Volume 1

Names:
Major Street Plan

Places:
Huntsville, AL

Types:
booklet cover

Dates:
1966

Volume 1

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Foreward

Names:

Huntsville Area Transportation Study

Places:

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Types:

booklet

Dates:

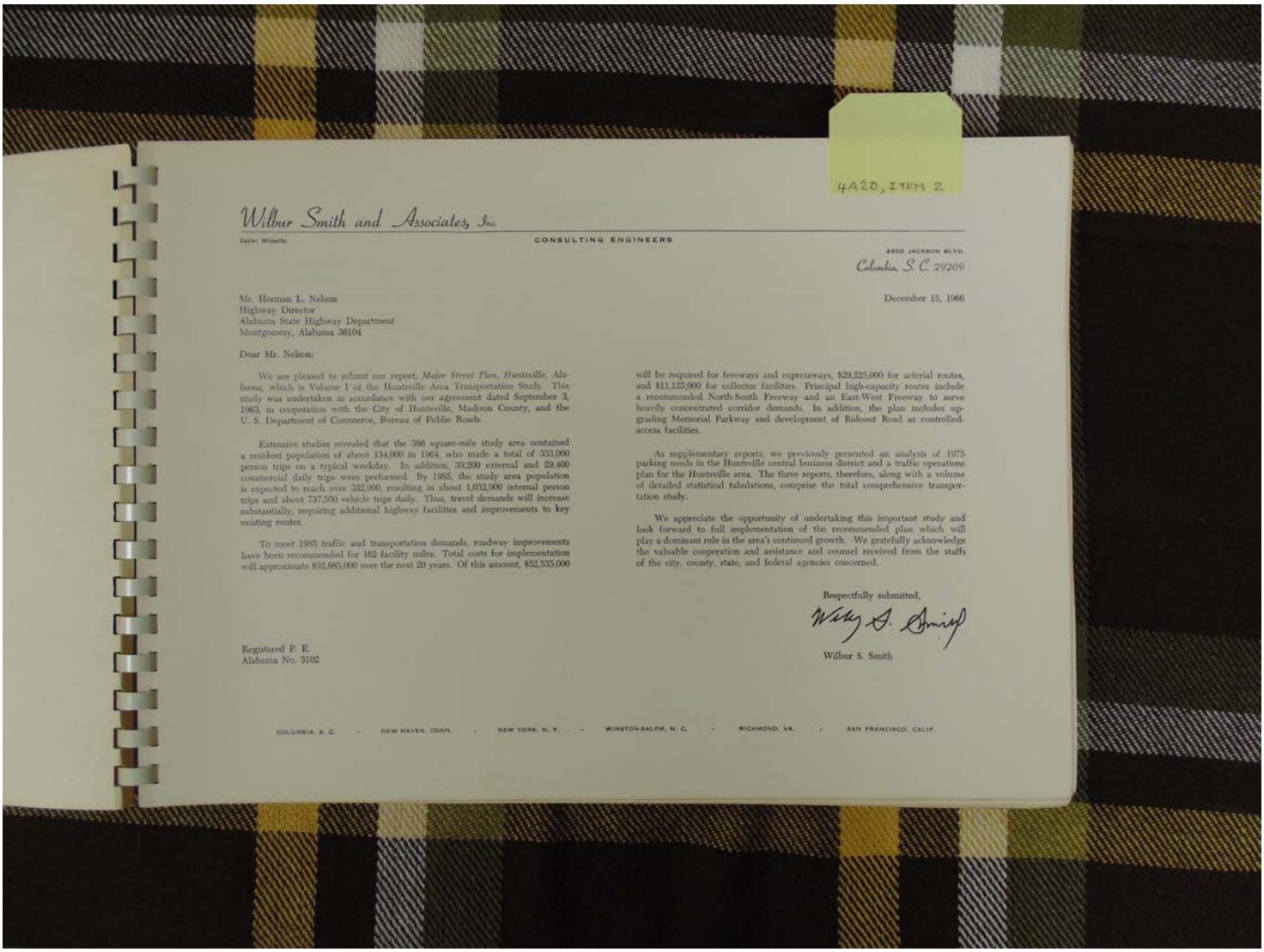
1966

Names:
Huntsville Area Transportation Study

Places:
Huntsville, AL

Types:
booklet

Dates:
1966



Names:

Major Street Plan, Huntsville,	Alabama	Smith, Wilbur S.	Wilbur Smith and Associates, Inc.
	Nelson, Herman L.		

Places:

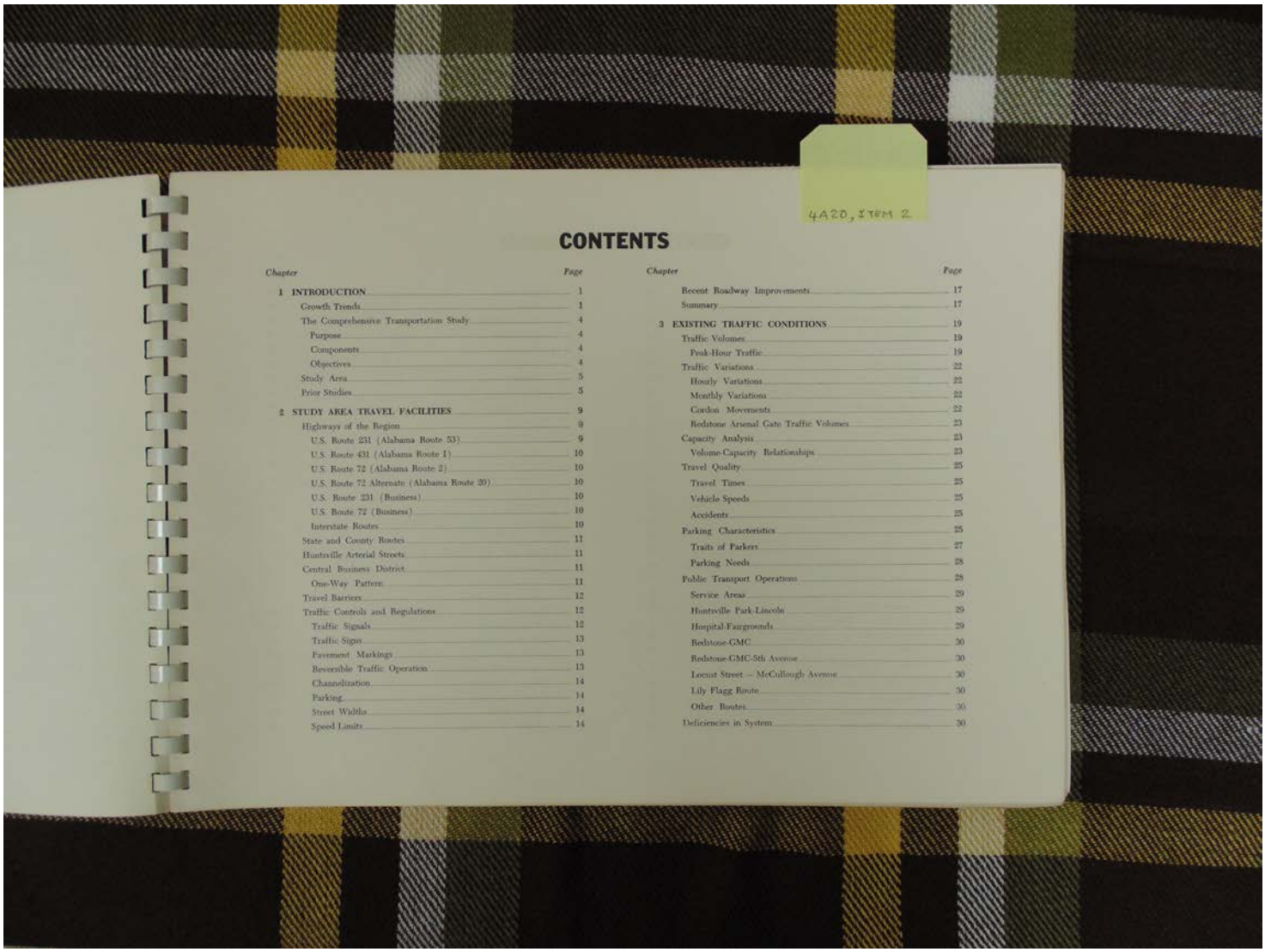
Columbia, SC	Montgomery, AL

Types:

address	booklet	correspondence	booklet

Dates:

Dec 15, 1966



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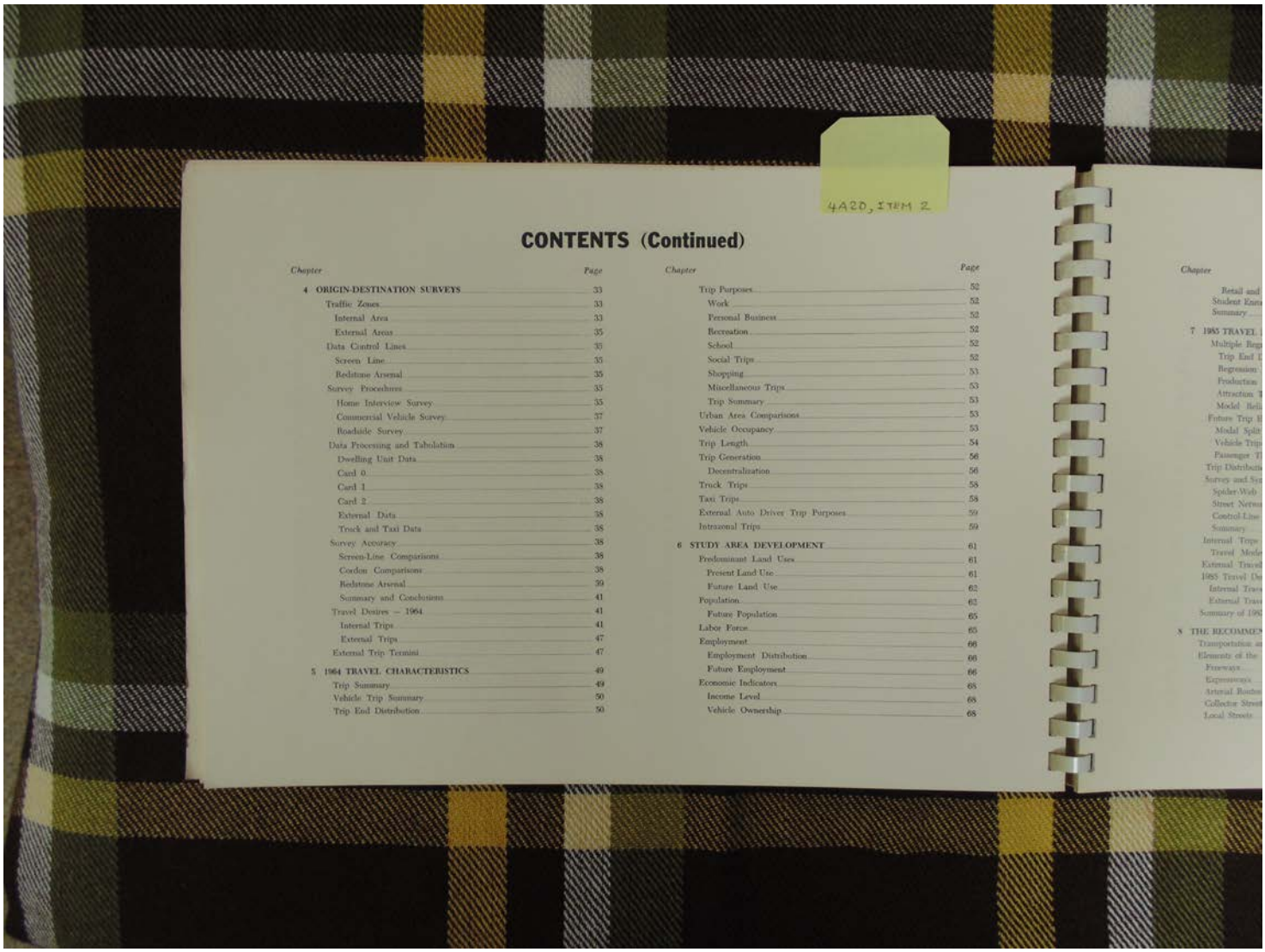

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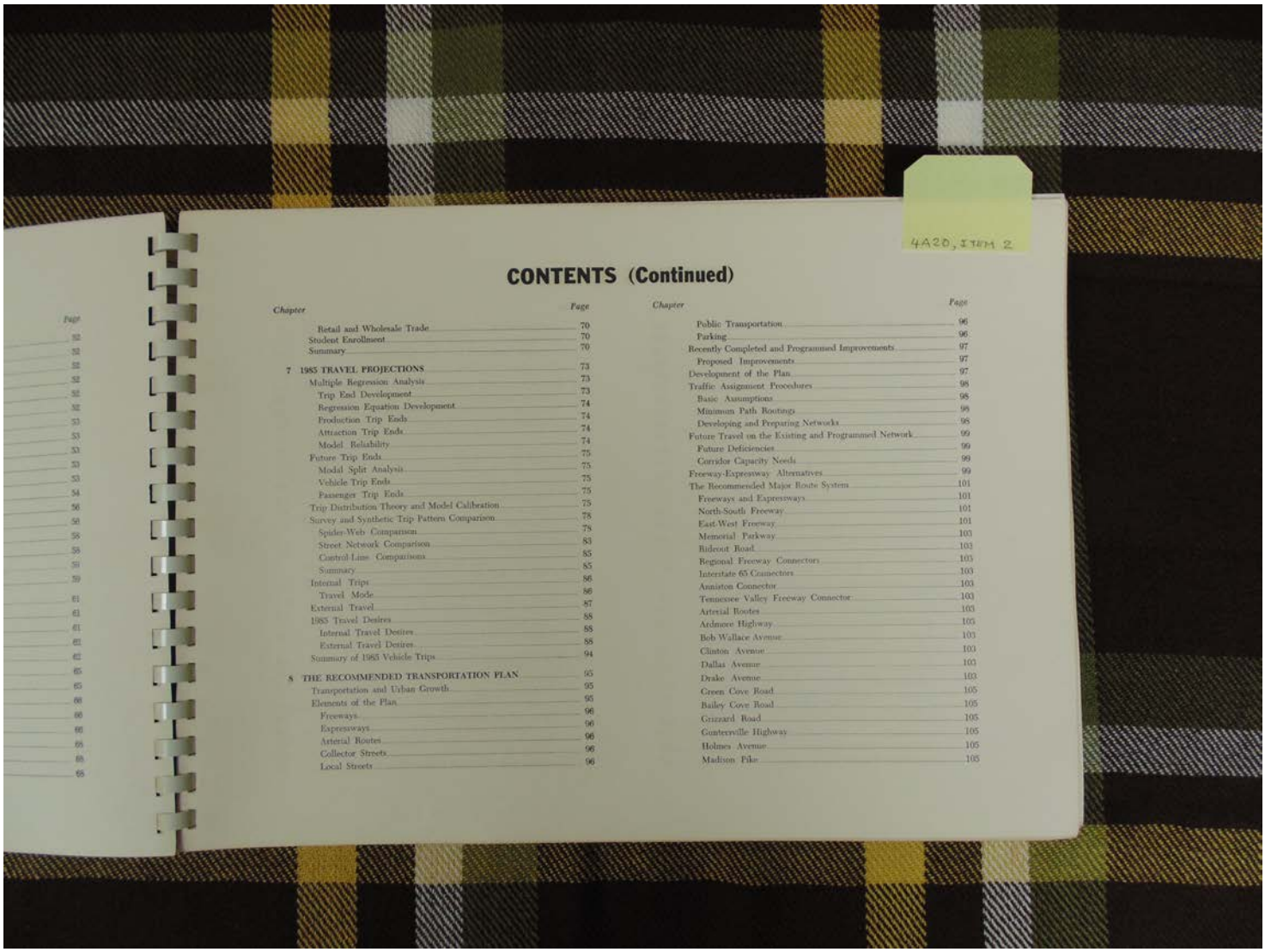

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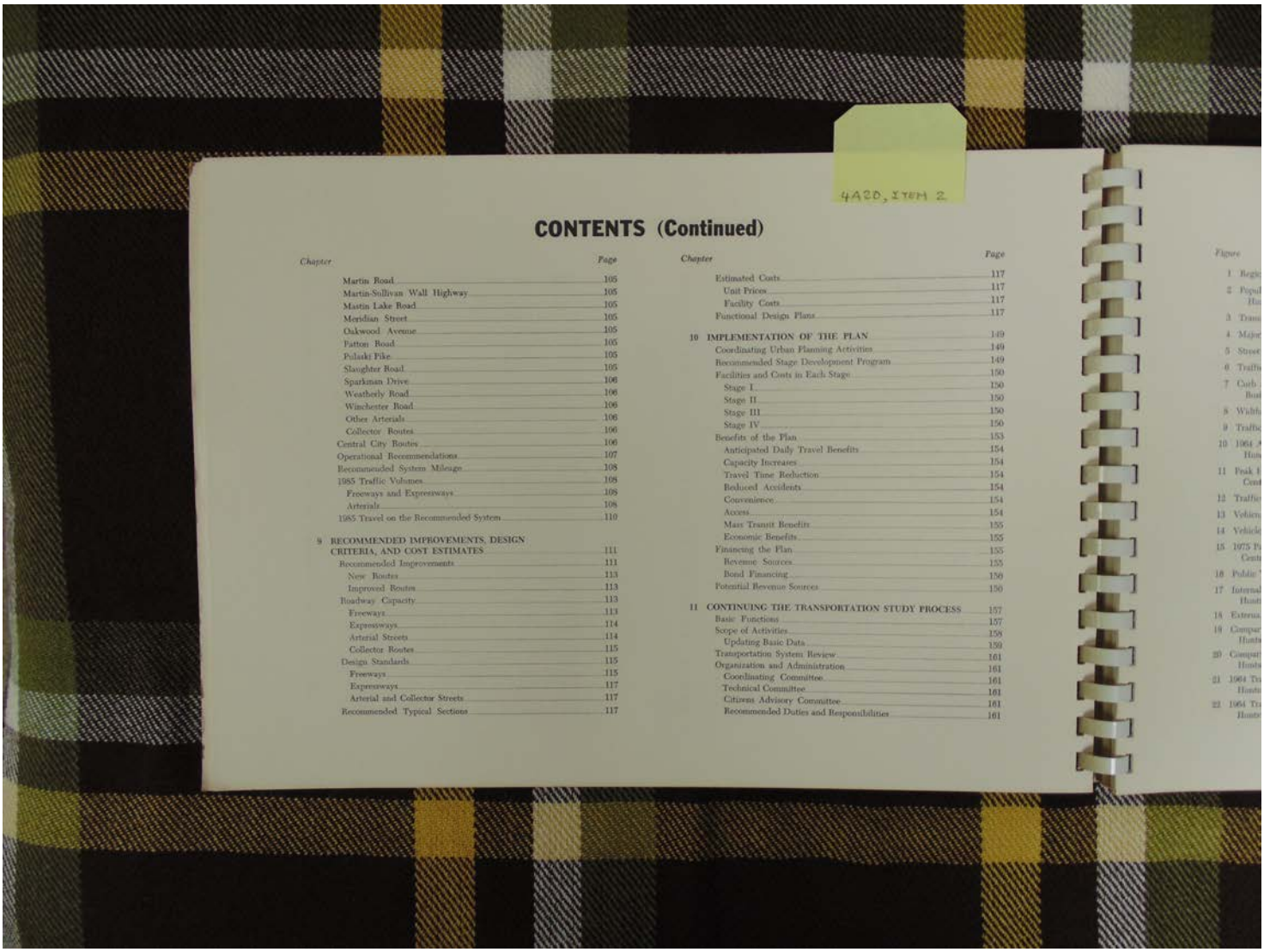

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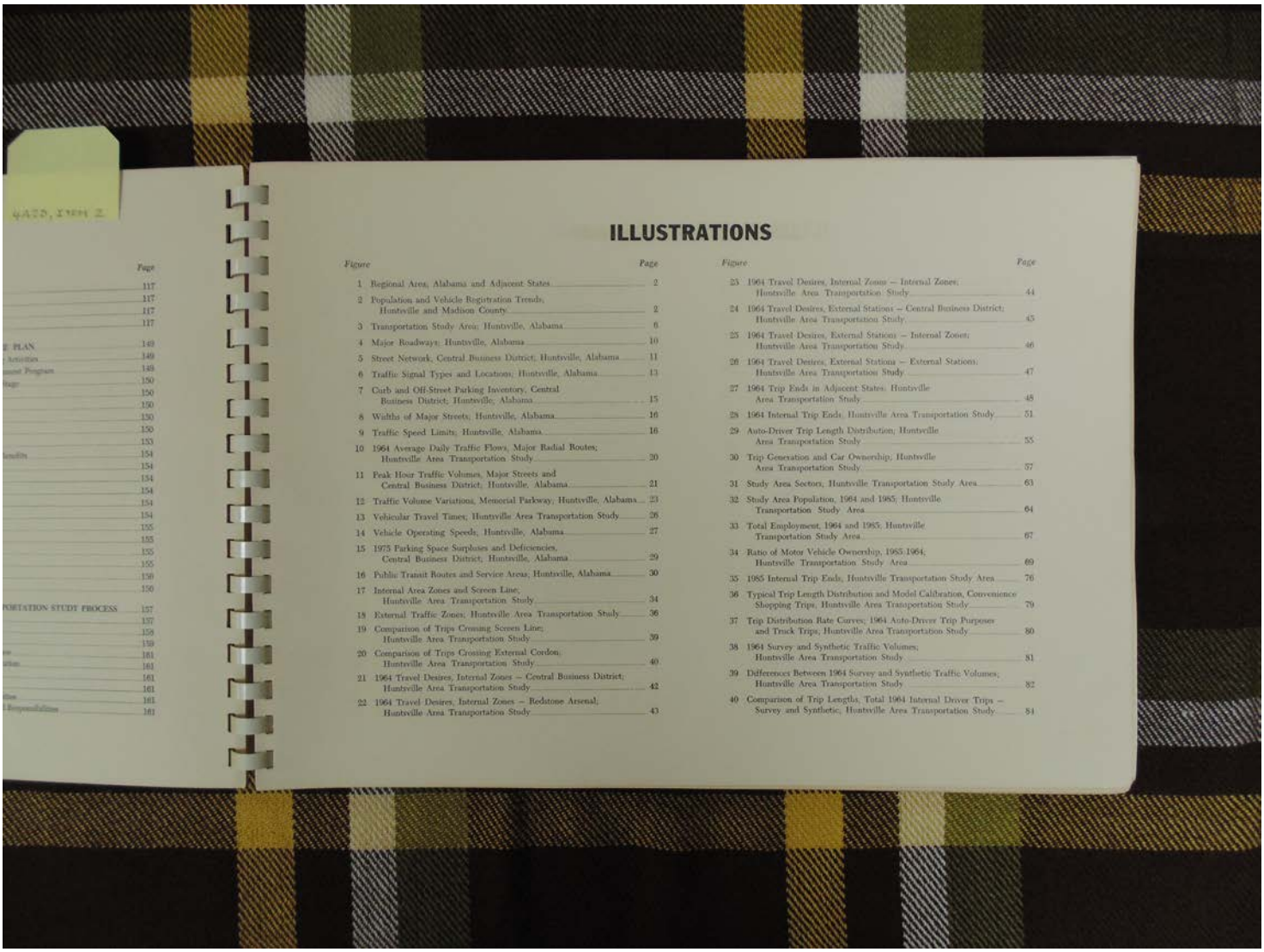

ILLUSTRATIONS

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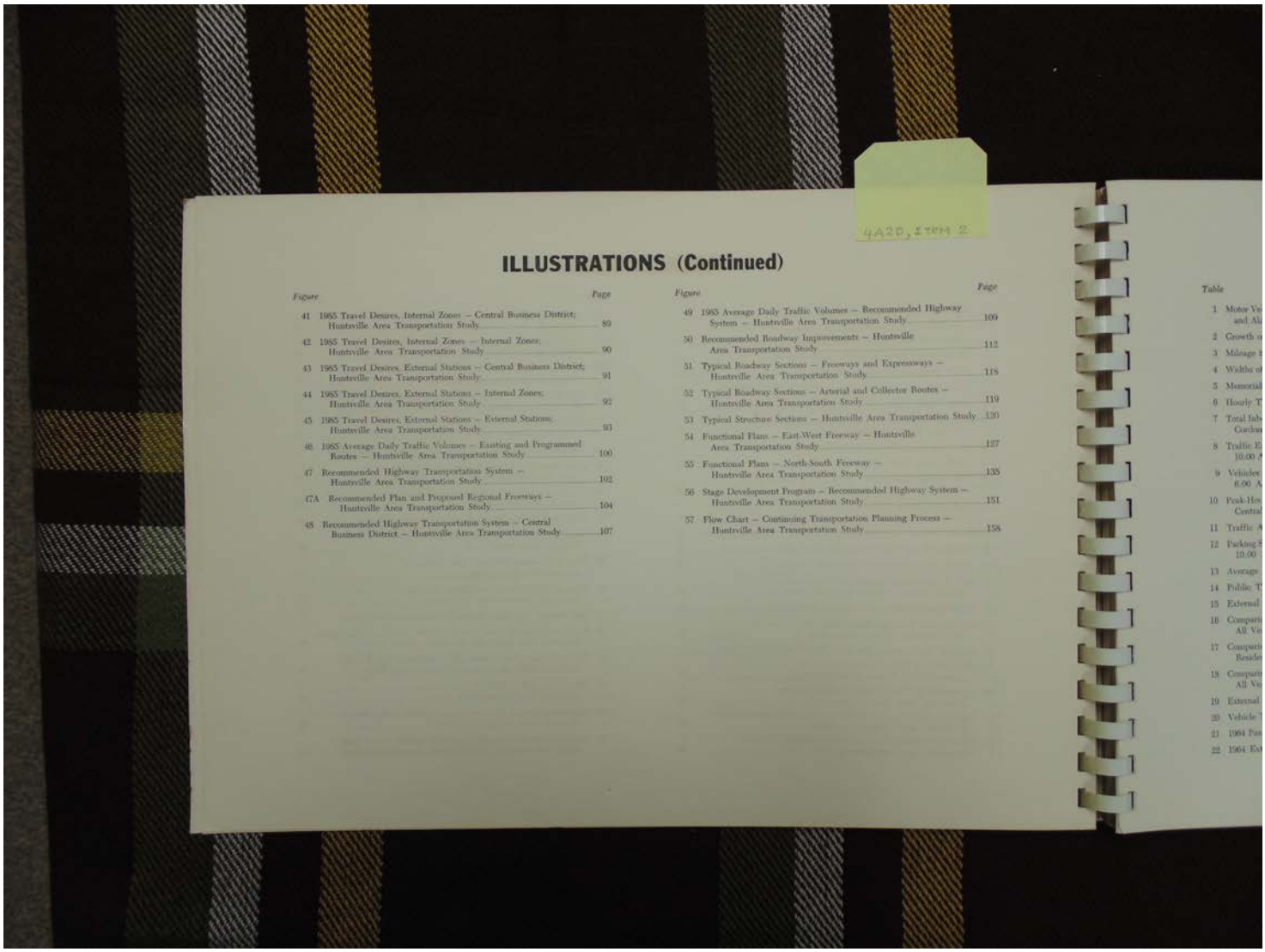

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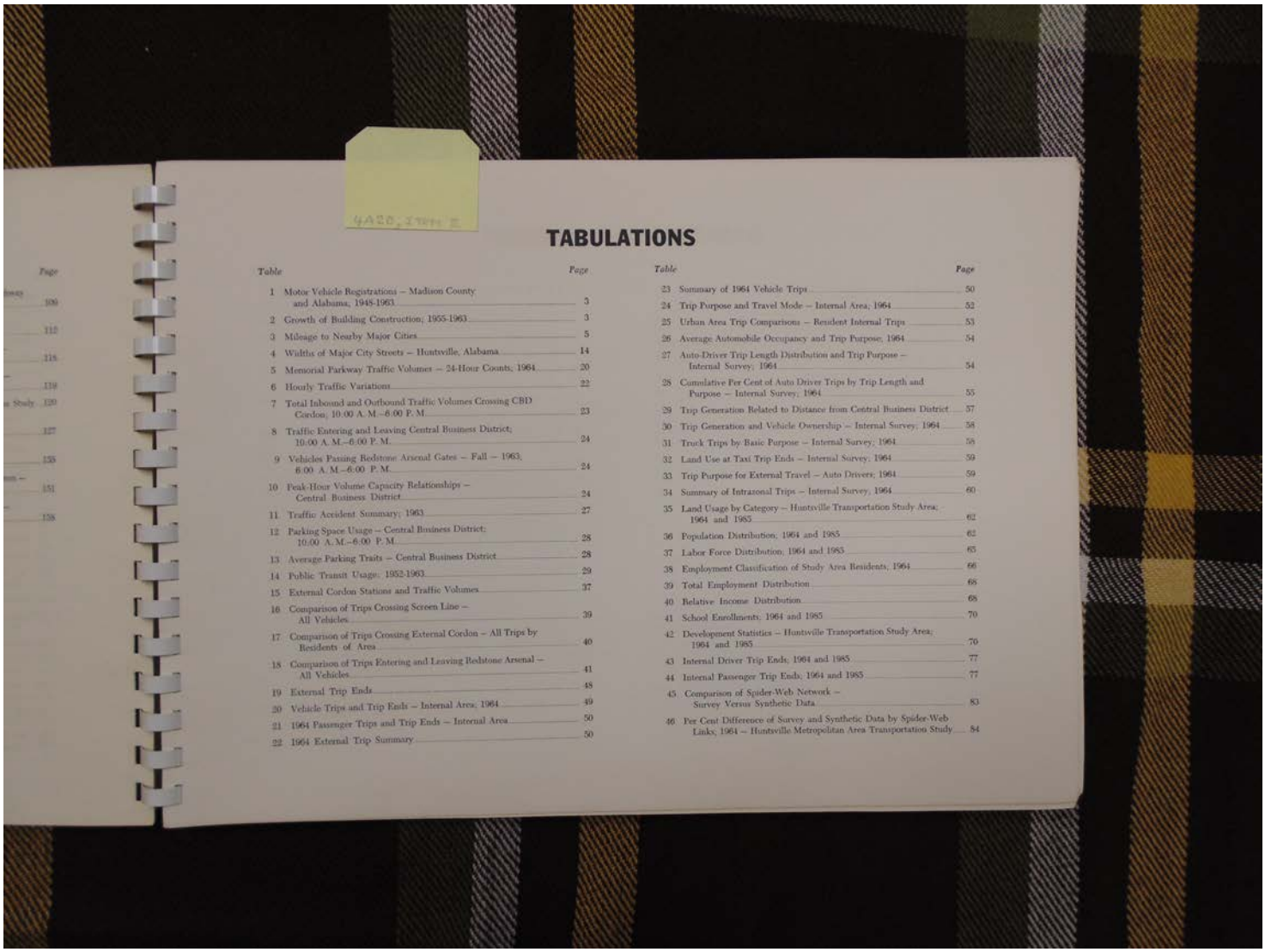

TABULATIONS

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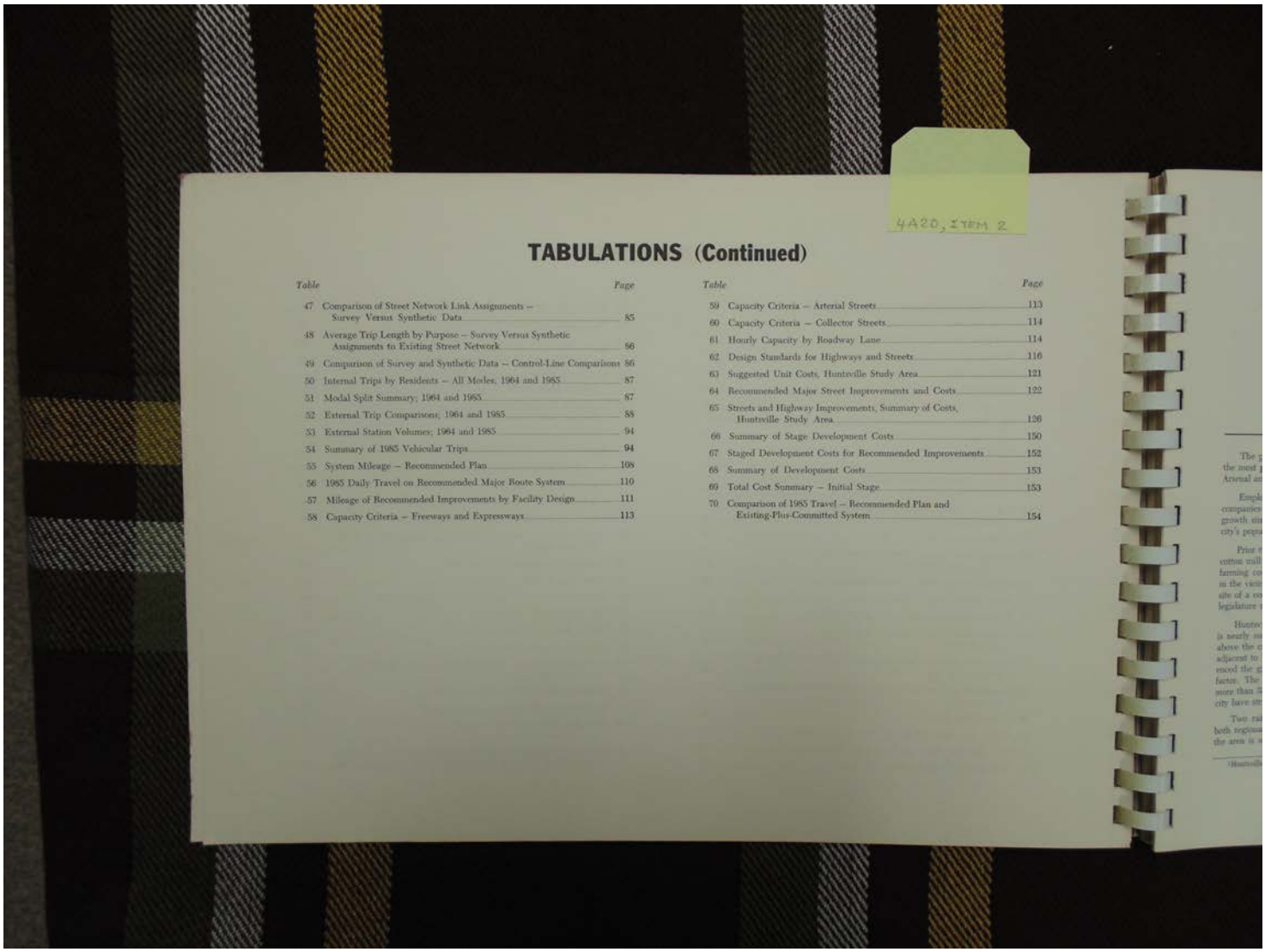

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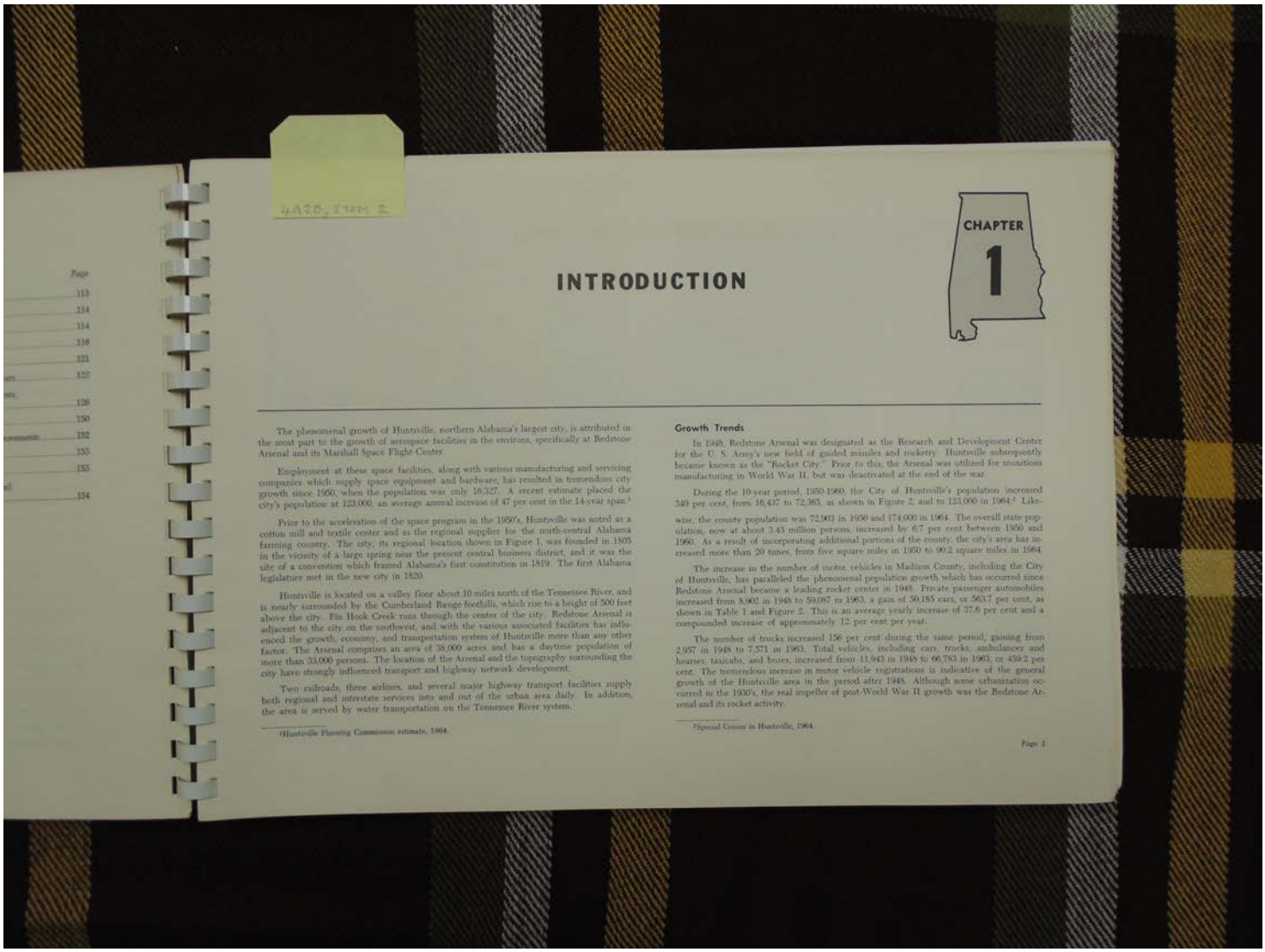

CHAPTER 1

INTRODUCTION

The phenomenal growth of Huntsville, northern Alabama's largest city, is attributed in the most part to the growth of aerospace facilities in the environs, specifically at Redstone Arsenal and its Marshall Space Flight Center.

