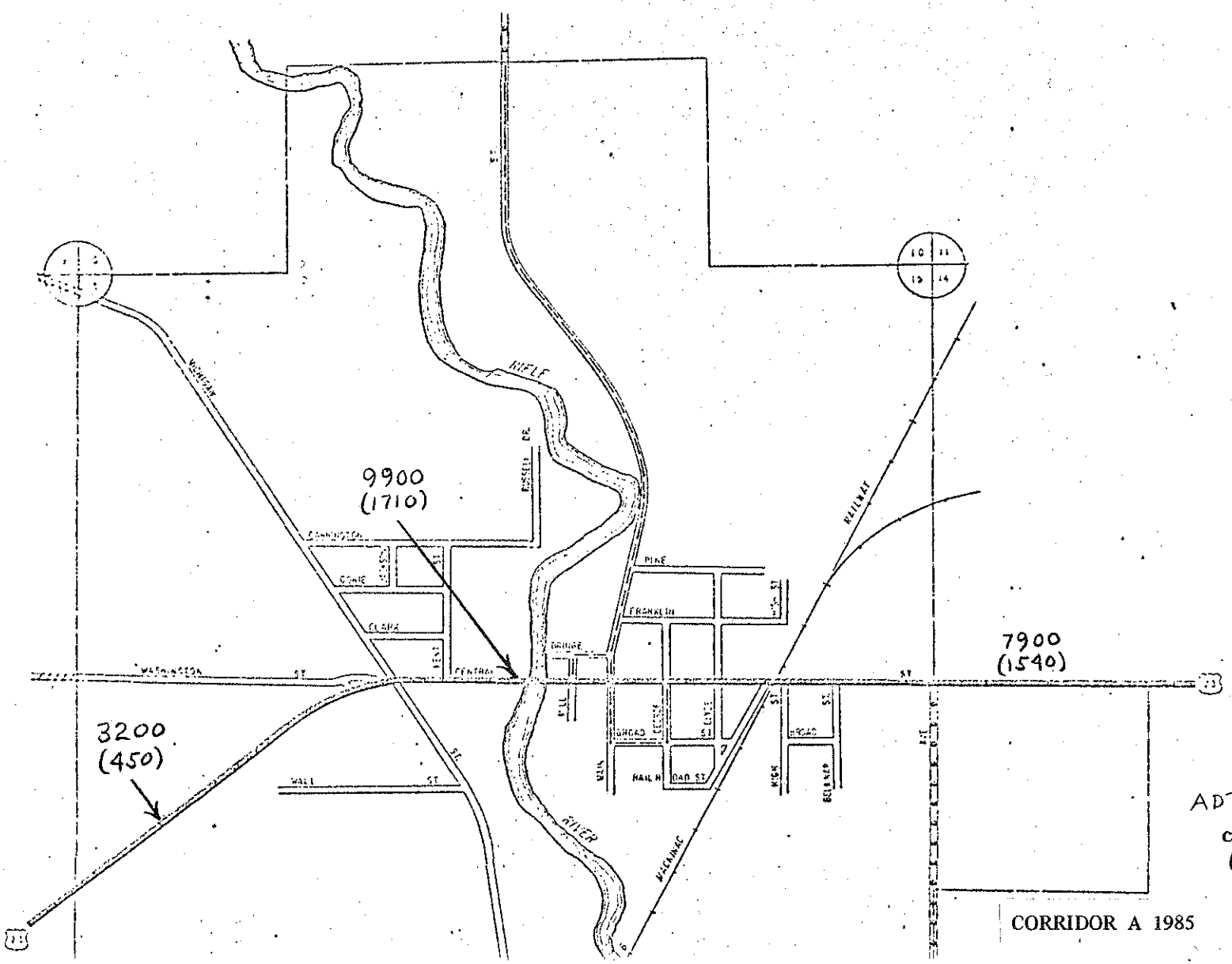

CITY OF

OMER

ARENAC CO.

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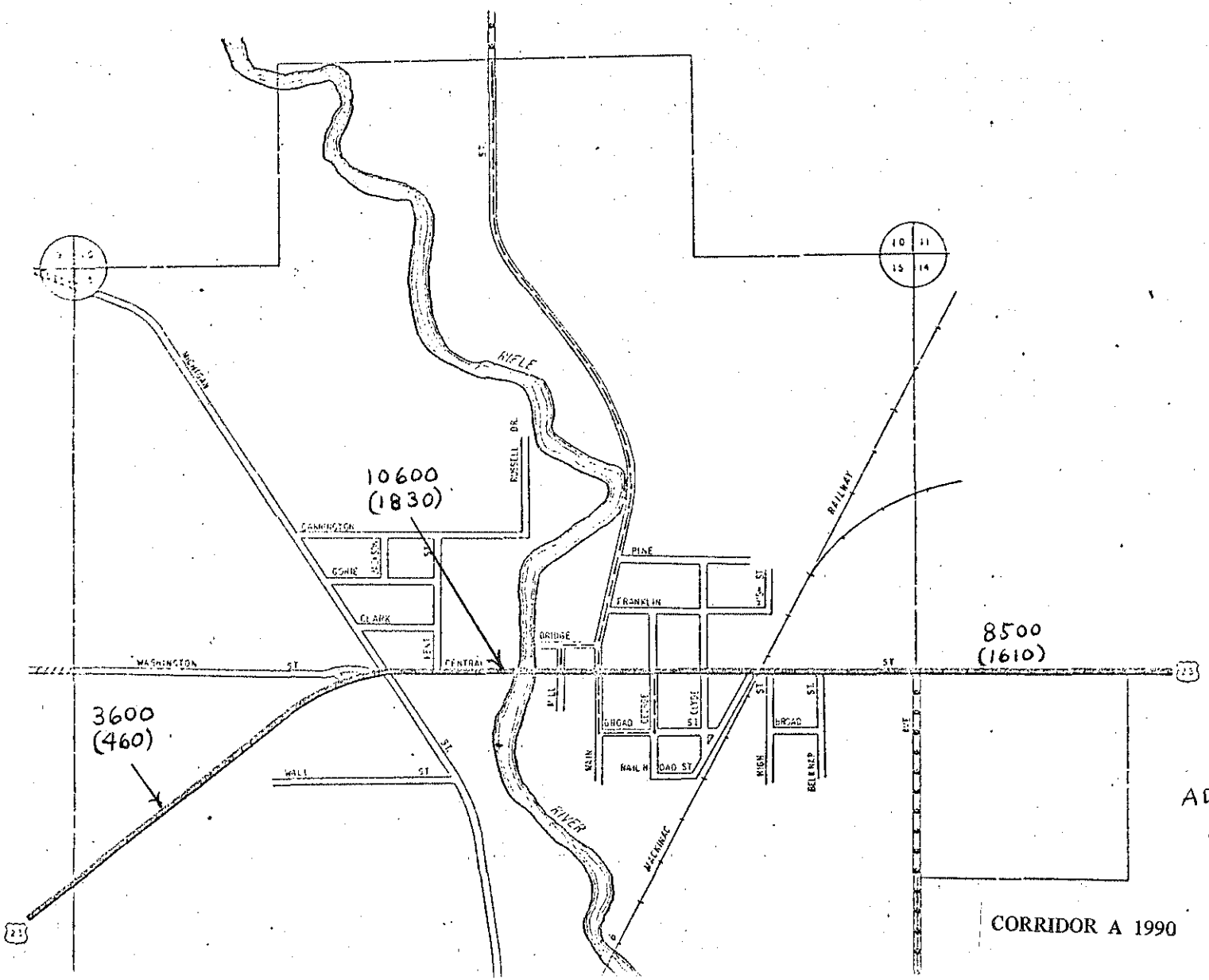
POP. 366-1970 CENSUS

STREET SYSTEMS

ACT 51 PUBLIC ACTS 1951



CORRIDOR A 1990

CITY OF

OMER

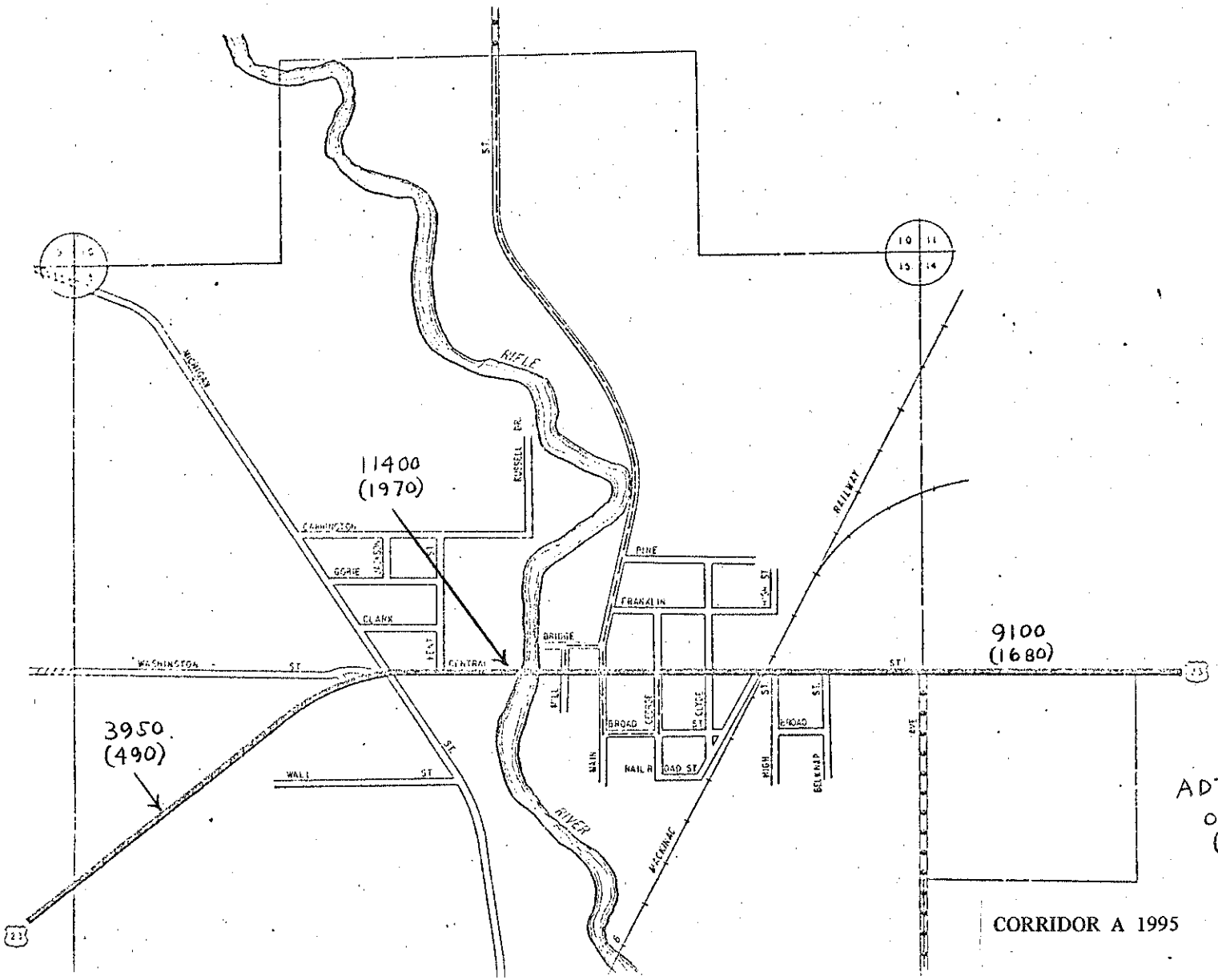
ARENAC CO.