Employment at these space facilities, along with various manufacturing and servicing companies which supply space equipment and hardware, has resulted in tremendous city growth since 1950, when the population was only 16,327. A recent estimate placed the city's population at 123,000, an average annual increase of 47 per cent in the 14-year span.[1]

Prior to the acceleration of the space program in the 1950's, Huntsville was noted as a cotton mill and textile center and as the regional supplier for the north-central Alabama farming country. The city, its regional location shown in Figure 1, was founded in 1805 in the vicinity of a large spring near the present central business district, and it was the site of a convention which framed Alabama's first constitution in 1819. The first Alabama legislature met in the new city in 1820.

Huntsville is located on a valley floor about 10 miles north of the Tennessee River, and is nearly surrounded by the Cumberland Range foothills, which rise to a height of 500 feet above the city. Pin Hook Creek runs through the center of the city. Redstone Arsenal is adjacent to the city on the southwest, and with the various associated facilities has influenced the growth, economy, and transportation system of Huntsville more than any other factor. The Arsenal comprises an area of 38,000 acres and has a daytime population of more than 33,000 persons. The location of the Arsenal and the topography surrounding the city have strongly influenced transport and highway network development.

Two railroads, three airlines, and several major highway transport facilities supply both regional and interstate services into and out of the urban area daily. In addition, the area is served by water transportation on the Tennessee River system.

[1]Huntsville Planning Commission estimate, 1964.

Growth Trends

In 1948, Redstone Arsenal was designated as the Research and Development Center for the U. S. Army's new field of guided missiles and rocketry. Huntsville subsequently became known as the "Rocket City." Prior to this, the Arsenal was utilized for munitions manufacturing in World War II, but was deactivated at the end of the war.

During the 10-year period, 1950-1960, the City of Huntsville's population increased 340 per cent, from 16,437 to 72,365, as shown in Figure 2, and to 123,000 in 1964.[2] Likewise, the county population was 72,903 in 1950 and 174,000 in 1964. The overall state population, now at about 3.43 million persons, increased by 6.7 per cent between 1950 and 1960. As a result of incorporating additional portions of the county, the city's area has increased more than 20 times, from five square miles in 1950 to 90.2 square miles in 1964.

The increase in the number of motor vehicles in Madison County, including the City of Huntsville, has paralleled the phenomenal population growth which has occurred since Redstone Arsenal became a leading rocket center in 1948. Private passenger automobiles increased from 8,902 in 1948 to 59,087 in 1963, a gain of 50,185 cars, or 563.7 per cent, as shown in Table 1 and Figure 2. This is an average yearly increase of 37.6 per cent and a compounded increase of approximately 12 per cent per year.

The number of trucks increased 156 per cent during the same period, gaining from 2,957 in 1948 to 7,571 in 1963. Total vehicles, including cars, trucks, ambulances and hearses, taxicabs, and buses, increased from 11,943 in 1948 to 66,783 in 1963, or 459.2 per cent. The tremendous increase in motor vehicle registrations is indicative of the general growth of the Huntsville area in the period after 1948. Although some urbanization occurred in the 1930's, the real impeller of post-World War II growth was the Redstone Arsenal and its rocket activity.

[2]Special Census in Huntsville, 1964.

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Major Street Plan

Names:

Growth Trends | Introduction - Chapter 1 | Marshall Space Flight Center | Redstone Arsenal

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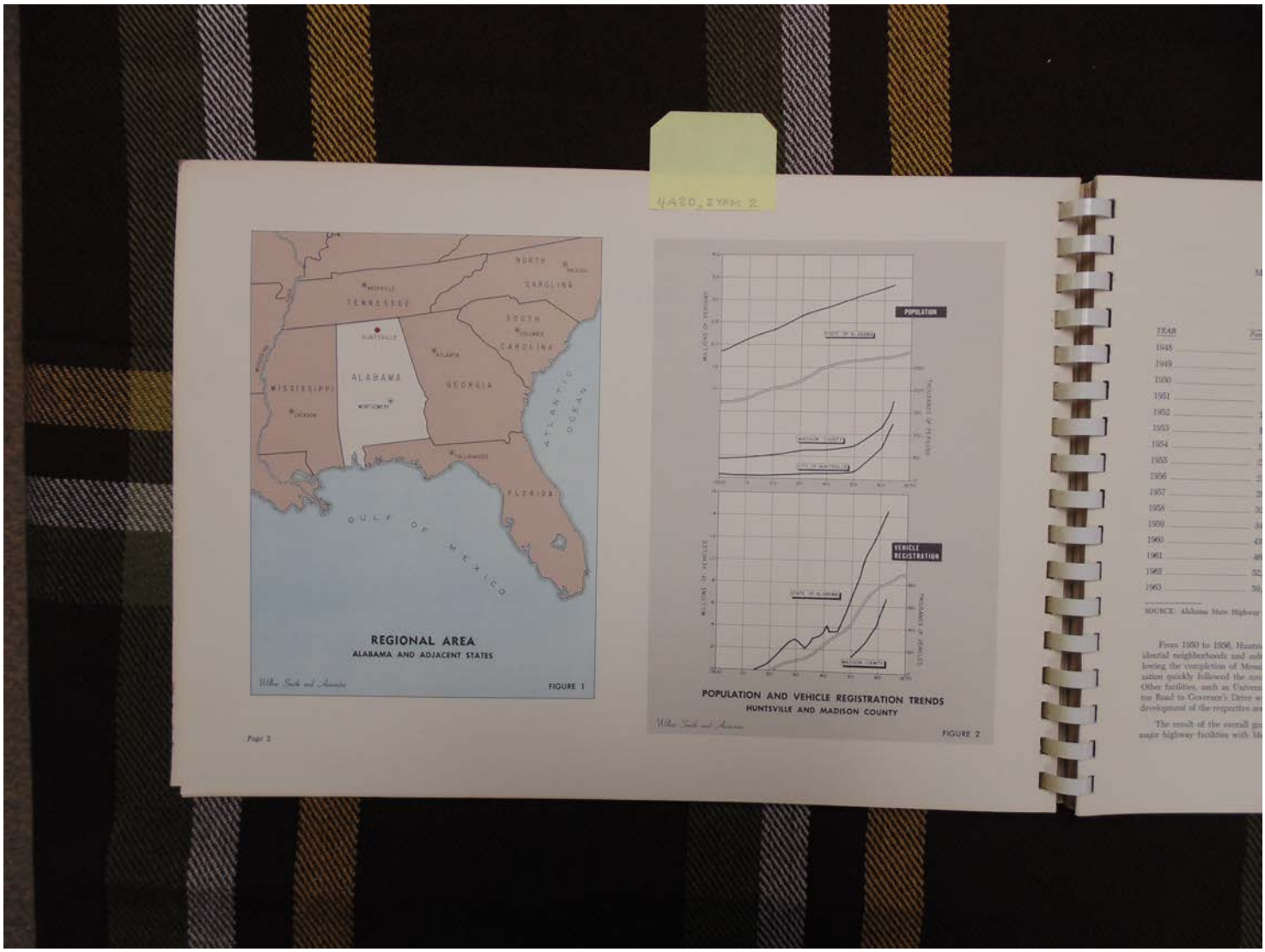

Major Street Plan

Names:

Population and Vehicle Registration
Trends
Regional Area

Places:

Huntsville, AL

Types:

booklet illustration
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map

Dates:

1966

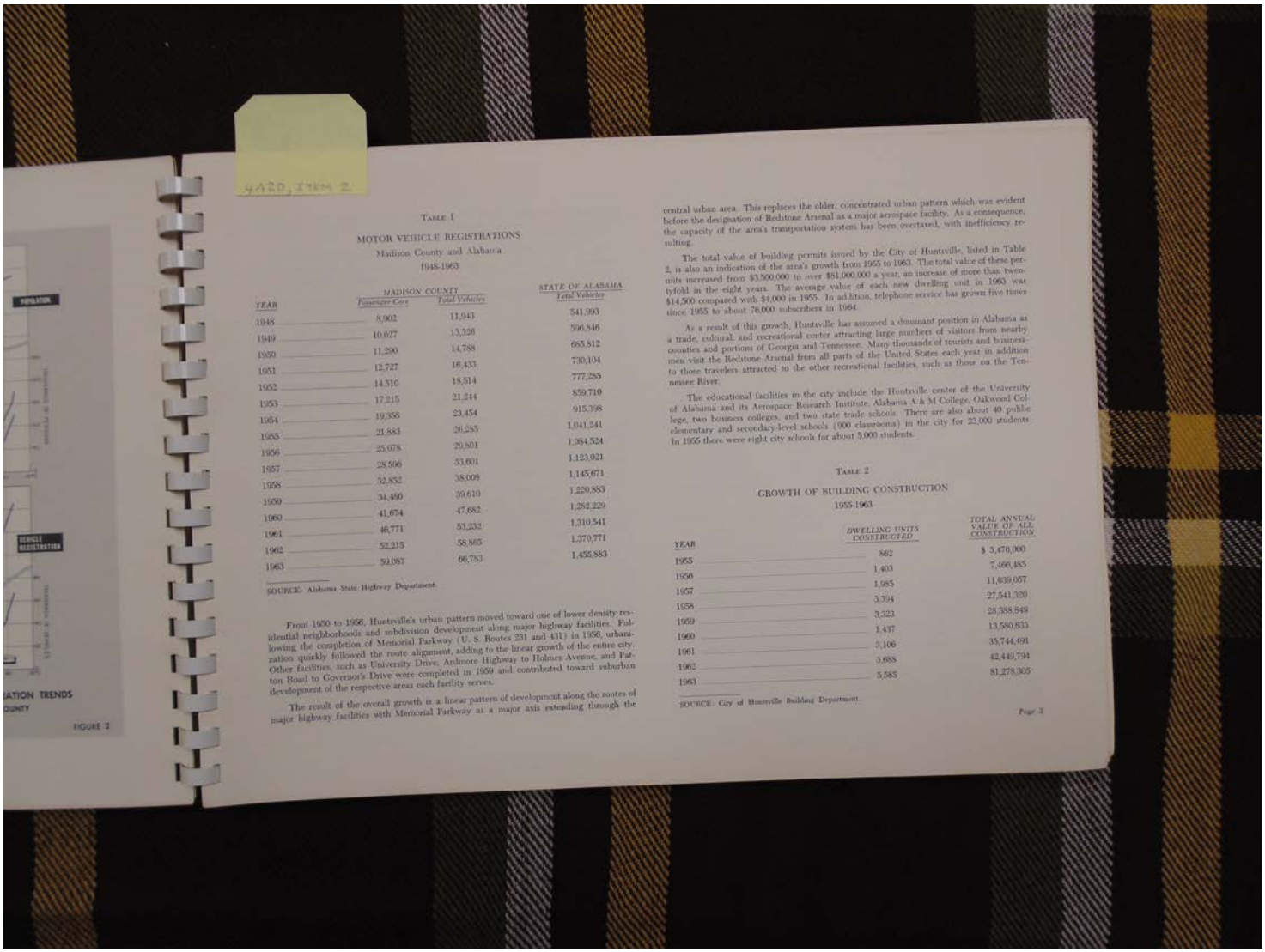

TABLE 1

MOTOR VEHICLE REGISTRATIONS

Madison County and Alabama

1948-1963

YEAR	MADISON COUNTY Passenger Cars	MADISON COUNTY Total Vehicles	STATE OF ALABAMA Total Vehicles
1948	8,902	11,943	541,993
1949	10,027	13,326	596,846
1950	11,290	14,788	665,812
1951	12,727	16,433	730,104
1952	14,510	18,514	777,285
1953	17,215	21,244	859,710
1954	19,358	23,454	915,398
1955	21,883	26,255	1,041,241
1956	25,078	29,801	1,084,524
1957	28,506	33,601	1,123,021
1958	32,852	38,009	1,145,671
1959	34,460	39,610	1,220,883
1960	41,674	47,682	1,282,229
1961	46,771	53,232	1,310,541
1962	52,215	58,865	1,370,771
1963	59,087	66,753	1,455,883

SOURCE: Alabama State Highway Department.

From 1950 to 1956, Huntsville's urban pattern moved toward one of lower density residential neighborhoods and subdivision development along major highway facilities. Following the completion of Memorial Parkway (U. S. Routes 231 and 431) in 1956, urbanization quickly followed the route alignment, adding to the linear growth of the entire city. Other facilities, such as University Drive, Ardmore Highway to Holmes Avenue, and Patton Road to Governor's Drive were completed in 1959 and contributed toward suburban development of the respective areas each facility serves.

The result of the overall growth is a linear pattern of development along the routes of major highway facilities with Memorial Parkway as a major axis extending through the central urban area. This replaces the older, concentrated urban pattern which was evident before the designation of Redstone Arsenal as a major aerospace facility. As a consequence, the capacity of the area's transportation system has been overtaxed, with inefficiency resulting.

The total value of building permits issued by the City of Huntsville, listed in Table 2, is also an indication of the area's growth from 1955 to 1963. The total value of these permits increased from $3,500,000 to over $81,000,000 a year, an increase of more than twenty-fold in the eight years. The average value of each new dwelling unit in 1963 was $14,500 compared with $4,000 in 1955. In addition, telephone service has grown five times since 1955 to about 76,000 subscribers in 1964.

As a result of this growth, Huntsville has assumed a dominant position in Alabama as a trade, cultural, and recreational center attracting large numbers of visitors from nearby counties and portions of Georgia and Tennessee. Many thousands of tourists and businessmen visit the Redstone Arsenal from all parts of the United States each year in addition to those travelers attracted to the other recreational facilities, such as those on the Tennessee River.

The educational facilities in the city include the Huntsville center of the University of Alabama and its Aerospace Research Institute, Alabama A & M College, Oakwood College, two business colleges, and two state trade schools. There are also about 40 public elementary and secondary-level schools (900 classrooms) in the city for 23,000 students. In 1955 there were eight city schools for about 5,000 students.

TABLE 2

GROWTH OF BUILDING CONSTRUCTION

1955-1963

YEAR	DWELLING UNITS CONSTRUCTED	TOTAL ANNUAL VALUE OF ALL CONSTRUCTION
1955	862	$ 3,478,000
1956	1,403	7,460,485
1957	1,985	11,039,057
1958	3,394	27,541,320
1959	3,323	28,388,849
1960	1,437	13,580,833
1961	3,106	35,744,491
1962	3,688	42,449,794
1963	5,585	81,278,305

SOURCE: City of Huntsville Building Department.

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Names:

Ardmore Highway
Building Construction
Governor's Drive
Holmes Avenue
Memorial Parkway
Motor Vehicle Registrations
Patton Road
University Drive

Places:

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Madison Co., AL

Types:

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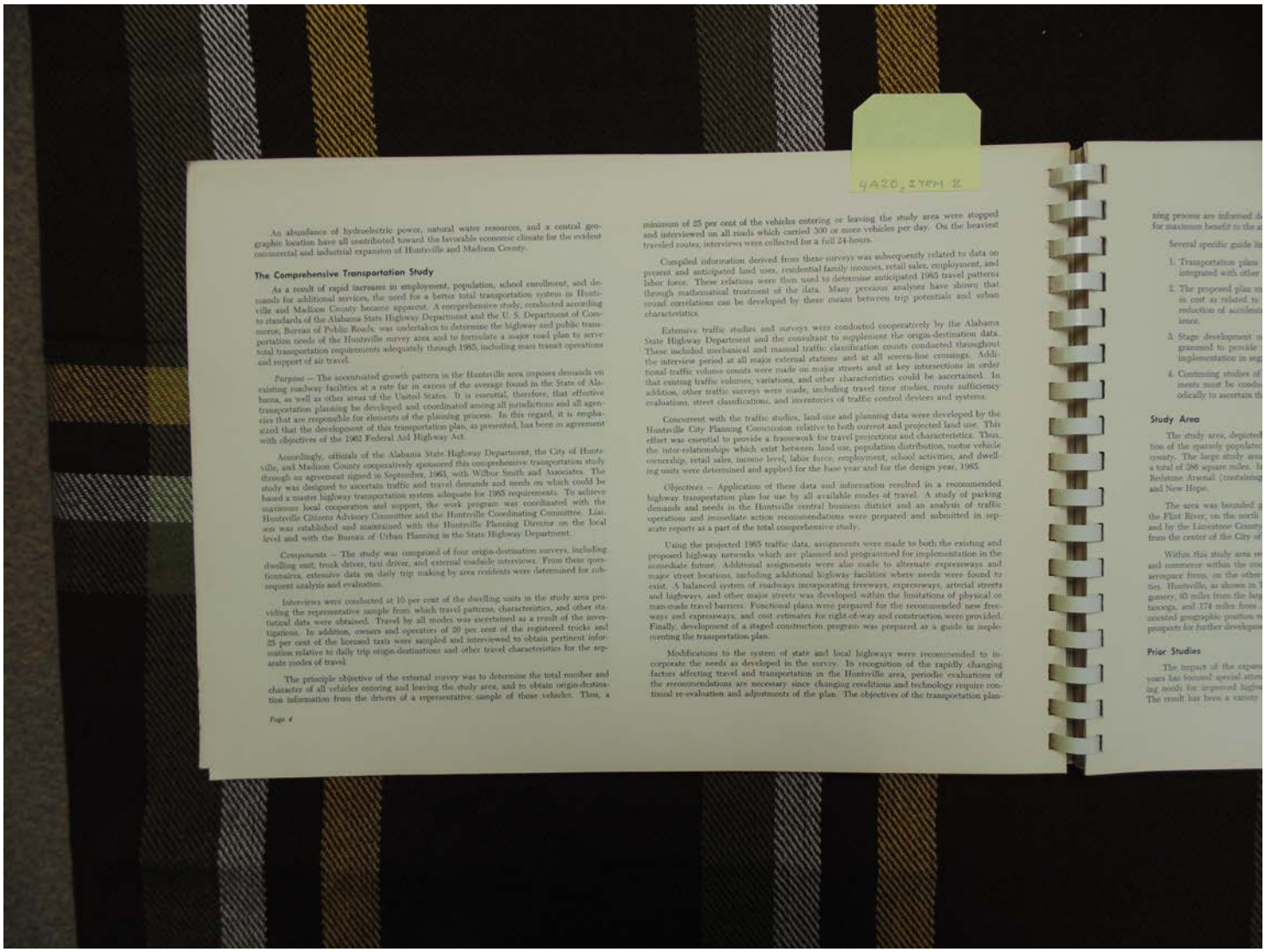
table

Dates:

1948-1963
1955-1963
1966



An abundance of hydroelectric power, natural water resources, and a central geographic location have all contributed toward the favorable economic climate for the evident commercial and industrial expansion of Huntsville and Madison County.

The Comprehensive Transportation Study

As a result of rapid increases in employment, population, school enrollment, and demands for additional services, the need for a better total transportation system in Huntsville and Madison County became apparent. A comprehensive study, conducted according to standards of the Alabama State Highway Department and the U. S. Department of Commerce, Bureau of Public Roads, was undertaken to determine the highway and public transportation needs of the Huntsville survey area and to formulate a major road plan to serve total transportation requirements adequately through 1985, including mass transit operations and support of air travel.

Purpose -- The accentuated growth pattern in the Huntsville area imposes demands on existing roadway facilities at a rate far in excess of the average found in the State of Alabama, as well as other areas of the United States. It is essential, therefore, that effective transportation planning be developed and coordinated among all jurisdictions and all agencies that are responsible for elements of the planning process. In this regard, it is emphasized that the development of this transportation plan, as presented, has been in agreement with objectives of the 1962 Federal Aid Highway Act.

Accordingly, officials of the Alabama State Highway Department, the City of Huntsville, and Madison County cooperatively sponsored this comprehensive transportation study through an agreement signed in September, 1963, with Wilbur Smith and Associates. The study was designed to ascertain traffic and travel demands and needs on which could be based a master highway transportation system adequate for 1985 requirements. To achieve maximum local cooperation and support, the work program was coordinated with the Huntsville Citizens Advisory Committee and the Huntsville Coordinating Committee. Liaison was established and maintained with the Huntsville Planning Director on the local level and with the Bureau of Urban Planning in the State Highway Department.

Components -- The study was comprised of four origin-destination surveys, including dwelling unit, truck driver, taxi driver, and external roadside interviews. From these questionnaires, extensive data on daily trip making by area residents were determined for subsequent analysis and evaluation.

Interviews were conducted at 10 per cent of the dwelling units in the study area providing the representative sample from which travel patterns, characteristics, and other statistical data were obtained. Travel by all modes was ascertained as a result of the investigations. In addition, owners and operators of 20 per cent of the registered trucks and 25 per cent of the licensed taxis were sampled and interviewed to obtain pertinent information relative to daily trip origin-destinations and other travel characteristics for the separate modes of travel.

The principle objective of the external survey was to determine the total number and character of all vehicles entering and leaving the study area, and to obtain origin-destination information from the drivers of a representative sample of those vehicles. Thus, a minimum of 25 per cent of the vehicles entering or leaving the study area were stopped and interviewed on all roads which carried 300 or more vehicles per day. On the heaviest traveled routes, interviews were collected for a full 24-hours.

Compiled information derived from these surveys was subsequently related to data on present and anticipated land uses, residential family incomes, retail sales, employment, and labor force. These relations were then used to determine anticipated 1985 travel patterns through mathematical treatment of the data. Many previous analyses have shown that sound correlations can be developed by these means between trip potentials and urban characteristics.

Extensive traffic studies and surveys were conducted cooperatively by the Alabama State Highway Department and the consultant to supplement the origin-destination data. These included mechanical and manual traffic classification counts conducted throughout the interview period at all major external stations and at all screen-line crossings. Additional traffic volume counts were made on major streets and at key intersections in order that existing traffic volumes, variations, and other characteristics could be ascertained. In addition, other traffic surveys were made, including travel time studies, route sufficiency evaluations, street classifications, and inventories of traffic control devices and systems.

Concurrent with the traffic studies, land-use and planning data were developed by the Huntsville City Planning Commission relative to both current and projected land use. This effort was essential to provide a framework for travel projections and characteristics. Thus, the inter-relationships which exist between land use, population distribution, motor vehicle ownership, retail sales, income level, labor force, employment, school activities, and dwelling units were determined and applied for the base year and for the design year, 1985.

Objectives -- Application of these data and information resulted in a recommended highway transportation plan for use by all available modes of travel. A study of parking demands and needs in the Huntsville central business district and an analysis of traffic operations and immediate action recommendations were prepared and submitted in separate reports as a part of the total comprehensive study.

Using the projected 1985 traffic data, assignments were made to both the existing and proposed highway networks which are planned and programmed for implementation in the immediate future. Additional assignments were also made to alternate expressways and major street locations, including additional highway facilities where needs were found to exist. A balanced system of roadways incorporating freeways, expressways, arterial streets and highways, and other major streets was developed within the limitations of physical or man-made travel barriers. Functional plans were prepared for the recommended new freeways and expressways, and cost estimates for right-of-way and construction were provided. Finally, development of a staged construction program was prepared as a guide in implementing the transportation plan.

Modifications to the system of state and local highways were recommended to incorporate the needs as developed in the survey. In recognition of the rapidly changing factors affecting travel and transportation in the Huntsville area, periodic evaluations of the recommendations are necessary since changing conditions and technology require continual re-evaluation and adjustments of the plan. The objectives of the transportation plan-

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for maximum benefit to the a

Several specific guide li

1. Transportation plans
integrated with other
2. The proposed plan m
its cost as related to
reduction of accident
ience.
3. Stage development s
grammed to provide
implementation in seg
4. Continuing studies of
ments must be conduc
odically to ascertain th

Study Area

The study area, depicted
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county. The large study area
a total of 286 square miles. It
Redstone Arsenal (containing
and New Hope.

The area was bounded
the Flint River, on the north
and by the Limestone County
from the center of the City of

Within this study area re
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aerospace firms, on the other
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tanooga, and 174 miles from
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prospects for further developm

Prior Studies

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The result has been a variety

Names:

Comprehensive Transportation Study
Huntsville City Planning Commission
State & Local Highways

Places:

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Dates:

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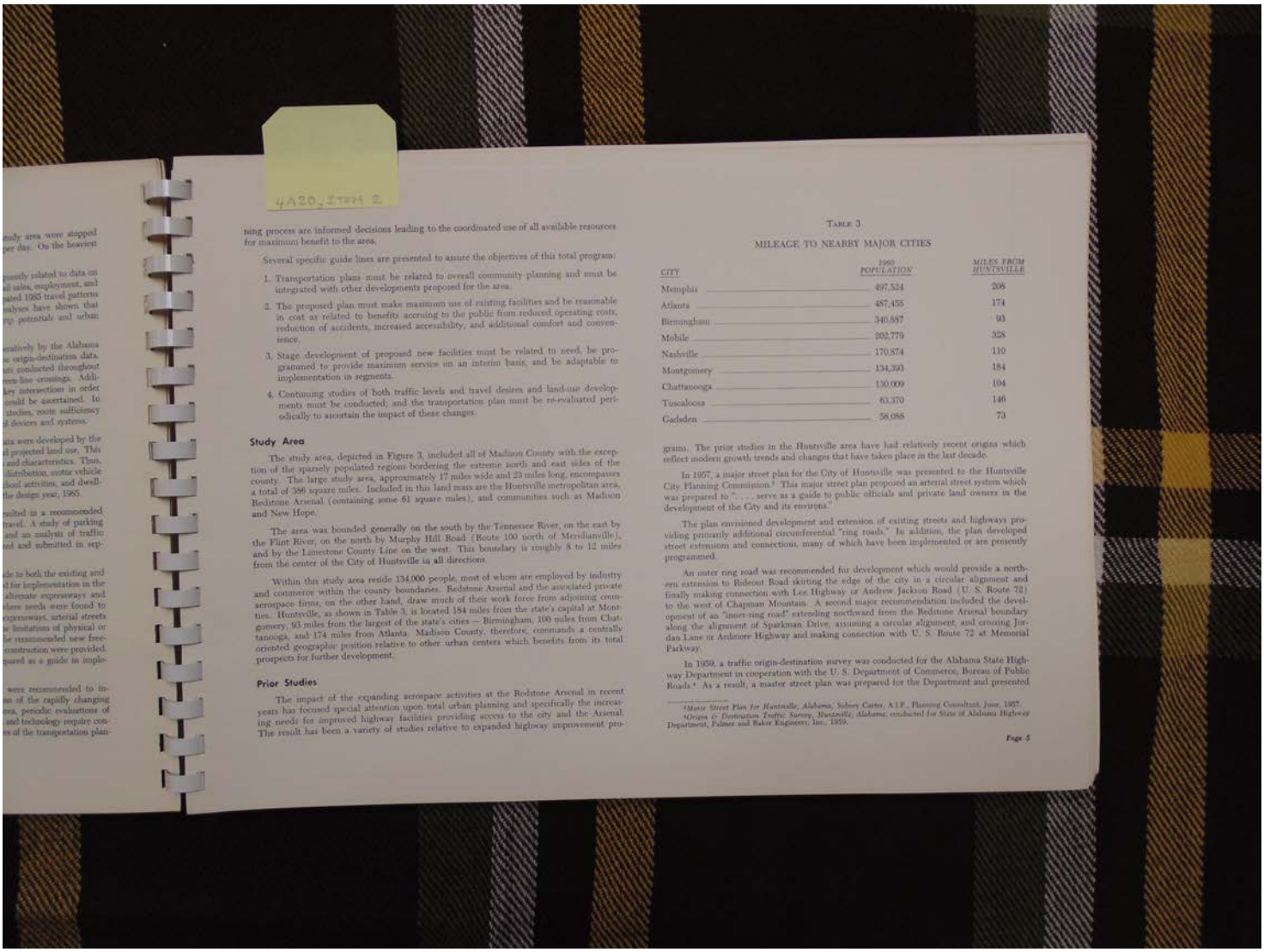

ning process are informed decisions leading to the coordinated use of all available resources for maximum benefit to the area.

Several specific guide lines are presented to assure the objectives of this total program:

1. Transportation plans must be related to overall community planning and must be integrated with other developments proposed for the area.
2. The proposed plan must make maximum use of existing facilities and be reasonable in cost as related to benefits accruing to the public from reduced operating costs, reduction of accidents, increased accessibility, and additional comfort and convenience.
3. Stage development of proposed new facilities must be related to need, be programmed to provide maximum service on an interim basis, and be adaptable to implementation in segments.
4. Continuing studies of both traffic levels and travel desires and land-use developments must be conducted; and the transportation plan must be re-evaluated periodically to ascertain the impact of these changes.

Study Area

The study area, depicted in Figure 3, included all of Madison County with the exception of the sparsely populated regions bordering the extreme north and east sides of the county. The large study area, approximately 17 miles wide and 23 miles long, encompasses a total of 366 square miles. Included in this land mass are the Huntsville metropolitan area, Redstone Arsenal (containing some 61 square miles), and communities such as Madison and New Hope.

The area was bounded generally on the south by the Tennessee River, on the east by the Flint River, on the north by Murphy Hill Road (Route 100 north of Meridianville), and by the Limestone County Line on the west. This boundary is roughly 8 to 12 miles from the center of the City of Huntsville in all directions.