T 19 N R 5 E

POP. 366-1970 CENSUS

STREET SYSTEMS

ACT 51 PUBLIC ACTS 1951



CITY OF

OMER

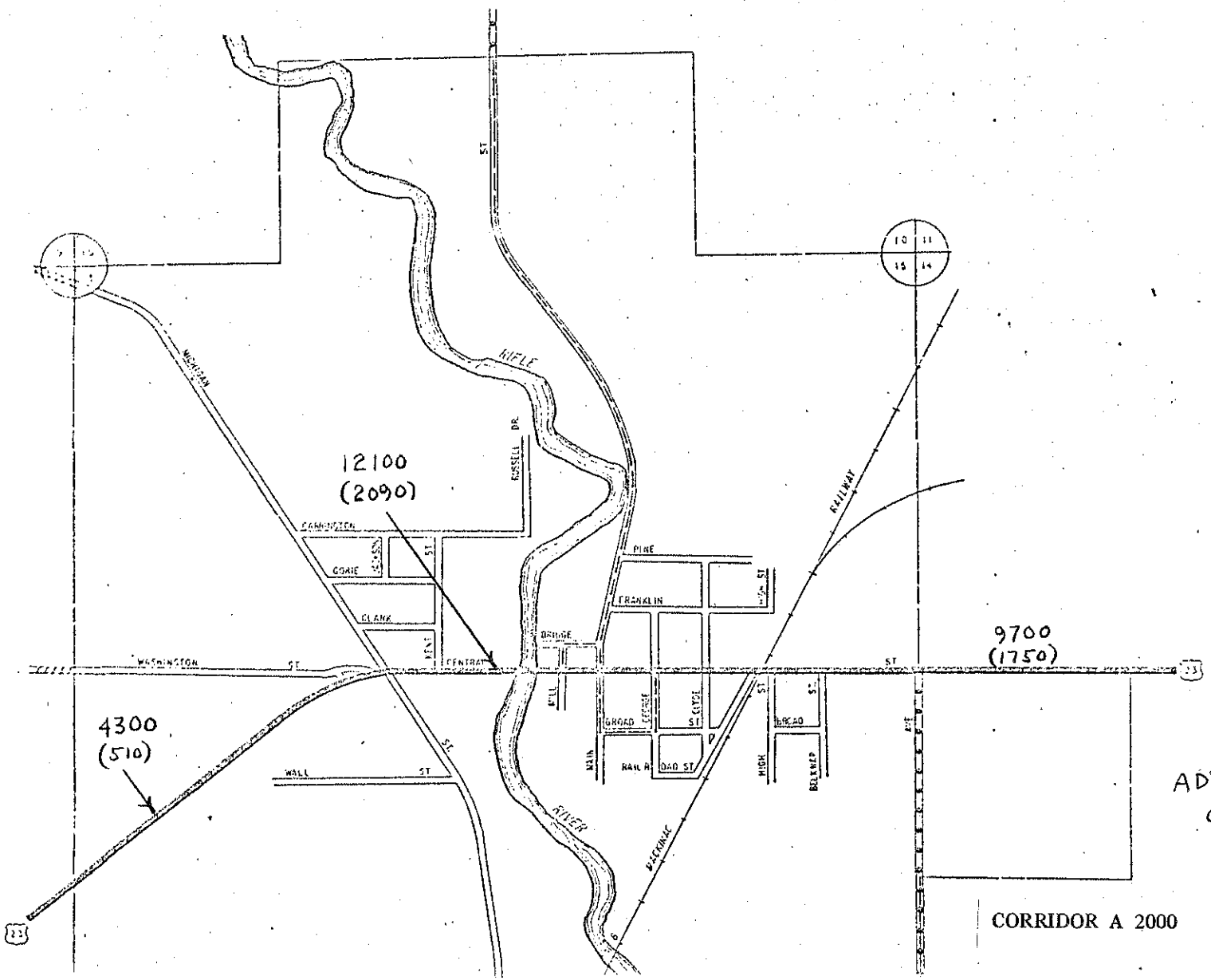
ARENAC CO.

T 19 N. R 5 E

POP 366-1970 CENSUS

STREET SYSTEMS

ACT 51 PUBLIC ACTS 1951



CITY OF

OMER

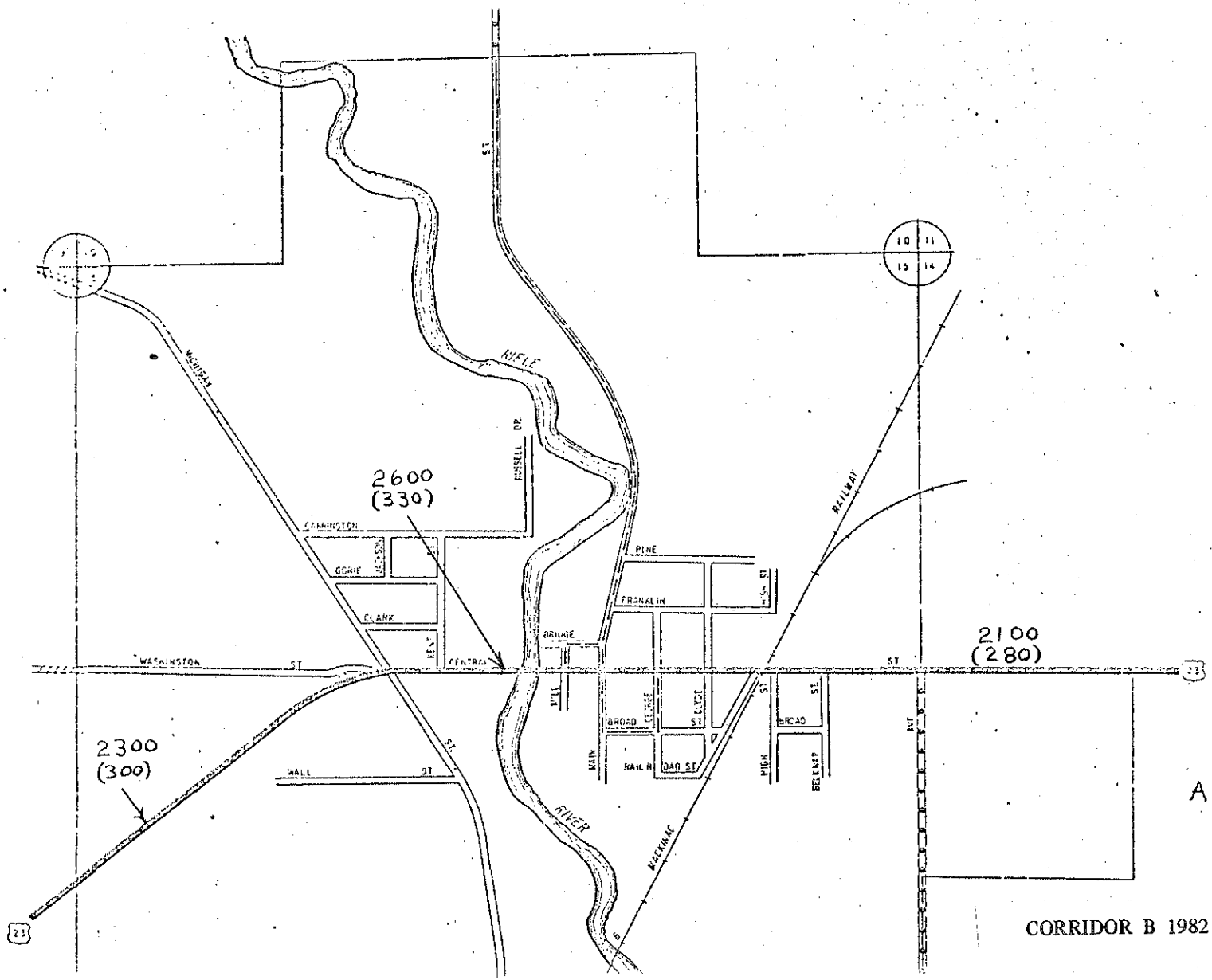
ARENAC CO.