Within this study area reside 134,000 people, most of whom are employed by industry and commerce within the county boundaries. Redstone Arsenal and the associated private aerospace firms, on the other hand, draw much of their work force from adjoining counties. Huntsville, as shown in Table 3, is located 184 miles from the state's capital at Montgomery, 93 miles from the largest of the state's cities — Birmingham, 100 miles from Chattanooga, and 174 miles from Atlanta. Madison County, therefore, commands a centrally oriented geographic position relative to other urban centers which benefits from its total prospects for further development.

Prior Studies

The impact of the expanding aerospace activities at the Redstone Arsenal in recent years has focused special attention upon total urban planning and specifically the increasing needs for improved highway facilities providing access to the city and the Arsenal. The result has been a variety of studies relative to expanded highway improvement programs. The prior studies in the Huntsville area have had relatively recent origins which reflect modern growth trends and changes that have taken place in the last decade.

TABLE 3

MILEAGE TO NEARBY MAJOR CITIES

CITY	1960 POPULATION	MILES FROM HUNTSVILLE
Memphis	497,524	208
Atlanta	487,455	174
Birmingham	340,887	93
Mobile	202,779	328
Nashville	170,874	110
Montgomery	134,393	184
Chattanooga	130,009	104
Tuscaloosa	63,370	146
Gadsden	58,088	73

In 1957, a major street plan for the City of Huntsville was presented to the Huntsville City Planning Commission.[3] This major street plan proposed an arterial street system which was prepared to ". . . . serve as a guide to public officials and private land owners in the development of the City and its environs."

The plan envisioned development and extension of existing streets and highways providing primarily additional circumferential "ring roads." In addition, the plan developed street extensions and connections, many of which have been implemented or are presently programmed.

An outer ring road was recommended for development which would provide a northern extension to Rideout Road skirting the edge of the city in a circular alignment and finally making connection with Lee Highway or Andrew Jackson Road (U. S. Route 72) to the west of Chapman Mountain. A second major recommendation included the development of an "inner-ring road" extending northward from the Redstone Arsenal boundary along the alignment of Sparkman Drive, assuming a circular alignment, and crossing Jordan Lane or Ardmore Highway and making connection with U. S. Route 72 at Memorial Parkway.

In 1959, a traffic origin-destination survey was conducted for the Alabama State Highway Department in cooperation with the U. S. Department of Commerce, Bureau of Public Roads.[4] As a result, a master street plan was prepared for the Department and presented

[3] *Major Street Plan for Huntsville, Alabama*, Sidney Carter, A.I.P., Planning Consultant, June, 1957.
[4] *Origin & Destination Traffic Survey, Huntsville, Alabama*, conducted for State of Alabama Highway Department, Palmer and Baker Engineers, Inc., 1959.

Names:

Mileage to Nearby Major Cities
Prior Studies
Study Area

Places:

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table

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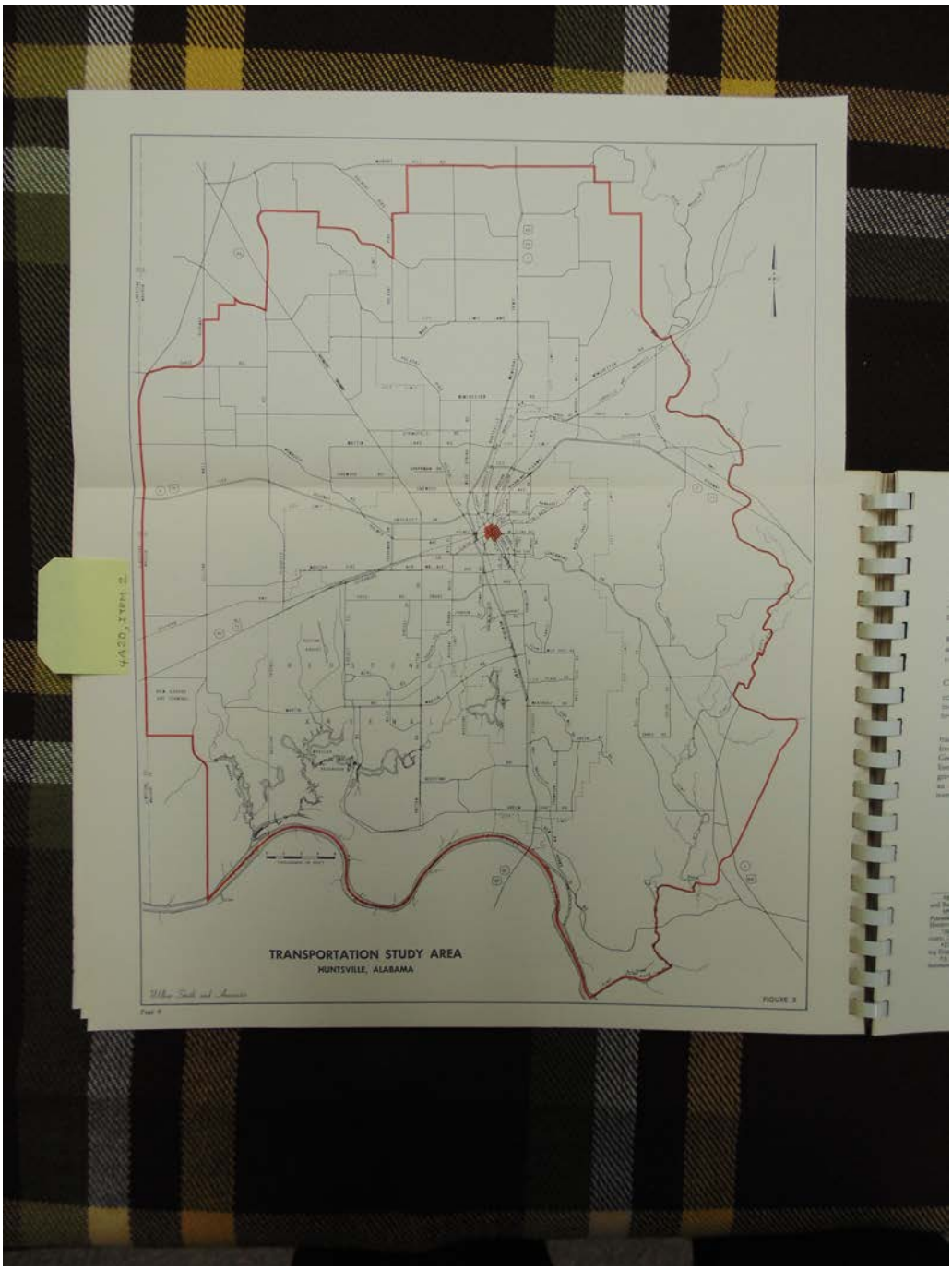

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Transportation Study Area

Places:
Huntsville, AL

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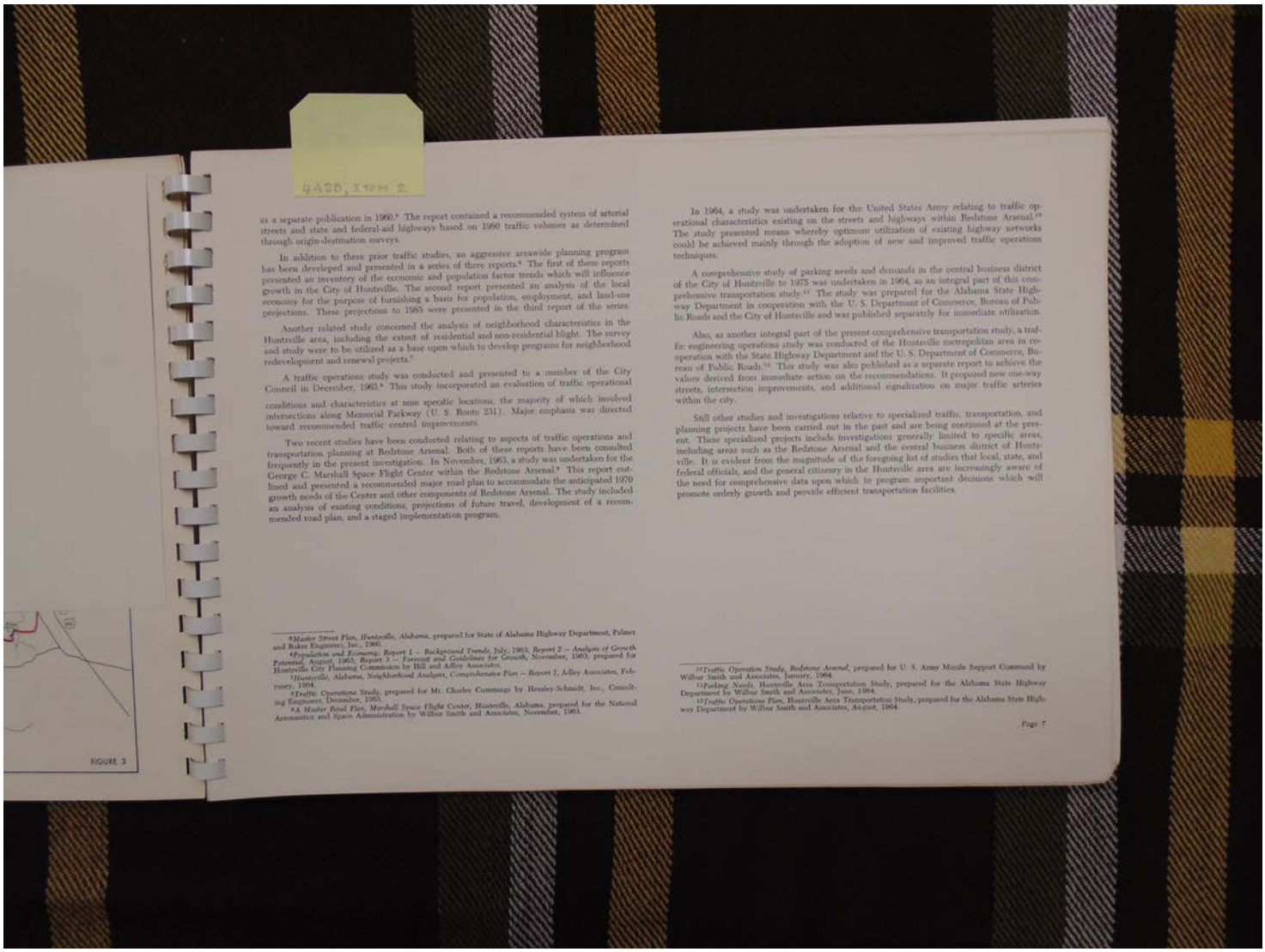


Names:

George C. Marshall Space Flight Center
Prior Studies
United States Army

Places:

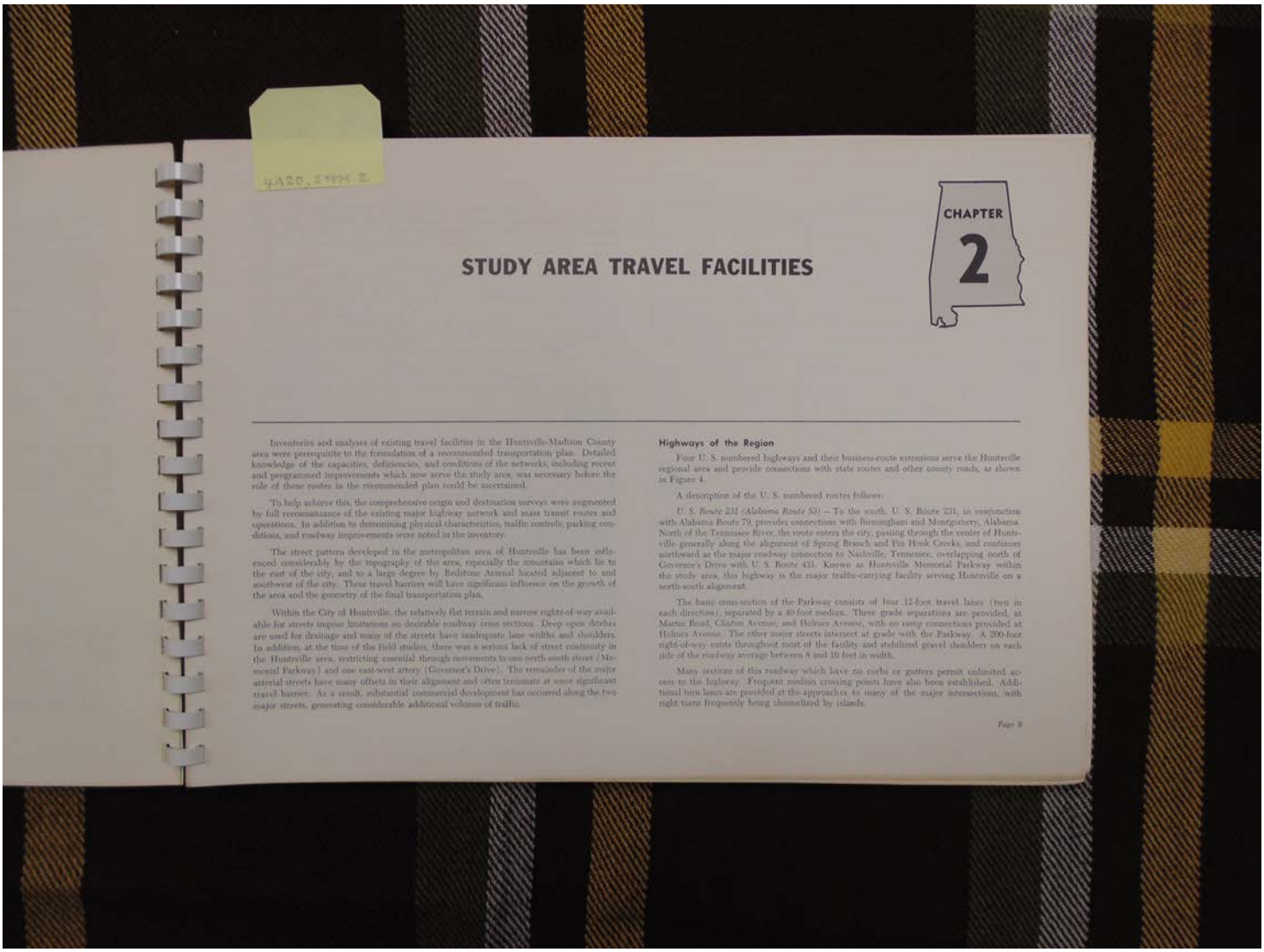
Huntsville, AL
Redstone Arsenal, AL

Types:

booklet

Dates:

1966



CHAPTER 2

STUDY AREA TRAVEL FACILITIES

Inventories and analyses of existing travel facilities in the Huntsville-Madison County area were prerequisite to the formulation of a recommended transportation plan. Detailed knowledge of the capacities, deficiencies, and conditions of the networks, including recent and programmed improvements which now serve the study area, was necessary before the role of these routes in the recommended plan could be ascertained.

To help achieve this, the comprehensive origin and destination surveys were augmented by full reconnaissance of the existing major highway network and mass transit routes and operations. In addition to determining physical characteristics, traffic controls, parking conditions, and roadway improvements were noted in the inventory.

The street pattern developed in the metropolitan area of Huntsville has been influenced considerably by the topography of the area, especially the mountains which lie to the east of the city, and to a large degree by Redstone Arsenal located adjacent to and southwest of the city. These travel barriers will have significant influence on the growth of the area and the geometry of the final transportation plan.

Within the City of Huntsville, the relatively flat terrain and narrow rights-of-way available for streets impose limitations on desirable roadway cross sections. Deep open ditches are used for drainage and many of the streets have inadequate lane widths and shoulders. In addition, at the time of the field studies, there was a serious lack of street continuity in the Huntsville area, restricting essential through movements to one north-south street (Memorial Parkway) and one east-west artery (Governor's Drive). The remainder of the major arterial streets have many offsets in their alignment and often terminate at some significant travel barrier. As a result, substantial commercial development has occurred along the two major streets, generating considerable additional volume of traffic.

Highways of the Region

Four U. S. numbered highways and their business-route extensions serve the Huntsville regional area and provide connections with state routes and other county roads, as shown in Figure 4.

A description of the U. S. numbered routes follows:

U. S. Route 231 (Alabama Route 53) — To the south, U. S. Route 231, in conjunction with Alabama Route 79, provides connections with Birmingham and Montgomery, Alabama. North of the Tennessee River, the route enters the city, passing through the center of Huntsville generally along the alignment of Spring Branch and Fin Hook Creeks, and continues northward as the major roadway connection to Nashville, Tennessee, overlapping north of Governor's Drive with U. S. Route 431. Known as Huntsville Memorial Parkway within the study area, this highway is the major traffic-carrying facility serving Huntsville on a north-south alignment.

The basic cross-section of the Parkway consists of four 12-foot travel lanes (two in each direction), separated by a 40-foot median. Three grade separations are provided, at Martin Road, Clinton Avenue, and Holmes Avenue, with no ramp connections provided at Holmes Avenue. The other major streets intersect at grade with the Parkway. A 200-foot right-of-way exists throughout most of the facility and stabilized gravel shoulders on each side of the roadway average between 8 and 10 feet in width.

Many sections of this roadway which have no curbs or gutters permit unlimited access to the highway. Frequent median crossing points have also been established. Additional turn lanes are provided at the approaches to many of the major intersections, with right turns frequently being channelized by islands.

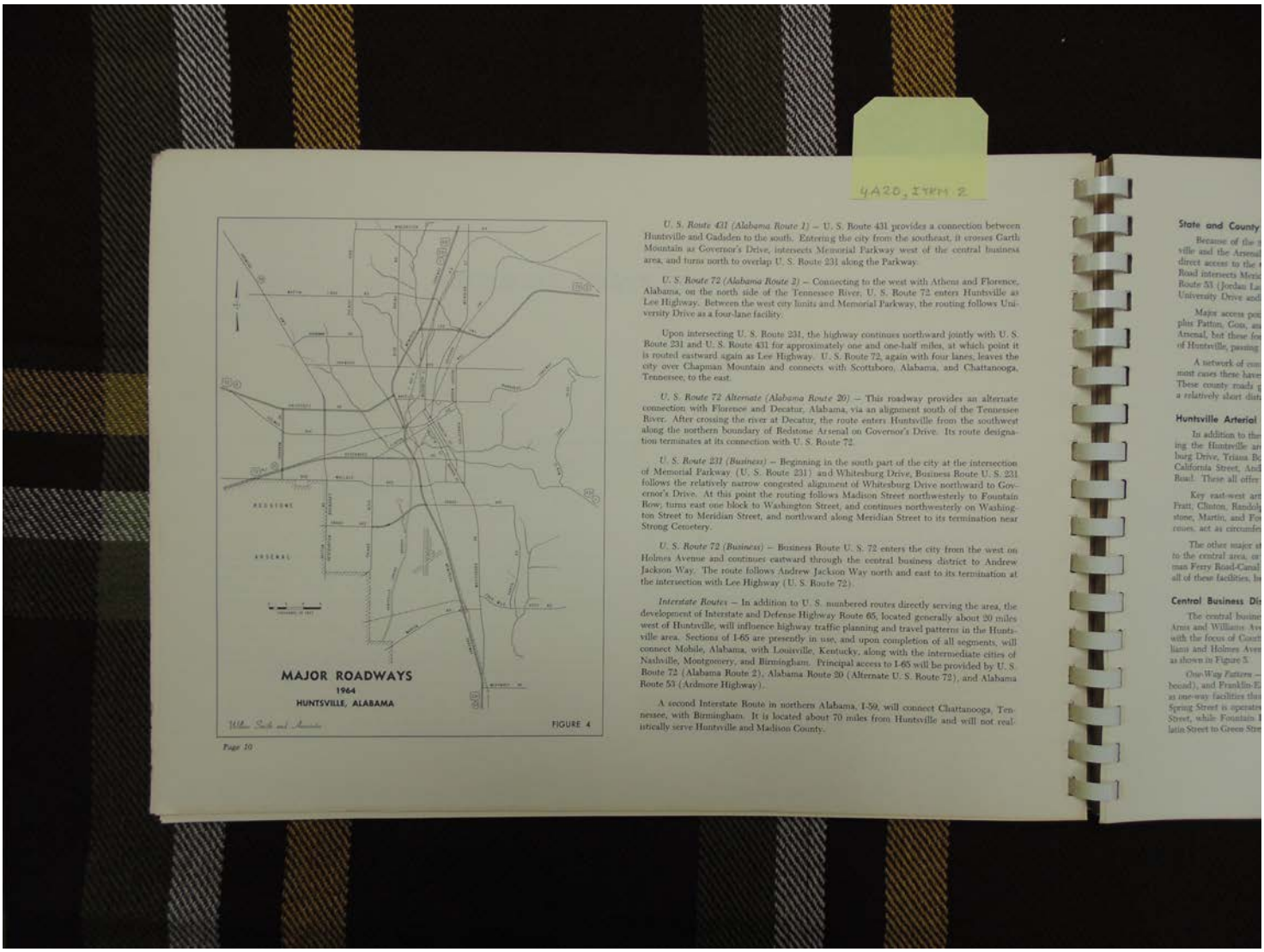
Page 9

Names:
Highways of the Region
Travel Facilities, Chapter 2

Places:
Huntsville, AL

Types:
booklet

Dates:
1966

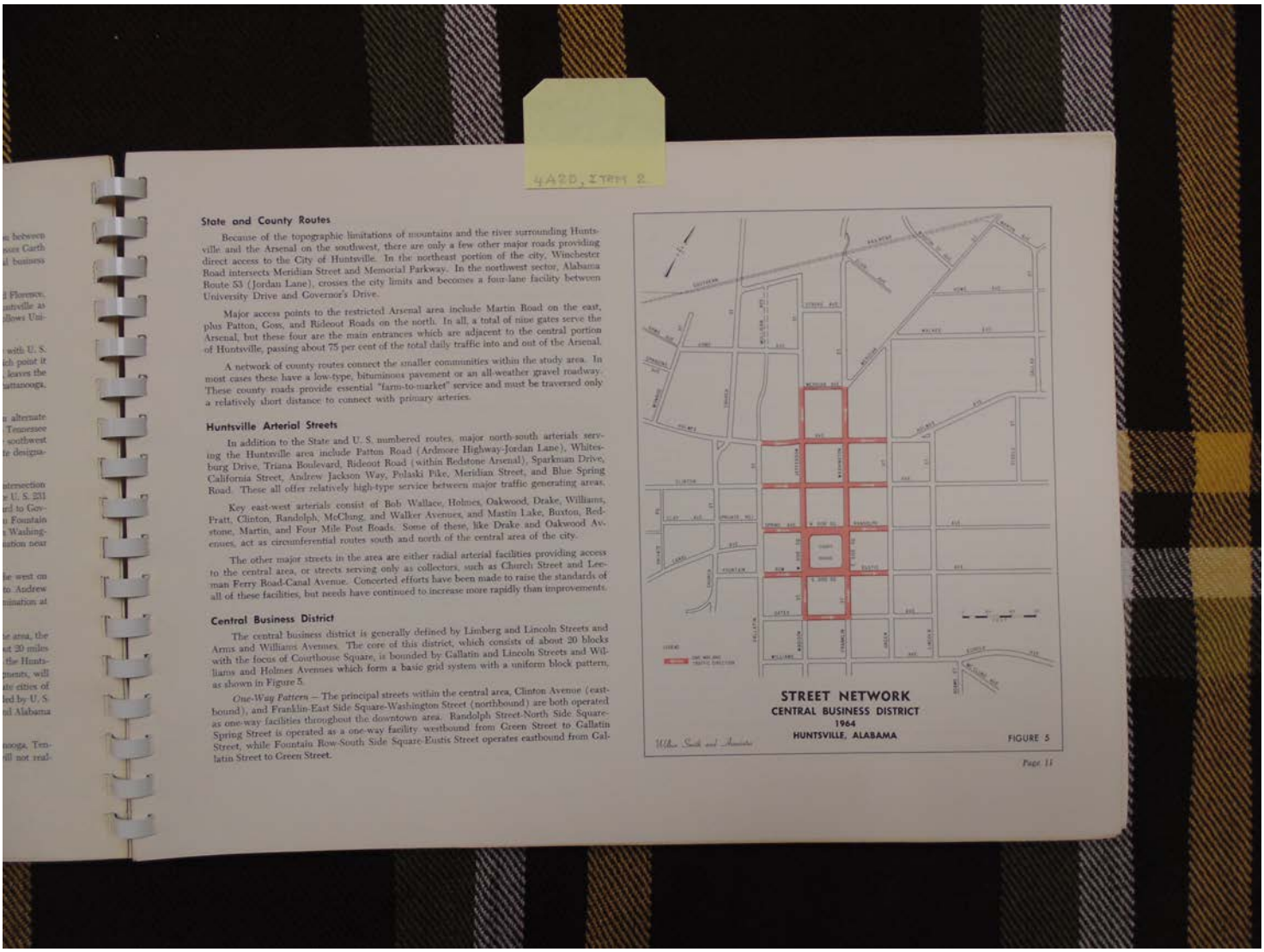


Names:
Major Roadways

Places:
Huntsville, AL

Types:
booklet map

Dates:
1966



State and County Routes

Because of the topographic limitations of mountains and the river surrounding Huntsville and the Arsenal on the southwest, there are only a few other major roads providing direct access to the City of Huntsville. In the northeast portion of the city, Winchester Road intersects Meridian Street and Memorial Parkway. In the northwest sector, Alabama Route 53 (Jordan Lane), crosses the city limits and becomes a four-lane facility between University Drive and Governor's Drive.

Major access points to the restricted Arsenal area include Martin Road on the east, plus Patton, Goss, and Rideout Roads on the north. In all, a total of nine gates serve the Arsenal, but these four are the main entrances which are adjacent to the central portion of Huntsville, passing about 75 per cent of the total daily traffic into and out of the Arsenal.

A network of county routes connect the smaller communities within the study area. In most cases these have a low-type, bituminous pavement or an all-weather gravel roadway. These county roads provide essential "farm-to-market" service and must be traversed only a relatively short distance to connect with primary arteries.

Huntsville Arterial Streets

In addition to the State and U. S. numbered routes, major north-south arterials serving the Huntsville area include Patton Road (Ardmore Highway-Jordan Lane), Whitesburg Drive, Triana Boulevard, Rideout Road (within Redstone Arsenal), Sparkman Drive, California Street, Andrew Jackson Way, Pulaski Pike, Meridian Street, and Blue Spring Road. These all offer relatively high-type service between major traffic generating areas.

Key east-west arterials consist of Bob Wallace, Holmes, Oakwood, Drake, Williams, Pratt, Clinton, Randolph, McClung, and Walker Avenues, and Martin Lake, Buxton, Redstone, Martin, and Four Mile Post Roads. Some of these, like Drake and Oakwood Avenues, act as circumferential routes south and north of the central area of the city.

The other major streets in the area are either radial arterial facilities providing access to the central area, or streets serving only as collectors, such as Church Street and Leeman Ferry Road-Canal Avenue. Concerted efforts have been made to raise the standards of all of these facilities, but needs have continued to increase more rapidly than improvements.

Central Business District

The central business district is generally defined by Limberg and Lincoln Streets and Arms and Williams Avenues. The core of this district, which consists of about 20 blocks with the focus of Courthouse Square, is bounded by Gallatin and Lincoln Streets and Williams and Holmes Avenues which form a basic grid system with a uniform block pattern, as shown in Figure 5.

One-Way Pattern – The principal streets within the central area, Clinton Avenue (eastbound), and Franklin-East Side Square-Washington Street (northbound) are both operated as one-way facilities throughout the downtown area. Randolph Street-North Side Square-Spring Street is operated as a one-way facility westbound from Green Street to Gallatin Street, while Fountain Row-South Side Square-Eustis Street operates eastbound from Gallatin Street to Green Street.

STREET NETWORK
CENTRAL BUSINESS DISTRICT
1964
HUNTSVILLE, ALABAMA

FIGURE 5

Page 11

Names:

Central Business District Street	Network	Huntsville Arterial Streets	State and County Routes

Places:

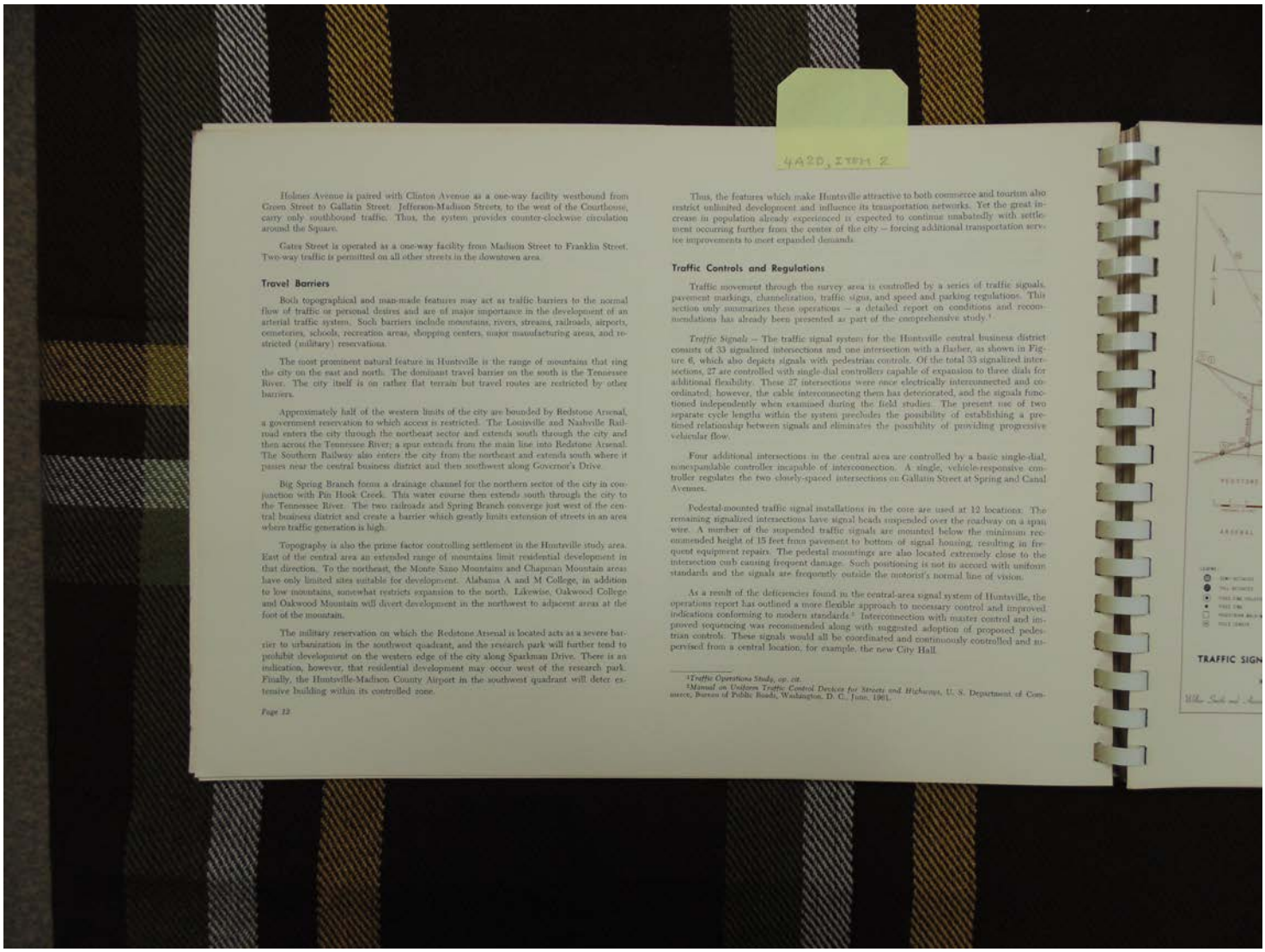
Huntsville, AL

Types:

booklet	booklet	illustration

Dates:

1966



Holmes Avenue is paired with Clinton Avenue as a one-way facility westbound from Green Street to Gallatin Street. Jefferson-Madison Streets, to the west of the Courthouse, carry only southbound traffic. Thus, the system provides counter-clockwise circulation around the Square.

Gates Street is operated as a one-way facility from Madison Street to Franklin Street. Two-way traffic is permitted on all other streets in the downtown area.

Travel Barriers

Both topographical and man-made features may act as traffic barriers to the normal flow of traffic or personal desires and are of major importance in the development of an arterial traffic system. Such barriers include mountains, rivers, streams, railroads, airports, cemeteries, schools, recreation areas, shopping centers, major manufacturing areas, and restricted (military) reservations.

The most prominent natural feature in Huntsville is the range of mountains that ring the city on the east and north. The dominant travel barrier on the south is the Tennessee River. The city itself is on rather flat terrain but travel routes are restricted by other barriers.

Approximately half of the western limits of the city are bounded by Redstone Arsenal, a government reservation to which access is restricted. The Louisville and Nashville Railroad enters the city through the northeast sector and extends south through the city and then across the Tennessee River; a spur extends from the main line into Redstone Arsenal. The Southern Railway also enters the city from the northeast and extends south where it passes near the central business district and then southwest along Governor's Drive.

Big Spring Branch forms a drainage channel for the northern sector of the city in conjunction with Pin Hook Creek. This water course then extends south through the city to the Tennessee River. The two railroads and Spring Branch converge just west of the central business district and create a barrier which greatly limits extension of streets in an area where traffic generation is high.

Topography is also the prime factor controlling settlement in the Huntsville study area. East of the central area an extended range of mountains limit residential development in that direction. To the northeast, the Monte Sano Mountains and Chapman Mountain areas have only limited sites suitable for development. Alabama A and M College, in addition to low mountains, somewhat restricts expansion to the north. Likewise, Oakwood College and Oakwood Mountain will divert development in the northwest to adjacent areas at the foot of the mountain.