T 19 N R 5E

POP. 366-1970 CENSUS

STREET SYSTEMS

ACT 51 PUBLIC ACTS 1951



CITY OF

OMER

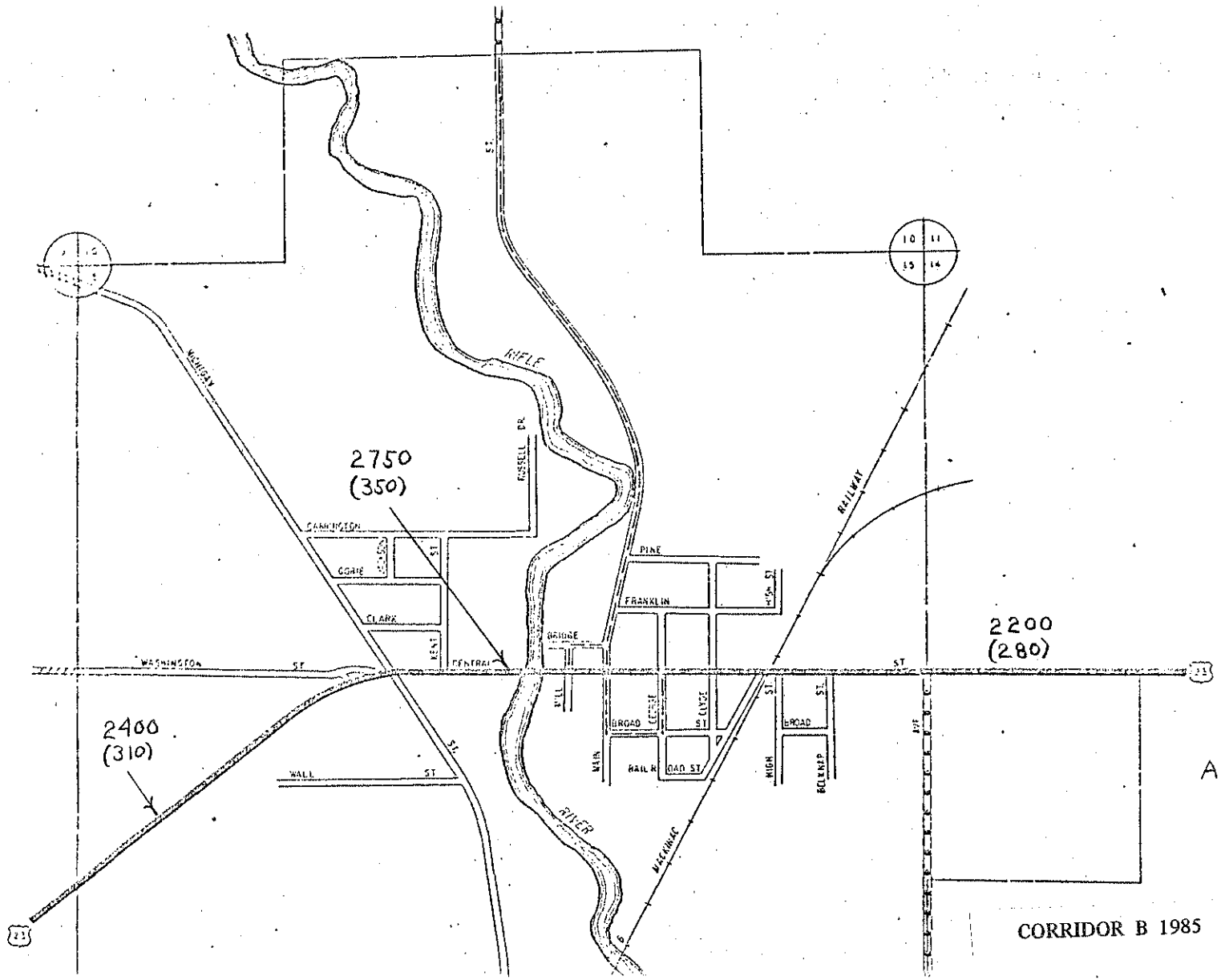
ARENAC CO.

T 19 N R 5 E

POP 366-1970 CENSUS

STREET SYSTEMS

ACT 51 PUBLIC ACTS 1951



CORRIDOR B 1985

CITY OF

OMER

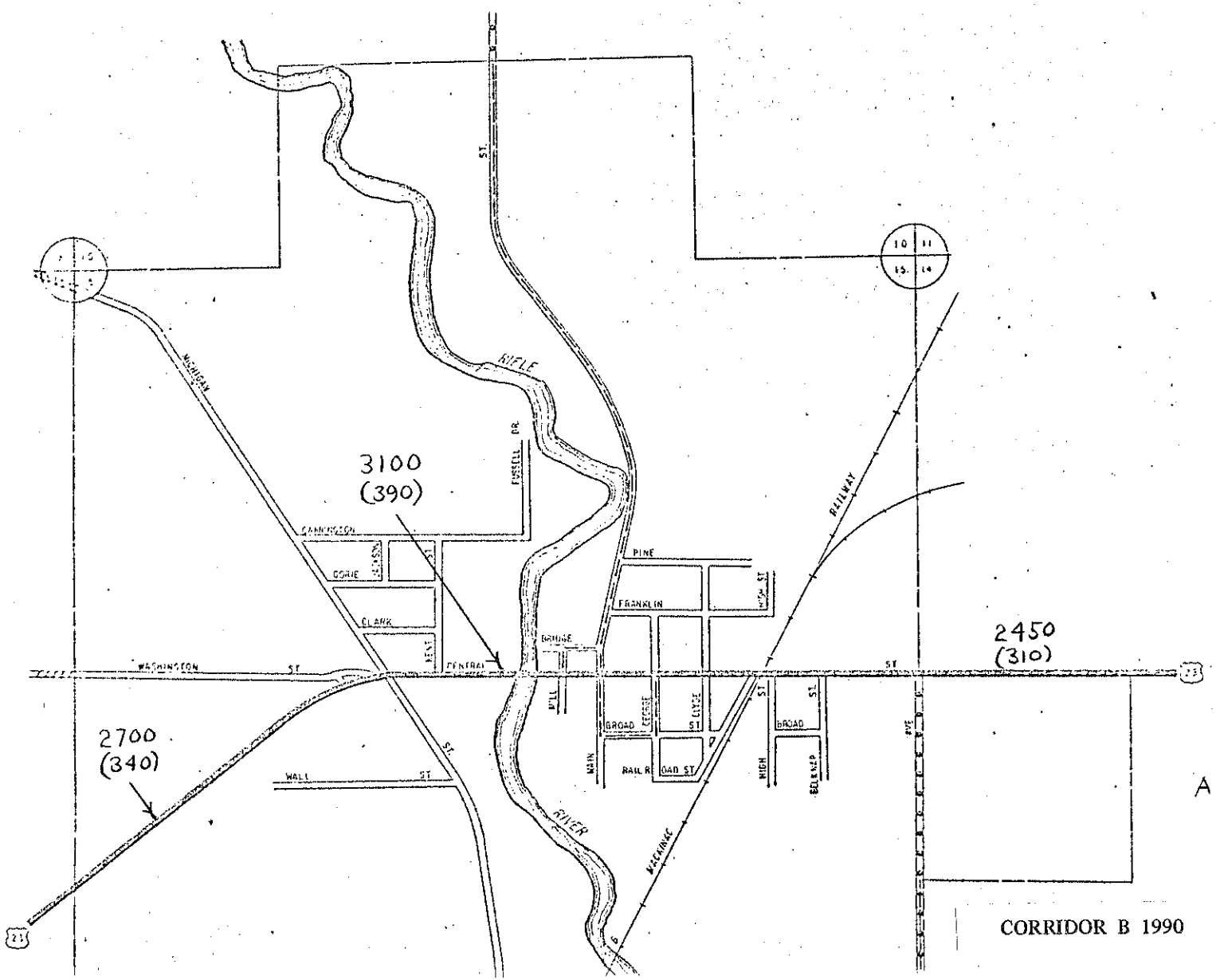
ARENAC CO.

T 19 N R 5 E

POP 366-1970 CENSUS

STREET SYSTEMS

ACT 51 PUBLIC ACTS 1951



CITY OF

OMER

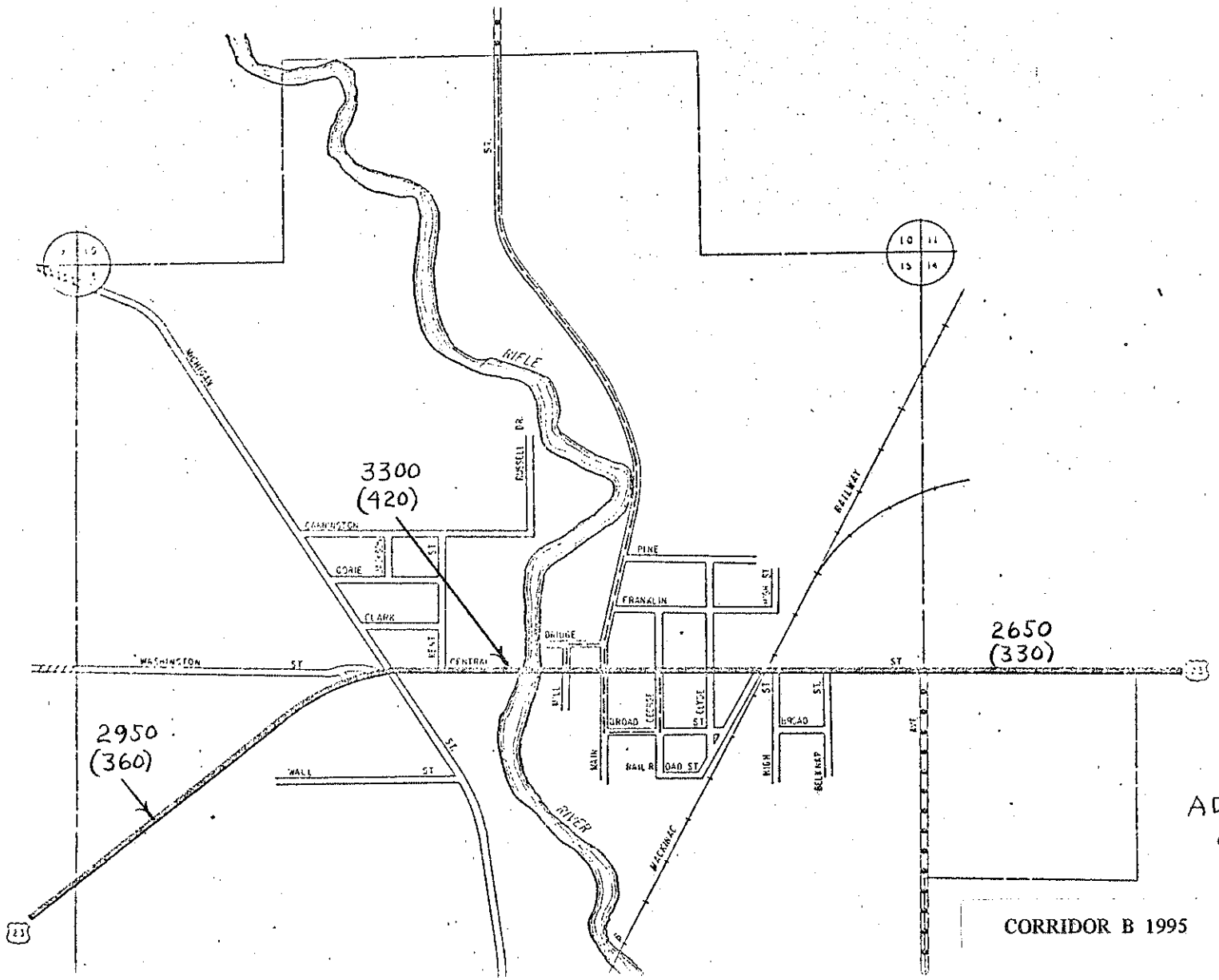
ARENAC CO.

T 19 N R 5 E

POP. 366-1970 CENSUS

STREET SYSTEMS

ACT 51 PUBLIC ACTS 1951



CITY OF

OMER

ARENAC CO.