The military reservation on which the Redstone Arsenal is located acts as a severe barrier to urbanization in the southwest quadrant, and the research park will further tend to prohibit development on the western edge of the city along Sparkman Drive. There is an indication, however, that residential development may occur west of the research park. Finally, the Huntsville-Madison County Airport in the southwest quadrant will deter extensive building within its controlled zone.

Thus, the features which make Huntsville attractive to both commerce and tourism also restrict unlimited development and influence its transportation networks. Yet the great increase in population already experienced is expected to continue unabatedly with settlement occurring further from the center of the city — forcing additional transportation service improvements to meet expanded demands.

Traffic Controls and Regulations

Traffic movement through the survey area is controlled by a series of traffic signals, pavement markings, channelization, traffic signs, and speed and parking regulations. This section only summarizes these operations — a detailed report on conditions and recommendations has already been presented as part of the comprehensive study.[1]

Traffic Signals — The traffic signal system for the Huntsville central business district consists of 33 signalized intersections and one intersection with a flasher, as shown in Figure 6, which also depicts signals with pedestrian controls. Of the total 33 signalized intersections, 27 are controlled with single-dial controllers capable of expansion to three dials for additional flexibility. These 27 intersections were once electrically interconnected and coordinated; however, the cable interconnecting them has deteriorated, and the signals functioned independently when examined during the field studies. The present use of two separate cycle lengths within the system precludes the possibility of establishing a pretimed relationship between signals and eliminates the possibility of providing progressive vehicular flow.

Four additional intersections in the central area are controlled by a basic single-dial, noncoordinable controller incapable of interconnection. A single, vehicle-responsive controller regulates the two closely-spaced intersections on Gallatin Street at Spring and Canal Avenues.

Pedestal-mounted traffic signal installations in the core are used at 12 locations. The remaining signalized intersections have signal heads suspended over the roadway on a span wire. A number of the suspended traffic signals are mounted below the minimum recommended height of 15 feet from pavement to bottom of signal housing, resulting in frequent equipment repairs. The pedestal mountings are also located extremely close to the intersection curb causing frequent damage. Such positioning is not in accord with uniform standards and the signals are frequently outside the motorist's normal line of vision.

As a result of the deficiencies found in the central-area signal system of Huntsville, the operations report has outlined a more flexible approach to necessary control and improved indications conforming to modern standards.[2] Interconnection with master control and improved sequencing was recommended along with suggested adoption of proposed pedestrian controls. These signals would all be coordinated and continuously controlled and supervised from a central location, for example, the new City Hall.

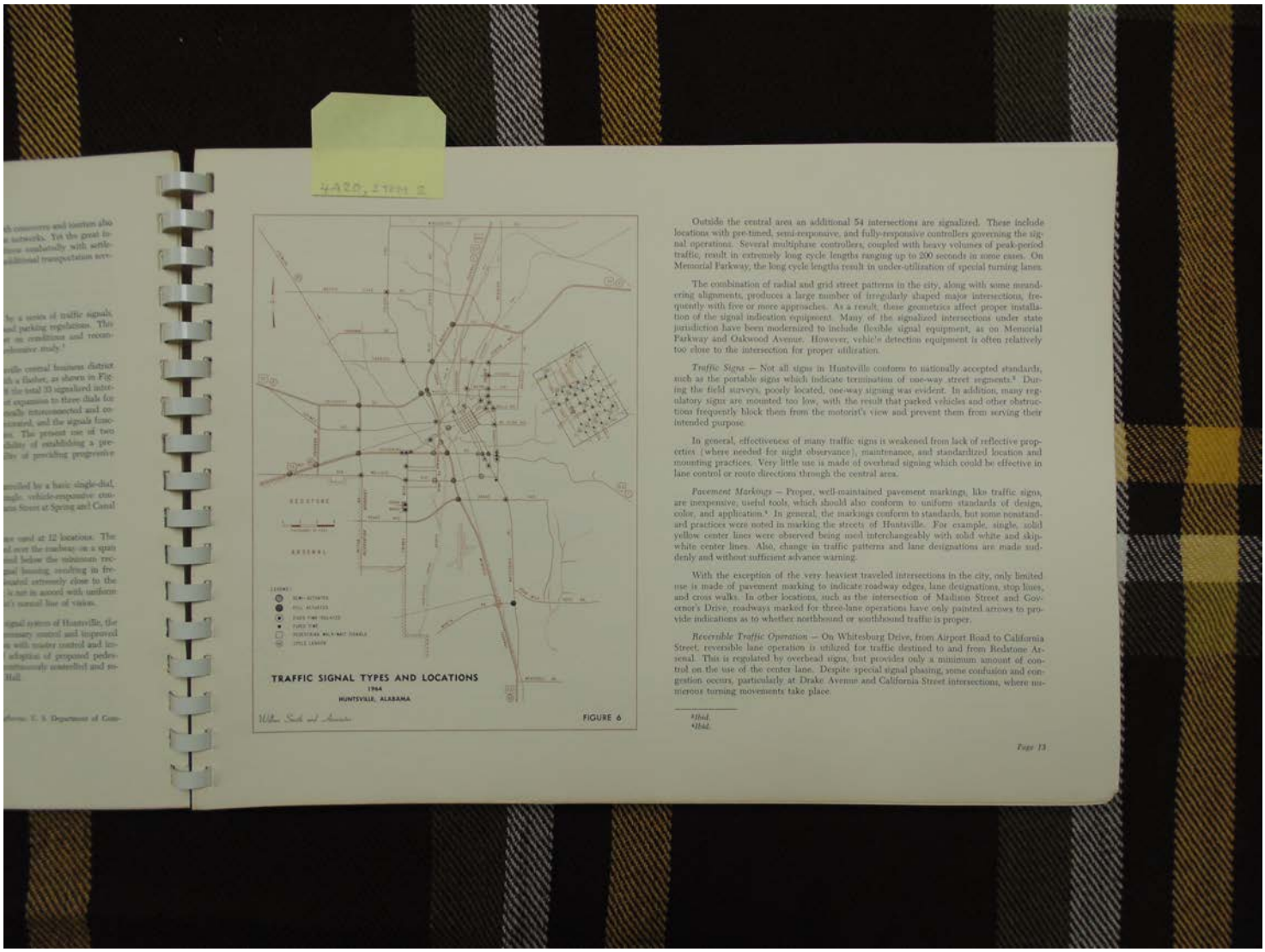
[1] *Traffic Operations Study, op. cit.*
[2] *Manual on Uniform Traffic Control Devices for Streets and Highways*, U. S. Department of Commerce, Bureau of Public Roads, Washington, D. C., June, 1961.

Names:
Traffic Controls & Regulations
Travel Barriers

Places:
Huntsville, AL

Types:
booklet

Dates:
1966



Names:

Traffic Controls & Regulations

Traffic Signal Types & Locations

Places:

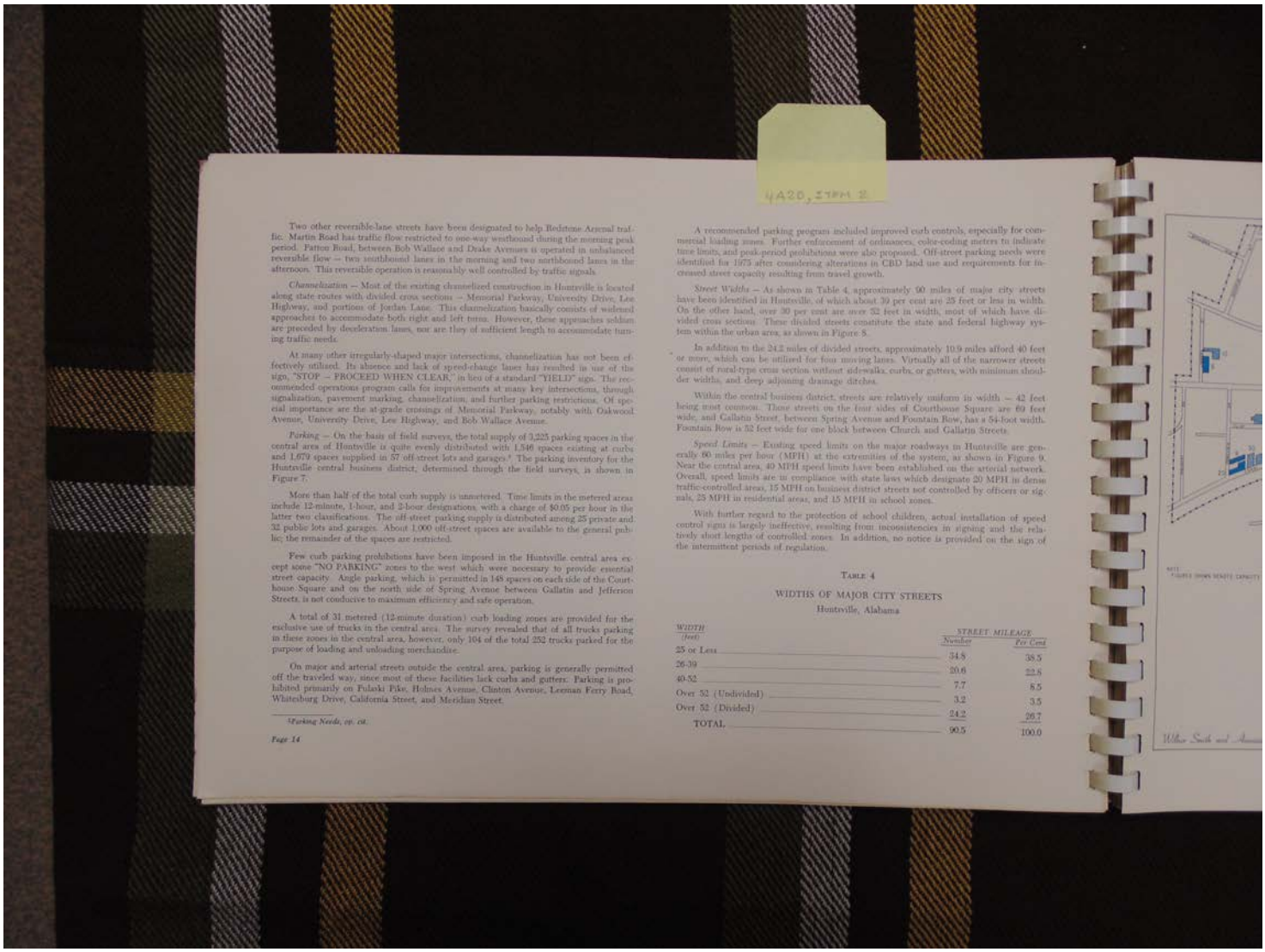
Huntsville, AL

Types:

booklet booklet illustration

Dates:

1966



Two other reversible-lane streets have been designated to help Redstone Arsenal traffic. Martin Road has traffic flow restricted to one-way westbound during the morning peak period. Patton Road, between Bob Wallace and Drake Avenues is operated in unbalanced reversible flow — two southbound lanes in the morning and two northbound lanes in the afternoon. This reversible operation is reasonably well controlled by traffic signals.

Channelization — Most of the existing channelized construction in Huntsville is located along state routes with divided cross sections — Memorial Parkway, University Drive, Lee Highway, and portions of Jordan Lane. This channelization basically consists of widened approaches to accommodate both right and left turns. However, these approaches seldom are preceded by deceleration lanes, nor are they of sufficient length to accommodate turning traffic needs.

At many other irregularly-shaped major intersections, channelization has not been effectively utilized. Its absence and lack of speed-change lanes has resulted in use of the sign, "STOP — PROCEED WHEN CLEAR," in lieu of a standard "YIELD" sign. The recommended operations program calls for improvements at many key intersections, through signalization, pavement marking, channelization, and further parking restrictions. Of special importance are the at-grade crossings of Memorial Parkway, notably with Oakwood Avenue, University Drive, Lee Highway, and Bob Wallace Avenue.

Parking — On the basis of field surveys, the total supply of 3,225 parking spaces in the central area of Huntsville is quite evenly distributed with 1,546 spaces existing at curbs and 1,679 spaces supplied in 57 off-street lots and garages.[1] The parking inventory for the Huntsville central business district, determined through the field surveys, is shown in Figure 7.

More than half of the total curb supply is unmetered. Time limits in the metered areas include 12-minute, 1-hour, and 2-hour designations with a charge of $0.05 per hour in the latter two classifications. The off-street parking supply is distributed among 25 private and 32 public lots and garages. About 1,000 off-street spaces are available to the general public; the remainder of the spaces are restricted.

Few curb parking prohibitions have been imposed in the Huntsville central area except some "NO PARKING" zones to the west which were necessary to provide essential street capacity. Angle parking, which is permitted in 148 spaces on each side of the Courthouse Square and on the north side of Spring Avenue between Gallatin and Jefferson Streets, is not conducive to maximum efficiency and safe operation.

A total of 31 metered (12-minute duration) curb loading zones are provided for the exclusive use of trucks in the central area. The survey revealed that of all trucks parking in these zones in the central area, however, only 104 of the total 252 trucks parked for the purpose of loading and unloading merchandise.

On major and arterial streets outside the central area, parking is generally permitted off the traveled way, since most of these facilities lack curbs and gutters. Parking is prohibited primarily on Pulaski Pike, Holmes Avenue, Clinton Avenue, Leeman Ferry Road, Whitesburg Drive, California Street, and Meridian Street.

[1] *Parking Needs, op. cit.*

A recommended parking program included improved curb controls, especially for commercial loading zones. Further enforcement of ordinances, color-coding meters to indicate time limits, and peak-period prohibitions were also proposed. Off-street parking needs were identified for 1975 after considering alterations in CBD land use and requirements for increased street capacity resulting from travel growth.

Street Widths — As shown in Table 4, approximately 90 miles of major city streets have been identified in Huntsville, of which about 39 per cent are 25 feet or less in width. On the other hand, over 30 per cent are over 52 feet in width, most of which have divided cross sections. These divided streets constitute the state and federal highway system within the urban area, as shown in Figure 8.

In addition to the 24.2 miles of divided streets, approximately 10.9 miles afford 40 feet or more, which can be utilized for four moving lanes. Virtually all of the narrower streets consist of rural-type cross section without sidewalks, curbs, or gutters, with minimum shoulder widths, and deep adjoining drainage ditches.

Within the central business district, streets are relatively uniform in width — 42 feet being most common. These streets on the four sides of Courthouse Square are 69 feet wide, and Gallatin Street, between Spring Avenue and Fountain Row, has a 54-foot width. Fountain Row is 52 feet wide for one block between Church and Gallatin Streets.

Speed Limits — Existing speed limits on the major roadways in Huntsville are generally 50 miles per hour (MPH) at the extremities of the system, as shown in Figure 9. Near the central area, 40 MPH speed limits have been established on the arterial network. Overall, speed limits are in compliance with state laws which designate 20 MPH in dense traffic-controlled areas, 15 MPH on business district streets not controlled by officers or signals, 25 MPH in residential areas, and 15 MPH in school zones.

With further regard to the protection of school children, actual installation of speed control signs is largely ineffective, resulting from inconsistencies in signing and the relatively short lengths of controlled zones. In addition, no notice is provided on the sign of the intermittent periods of regulation.

TABLE 4

WIDTHS OF MAJOR CITY STREETS
Huntsville, Alabama

Width (feet)	*Street Mileage*	
	Number	*Per Cent*
25 or Less	34.8	38.5
26-39	20.6	22.8
40-52	7.7	8.5
Over 52 (Undivided)	3.2	3.5
Over 52 (Divided)	24.2	26.7
TOTAL	90.5	100.0

Names:

Traffic Controls & Regulations

Widths of City Streets

Places:

Huntsville, AL

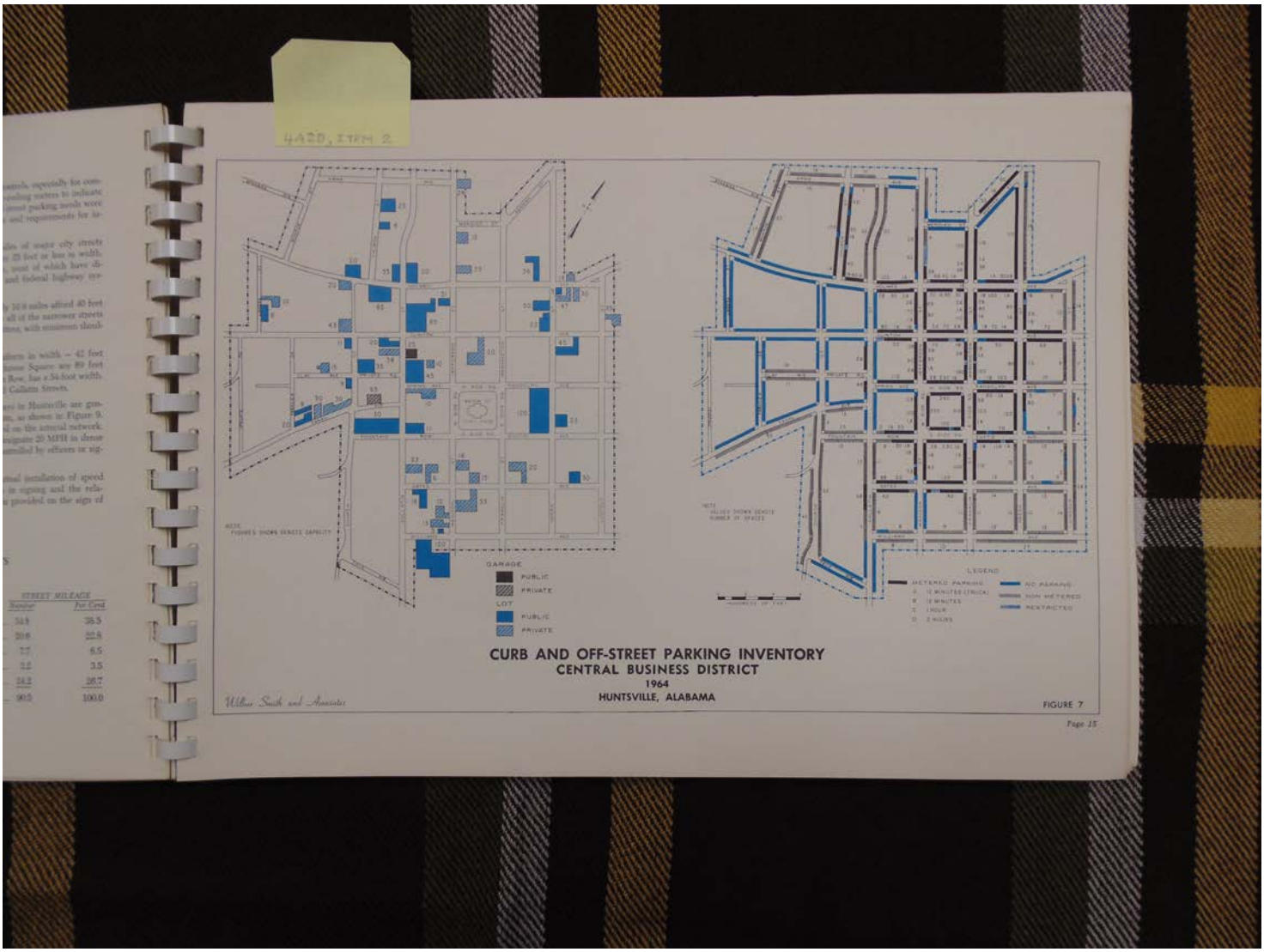
Types:

booklet

table

Dates:

1966

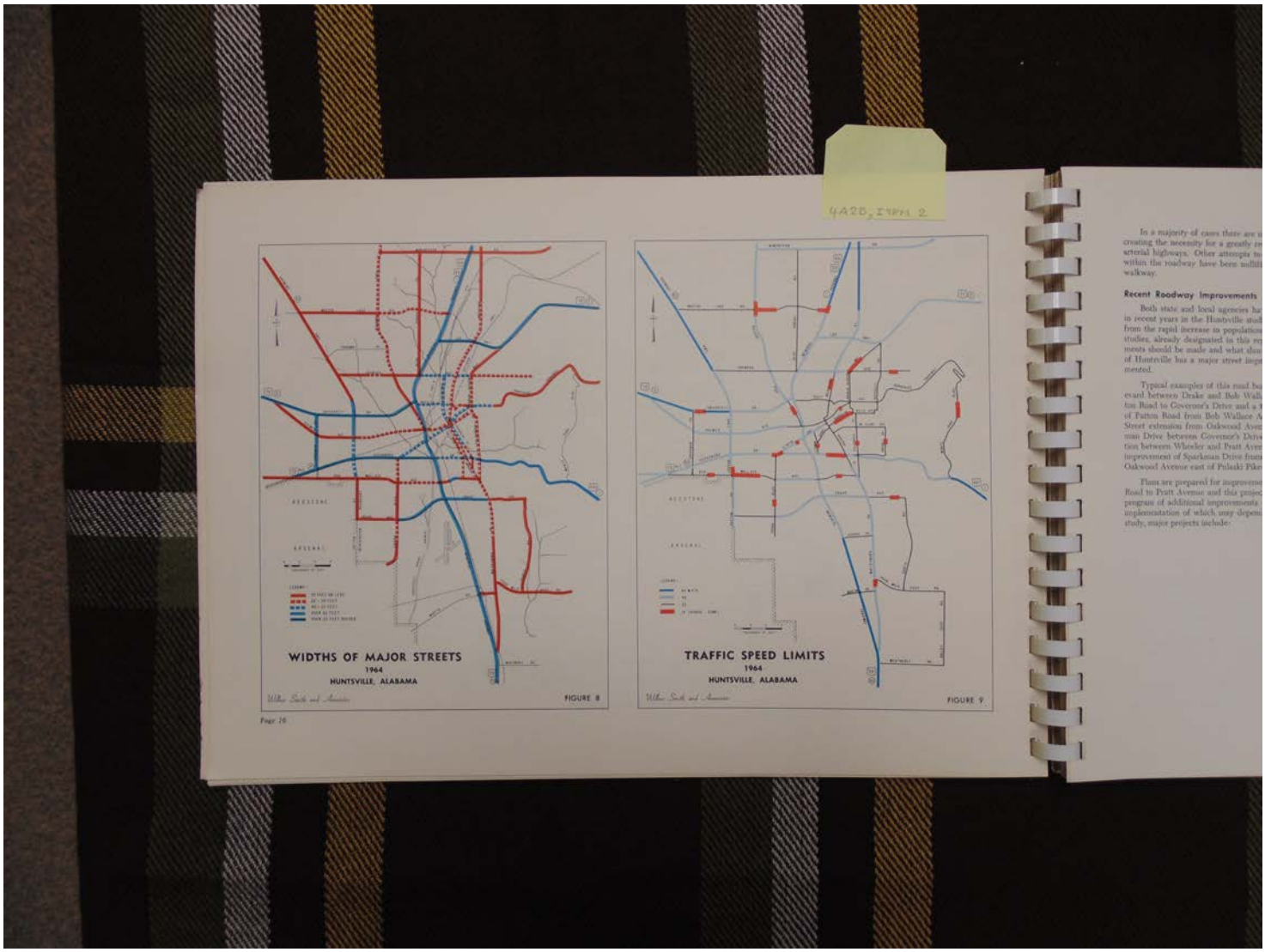


Names:
Curb & Off-Street Parking

Places:
Huntsville, AL

Types:
illustration

Dates:
1966

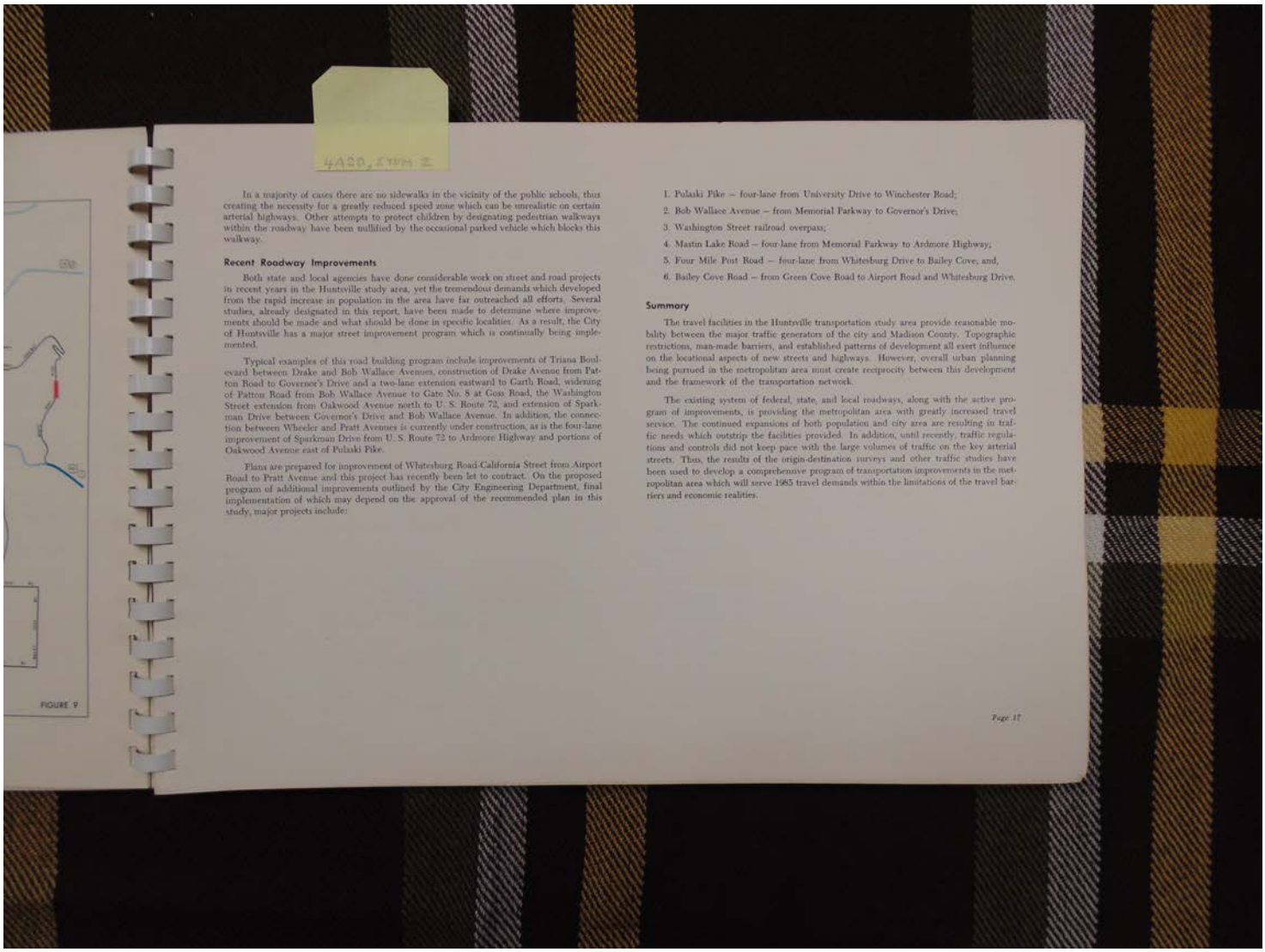


Names:
Traffic Speed Limits
Widths of Major Streets

Places:
Huntsville, AL

Types:
illustration

Dates:
1966



In a majority of cases there are no sidewalks in the vicinity of the public schools, thus creating the necessity for a greatly reduced speed zone which can be unrealistic on certain arterial highways. Other attempts to protect children by designating pedestrian walkways within the roadway have been nullified by the occasional parked vehicle which blocks this walkway.

Recent Roadway Improvements

Both state and local agencies have done considerable work on street and road projects in recent years in the Huntsville study area, yet the tremendous demands which developed from the rapid increase in population in the area have far outreached all efforts. Several studies, already designated in this report, have been made to determine where improvements should be made and what should be done in specific localities. As a result, the City of Huntsville has a major street improvement program which is continually being implemented.

Typical examples of this road building program include improvements of Triana Boulevard between Drake and Bob Wallace Avenues, construction of Drake Avenue from Patton Road to Governor's Drive and a two-lane extension eastward to Garth Road, widening of Patton Road from Bob Wallace Avenue to Gate No. 8 at Goss Road, the Washington Street extension from Oakwood Avenue north to U. S. Route 72, and extension of Sparkman Drive between Governor's Drive and Bob Wallace Avenue. In addition, the connection between Wheeler and Pratt Avenues is currently under construction, as is the four-lane improvement of Sparkman Drive from U. S. Route 72 to Ardmore Highway and portions of Oakwood Avenue east of Pulaski Pike.

Plans are prepared for improvement of Whitesburg Road-California Street from Airport Road to Pratt Avenue and this project has recently been let to contract. On the proposed program of additional improvements outlined by the City Engineering Department, final implementation of which may depend on the approval of the recommended plan in this study, major projects include:

1. Pulaski Pike — four-lane from University Drive to Winchester Road;
2. Bob Wallace Avenue — from Memorial Parkway to Governor's Drive;
3. Washington Street railroad overpass;
4. Mastin Lake Road — four-lane from Memorial Parkway to Ardmore Highway;
5. Four Mile Post Road — four-lane from Whitesburg Drive to Bailey Cove; and,
6. Bailey Cove Road — from Green Cove Road to Airport Road and Whitesburg Drive.

Summary

The travel facilities in the Huntsville transportation study area provide reasonable mobility between the major traffic generators of the city and Madison County. Topographic restrictions, man-made barriers, and established patterns of development all exert influence on the locational aspects of new streets and highways. However, overall urban planning being pursued in the metropolitan area must create reciprocity between this development and the framework of the transportation network.

The existing system of federal, state, and local roadways, along with the active program of improvements, is providing the metropolitan area with greatly increased travel service. The continued expansions of both population and city area are resulting in traffic needs which outstrip the facilities provided. In addition, until recently, traffic regulations and controls did not keep pace with the large volumes of traffic on the key arterial streets. Thus, the results of the origin-destination surveys and other traffic studies have been used to develop a comprehensive program of transportation improvements in the metropolitan area which will serve 1985 travel demands within the limitations of the travel barriers and economic realities.

Page 17

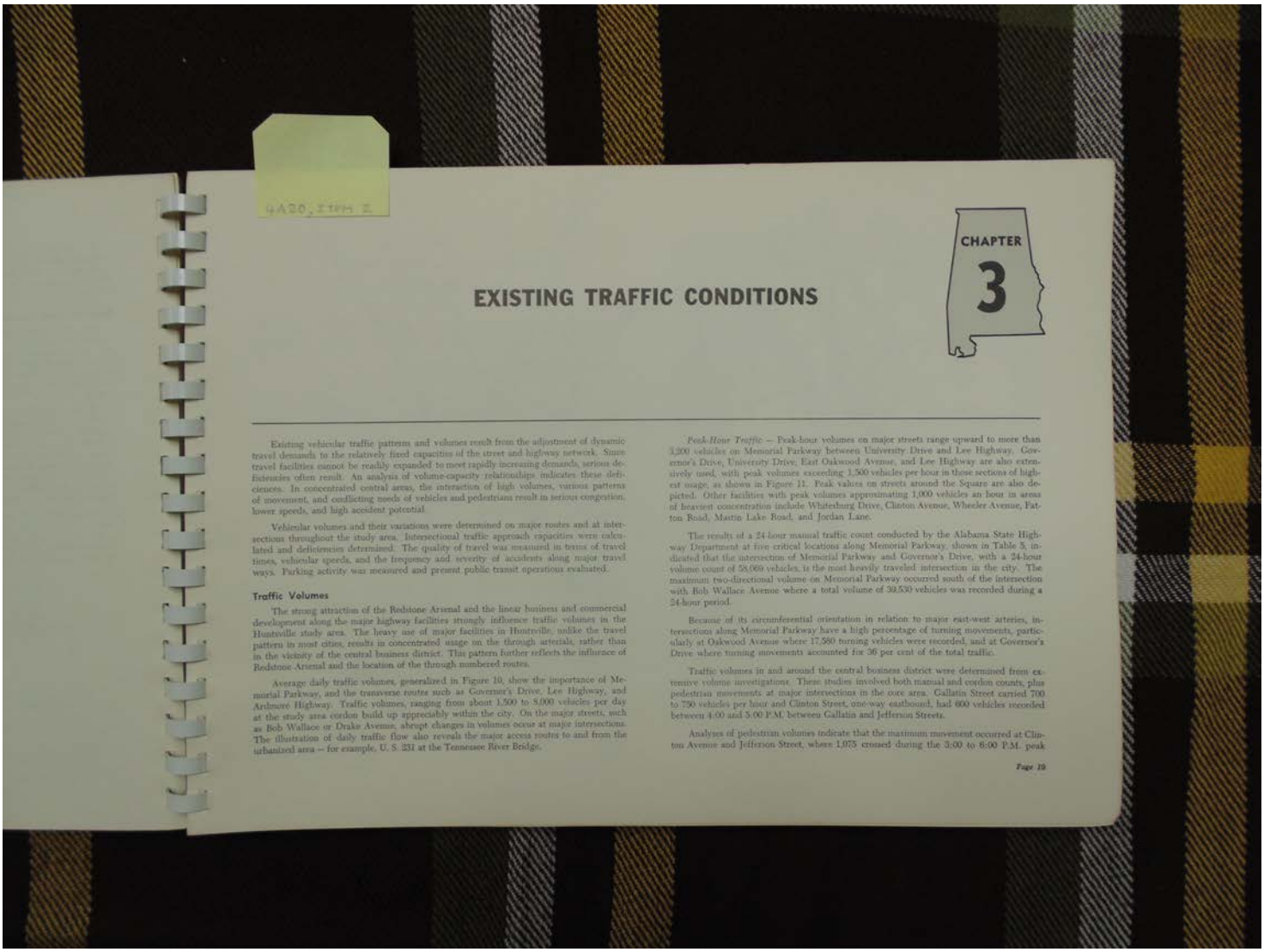
FIGURE 9

Names:
Recent Roadway Improvements

Places:
Huntsville, AL

Types:
booklet

Dates:
1966



4A20, Item 2

CHAPTER 3

EXISTING TRAFFIC CONDITIONS

Existing vehicular traffic patterns and volumes result from the adjustment of dynamic travel demands to the relatively fixed capacities of the street and highway network. Since travel facilities cannot be readily expanded to meet rapidly increasing demands, serious deficiencies often result. An analysis of volume-capacity relationships indicates these deficiencies. In concentrated central areas, the interaction of high volumes, various patterns of movement, and conflicting needs of vehicles and pedestrians result in serious congestion, lower speeds, and high accident potential.

Vehicular volumes and their variations were determined on major routes and at intersections throughout the study area. Intersectional traffic approach capacities were calculated and deficiencies determined. The quality of travel was measured in terms of travel times, vehicular speeds, and the frequency and severity of accidents along major travel ways. Parking activity was measured and present public transit operations evaluated.

Traffic Volumes

The strong attraction of the Redstone Arsenal and the linear business and commercial development along the major highway facilities strongly influence traffic volumes in the Huntsville study area. The heavy use of major facilities in Huntsville, unlike the travel pattern in most cities, results in concentrated usage on the through arterials, rather than in the vicinity of the central business district. This pattern further reflects the influence of Redstone Arsenal and the location of the through numbered routes.

Average daily traffic volumes, generalized in Figure 10, show the importance of Memorial Parkway, and the transverse routes such as Governor's Drive, Lee Highway, and Ardmore Highway. Traffic volumes, ranging from about 1,500 to 8,000 vehicles per day at the study area cordon build up appreciably within the city. On the major streets, such as Bob Wallace or Drake Avenue, abrupt changes in volumes occur at major intersections. The illustration of daily traffic flow also reveals the major access routes to and from the urbanized area -- for example, U. S. 231 at the Tennessee River Bridge.

Peak-Hour Traffic -- Peak-hour volumes on major streets range upward to more than 3,200 vehicles on Memorial Parkway between University Drive and Lee Highway. Governor's Drive, University Drive, East Oakwood Avenue, and Lee Highway are also extensively used, with peak volumes exceeding 1,500 vehicles per hour in those sections of highest usage, as shown in Figure 11. Peak values on streets around the Square are also depicted. Other facilities with peak volumes approximating 1,000 vehicles an hour in areas of heaviest concentration include Whitesburg Drive, Clinton Avenue, Wheeler Avenue, Fatton Road, Martin Lake Road, and Jordan Lane.

The results of a 24-hour manual traffic count conducted by the Alabama State Highway Department at five critical locations along Memorial Parkway, shown in Table 5, indicated that the intersection of Memorial Parkway and Governor's Drive, with a 24-hour volume count of 58,069 vehicles, is the most heavily traveled intersection in the city. The maximum two-directional volume on Memorial Parkway occurred south of the intersection with Bob Wallace Avenue where a total volume of 39,530 vehicles was recorded during a 24-hour period.

Because of its circumferential orientation in relation to major east-west arteries, intersections along Memorial Parkway have a high percentage of turning movements, particularly at Oakwood Avenue where 17,580 turning vehicles were recorded, and at Governor's Drive where turning movements accounted for 36 per cent of the total traffic.

Traffic volumes in and around the central business district were determined from extensive volume investigations. These studies involved both manual and cordon counts, plus pedestrian movements at major intersections in the core area. Gallatin Street carried 700 to 750 vehicles per hour and Clinton Street, one-way eastbound, had 600 vehicles recorded between 4:00 and 5:00 P.M. between Gallatin and Jefferson Streets.

Analyses of pedestrian volumes indicate that the maximum movement occurred at Clinton Avenue and Jefferson Street, where 1,075 crossed during the 5:00 to 6:00 P.M. peak

Names:
Existing Traffic Conditions -
Chapter 3 Traffic Volumes

Places:
Huntsville, AL

Types:
booklet

Dates:
1966

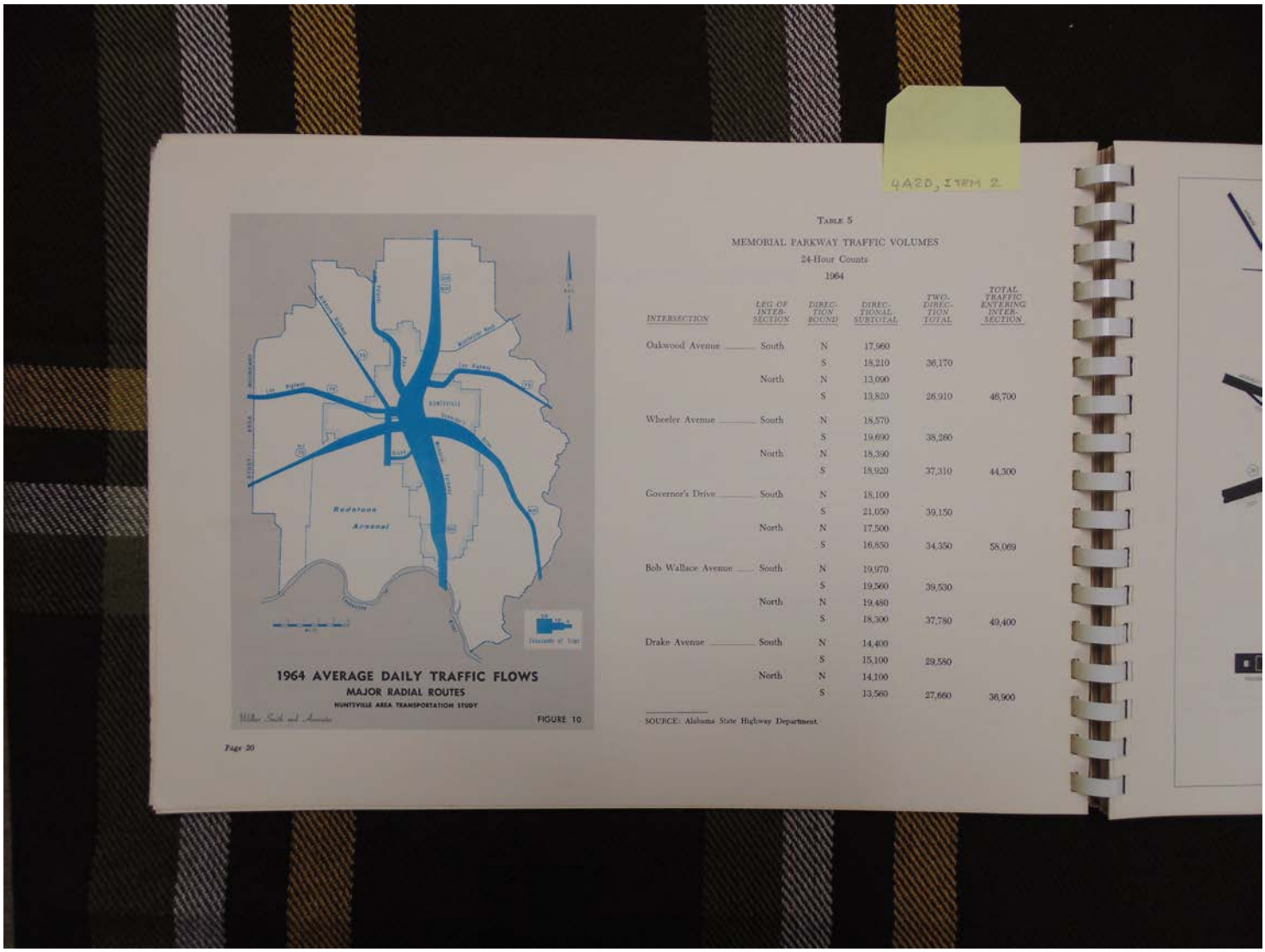


TABLE 5

MEMORIAL PARKWAY TRAFFIC VOLUMES

24-Hour Counts

1964

INTERSECTION	LEG OF INTERSECTION	DIRECTION BOUND	DIRECTIONAL SUBTOTAL	TWO-DIRECTION TOTAL	TOTAL TRAFFIC ENTERING INTERSECTION
Oakwood Avenue	South	N	17,960		
		S	18,210	36,170	
	North	N	13,090		
		S	13,820	26,910	46,700
Wheeler Avenue	South	N	18,570		
		S	19,690	38,260	
	North	N	18,390		
		S	18,920	37,310	44,300
Governor's Drive	South	N	18,100		
		S	21,050	39,150	
	North	N	17,500		
		S	16,850	34,350	58,069
Bob Wallace Avenue	South	N	19,970		
		S	19,560	39,530	
	North	N	19,480		
		S	18,300	37,780	49,400
Drake Avenue	South	N	14,400		
		S	15,100	29,580	
	North	N	14,100		
		S	13,560	27,660	36,900

SOURCE: Alabama State Highway Department.

Names:

Average Daily Traffic Flows
Memorial Parkway Traffic Volumes

Places:

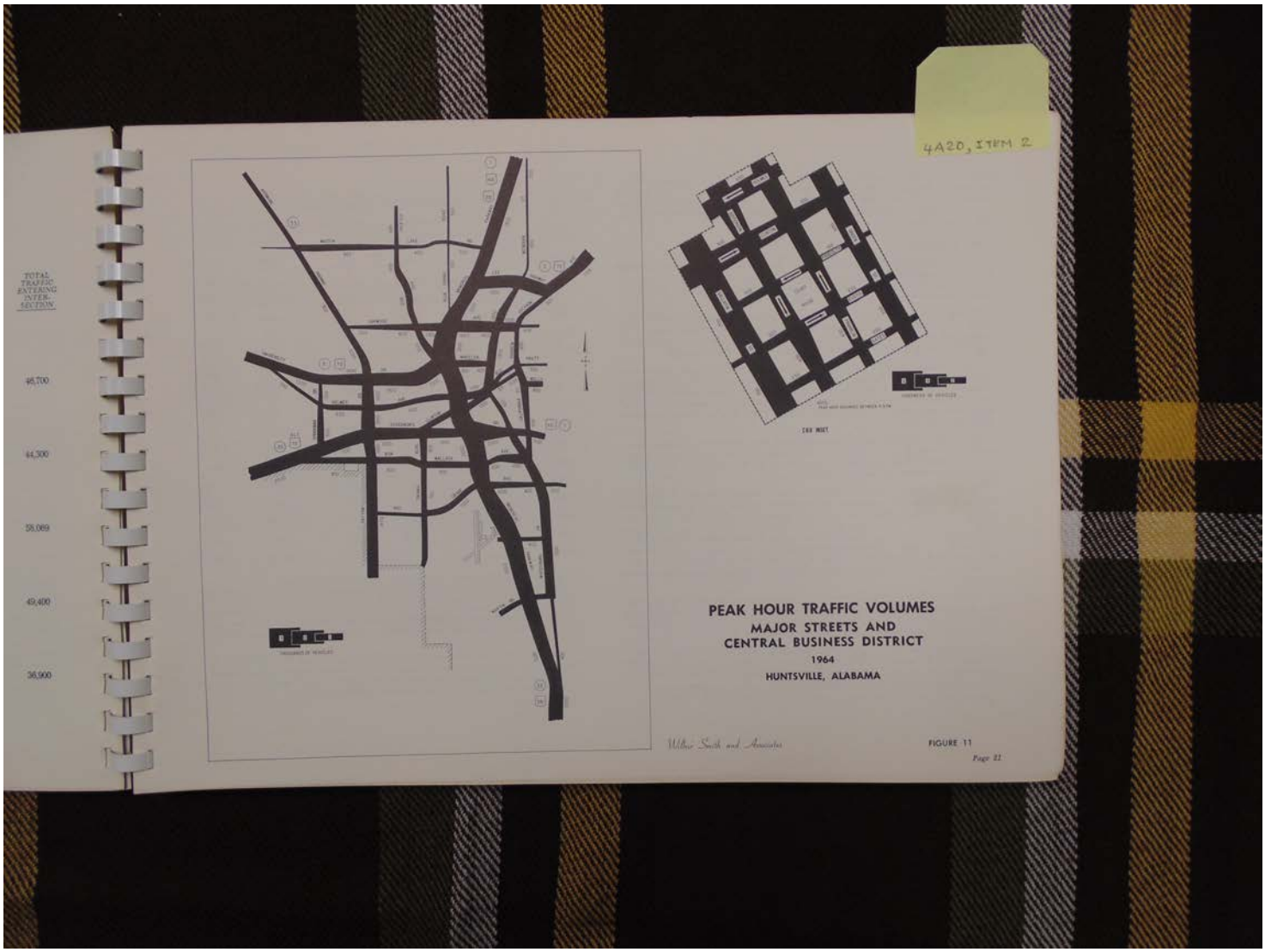
Huntsville, AL

Types:

illustration
table

Dates:

1966

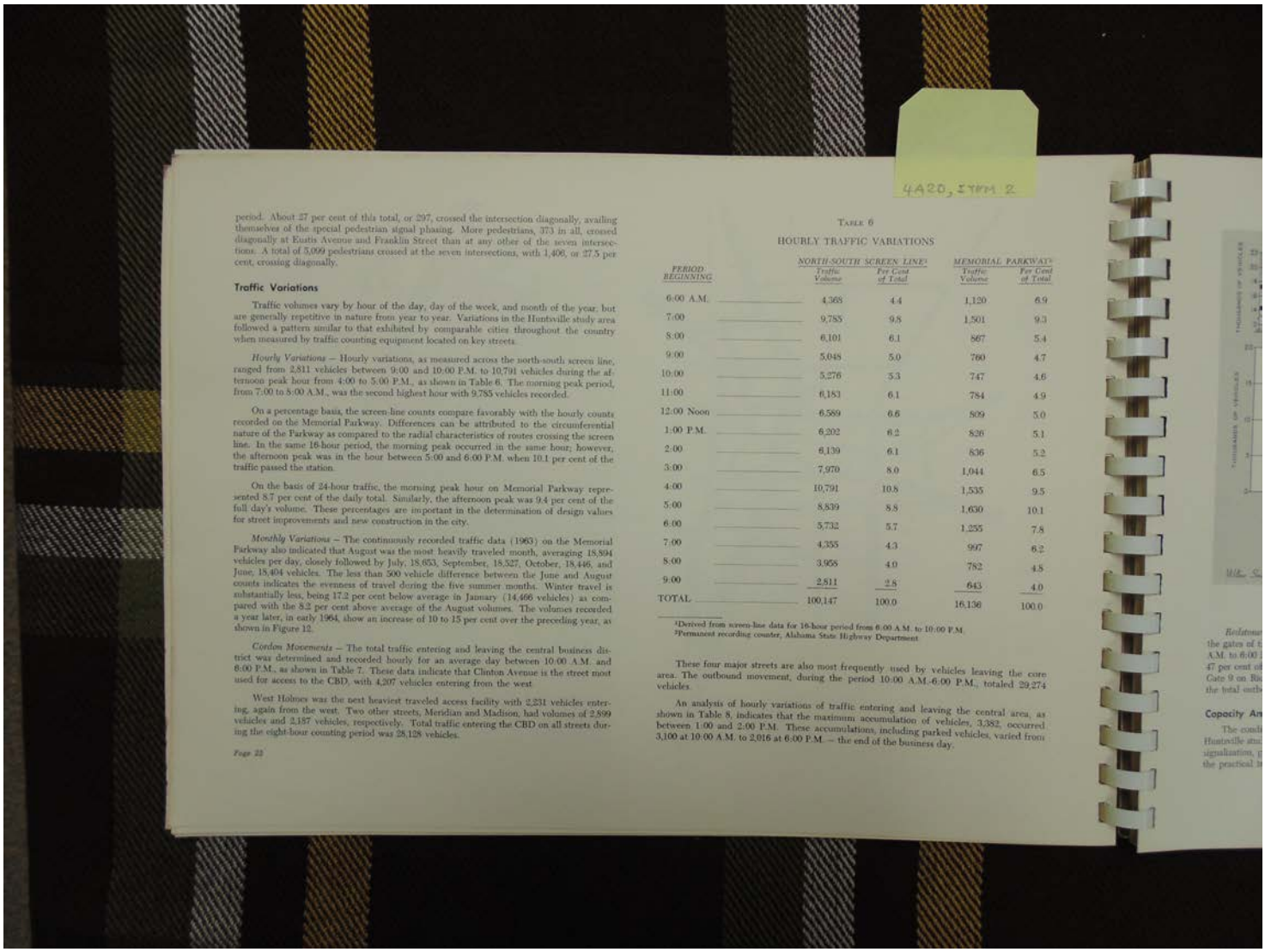


Names:
Peak Hour Traffic Volumes

Places:
Huntsville, AL

Types:
illustration

Dates:
1966



period. About 27 per cent of this total, or 297, crossed the intersection diagonally, availing themselves of the special pedestrian signal phasing. More pedestrians, 373 in all, crossed diagonally at Eustis Avenue and Franklin Street than at any other of the seven intersections. A total of 5,099 pedestrians crossed at the seven intersections, with 1,406, or 27.5 per cent, crossing diagonally.

Traffic Variations

Traffic volumes vary by hour of the day, day of the week, and month of the year, but are generally repetitive in nature from year to year. Variations in the Huntsville study area followed a pattern similar to that exhibited by comparable cities throughout the country when measured by traffic counting equipment located on key streets.

Hourly Variations – Hourly variations, as measured across the north-south screen line, ranged from 2,811 vehicles between 9:00 and 10:00 P.M. to 10,791 vehicles during the afternoon peak hour from 4:00 to 5:00 P.M., as shown in Table 6. The morning peak period, from 7:00 to 8:00 A.M., was the second highest hour with 9,785 vehicles recorded.

On a percentage basis, the screen-line counts compare favorably with the hourly counts recorded on the Memorial Parkway. Differences can be attributed to the circumferential nature of the Parkway as compared to the radial characteristics of routes crossing the screen line. In the same 16-hour period, the morning peak occurred in the same hour; however, the afternoon peak was in the hour between 5:00 and 6:00 P.M. when 10.1 per cent of the traffic passed the station.

On the basis of 24-hour traffic, the morning peak hour on Memorial Parkway represented 8.7 per cent of the daily total. Similarly, the afternoon peak was 9.4 per cent of the full day's volume. These percentages are important in the determination of design values for street improvements and new construction in the city.

Monthly Variations – The continuously recorded traffic data (1963) on the Memorial Parkway also indicated that August was the most heavily traveled month, averaging 18,894 vehicles per day, closely followed by July, 18,653, September, 18,527, October, 18,446, and June, 18,404 vehicles. The less than 500 vehicle difference between the June and August counts indicates the evenness of travel during the five summer months. Winter travel is substantially less, being 17.2 per cent below average in January (14,466 vehicles) as compared with the 8.2 per cent above average of the August volumes. The volumes recorded a year later, in early 1964, show an increase of 10 to 15 per cent over the preceding year, as shown in Figure 12.

Cordon Movements – The total traffic entering and leaving the central business district was determined and recorded hourly for an average day between 10:00 A.M. and 6:00 P.M., as shown in Table 7. These data indicate that Clinton Avenue is the street most used for access to the CBD, with 4,207 vehicles entering from the west.

West Holmes was the next heaviest traveled access facility with 2,231 vehicles entering, again from the west. Two other streets, Meridian and Madison, had volumes of 2,599 vehicles and 2,187 vehicles, respectively. Total traffic entering the CBD on all streets during the eight-hour counting period was 28,128 vehicles.

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TABLE 6

HOURLY TRAFFIC VARIATIONS

PERIOD BEGINNING	NORTH-SOUTH SCREEN LINE[1] Traffic Volume	NORTH-SOUTH SCREEN LINE[1] Per Cent of Total	MEMORIAL PARKWAY[2] Traffic Volume	MEMORIAL PARKWAY[2] Per Cent of Total
6:00 A.M.	4,368	4.4	1,120	6.9
7:00	9,785	9.8	1,501	9.3
8:00	6,101	6.1	867	5.4
9:00	5,048	5.0	760	4.7
10:00	5,276	5.3	747	4.6
11:00	6,183	6.1	784	4.9
12:00 Noon	6,589	6.6	809	5.0
1:00 P.M.	6,202	6.2	826	5.1
2:00	6,139	6.1	836	5.2
3:00	7,970	8.0	1,044	6.5
4:00	10,791	10.8	1,535	9.5
5:00	8,839	8.8	1,630	10.1
6:00	5,732	5.7	1,255	7.8
7:00	4,355	4.3	997	6.2
8:00	3,958	4.0	782	4.8
9:00	2,811	2.8	643	4.0
TOTAL	100,147	100.0	16,136	100.0

[1]Derived from screen-line data for 16-hour period from 6:00 A.M. to 10:00 P.M.
[2]Permanent recording counter, Alabama State Highway Department

These four major streets are also most frequently used by vehicles leaving the core area. The outbound movement, during the period 10:00 A.M.-6:00 P.M., totaled 29,274 vehicles.

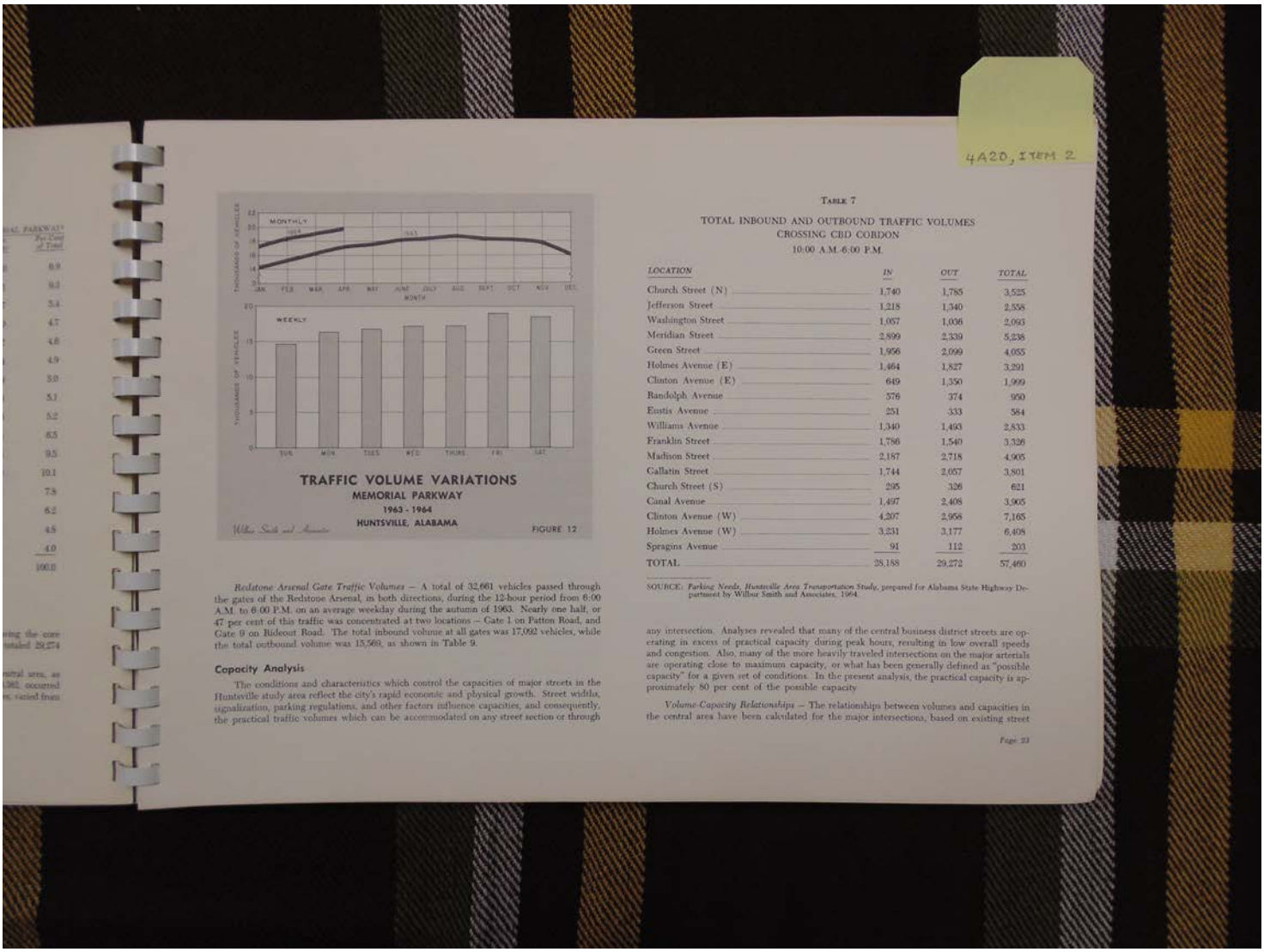
An analysis of hourly variations of traffic entering and leaving the central area, as shown in Table 8, indicates that the maximum accumulation of vehicles, 3,382, occurred between 1:00 and 2:00 P.M. These accumulations, including parked vehicles, varied from 3,100 at 10:00 A.M. to 2,016 at 6:00 P.M. – the end of the business day.

Names:
Hourly Traffic Variations
Traffic Variations

Places:
Huntsville, AL

Types:
booklet
table

Dates:
1966



Central Business District

Names:

Central Business District Traffic
Traffic Volume Variations

Places:

Huntsville, AL

Types:

illustration
table

Dates:

1966

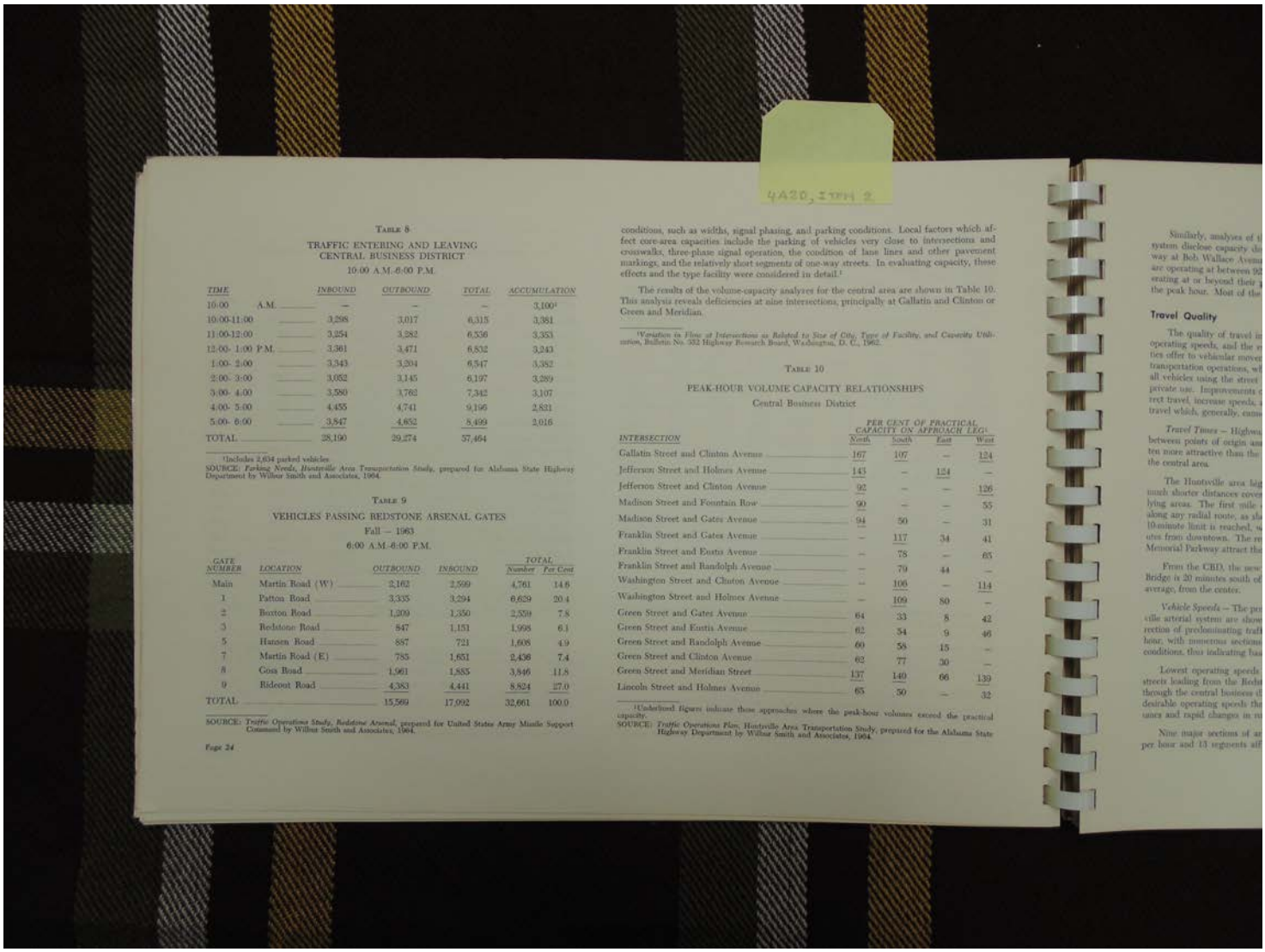


TABLE 8

TRAFFIC ENTERING AND LEAVING CENTRAL BUSINESS DISTRICT

10:00 A.M.–6:00 P.M.

TIME	INBOUND	OUTBOUND	TOTAL	ACCUMULATION
10:00 A.M.	–	–	–	3,100[1]
10:00-11:00	3,298	3,017	6,315	3,381
11:00-12:00	3,254	3,282	6,536	3,353
12:00- 1:00 P.M.	3,361	3,471	6,832	3,243
1:00- 2:00	3,343	3,204	6,547	3,382
2:00- 3:00	3,052	3,145	6,197	3,289
3:00- 4:00	3,580	3,762	7,342	3,107
4:00- 5:00	4,455	4,741	9,196	2,821
5:00- 6:00	3,847	4,652	8,499	2,016
TOTAL	28,190	29,274	57,464	

[1]Includes 2,634 parked vehicles.
SOURCE: *Parking Needs, Huntsville Area Transportation Study*, prepared for Alabama State Highway Department by Wilbur Smith and Associates, 1964.

TABLE 9

VEHICLES PASSING REDSTONE ARSENAL GATES

Fall — 1963

6:00 A.M.–6:00 P.M.

GATE NUMBER	LOCATION	OUTBOUND	INBOUND	TOTAL Number	TOTAL Per Cent
Main	Martin Road (W)	2,162	2,599	4,761	14.6
1	Patton Road	3,335	3,294	6,629	20.4
2	Buxton Road	1,209	1,350	2,559	7.8
3	Redstone Road	847	1,151	1,998	6.1
5	Hansen Road	887	721	1,608	4.9
7	Martin Road (E)	785	1,651	2,436	7.4
8	Goss Road	1,961	1,885	3,846	11.8
9	Rideout Road	4,383	4,441	8,824	27.0
TOTAL		15,569	17,092	32,661	100.0

SOURCE: *Traffic Operations Study, Redstone Arsenal*, prepared for United States Army Missile Support Command by Wilbur Smith and Associates, 1964.

Page 24

conditions, such as widths, signal phasing, and parking conditions. Local factors which affect core-area capacities include the parking of vehicles very close to intersections and crosswalks, three-phase signal operation, the condition of lane lines and other pavement markings, and the relatively short segments of one-way streets. In evaluating capacity, these effects and the type facility were considered in detail.[1]

The results of the volume-capacity analyses for the central area are shown in Table 10. This analysis reveals deficiencies at nine intersections, principally at Gallatin and Clinton or Green and Meridian.

[1]*Variation in Flow at Intersections as Related to Size of City, Type of Facility, and Capacity Utilization*, Bulletin No. 332 Highway Research Board, Washington, D. C., 1962.

TABLE 10

PEAK-HOUR VOLUME CAPACITY RELATIONSHIPS

Central Business District

INTERSECTION	PER CENT OF PRACTICAL CAPACITY ON APPROACH LEG North	South	East	West
Gallatin Street and Clinton Avenue	167	107	–	124
Jefferson Street and Holmes Avenue	143	–	124	–
Jefferson Street and Clinton Avenue	92	–	–	126
Madison Street and Fountain Row	90	–	–	55
Madison Street and Gates Avenue	94	50	–	31
Franklin Street and Gates Avenue	–	117	34	41
Franklin Street and Eustis Avenue	–	78	–	65
Franklin Street and Randolph Avenue	–	79	44	–
Washington Street and Clinton Avenue	–	106	–	114
Washington Street and Holmes Avenue	–	109	80	–
Green Street and Gates Avenue	64	33	8	42
Green Street and Eustis Avenue	62	54	9	46
Green Street and Randolph Avenue	60	58	15	–
Green Street and Clinton Avenue	62	77	30	–
Green Street and Meridian Street	137	140	66	139
Lincoln Street and Holmes Avenue	65	50	–	32

[1]Underlined figures indicate those approaches where the peak-hour volumes exceed the practical capacity.
SOURCE: *Traffic Operations Plan*, Huntsville Area Transportation Study, prepared for the Alabama State Highway Department by Wilbur Smith and Associates, 1964.