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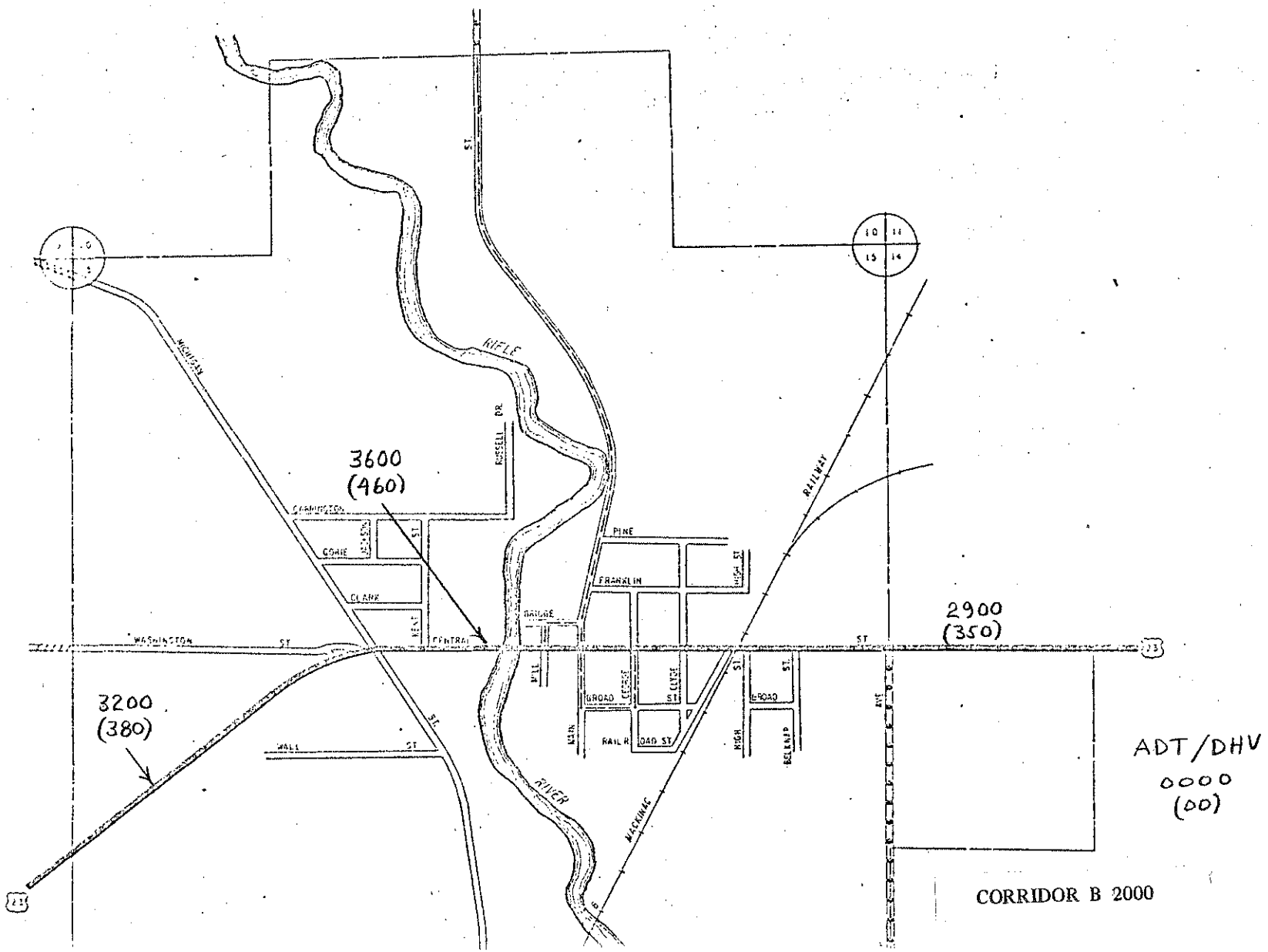
POP. 366-1970 CENSUS

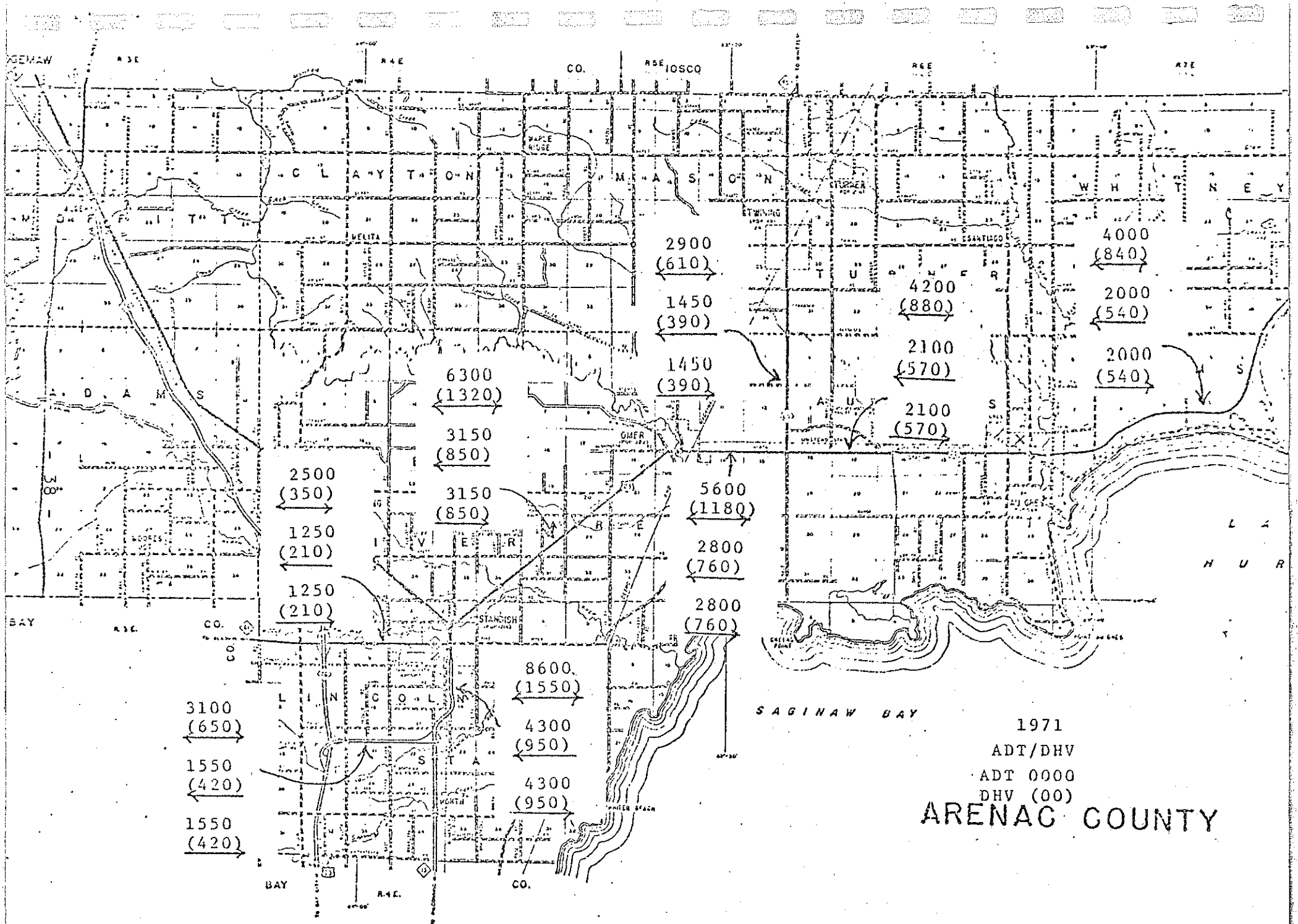
STREET SYSTEMS

ACT 51 PUBLIC ACTS 1951



BASE AND FUTURE YEAR
TRAFFIC FORECASTS

1971
1982
1985
1990
1995
2000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1550
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1550
(420)
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2100
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2100
(570)
4000
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SAGINAW BAY
1971
ADT/DHV
ADT 0000
DHV (00)
ARENAC COUNTY