Travel Quality

Names:

Central Business District Traffic
Peak-Hour Volume Capacity in
Business District
Redstone Arsenal Gate Traffic

Places:

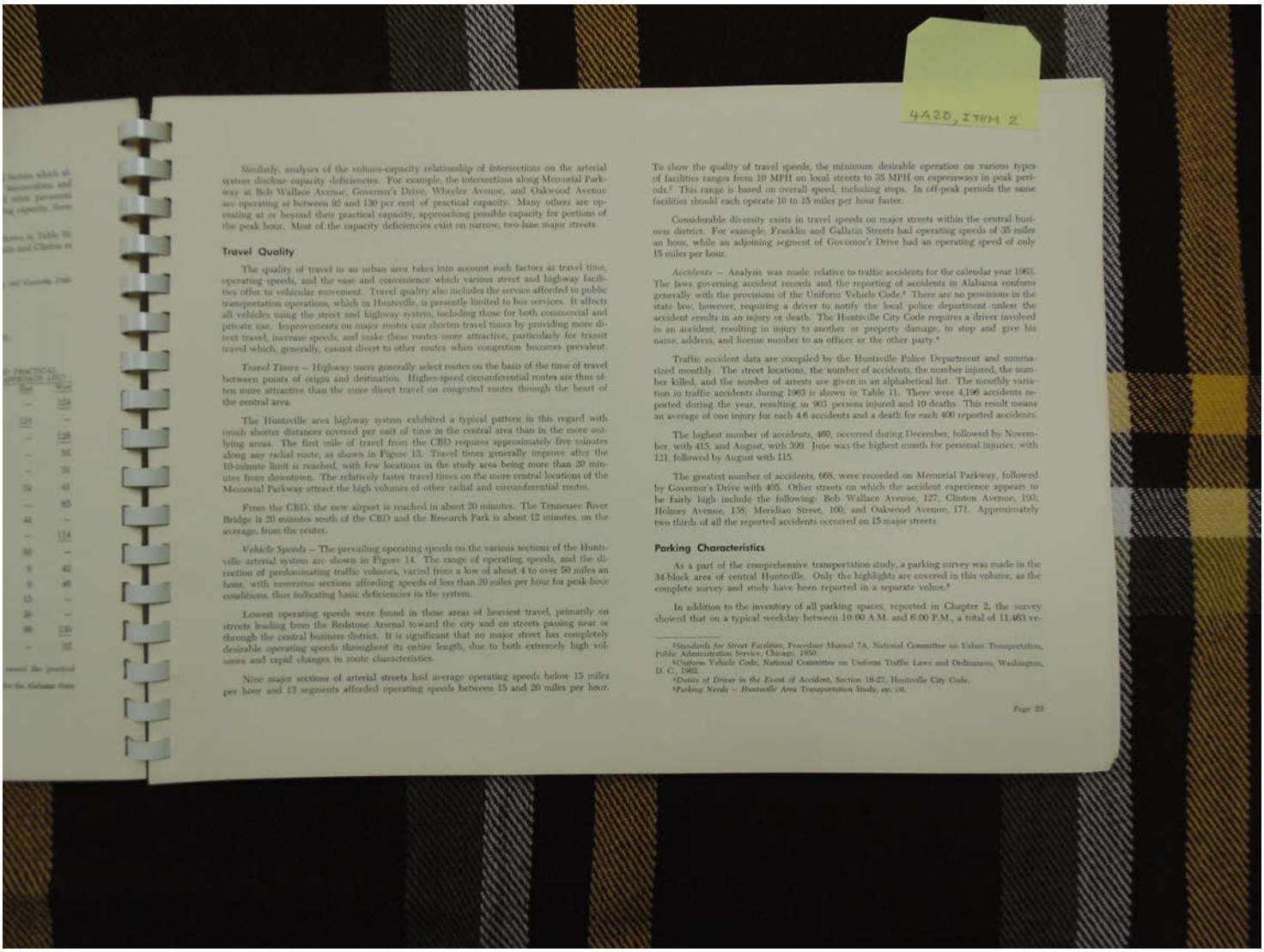
Huntsville, AL

Types:

table

Dates:

1966



Similarly, analyses of the volume-capacity relationship of intersections on the arterial system disclose capacity deficiencies. For example, the intersections along Memorial Parkway at Bob Wallace Avenue, Governor's Drive, Wheeler Avenue, and Oakwood Avenue are operating at between 92 and 130 per cent of practical capacity. Many others are operating at or beyond their practical capacity, approaching possible capacity for portions of the peak hour. Most of the capacity deficiencies exist on narrow, two-lane major streets.

Travel Quality

The quality of travel in an urban area takes into account such factors as travel time, operating speeds, and the ease and convenience which various street and highway facilities offer to vehicular movement. Travel quality also includes the service afforded to public transportation operations, which in Huntsville, is presently limited to bus services. It affects all vehicles using the street and highway system, including those for both commercial and private use. Improvements on major routes can shorten travel times by providing more direct travel, increase speeds, and make these routes more attractive, particularly for transit travel which, generally, cannot divert to other routes when congestion becomes prevalent.

Travel Times — Highway users generally select routes on the basis of the time of travel between points of origin and destination. Higher-speed circumferential routes are thus often more attractive than the more direct travel on congested routes through the heart of the central area.

The Huntsville area highway system exhibited a typical pattern in this regard with much shorter distances covered per unit of time in the central area than in the more outlying areas. The first mile of travel from the CBD requires approximately five minutes along any radial route, as shown in Figure 13. Travel times generally improve after the 10-minute limit is reached, with few locations in the study area being more than 20 minutes from downtown. The relatively faster travel times on the more central locations of the Memorial Parkway attract the high volumes of other radial and circumferential routes.

From the CBD, the new airport is reached in about 20 minutes. The Tennessee River Bridge is 20 minutes south of the CBD and the Research Park is about 12 minutes, on the average, from the center.

Vehicle Speeds — The prevailing operating speeds on the various sections of the Huntsville arterial system are shown in Figure 14. The range of operating speeds, and the direction of predominating traffic volumes, varied from a low of about 4 to over 50 miles an hour, with numerous sections affording speeds of less than 20 miles per hour for peak-hour conditions, thus indicating basic deficiencies in the system.

Lowest operating speeds were found in those areas of heaviest travel, primarily on streets leading from the Redstone Arsenal toward the city and on streets passing near or through the central business district. It is significant that no major street has completely desirable operating speeds throughout its entire length, due to both extremely high volumes and rapid changes in route characteristics.

Nine major sections of arterial streets had average operating speeds below 15 miles per hour and 13 segments afforded operating speeds between 15 and 20 miles per hour.

To show the quality of travel speeds, the minimum desirable operation on various types of facilities ranges from 10 MPH on local streets to 35 MPH on expressways in peak periods.[2] This range is based on overall speed, including stops. In off-peak periods the same facilities should each operate 10 to 15 miles per hour faster.

Considerable diversity exists in travel speeds on major streets within the central business district. For example, Franklin and Gallatin Streets had operating speeds of 35 miles an hour, while an adjoining segment of Governor's Drive had an operating speed of only 15 miles per hour.

Accidents — Analysis was made relative to traffic accidents for the calendar year 1963. The laws governing accident records and the reporting of accidents in Alabama conform generally with the provisions of the Uniform Vehicle Code.[3] There are no provisions in the state law, however, requiring a driver to notify the local police department unless the accident results in an injury or death. The Huntsville City Code requires a driver involved in an accident, resulting in injury to another or property damage, to stop and give his name, address, and license number to an officer or the other party.[4]

Traffic accident data are compiled by the Huntsville Police Department and summarized monthly. The street locations, the number of accidents, the number injured, the number killed, and the number of arrests are given in an alphabetical list. The monthly variation in traffic accidents during 1963 is shown in Table 11. There were 4,196 accidents reported during the year, resulting in 903 persons injured and 10 deaths. This result means an average of one injury for each 4.6 accidents and a death for each 400 reported accidents.

The highest number of accidents, 460, occurred during December, followed by November, with 415, and August, with 399. June was the highest month for personal injuries, with 121, followed by August with 115.

The greatest number of accidents, 668, were recorded on Memorial Parkway, followed by Governor's Drive with 405. Other streets on which the accident experience appears to be fairly high include the following: Bob Wallace Avenue, 127; Clinton Avenue, 193; Holmes Avenue, 138; Meridian Street, 100; and Oakwood Avenue, 171. Approximately two thirds of all the reported accidents occurred on 15 major streets.

Parking Characteristics

As a part of the comprehensive transportation study, a parking survey was made in the 34-block area of central Huntsville. Only the highlights are covered in this volume, as the complete survey and study have been reported in a separate volume.[5]

In addition to the inventory of all parking spaces, reported in Chapter 2, the survey showed that on a typical weekday between 10:00 A.M. and 6:00 P.M., a total of 11,463 ve-

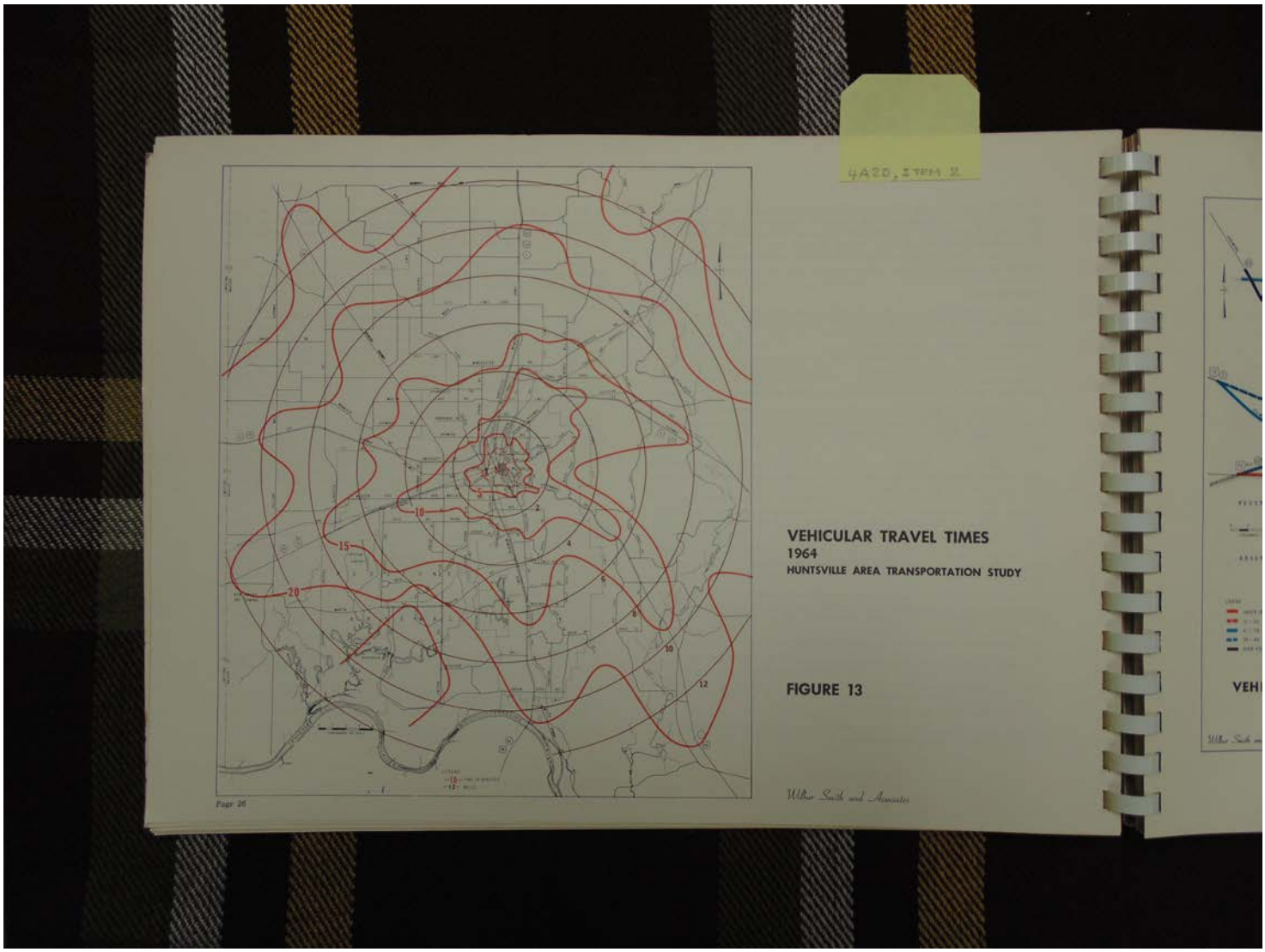
[2] *Standards for Street Facilities*, Procedure Manual 7A, National Committee on Urban Transportation, Public Administration Service, Chicago, 1950.
[3] *Uniform Vehicle Code*, National Committee on Uniform Traffic Laws and Ordinances, Washington, D. C., 1962.
[4] *Duties of Driver in the Event of Accident*, Section 18-27, Huntsville City Code.
[5] *Parking Needs — Huntsville Area Transportation Study*, *op. cit.*

Names:
Parking Characteristics
Travel Quality

Places:
Huntsville, AL

Types:
booklet

Dates:
1966

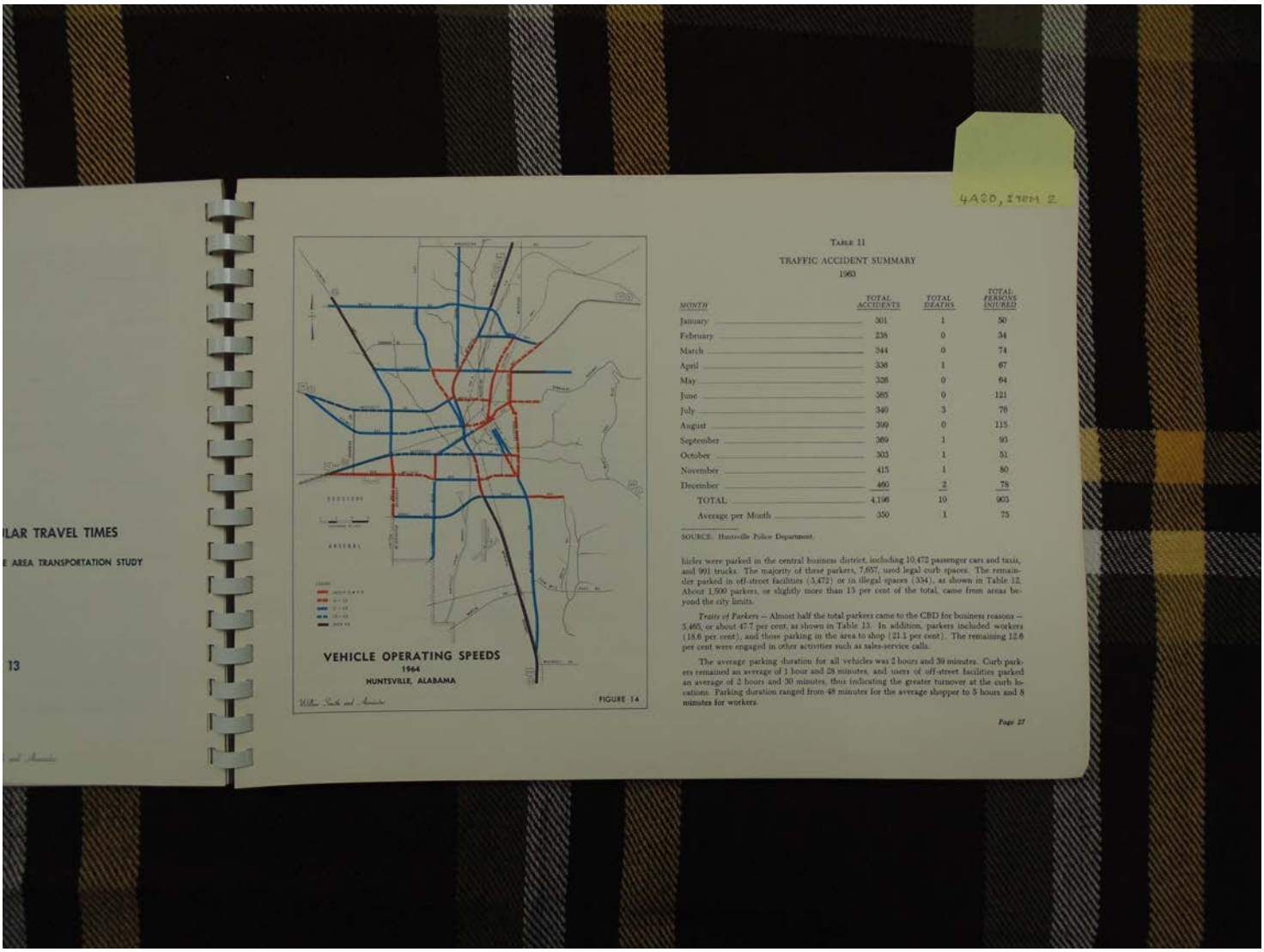


Names:
Vehicular Travel Times

Places:
Huntsville, AL

Types:
map illustration

Dates:
1966



Names:

Parking Characteristics
Traffic Accident Summary
Vehicle Operating Speeds

Places:

Huntsville, AL

Types:

booklet
map
illustration
table

Dates:

1966

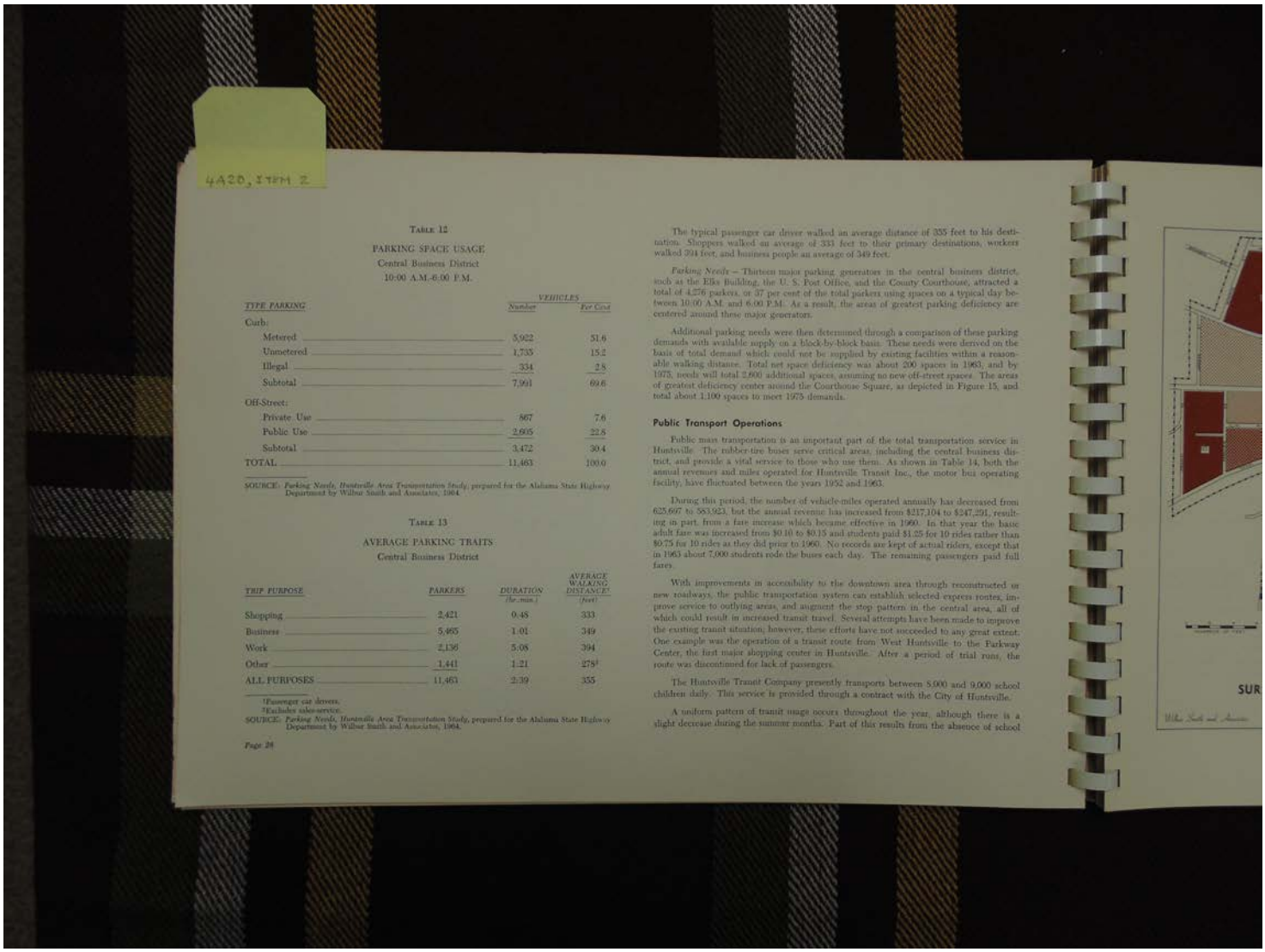


TABLE 12

PARKING SPACE USAGE
Central Business District
10:00 A.M.-6:00 P.M.

TYPE PARKING	VEHICLES Number	VEHICLES Per Cent
Curb:		
Metered	5,922	51.6
Unmetered	1,735	15.2
Illegal	334	2.8
Subtotal	7,991	69.6
Off-Street:		
Private Use	867	7.6
Public Use	2,605	22.8
Subtotal	3,472	30.4
TOTAL	11,463	100.0

SOURCE: *Parking Needs, Huntsville Area Transportation Study*, prepared for the Alabama State Highway Department by Wilbur Smith and Associates, 1964.

TABLE 13

AVERAGE PARKING TRAITS
Central Business District

TRIP PURPOSE	PARKERS	DURATION (hr.-min.)	AVERAGE WALKING DISTANCE[1] (feet)
Shopping	2,421	0:48	333
Business	5,465	1:01	349
Work	2,136	5:08	394
Other	1,441	1:21	278[2]
ALL PURPOSES	11,463	2:39	355

[1]Passenger car drivers.
[2]Excludes taxi-service.
SOURCE: *Parking Needs, Huntsville Area Transportation Study*, prepared for the Alabama State Highway Department by Wilbur Smith and Associates, 1964.

Page 24

The typical passenger car driver walked an average distance of 355 feet to his destination. Shoppers walked an average of 333 feet to their primary destinations, workers walked 394 feet, and business people an average of 349 feet.

Parking Needs – Thirteen major parking generators in the central business district, such as the Elks Building, the U. S. Post Office, and the County Courthouse, attracted a total of 4,276 parkers, or 37 per cent of the total parkers using spaces on a typical day between 10:00 A.M. and 6:00 P.M. As a result, the areas of greatest parking deficiency are centered around these major generators.

Additional parking needs were then determined through a comparison of these parking demands with available supply on a block-by-block basis. These needs were derived on the basis of total demand which could not be supplied by existing facilities within a reasonable walking distance. Total net space deficiency was about 200 spaces in 1963, and by 1975, needs will total 2,800 additional spaces, assuming no new off-street spaces. The areas of greatest deficiency center around the Courthouse Square, as depicted in Figure 15, and total about 1,100 spaces to meet 1975 demands.

Public Transport Operations

Public mass transportation is an important part of the total transportation service in Huntsville. The rubber-tire buses serve critical areas, including the central business district, and provide a vital service to those who use them. As shown in Table 14, both the annual revenues and miles operated for Huntsville Transit Inc., the motor bus operating facility, have fluctuated between the years 1952 and 1963.

During this period, the number of vehicle-miles operated annually has decreased from 625,607 to 583,923, but the annual revenue has increased from $217,104 to $247,291, resulting in part, from a fare increase which became effective in 1960. In that year the basic adult fare was increased from $0.10 to $0.15 and students paid $1.25 for 10 rides rather than $0.75 for 10 rides as they did prior to 1960. No records are kept of actual riders, except that in 1963 about 7,000 students rode the buses each day. The remaining passengers paid full fares.

With improvements in accessibility to the downtown area through reconstructed or new roadways, the public transportation system can establish selected express routes, improve service to outlying areas, and augment the stop pattern in the central area, all of which could result in increased transit travel. Several attempts have been made to improve the existing transit situation; however, these efforts have not succeeded to any great extent. One example was the operation of a transit route from West Huntsville to the Parkway Center, the first major shopping center in Huntsville. After a period of trial runs, the route was discontinued for lack of passengers.

The Huntsville Transit Company presently transports between 8,000 and 9,000 school children daily. This service is provided through a contract with the City of Huntsville.

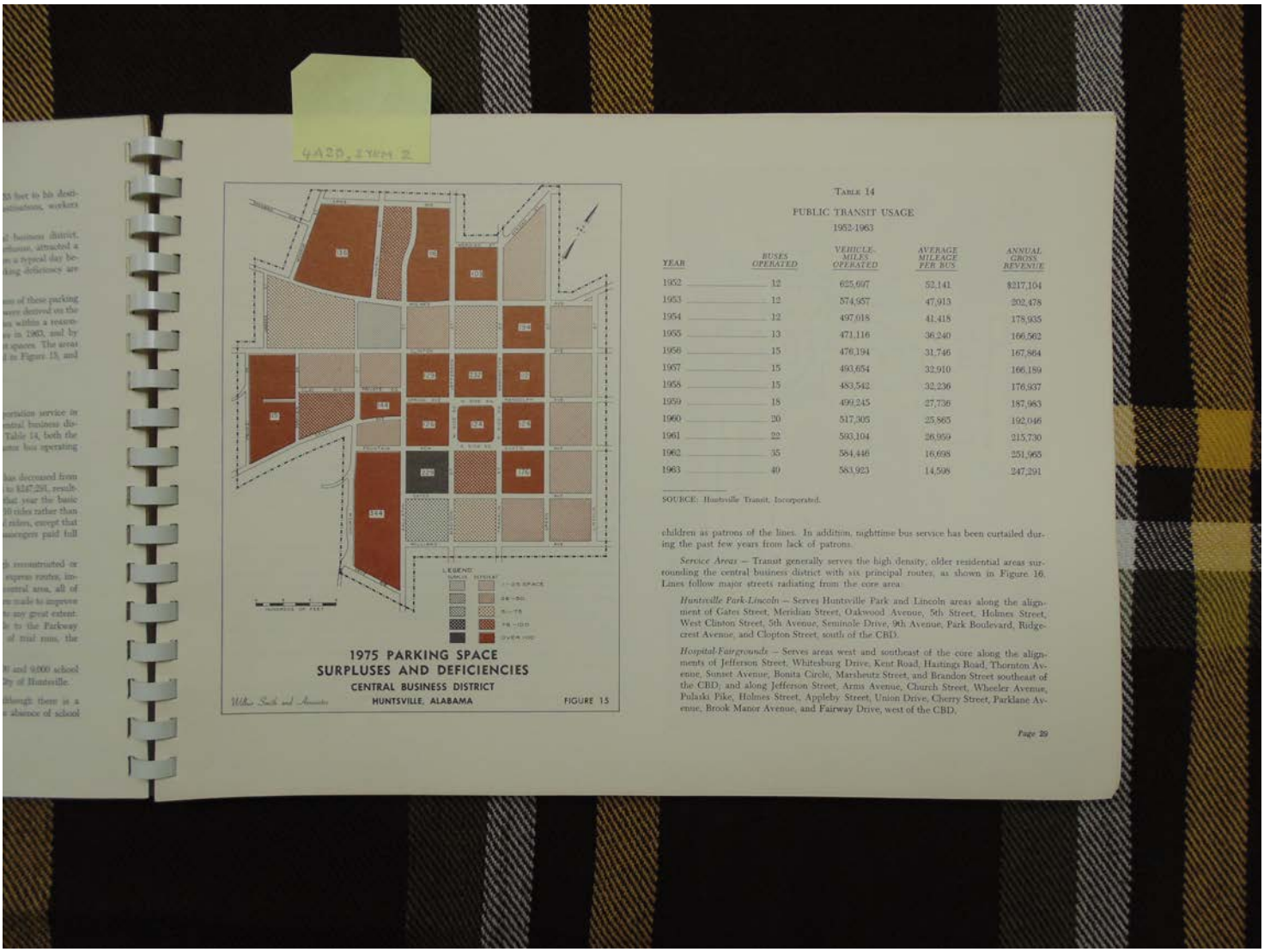
A uniform pattern of transit usage occurs throughout the year, although there is a slight decrease during the summer months. Part of this results from the absence of school