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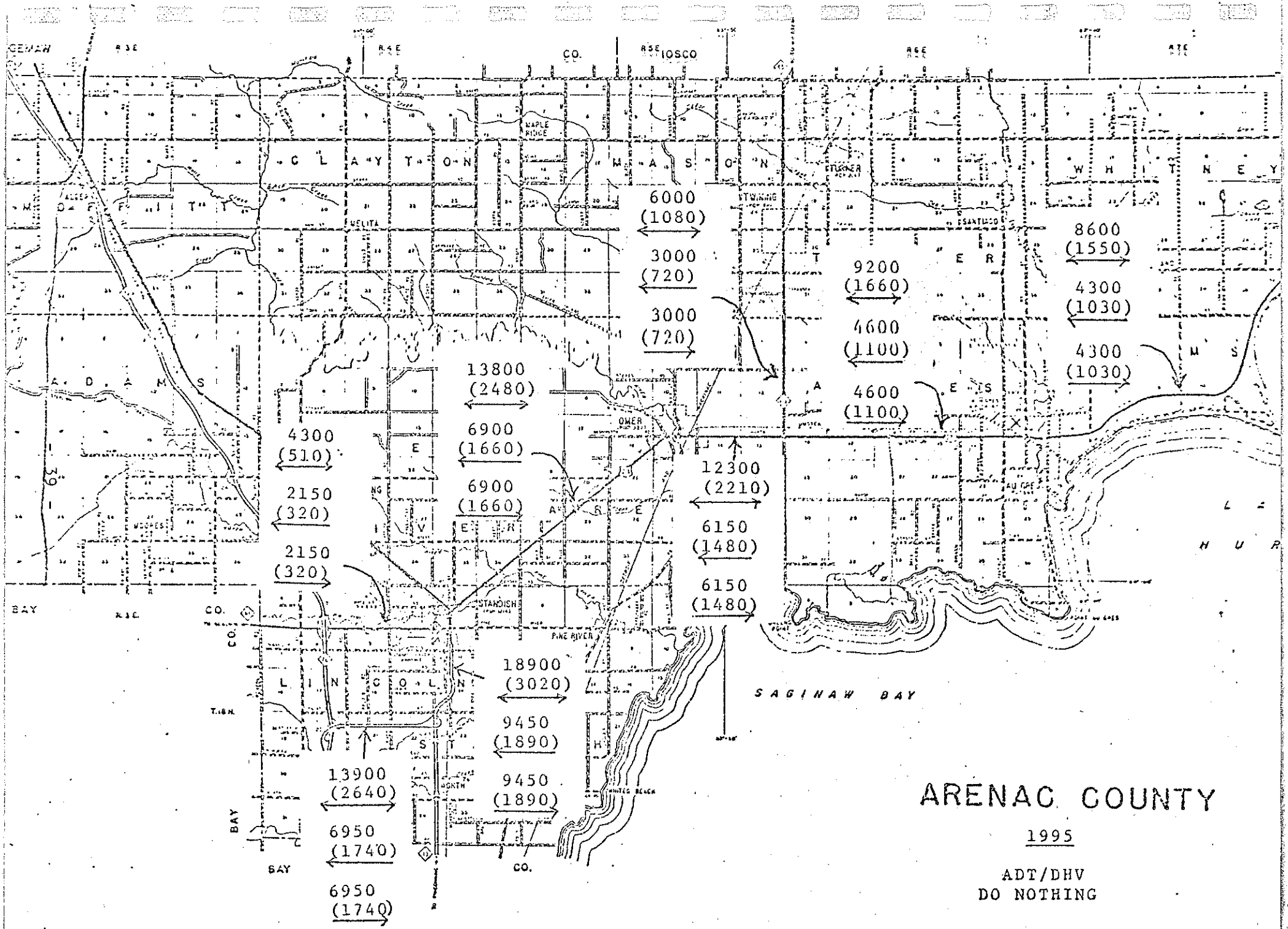
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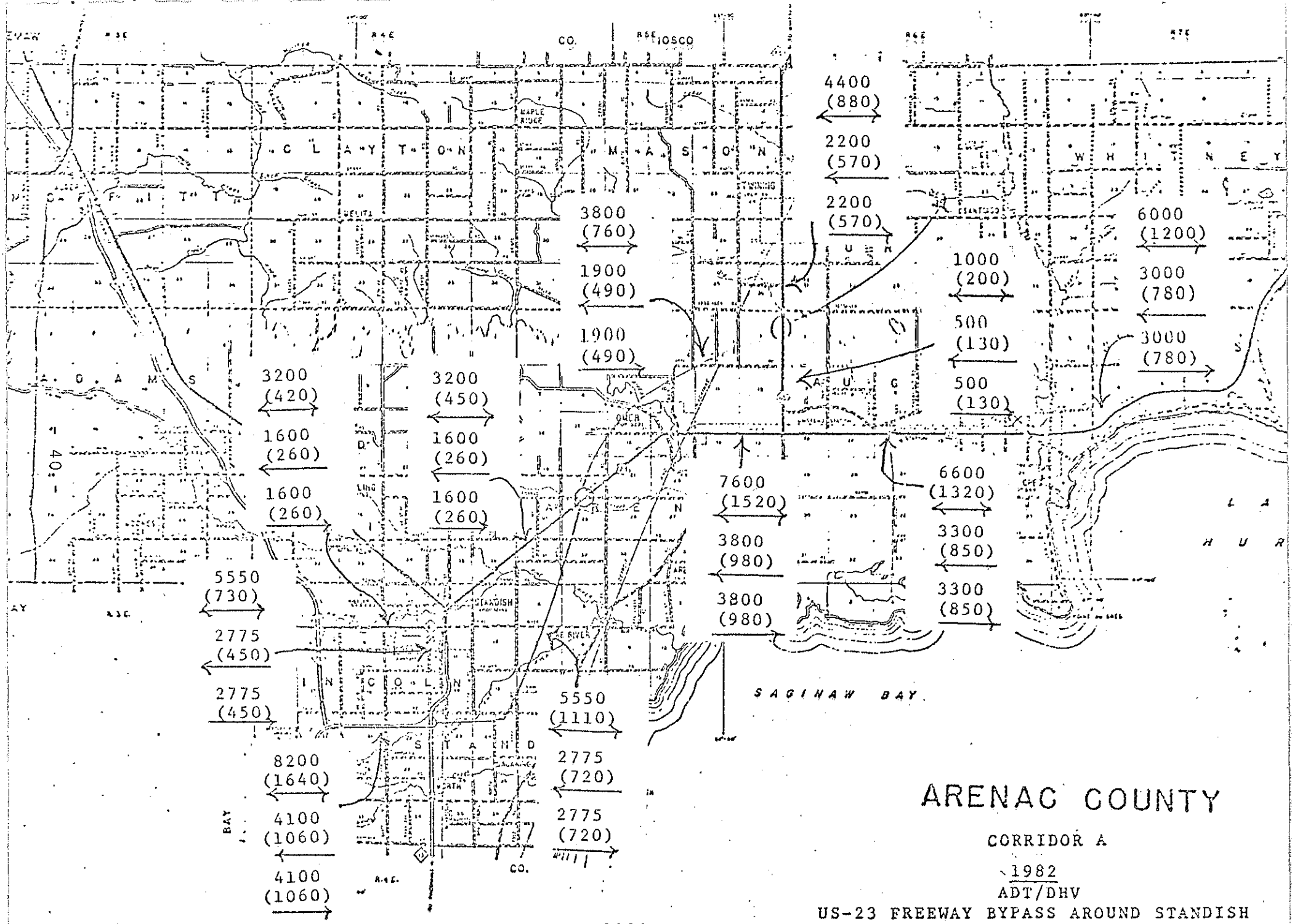
CLAY TOWN
MASON
WHITNEY
ADAMS
LINCOLN
SAGINAW BAY
ARENAC COUNTY
1995
ADT/DHV
DO NOTHING

Revised 2/76

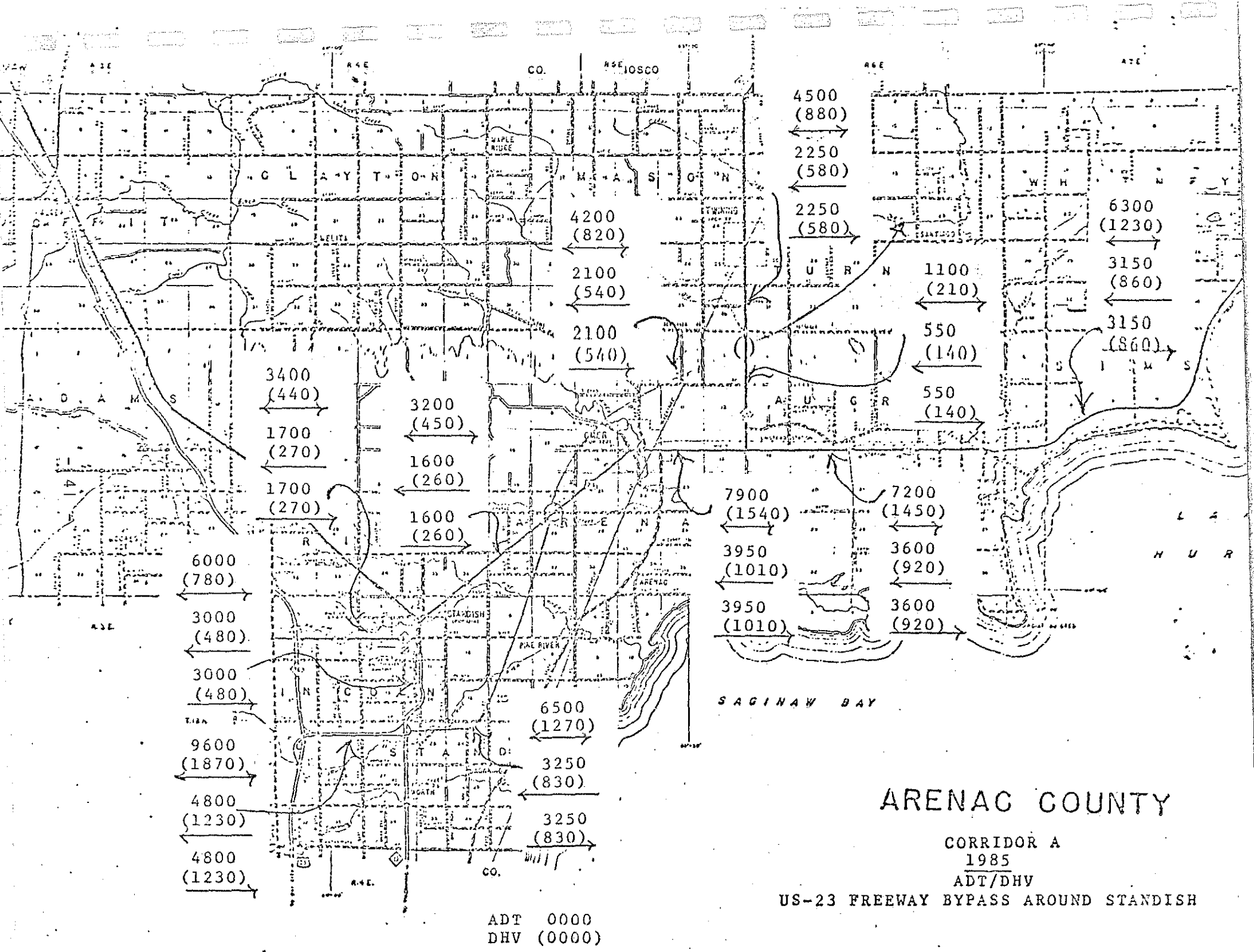


ARENAC COUNTY

CORRIDOR A

1982
ADT/DHV

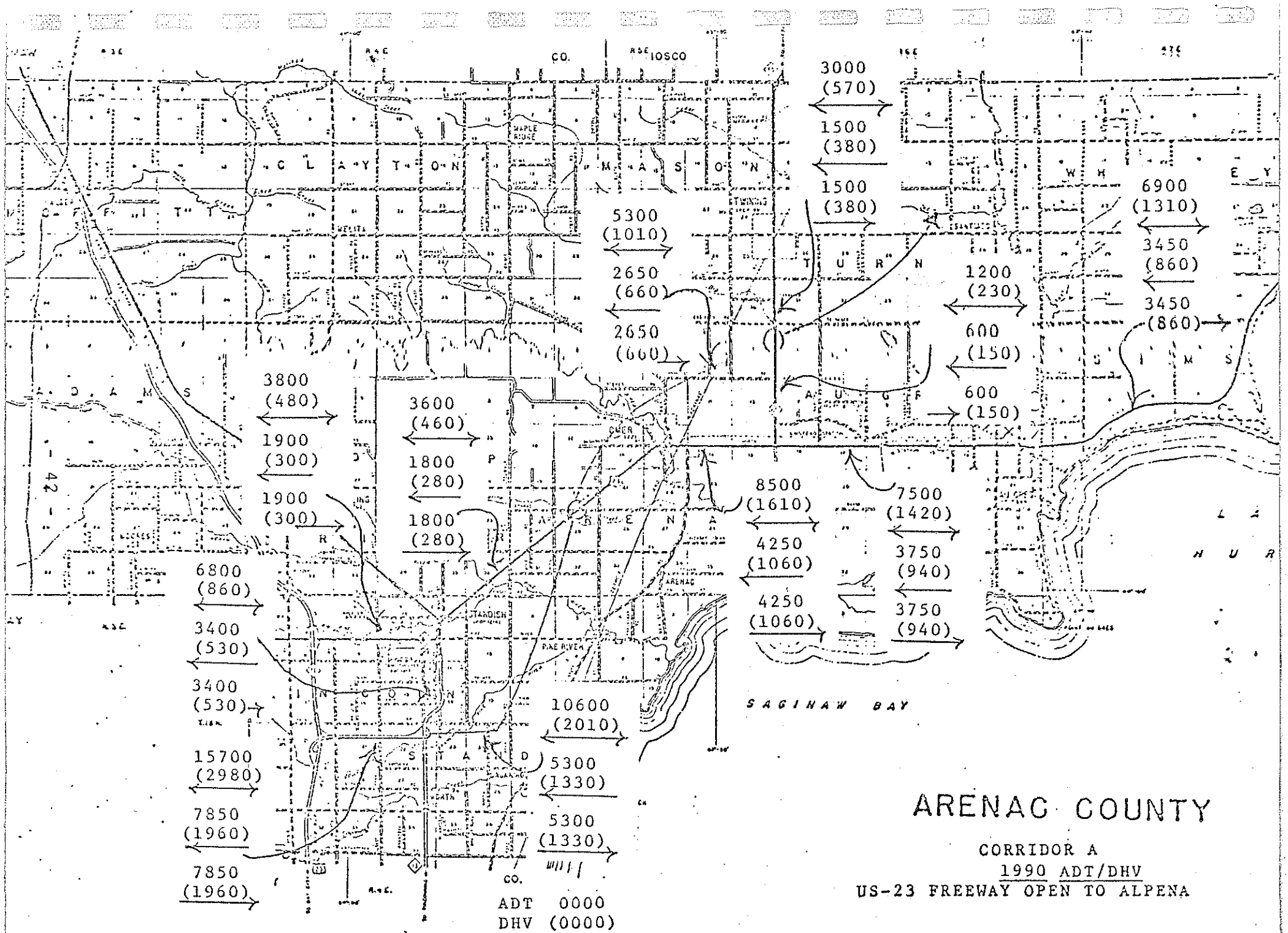
US-23 FREEWAY BYPASS AROUND STANDISH



ARENAC COUNTY

CORRIDOR A
1985
ADT/DHV
US-23 FREEWAY BYPASS AROUND STANDISH

Revised 2/76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7850
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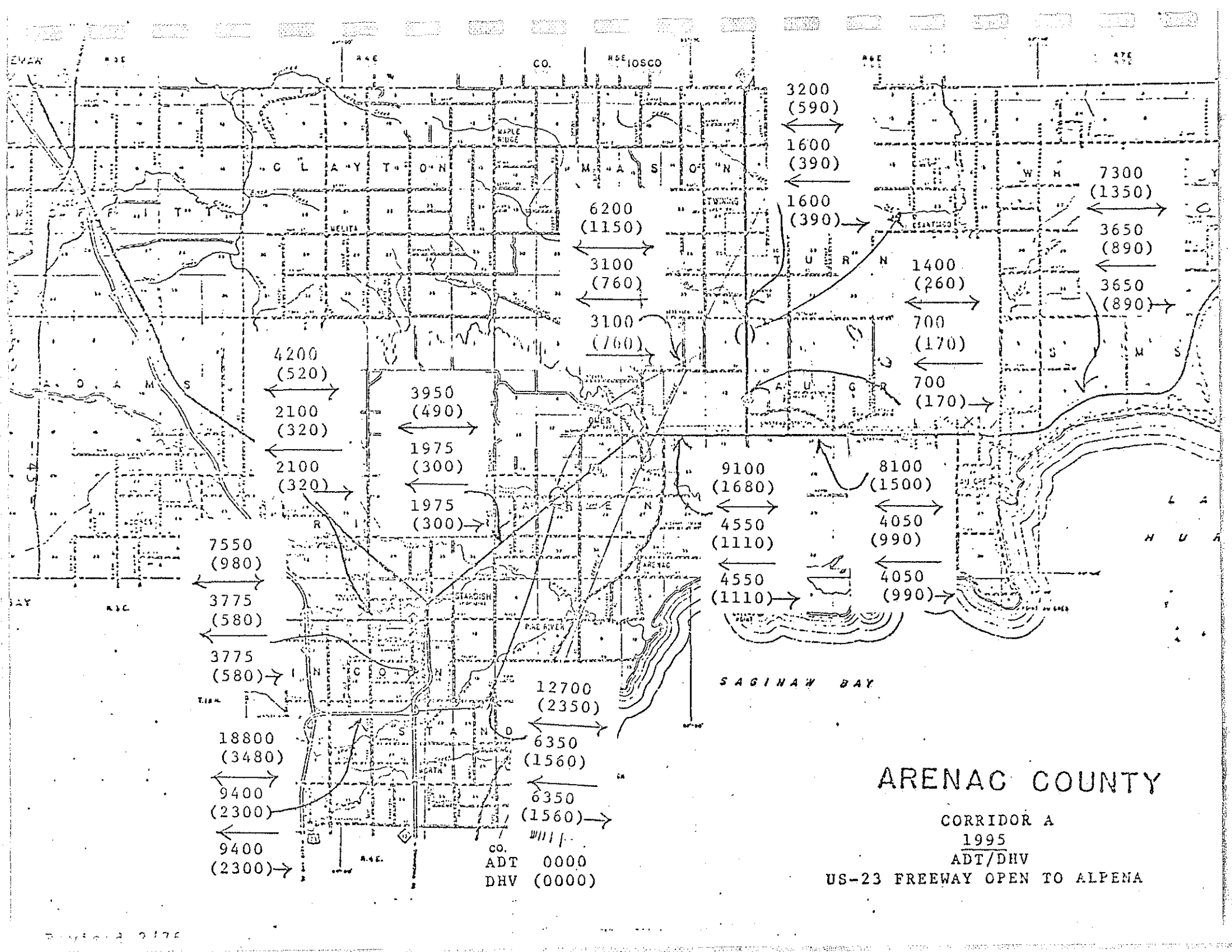
CO.
ADT 0000
DHV (0000)
SAGINAW BAY
ARENAC COUNTY
CORRIDOR A
1990 ADT/DHV
US-23 FREEWAY OPEN TO ALPENA