Names:
Average Parking Traits
Parking Space Usage
Public Transport Operations

Places:
Huntsville, AL

Types:
booklet
table

Dates:
1966

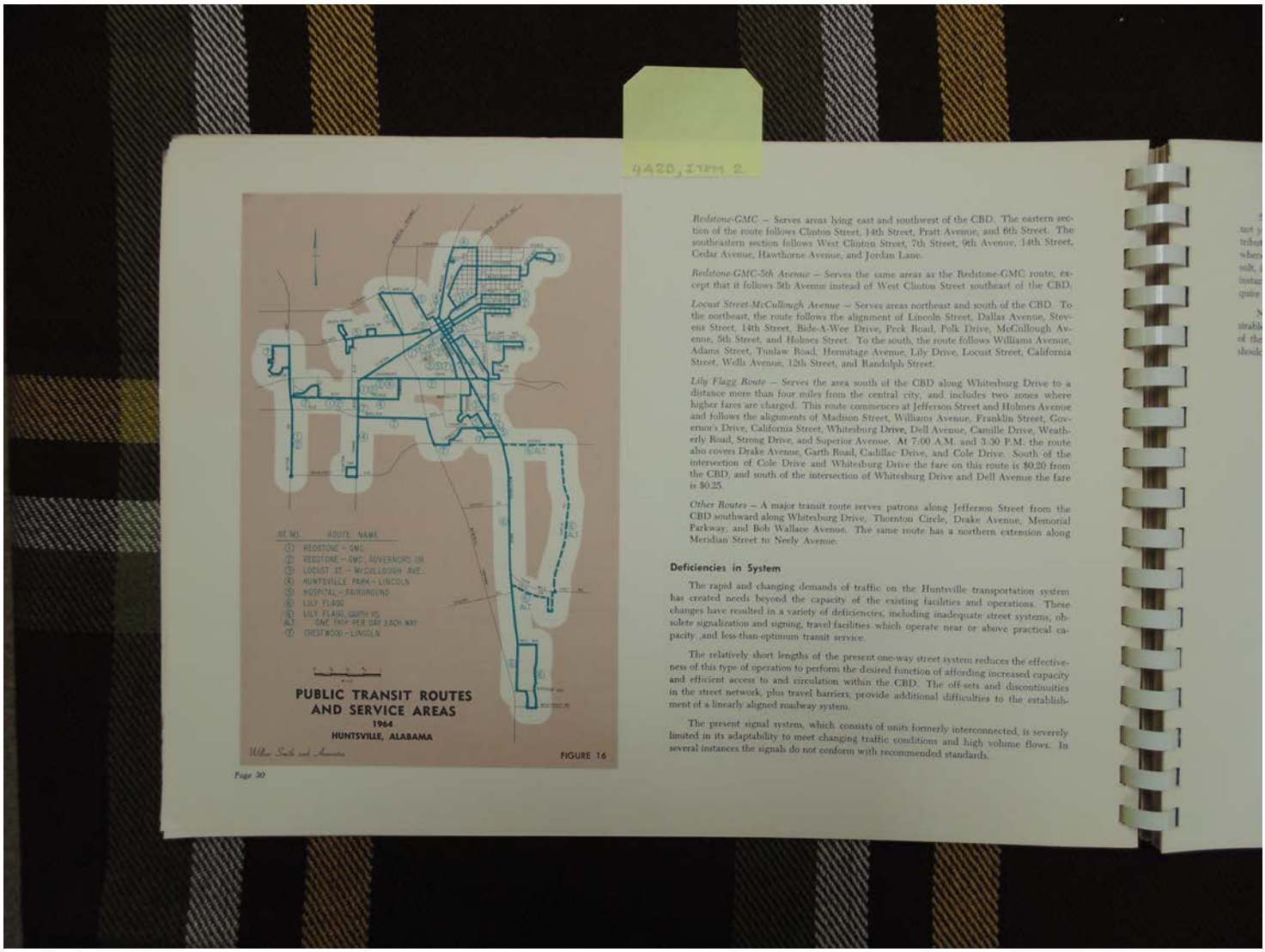


Names:
1976 Parking Spaces Public Transit Usage

Places:
Huntsville, AL

Types:
booklet table illustration

Dates:
1966

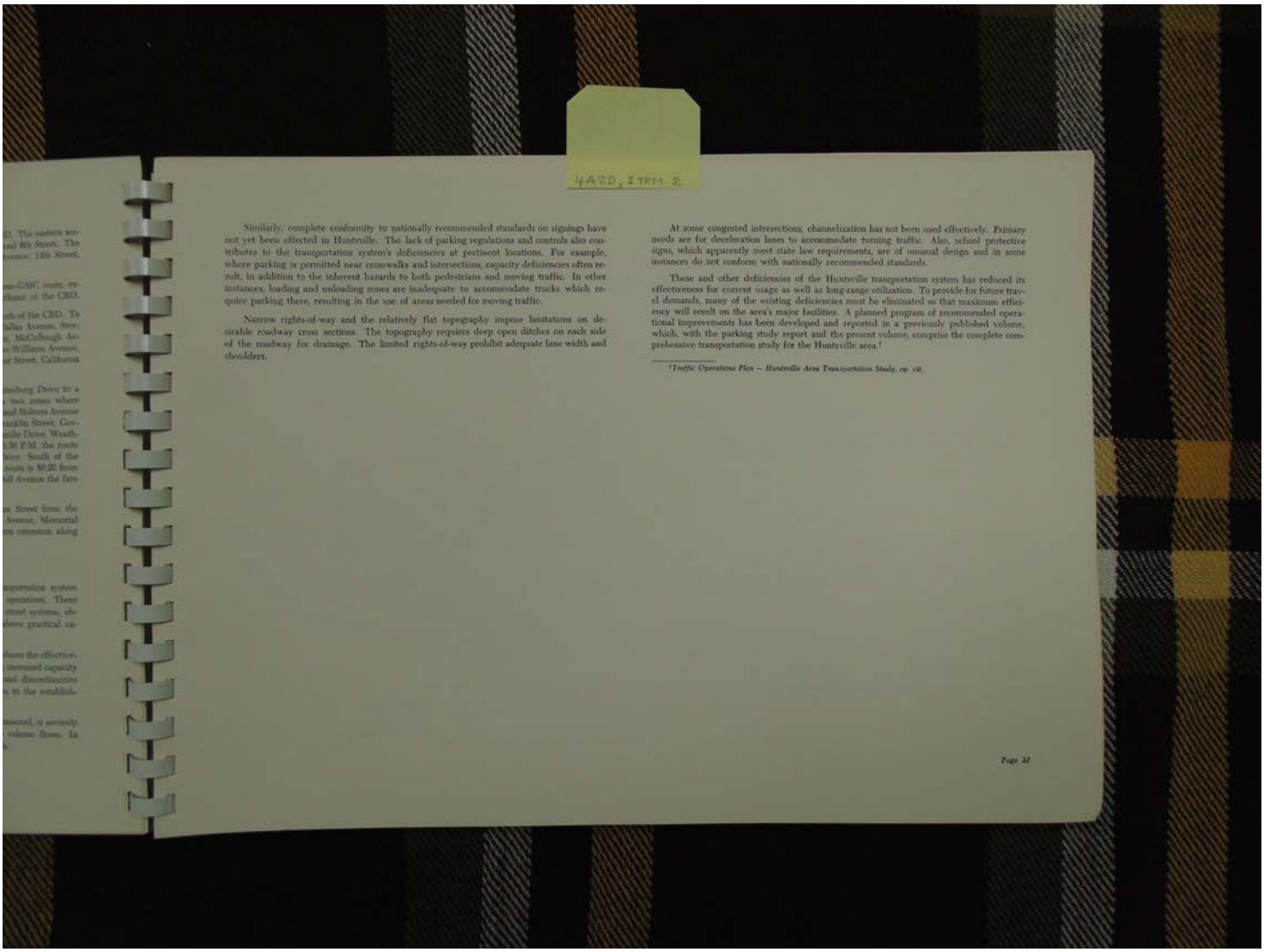


Names:
Deficiencies in Transportation
System
Public Transit Routes

Places:
Huntsville, AL

Types:
booklet
booklet
map

Dates:
1966

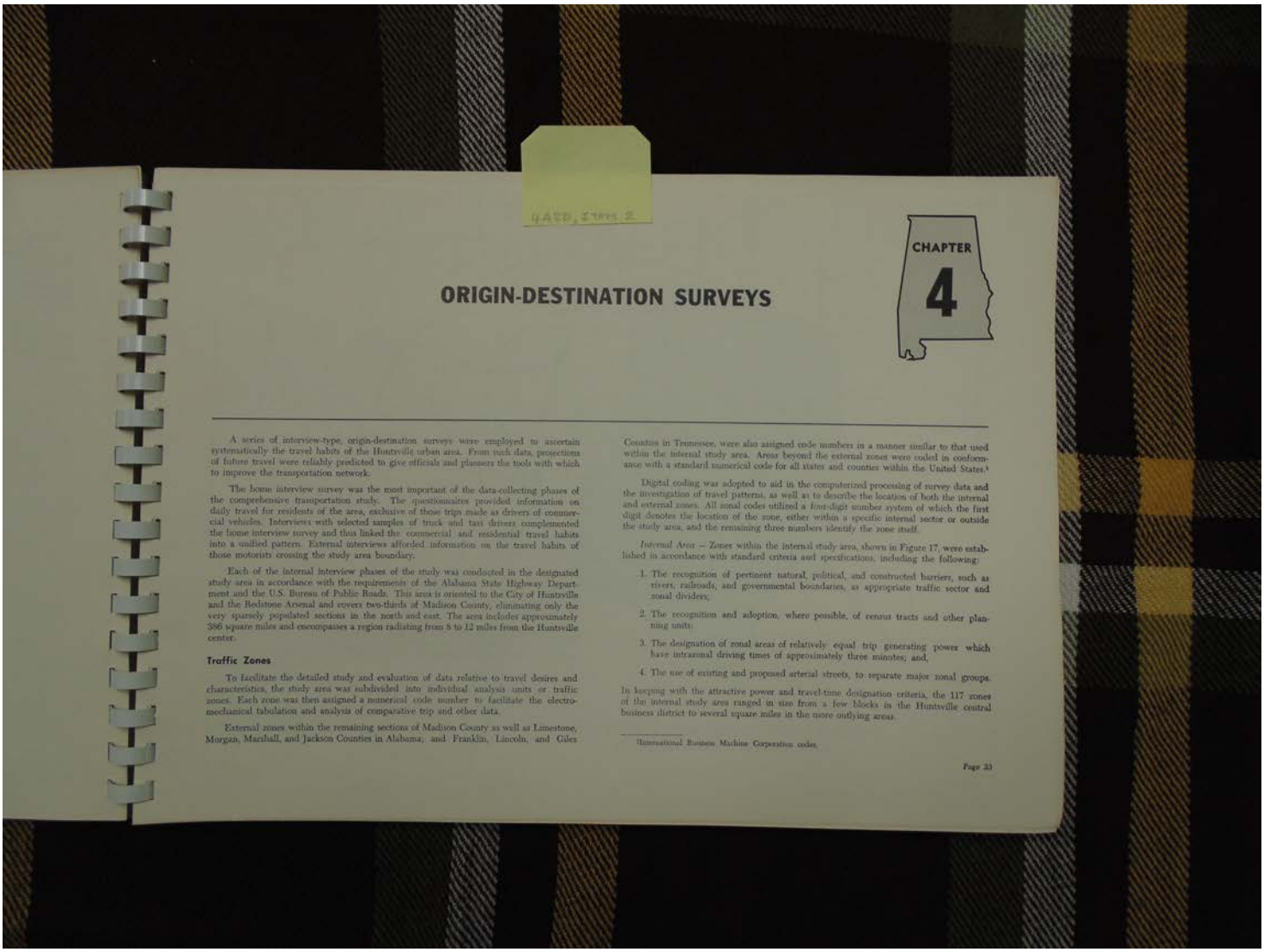


Names:
Deficiencies in Transportation System

Places:
Huntsville, AL

Types:
booklet

Dates:
1966



CHAPTER 4

ORIGIN-DESTINATION SURVEYS

A series of interview-type, origin-destination surveys were employed to ascertain systematically the travel habits of the Huntsville urban area. From such data, projections of future travel were reliably predicted to give officials and planners the tools with which to improve the transportation network.

The home interview survey was the most important of the data-collecting phases of the comprehensive transportation study. The questionnaires provided information on daily travel for residents of the area, exclusive of those trips made as drivers of commercial vehicles. Interviews with selected samples of truck and taxi drivers complemented the home interview survey and thus linked the commercial and residential travel habits into a unified pattern. External interviews afforded information on the travel habits of those motorists crossing the study area boundary.

Each of the internal interview phases of the study was conducted in the designated study area in accordance with the requirements of the Alabama State Highway Department and the U.S. Bureau of Public Roads. This area is oriented to the City of Huntsville and the Redstone Arsenal and covers two-thirds of Madison County, eliminating only the very sparsely populated sections in the north and east. The area includes approximately 386 square miles and encompasses a region radiating from 8 to 12 miles from the Huntsville center.

Traffic Zones

To facilitate the detailed study and evaluation of data relative to travel desires and characteristics, the study area was subdivided into individual analysis units or traffic zones. Each zone was then assigned a numerical code number to facilitate the electro-mechanical tabulation and analysis of comparative trip and other data.

External zones within the remaining sections of Madison County as well as Limestone, Morgan, Marshall, and Jackson Counties in Alabama; and Franklin, Lincoln, and Giles Counties in Tennessee, were also assigned code numbers in a manner similar to that used within the internal study area. Areas beyond the external zones were coded in conformance with a standard numerical code for all states and counties within the United States.[1]

Digital coding was adopted to aid in the computerized processing of survey data and the investigation of travel patterns, as well as to describe the location of both the internal and external zones. All zonal codes utilized a four-digit number system of which the first digit denotes the location of the zone, either within a specific internal sector or outside the study area, and the remaining three numbers identify the zone itself.

Internal Area – Zones within the internal study area, shown in Figure 17, were established in accordance with standard criteria and specifications, including the following:

1. The recognition of pertinent natural, political, and constructed barriers, such as rivers, railroads, and governmental boundaries, as appropriate traffic sector and zonal dividers;
2. The recognition and adoption, where possible, of census tracts and other planning units;
3. The designation of zonal areas of relatively equal trip generating power which have intrazonal driving times of approximately three minutes; and,
4. The use of existing and proposed arterial streets, to separate major zonal groups.

In keeping with the attractive power and travel-time designation criteria, the 117 zones of the internal study area ranged in size from a few blocks in the Huntsville central business district to several square miles in the more outlying areas.

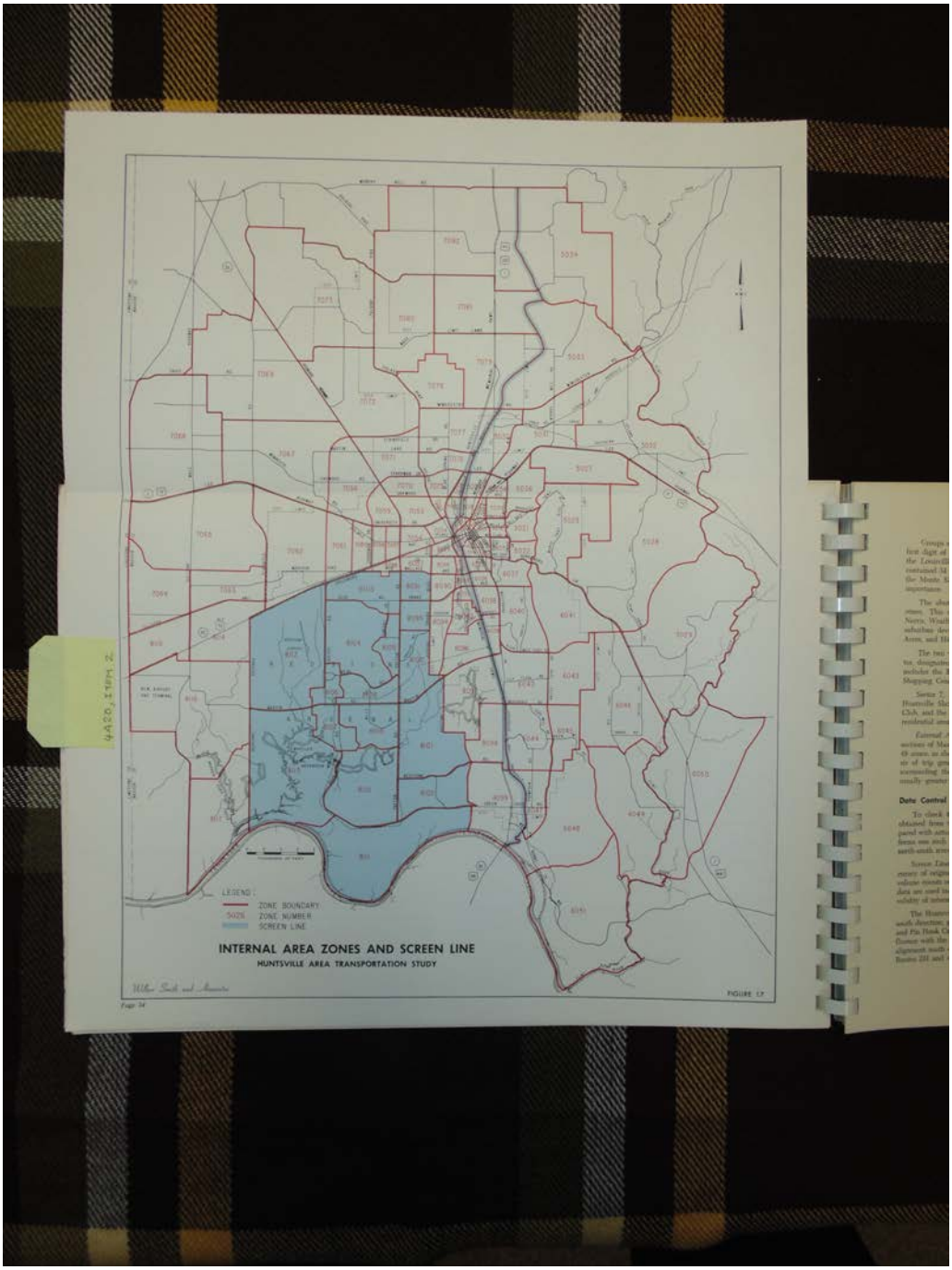
[1] International Business Machine Corporation codes.

Names:
Origin - Destination Surveys - Chapter 4
Traffic Zones

Places:
Huntsville, AL

Types:
booklet

Dates:
1966

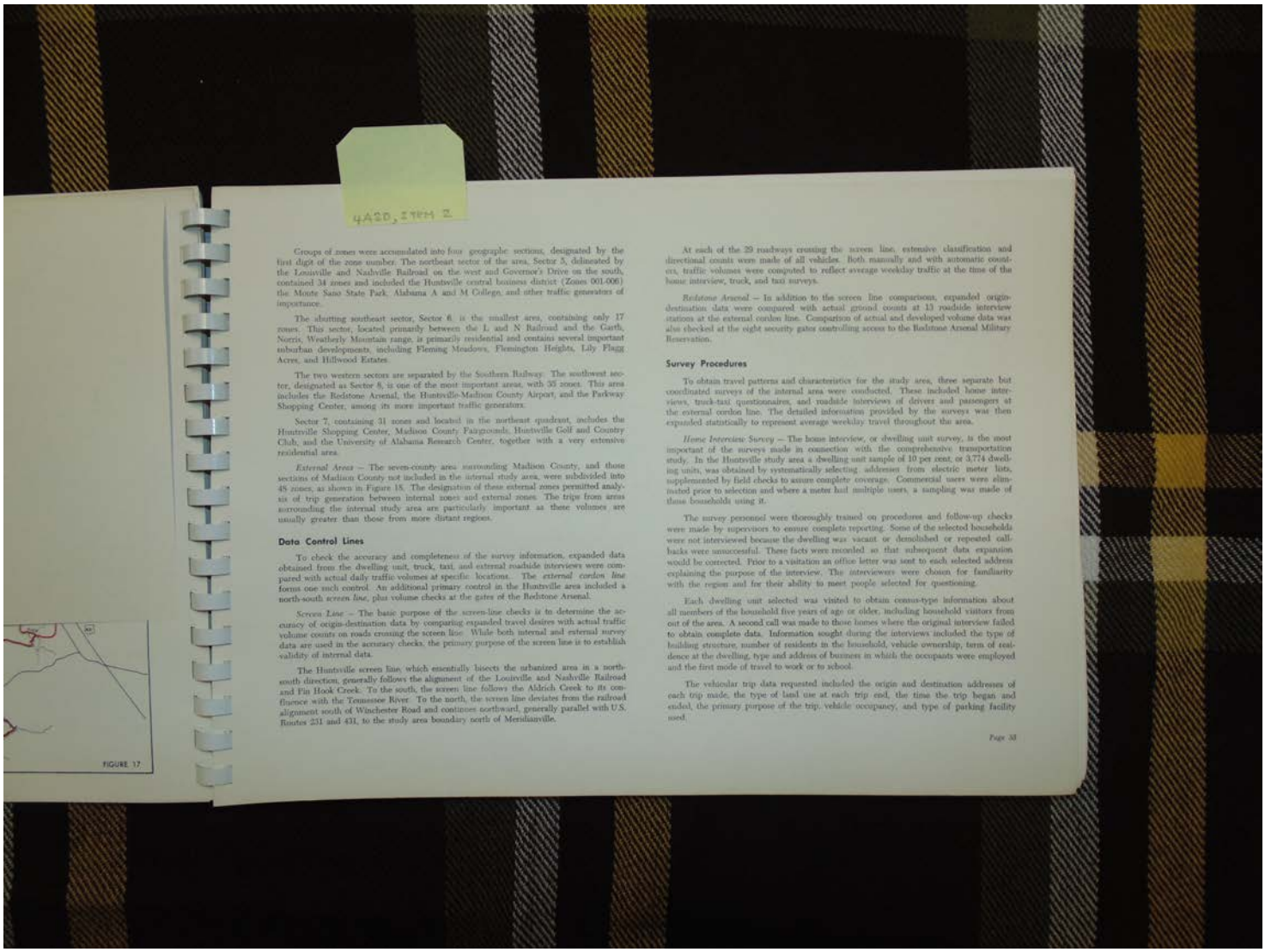


Names:
Internal Area Zones

Places:
Huntsville, AL

Types:
booklet map

Dates:
1966



Groups of zones were accumulated into four geographic sections, designated by the first digit of the zone number. The northeast sector of the area, Sector 5, delineated by the Louisville and Nashville Railroad on the west and Governor's Drive on the south, contained 34 zones and included the Huntsville central business district (Zones 001-006) the Monte Sano State Park, Alabama A and M College, and other traffic generators of importance.

The abutting southeast sector, Sector 6, is the smallest area, containing only 17 zones. This sector, located primarily between the L and N Railroad and the Garth, Norris, Weatherly Mountain range, is primarily residential and contains several important suburban developments, including Fleming Meadows, Flemington Heights, Lily Flagg Acres, and Hillwood Estates.

The two western sectors are separated by the Southern Railway. The southwest sector, designated as Sector 8, is one of the most important areas, with 35 zones. This area includes the Redstone Arsenal, the Huntsville-Madison County Airport, and the Parkway Shopping Center, among its more important traffic generators.

Sector 7, containing 31 zones and located in the northeast quadrant, includes the Huntsville Shopping Center, Madison County Fairgrounds, Huntsville Golf and Country Club, and the University of Alabama Research Center, together with a very extensive residential area.

External Areas — The seven-county area surrounding Madison County, and those sections of Madison County not included in the internal study area, were subdivided into 48 zones, as shown in Figure 18. The designation of these external zones permitted analysis of trip generation between internal zones and external zones. The trips from areas surrounding the internal study area are particularly important as these volumes are usually greater than those from more distant regions.

Data Control Lines

To check the accuracy and completeness of the survey information, expanded data obtained from the dwelling unit, truck, taxi, and external roadside interviews were compared with actual daily traffic volumes at specific locations. The *external cordon line* forms one such control. An additional primary control in the Huntsville area included a north-south *screen line*, plus volume checks at the gates of the Redstone Arsenal.

Screen Line — The basic purpose of the screen-line checks is to determine the accuracy of origin-destination data by comparing expanded travel desires with actual traffic volume counts on roads crossing the screen line. While both internal and external survey data are used in the accuracy checks, the primary purpose of the screen line is to establish validity of internal data.

The Huntsville screen line, which essentially bisects the urbanized area in a north-south direction, generally follows the alignment of the Louisville and Nashville Railroad and Fin Hook Creek. To the south, the screen line follows the Aldrich Creek to its confluence with the Tennessee River. To the north, the screen line deviates from the railroad alignment south of Winchester Road and continues northward, generally parallel with U.S. Routes 231 and 431, to the study area boundary north of Meridianville.

At each of the 29 roadways crossing the screen line, extensive classification and directional counts were made of all vehicles. Both manually and with automatic counters, traffic volumes were computed to reflect average weekday traffic at the time of the home interview, truck, and taxi surveys.

Redstone Arsenal — In addition to the screen line comparisons, expanded origin-destination data were compared with actual ground counts at 13 roadside interview stations at the external cordon line. Comparison of actual and developed volume data was also checked at the eight security gates controlling access to the Redstone Arsenal Military Reservation.

Survey Procedures

To obtain travel patterns and characteristics for the study area, three separate but coordinated surveys of the internal area were conducted. These included home interviews, truck-taxi questionnaires, and roadside interviews of drivers and passengers at the external cordon line. The detailed information provided by the surveys was then expanded statistically to represent average weekday travel throughout the area.

Home Interview Survey — The home interview, or dwelling unit survey, is the most important of the surveys made in connection with the comprehensive transportation study. In the Huntsville study area a dwelling unit sample of 10 per cent, or 3,774 dwelling units, was obtained by systematically selecting addresses from electric meter lists, supplemented by field checks to assure complete coverage. Commercial users were eliminated prior to selection and where a meter had multiple users, a sampling was made of those households using it.

The survey personnel were thoroughly trained on procedures and follow-up checks were made by supervisors to ensure complete reporting. Some of the selected households were not interviewed because the dwelling was vacant or demolished or repeated call-backs were unsuccessful. These facts were recorded so that subsequent data expansion would be corrected. Prior to a visitation an office letter was sent to each selected address explaining the purpose of the interview. The interviewers were chosen for familiarity with the region and for their ability to meet people selected for questioning.

Each dwelling unit selected was visited to obtain census-type information about all members of the household five years of age or older, including household visitors from out of the area. A second call was made to those homes where the original interview failed to obtain complete data. Information sought during the interviews included the type of building structure, number of residents in the household, vehicle ownership, term of residence at the dwelling, type and address of business in which the occupants were employed and the first mode of travel to work or to school.

The vehicular trip data requested included the origin and destination addresses of each trip made, the type of land use at each trip end, the time the trip began and ended, the primary purpose of the trip, vehicle occupancy, and type of parking facility used.

Page 38

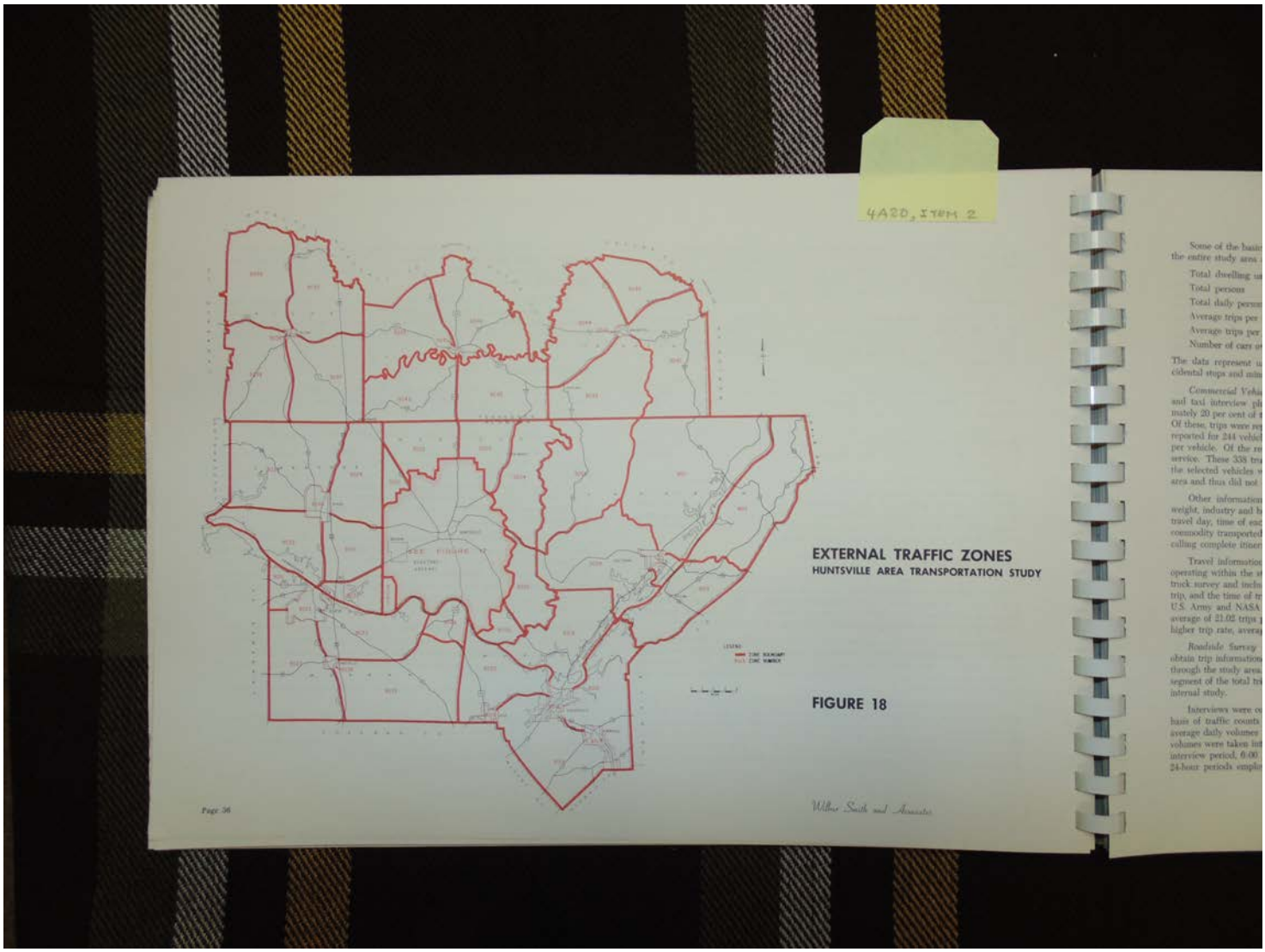
FIGURE 17

Names:
Data Control Lines Survey Procedures

Places:
Huntsville, AL

Types:
booklet

Dates:
1966

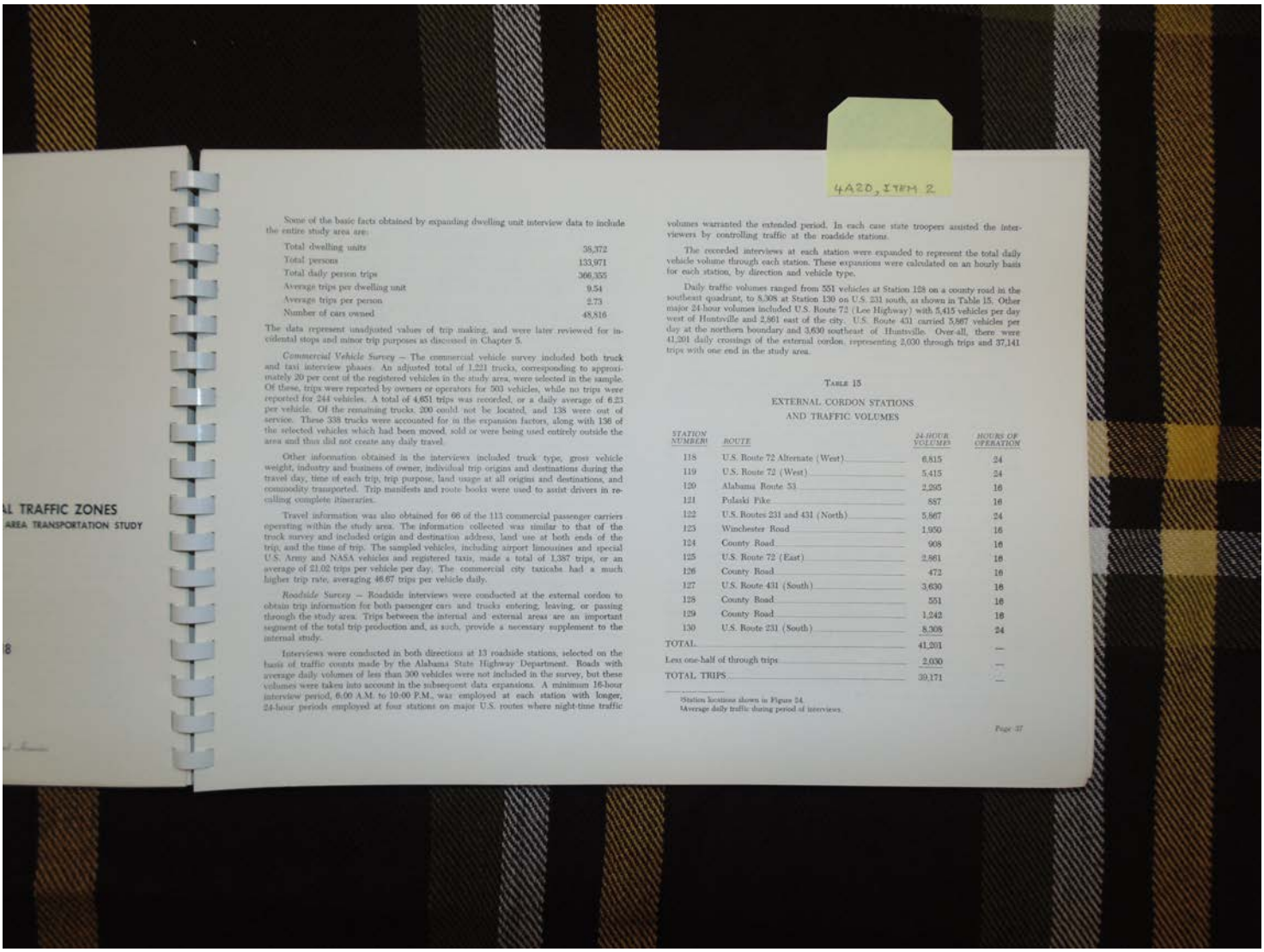


Names:
External Traffic Zones

Places:
Huntsville, AL

Types:
map

Dates:
1966



4A20, ITEM 2

AL TRAFFIC ZONES
AREA TRANSPORTATION STUDY

Some of the basic facts obtained by expanding dwelling unit interview data to include the entire study area are:

Total dwelling units	58,372
Total persons	133,971
Total daily person trips	366,355
Average trips per dwelling unit	9.54
Average trips per person	2.73
Number of cars owned	48,816

The data represent unadjusted values of trip making, and were later reviewed for incidental stops and minor trip purposes as discussed in Chapter 5.

Commercial Vehicle Survey — The commercial vehicle survey included both truck and taxi interview phases. An adjusted total of 1,221 trucks, corresponding to approximately 20 per cent of the registered vehicles in the study area, were selected in the sample. Of these, trips were reported by owners or operators for 503 vehicles, while no trips were reported for 244 vehicles. A total of 4,651 trips was recorded, or a daily average of 6.23 per vehicle. Of the remaining trucks, 200 could not be located, and 138 were out of service. These 338 trucks were accounted for in the expansion factors, along with 136 of the selected vehicles which had been moved, sold or were being used entirely outside the area and thus did not create any daily travel.

Other information obtained in the interviews included truck type, gross vehicle weight, industry and business of owner, individual trip origins and destinations during the travel day, time of each trip, trip purpose, land usage at all origins and destinations, and commodity transported. Trip manifests and route books were used to assist drivers in recalling complete itineraries.

Travel information was also obtained for 66 of the 113 commercial passenger carriers operating within the study area. The information collected was similar to that of the truck survey and included origin and destination address, land use at both ends of the trip, and the time of trip. The sampled vehicles, including airport limousines and special U.S. Army and NASA vehicles and registered taxis, made a total of 1,387 trips, or an average of 21.02 trips per vehicle per day. The commercial city taxicabs had a much higher trip rate, averaging 46.67 trips per vehicle daily.

Roadside Survey — Roadside interviews were conducted at the external cordon to obtain trip information for both passenger cars and trucks entering, leaving, or passing through the study area. Trips between the internal and external areas are an important segment of the total trip production and, as such, provide a necessary supplement to the internal study.

Interviews were conducted in both directions at 13 roadside stations, selected on the basis of traffic counts made by the Alabama State Highway Department. Roads with average daily volumes of less than 300 vehicles were not included in the survey, but these volumes were taken into account in the subsequent data expansions. A minimum 16-hour interview period, 6:00 A.M. to 10:00 P.M., was employed at each station with longer, 24-hour periods employed at four stations on major U.S. routes where night-time traffic volumes warranted the extended period. In each case state troopers assisted the interviewers by controlling traffic at the roadside stations.

The recorded interviews at each station were expanded to represent the total daily vehicle volume through each station. These expansions were calculated on an hourly basis for each station, by direction and vehicle type.

Daily traffic volumes ranged from 551 vehicles at Station 128 on a county road in the southeast quadrant, to 8,308 at Station 130 on U.S. 231 south, as shown in Table 15. Other major 24-hour volumes included U.S. Route 72 (Lee Highway) with 5,415 vehicles per day west of Huntsville and 2,861 east of the city. U.S. Route 431 carried 3,867 vehicles per day at the northern boundary and 3,630 southeast of Huntsville. Over-all, there were 41,201 daily crossings of the external cordon, representing 2,030 through trips and 37,141 trips with one end in the study area.

TABLE 15

EXTERNAL CORDON STATIONS AND TRAFFIC VOLUMES

STATION NUMBER[1]	ROUTE	24-HOUR VOLUMES	HOURS OF OPERATION
118	U.S. Route 72 Alternate (West)	6,815	24
119	U.S. Route 72 (West)	5,415	24
120	Alabama Route 53	2,295	16
121	Pulaski Pike	887	16
122	U.S. Routes 231 and 431 (North)	5,867	24
123	Winchester Road	1,950	16
124	County Road	908	16
125	U.S. Route 72 (East)	2,861	16
126	County Road	472	16
127	U.S. Route 431 (South)	3,630	16
128	County Road	551	16
129	County Road	1,242	16
130	U.S. Route 231 (South)	8,308	24
TOTAL		41,201	—
Less one-half of through trips		2,030	—
TOTAL TRIPS		39,171	—

[1]Station locations shown in Figure 24.
[2]Average daily traffic during period of interviews.