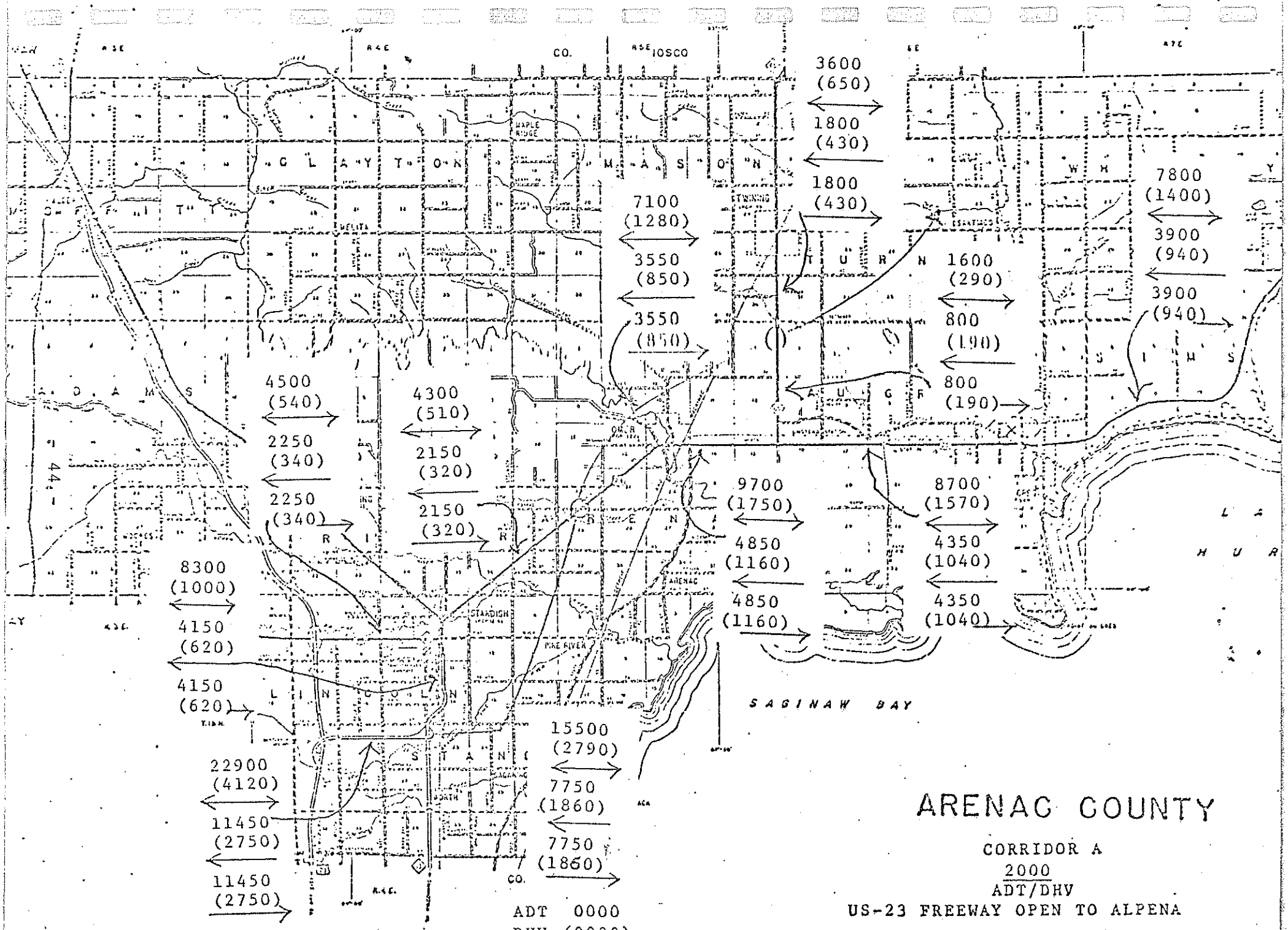
ARENAC COUNTY

CORRIDOR A

1995

ADT/DHV

US-23 FREEWAY OPEN TO ALPENA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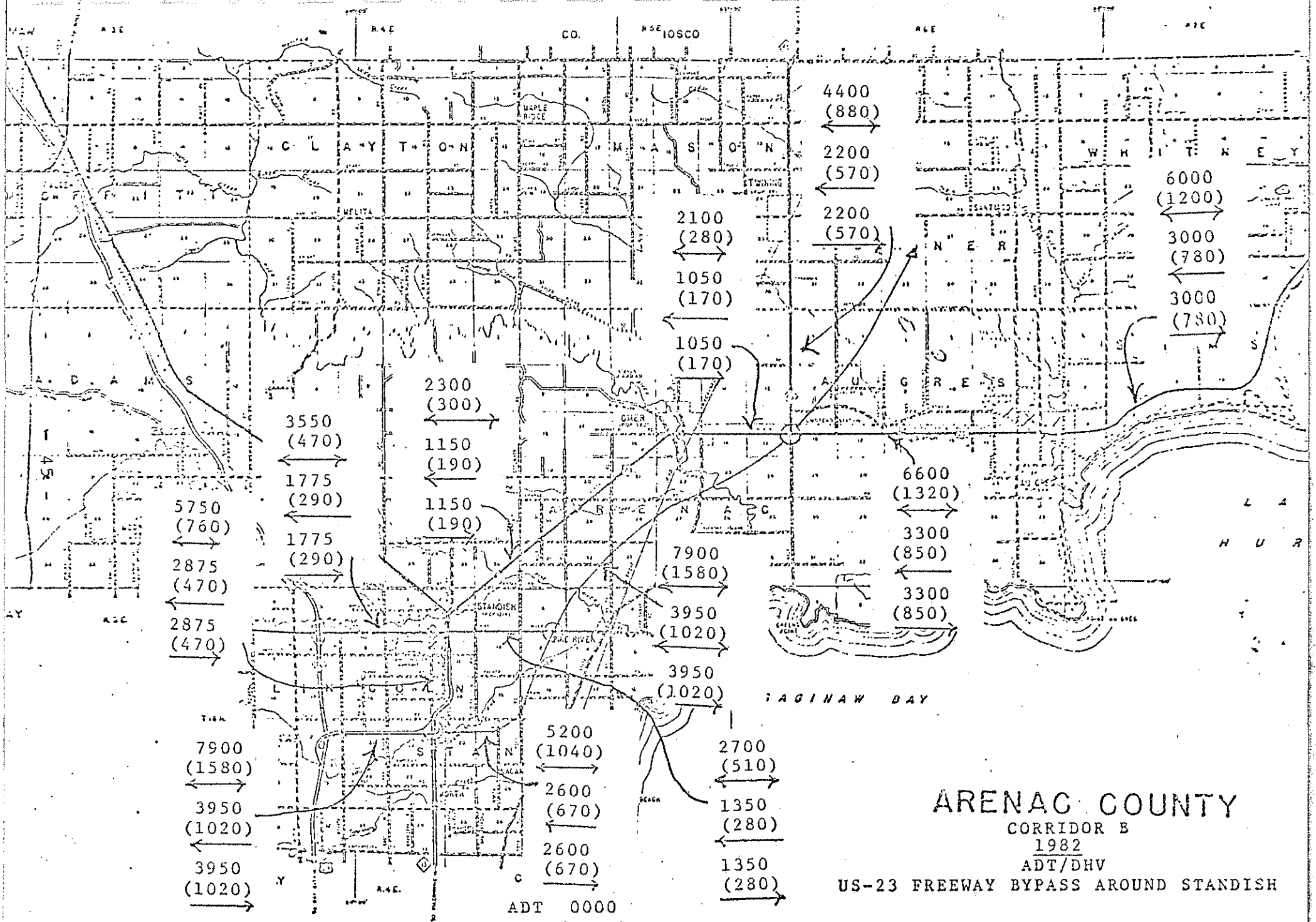
DHV (0000)
SAGINAW BAY
ARENAC COUNTY
CORRIDOR A
2000
ADT/DHV
US-23 FREEWAY OPEN TO ALPENA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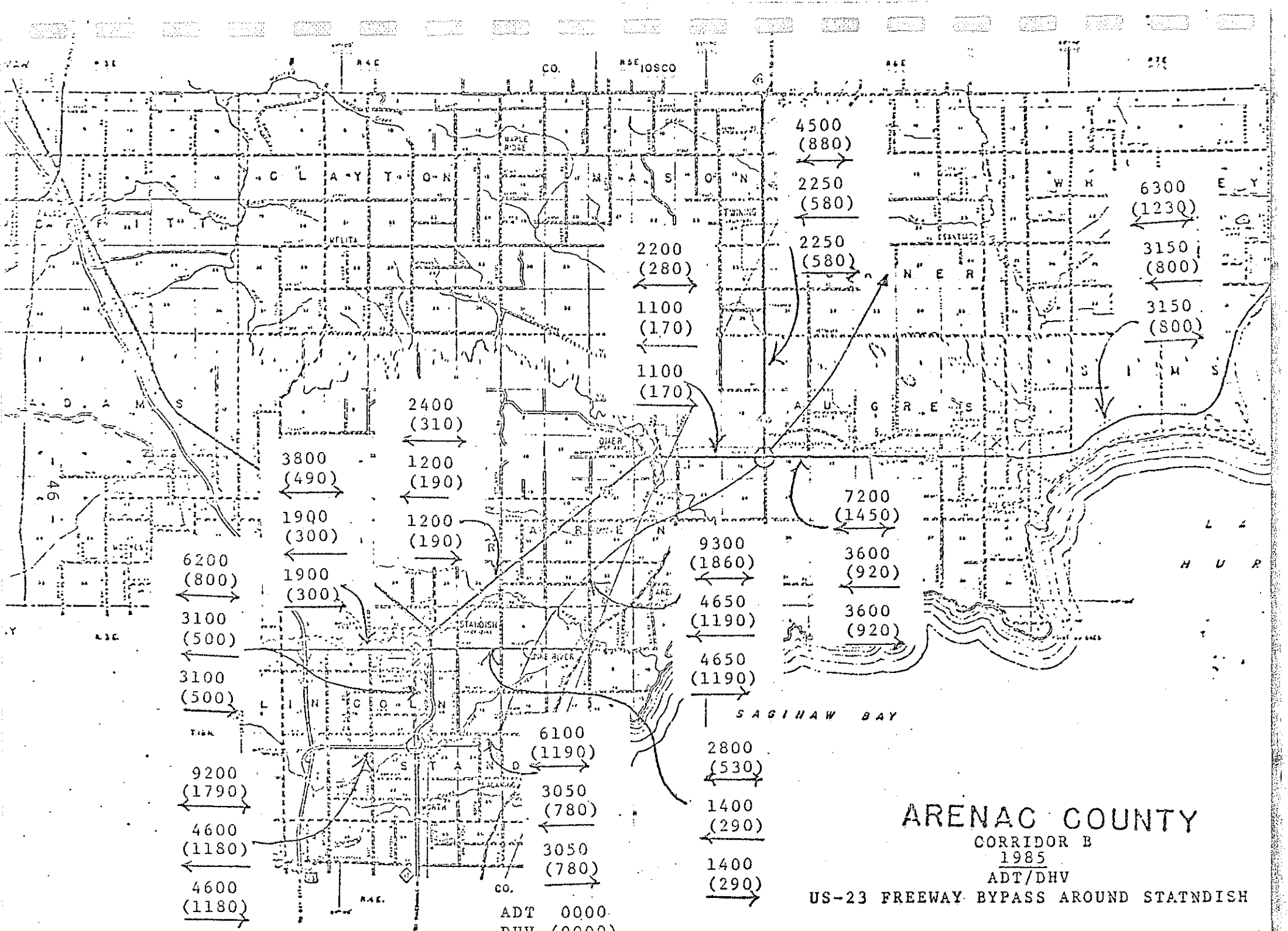
ADT 0000
DHV (0000)
I 45
CLAYTON
MASON
WHITNEY
ADAMS
AUGRES
ARENAC
LAKE HURON
SAGINAW BAY
STANDISH
IOSCO
ARENAC COUNTY
CORRIDOR B
1982
ADT/DHV
US-23 FREEWAY BYPASS AROUND STANDISH



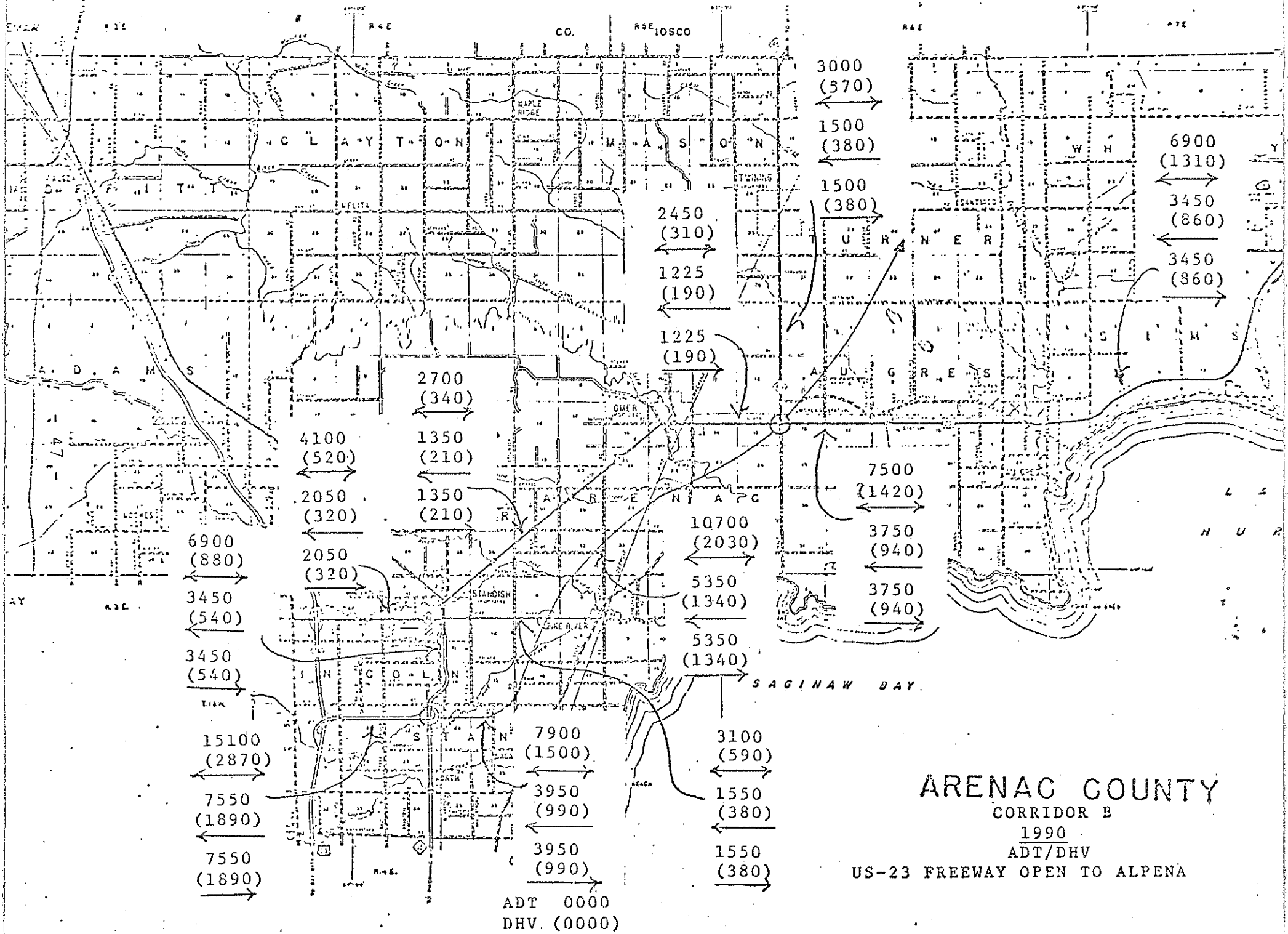
ARENAC COUNTY

CORRIDOR B

1985

ADT/DHV

US-23 FREEWAY BYPASS AROUND STATNDISH



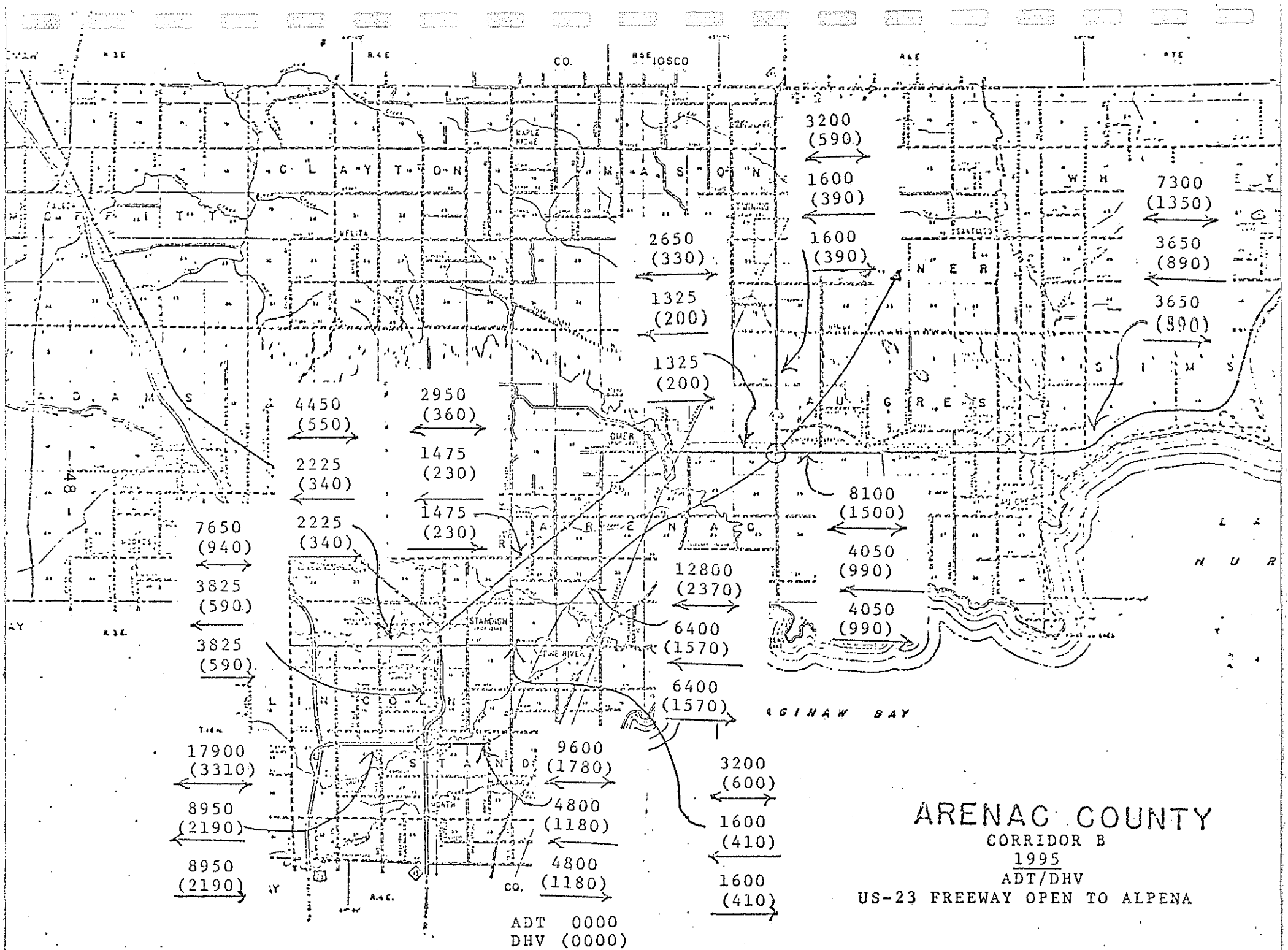
ARENAC COUNTY

CORRIDOR B

1990

ADT/DHV

US-23 FREEWAY OPEN TO ALPENA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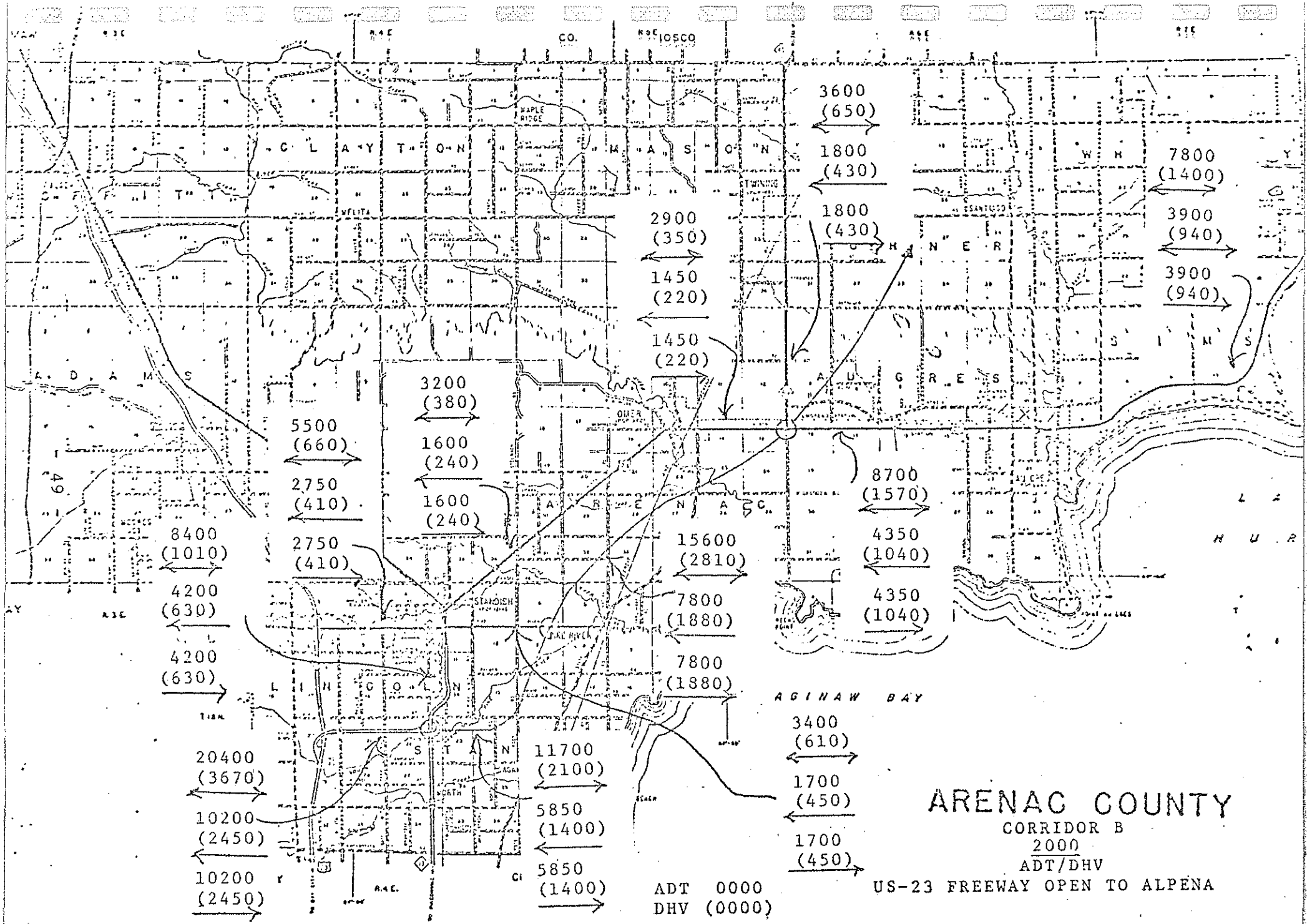
DHV (0000)
ARENAC COUNTY
CORRIDOR B
1995
ADT/DHV
US-23 FREEWAY OPEN TO ALPENA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ADT 0000
DHV (0000)
ARENAC COUNTY
CORRIDOR B
2000
ADT/DHV
US-23 FREEWAY OPEN TO ALPENA

Revised 2/76

CONCLUSION

A deficient level of service is shown on US-23 for 1971 from the city limits on both ends of Standish into the business district. All other segments are approaching dificient levels, along US-23. Taking the "Do-Nothing" alternatives into consideration the 1995 level of service on all segments will show a level of service "F" which is critical. The Do-Nothing approach shows level of service "F" with parking and without parking. A field trip to the study area noted that there was metered parallel parking on both sides of the state trunkline in the city of Standish. If parking were removed, traffic would tend to flow smoother during the week, however, during the week-ends traffic would continue to be congested because there would be three lanes in one direction merging to one lane at the north end of Main Street. Since this is primarily a recreational route Northbound traffic will peak on Friday night and Southbound traffic will peak on late Sunday afternoon. By 1995 removal of parking will have little or no significance as capacity deficiencies will remain critical.

Corridor A with parking or without parking relieves congested traffic from the city of Standish, but would not relieve capacity deficiencies in the village of Omer. Recreational vehicles would be getting off the assumed by-pass just west of Omer to get to the coastal towns such as Tawas and AuGres, which have a high concentration of recreational facilities.

Corridor B would relieve traffic from Standish and Omer because the assumed by-pass would extend to the east of Omer crossing US-23 near M-65. The majority of the traffic, being recreational, would

by-pass Standish and Omer, therefore, reducing congestion and improving the level of service from "E" to a free flow level of service from "A".