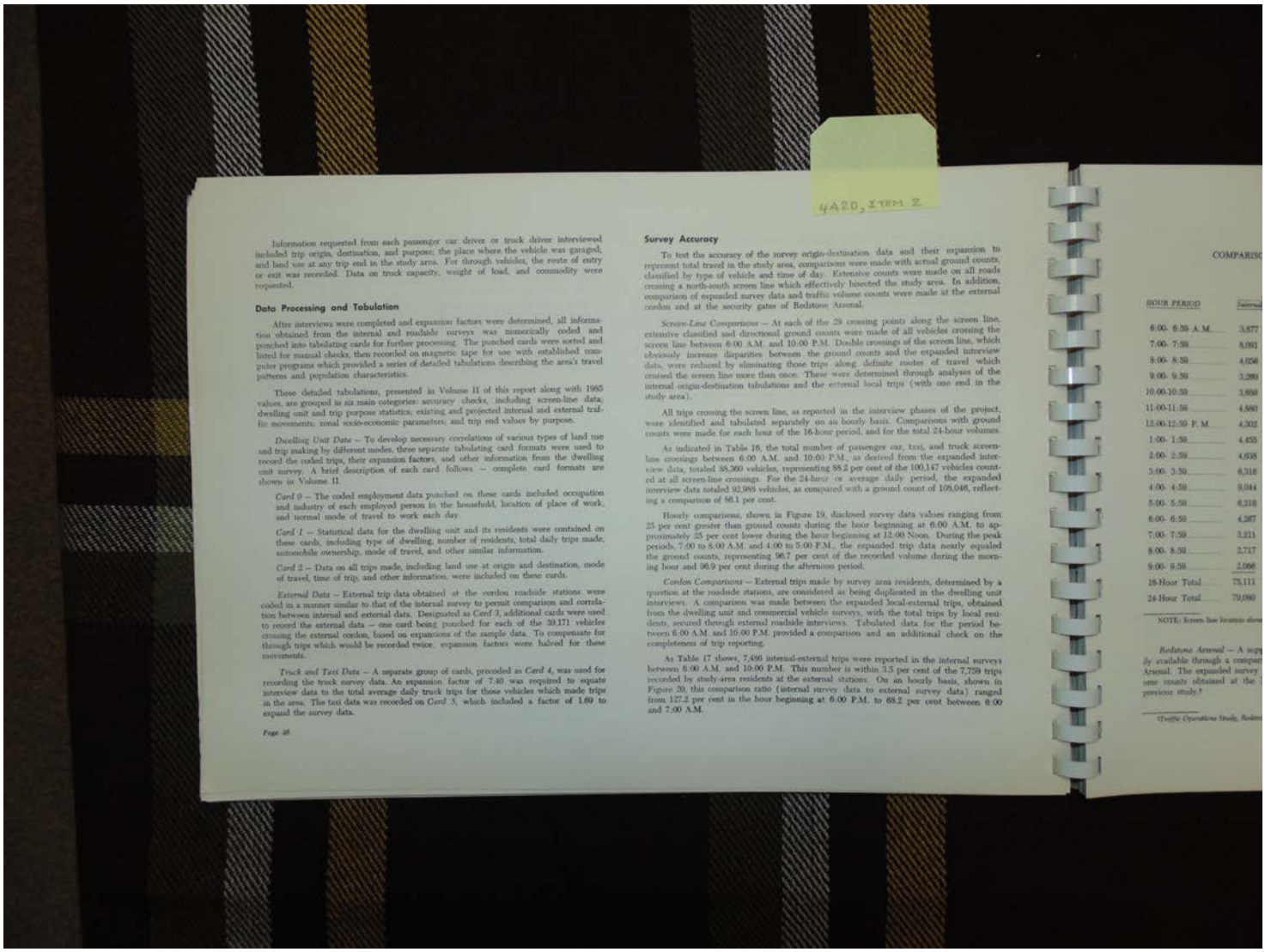
Page 37

Names:
External Cordon Stations & Traffic Volumes Survey Procedures

Places:
Huntsville, AL

Types:
booklet table

Dates:
1966



Information requested from each passenger car driver or truck driver interviewed included trip origin, destination, and purpose; the place where the vehicle was garaged; and land use at any trip end in the study area. For through vehicles, the route of entry or exit was recorded. Data on truck capacity, weight of load, and commodity were requested.

Data Processing and Tabulation

After interviews were completed and expansion factors were determined, all information obtained from the internal and roadside surveys was numerically coded and punched into tabulating cards for further processing. The punched cards were sorted and listed for manual checks, then recorded on magnetic tape for use with established computer programs which provided a series of detailed tabulations describing the area's travel patterns and population characteristics.

These detailed tabulations, presented in Volume II of this report along with 1955 values, are grouped in six main categories: accuracy checks, including screen-line data; dwelling unit and trip purpose statistics; existing and projected internal and external traffic movements; zonal socio-economic parameters; and trip end values by purpose.

Dwelling Unit Data — To develop necessary correlations of various types of land use and trip making by different modes, three separate tabulating card formats were used to record the coded trips, their expansion factors, and other information from the dwelling unit survey. A brief description of each card follows — complete card formats are shown in Volume II.

Card 0 — The coded employment data punched on these cards included occupation and industry of each employed person in the household, location of place of work, and normal mode of travel to work each day.

Card 1 — Statistical data for the dwelling unit and its residents were contained on these cards, including type of dwelling, number of residents, total daily trips made, automobile ownership, mode of travel, and other similar information.

Card 2 — Data on all trips made, including land use at origin and destination, mode of travel, time of trip, and other information, were included on these cards.

External Data — External trip data obtained at the cordon roadside stations were coded in a manner similar to that of the internal survey to permit comparison and correlation between internal and external data. Designated as *Card 3*, additional cards were used to record the external data — one card being punched for each of the 30,171 vehicles crossing the external cordon, based on expansions of the sample data. To compensate for through trips which would be recorded twice, expansion factors were halved for these movements.

Truck and Taxi Data — A separate group of cards, precoded as *Card 4*, was used for recording the truck survey data. An expansion factor of 7.40 was required to equate interview data to the total average daily truck trips for those vehicles which made trips in the area. The taxi data was recorded on *Card 5*, which included a factor of 1.89 to expand the survey data.

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Survey Accuracy

To test the accuracy of the survey origin-destination data and their expansion to represent total travel in the study area, comparisons were made with actual ground counts, classified by type of vehicle and time of day. Extensive counts were made on all roads crossing a north-south screen line which effectively bisected the study area. In addition, comparison of expanded survey data and traffic volume counts were made at the external cordon and at the security gates of Redstone Arsenal.

Screen-Line Comparisons — At each of the 29 crossing points along the screen line, extensive classified and directional ground counts were made of all vehicles crossing the screen line between 6:00 A.M. and 10:00 P.M. Double crossings of the screen line, which obviously increase disparities between the ground counts and the expanded interview data, were reduced by eliminating those trips along definite routes of travel which crossed the screen line more than once. These were determined through analyses of the internal origin-destination tabulations and the external local trips (with one end in the study area).

All trips crossing the screen line, as reported in the interview phases of the project, were identified and tabulated separately on an hourly basis. Comparisons with ground counts were made for each hour of the 16-hour period, and for the total 24-hour volumes.

As indicated in Table 16, the total number of passenger car, taxi, and truck screen-line crossings between 6:00 A.M. and 10:00 P.M., as derived from the expanded interview data, totaled 88,360 vehicles, representing 88.2 per cent of the 100,147 vehicles counted at all screen-line crossings. For the 24-hour or average daily period, the expanded interview data totaled 92,988 vehicles, as compared with a ground count of 108,046, reflecting a comparison of 86.1 per cent.

Hourly comparisons, shown in Figure 19, disclosed survey data values ranging from 25 per cent greater than ground counts during the hour beginning at 6:00 A.M. to approximately 25 per cent lower during the hour beginning at 12:00 Noon. During the peak periods, 7:00 to 8:00 A.M. and 4:00 to 5:00 P.M., the expanded trip data nearly equaled the ground counts, representing 96.7 per cent of the recorded volume during the morning hour and 96.9 per cent during the afternoon period.

Cordon Comparisons — External trips made by survey area residents, determined by a question at the roadside stations, are considered as being duplicated in the dwelling unit interviews. A comparison was made between the expanded local-external trips, obtained from the dwelling unit and commercial vehicle surveys, with the total trips by local residents, secured through external roadside interviews. Tabulated data for the period between 6:00 A.M. and 10:00 P.M. provided a comparison and an additional check on the completeness of trip reporting.

As Table 17 shows, 7,486 internal-external trips were reported in the internal surveys between 6:00 A.M. and 10:00 P.M. This number is within 3.5 per cent of the 7,759 trips recorded by study-area residents at the external stations. On an hourly basis, shown in Figure 20, this comparison ratio (internal survey data to external survey data) ranged from 127.2 per cent in the hour beginning at 6:00 P.M. to 68.2 per cent between 6:00 and 7:00 A.M.

COMPARIS

HOUR PERIOD	
6:00- 6:59 A.M.	3,877
7:00- 7:59	8,091
8:00- 8:59	4,056
9:00- 9:59	3,299
10:00-10:59	3,898
11:00-11:59	4,880
12:00-12:59 P.M.	4,302
1:00- 1:59	4,455
2:00- 2:59	4,935
3:00- 3:59	6,518
4:00- 4:59	9,044
5:00- 5:59	8,218
6:00- 6:59	4,287
7:00- 7:59	3,213
8:00- 8:59	2,717
9:00- 9:59	2,066
16-Hour Total	73,111
24-Hour Total	79,080

NOTE: Screen line location shown

Redstone Arsenal — A supp
ily available through a compar
Arsenal. The expanded survey
ume counts obtained at the
previous study.[5]

[5]Traffic Operations Study, Redst

Names:
Data Processing & Tabulation
Survey Accuracy

Places:
Huntsville, AL

Types:
booklet

Dates:
1966

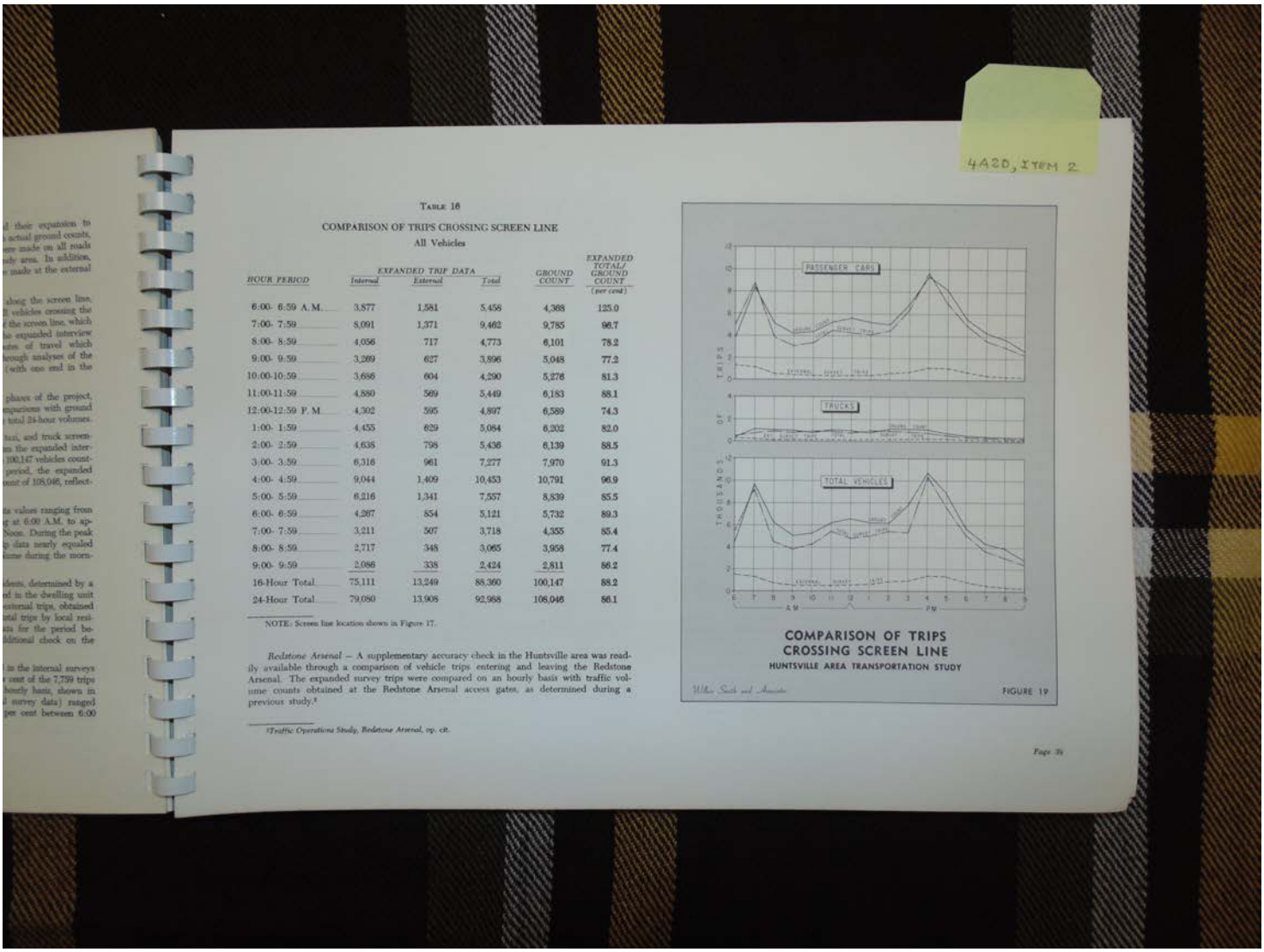


TABLE 16

COMPARISON OF TRIPS CROSSING SCREEN LINE
All Vehicles

HOUR PERIOD	EXPANDED TRIP DATA: Internal	External	Total	GROUND COUNT	EXPANDED TOTAL/ GROUND COUNT (per cent)
6:00- 6:59 A.M.	3,877	1,581	5,458	4,368	125.0
7:00- 7:59	8,091	1,371	9,462	9,785	96.7
8:00- 8:59	4,056	717	4,773	6,101	78.2
9:00- 9:59	3,269	627	3,896	5,048	77.2
10:00-10:59	3,686	604	4,290	5,276	81.3
11:00-11:59	4,880	569	5,449	6,183	88.1
12:00-12:59 P.M.	4,302	595	4,897	6,589	74.3
1:00- 1:59	4,455	629	5,084	6,202	82.0
2:00- 2:59	4,638	798	5,436	6,139	88.5
3:00- 3:59	6,316	961	7,277	7,970	91.3
4:00- 4:59	9,044	1,409	10,453	10,791	96.9
5:00- 5:59	6,216	1,341	7,557	8,839	85.5
6:00- 6:59	4,267	854	5,121	5,732	89.3
7:00- 7:59	3,211	507	3,718	4,355	85.4
8:00- 8:59	2,717	348	3,065	3,958	77.4
9:00- 9:59	2,086	338	2,424	2,811	86.2
16-Hour Total	75,111	13,249	88,360	100,147	88.2
24-Hour Total	79,080	13,908	92,988	108,046	86.1

NOTE: Screen line location shown in Figure 17.

Redstone Arsenal — A supplementary accuracy check in the Huntsville area was readily available through a comparison of vehicle trips entering and leaving the Redstone Arsenal. The expanded survey trips were compared on an hourly basis with traffic volume counts obtained at the Redstone Arsenal access gates, as determined during a previous study.[5]

[5]*Traffic Operations Study, Redstone Arsenal, op. cit.*

COMPARISON OF TRIPS
CROSSING SCREEN LINE
HUNTSVILLE AREA TRANSPORTATION STUDY

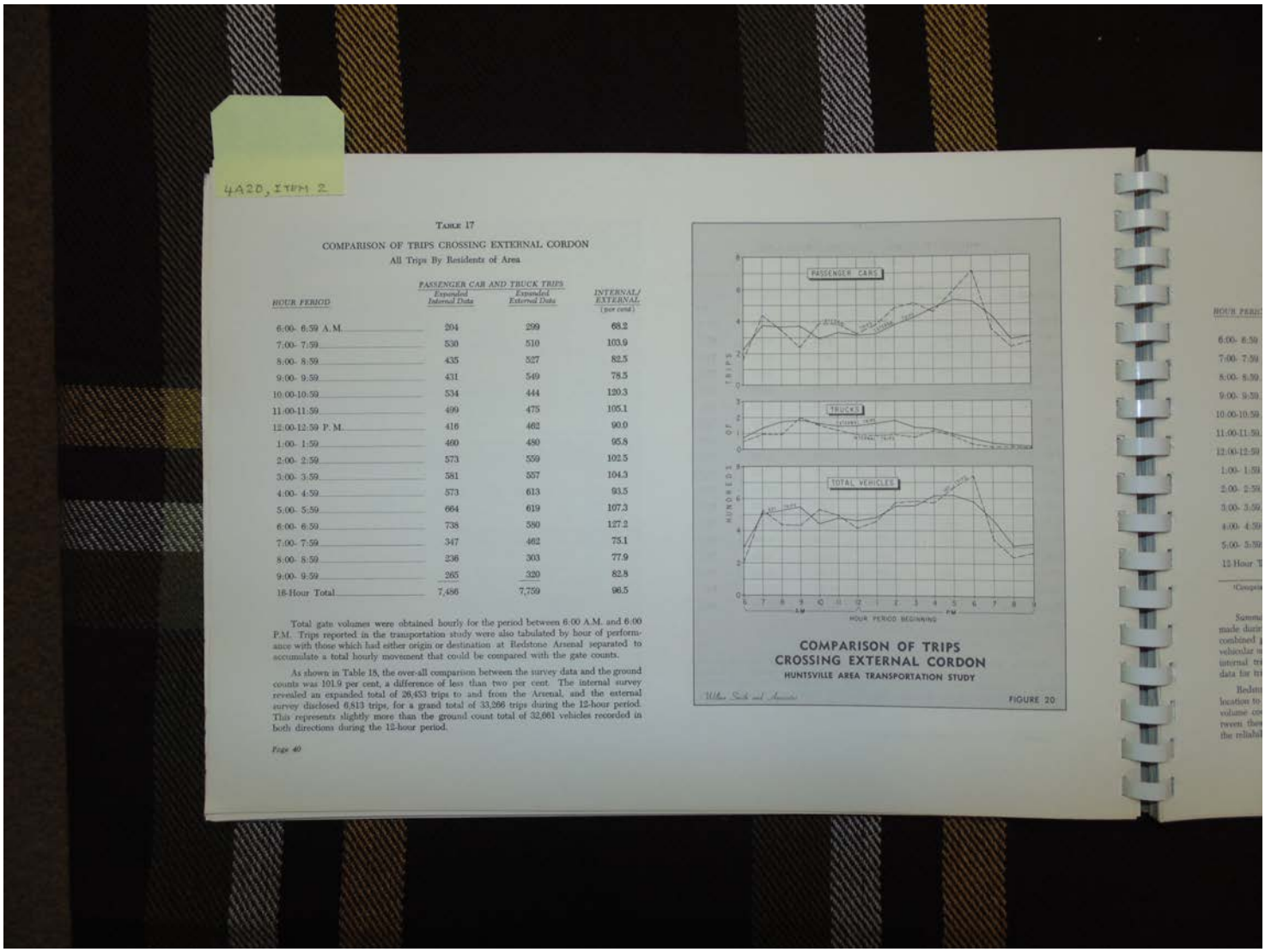
FIGURE 19

Names:
Comparison of Trips Crossing Screen Line

Places:
Huntsville, AL

Types:
table illustration

Dates:
1966



Names:

Comparison of Trips Cordon
Crossing External

Places:

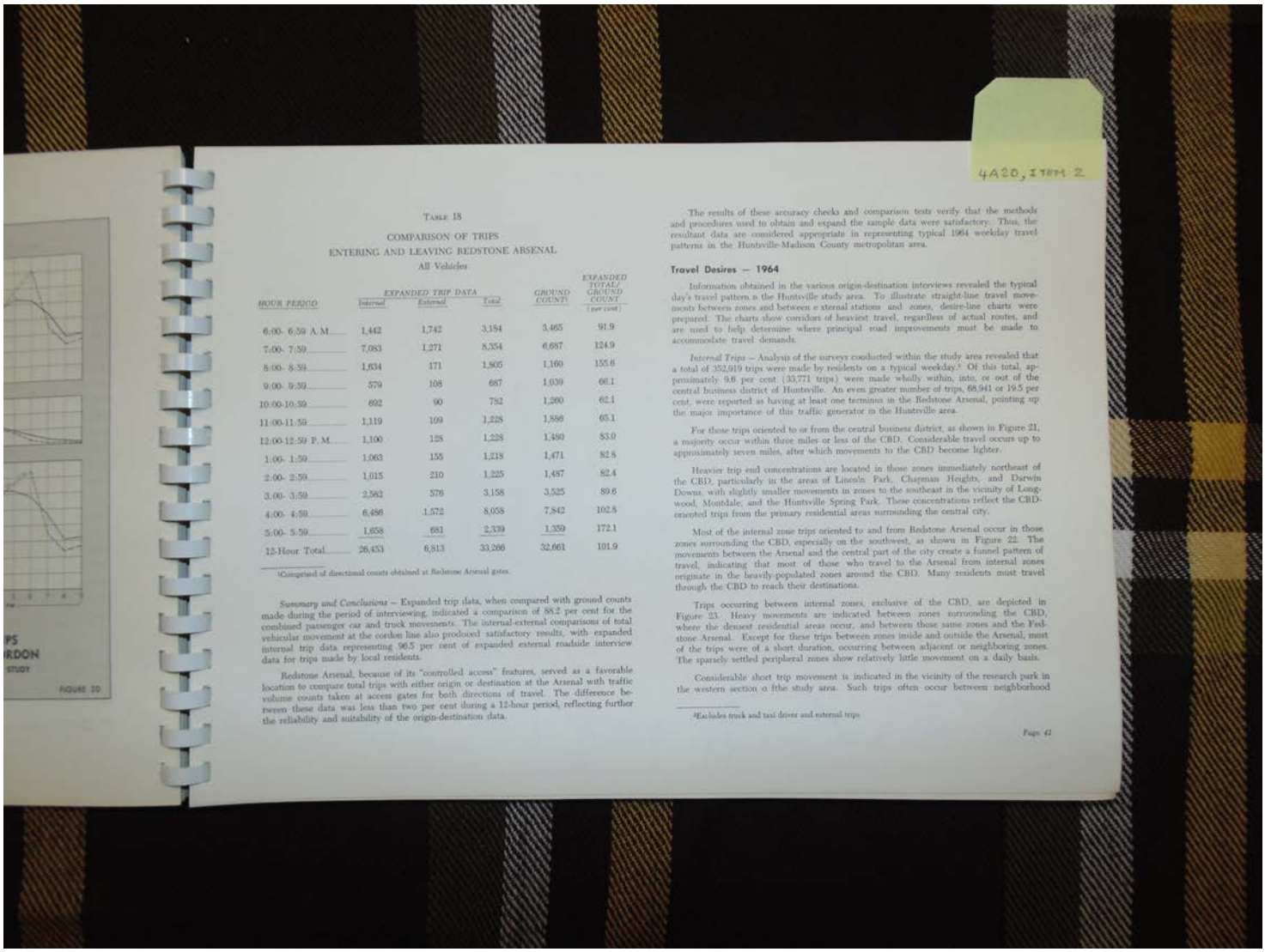
Huntsville, AL

Types:

table illustration

Dates:

1966



4A20, ITEM 2

TABLE 18

COMPARISON OF TRIPS
ENTERING AND LEAVING REDSTONE ARSENAL
All Vehicles

HOUR PERIOD	EXPANDED TRIP DATA Internal	External	Total	GROUND COUNT	EXPANDED TOTAL/ GROUND COUNT (per cent)
6:00- 6:59 A.M.	1,442	1,742	3,184	3,465	91.9
7:00- 7:59	7,083	1,271	8,354	6,687	124.9
8:00- 8:59	1,634	171	1,805	1,160	155.6
9:00- 9:59	579	108	687	1,039	66.1
10:00-10:59	692	90	782	1,260	62.1
11:00-11:59	1,119	109	1,228	1,886	65.1
12:00-12:59 P.M.	1,100	128	1,228	1,480	83.0
1:00- 1:59	1,063	155	1,218	1,471	82.8
2:00- 2:59	1,015	210	1,225	1,487	82.4
3:00- 3:59	2,582	576	3,158	3,525	89.6
4:00- 4:59	6,486	1,572	8,058	7,842	102.8
5:00- 5:59	1,658	681	2,339	1,359	172.1
12-Hour Total	26,453	6,813	33,266	32,661	101.9

[1]Comprised of directional counts obtained at Redstone Arsenal gates.

Summary and Conclusions – Expanded trip data, when compared with ground counts made during the period of interviewing, indicated a comparison of 88.2 per cent for the combined passenger car and truck movements. The internal-external comparisons of total vehicular movement at the cordon line also produced satisfactory results, with expanded internal trip data representing 96.5 per cent of expanded external roadside interview data for trips made by local residents.

Redstone Arsenal, because of its "controlled access" features, served as a favorable location to compare total trips with either origin or destination at the Arsenal with traffic volume counts taken at access gates for both directions of travel. The difference between these data was less than two per cent during a 12-hour period, reflecting further the reliability and suitability of the origin-destination data.

The results of these accuracy checks and comparison tests verify that the methods and procedures used to obtain and expand the sample data were satisfactory. Thus, the resultant data are considered appropriate in representing typical 1964 weekday travel patterns in the Huntsville-Madison County metropolitan area.

Travel Desires – 1964

Information obtained in the various origin-destination interviews revealed the typical day's travel pattern n the Huntsville study area. To illustrate straight-line travel movements between zones and between e xternal stations and zones, desire-line charts were prepared. The charts show corridors of heaviest travel, regardless of actual routes, and are used to help determine where principal road improvements must be made to accommodate travel demands.

Internal Trips – Analysis of the surveys conducted within the study area revealed that a total of 352,919 trips were made by residents on a typical weekday.[1] Of this total, approximately 9.6 per cent (33,771 trips) were made wholly within, into, or out of the central business district of Huntsville. An even greater number of trips, 68,941 or 19.5 per cent, were reported as having at least one terminus in the Redstone Arsenal, pointing up the major importance of this traffic generator in the Huntsville area.

For those trips oriented to or from the central business district, as shown in Figure 21, a majority occur within three miles or less of the CBD. Considerable travel occurs up to approximately seven miles, after which movements to the CBD become lighter.

Heavier trip end concentrations are located in those zones immediately northeast of the CBD, particularly in the areas of Lincoln Park, Chapman Heights, and Darwin Downs, with slightly smaller movements in zones to the southeast in the vicinity of Longwood, Montdale, and the Huntsville Spring Park. These concentrations reflect the CBD-oriented trips from the primary residential areas surrounding the central city.

Most of the internal zone trips oriented to and from Redstone Arsenal occur in those zones surrounding the CBD, especially on the southwest, as shown in Figure 22. The movements between the Arsenal and the central part of the city create a funnel pattern of travel, indicating that most of those who travel to the Arsenal from internal zones originate in the heavily-populated zones around the CBD. Many residents must travel through the CBD to reach their destinations.

Trips occurring between internal zones, exclusive of the CBD, are depicted in Figure 23. Heavy movements are indicated between zones surrounding the CBD, where the densest residential areas occur, and between those same zones and the Redstone Arsenal. Except for these trips between zones inside and outside the Arsenal, most of the trips were of a short duration, occurring between adjacent or neighboring zones. The sparsely settled peripheral zones show relatively little movement on a daily basis.

Considerable short trip movement is indicated in the vicinity of the research park in the western section o fthe study area. Such trips often occur between neighborhood

[1]Excludes truck and taxi driver and external trips

Names:

Comparison of Trips - Redstone Arsenal

Travel Desires -1964

Places:

Huntsville, AL

Types:

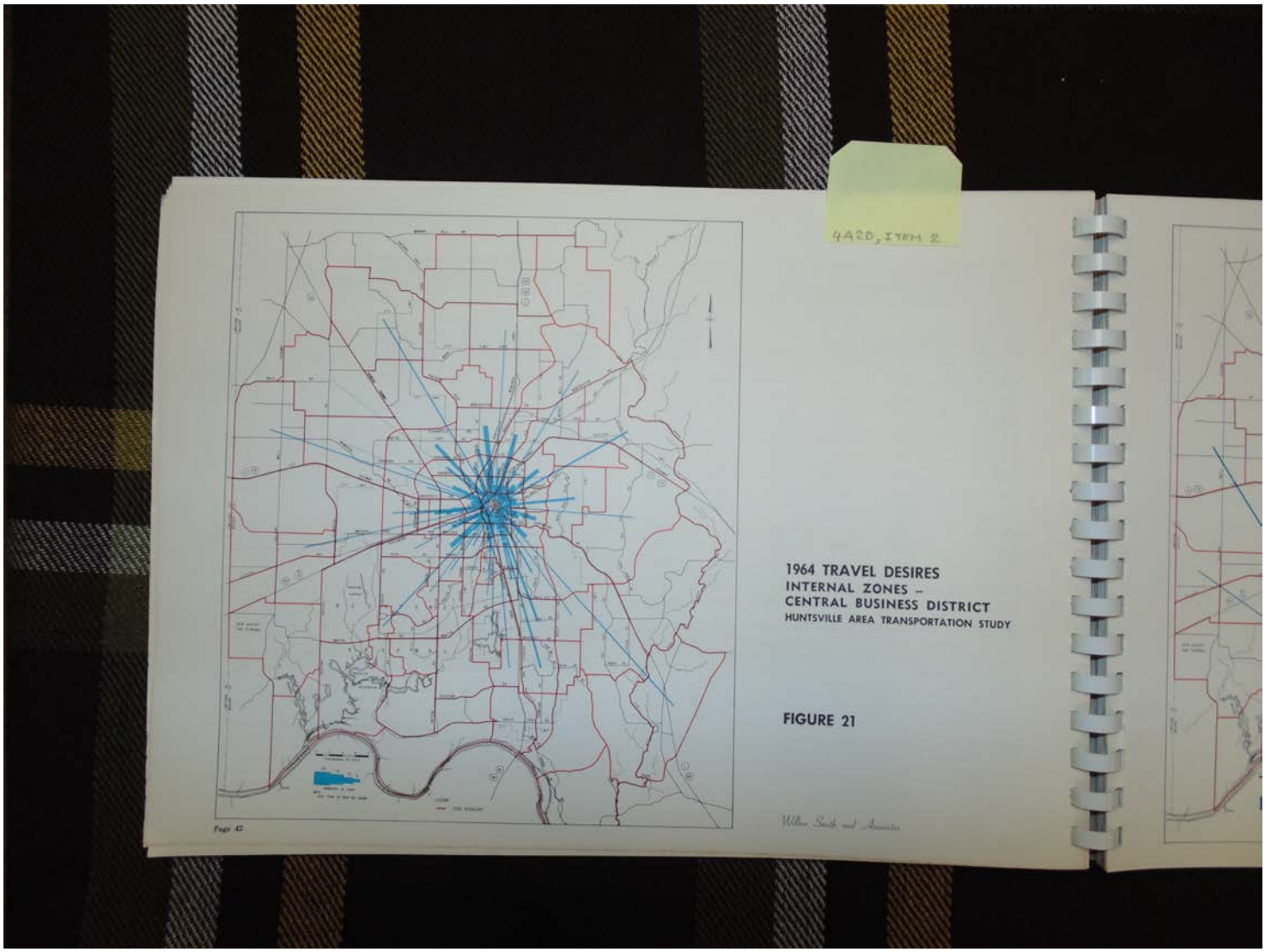
booklet

table

Dates:

1964

1966

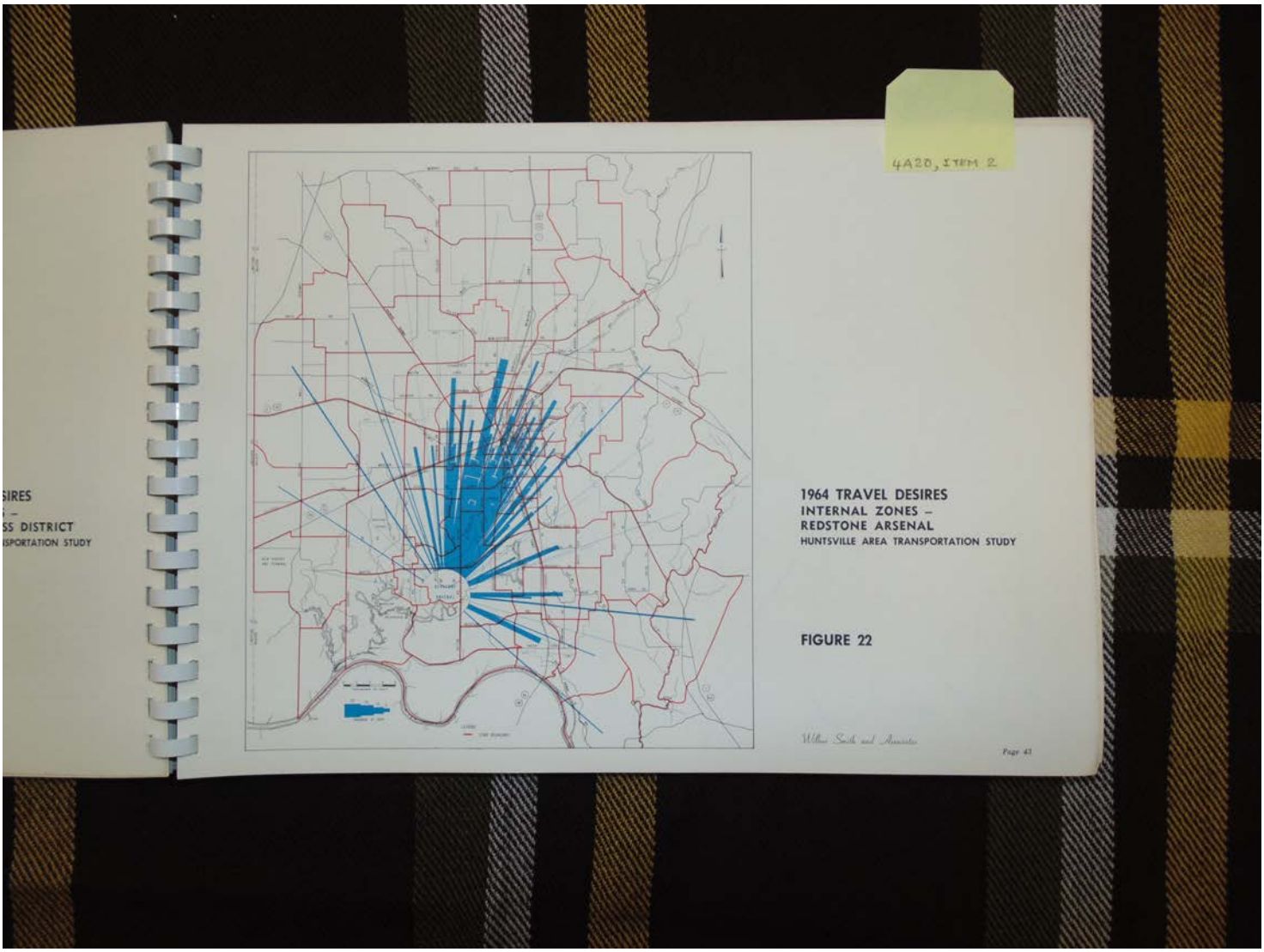


Names:
1964 Travel Desires
Internal Zones

Places:
Huntsville, AL

Types:
map

Dates:
1964

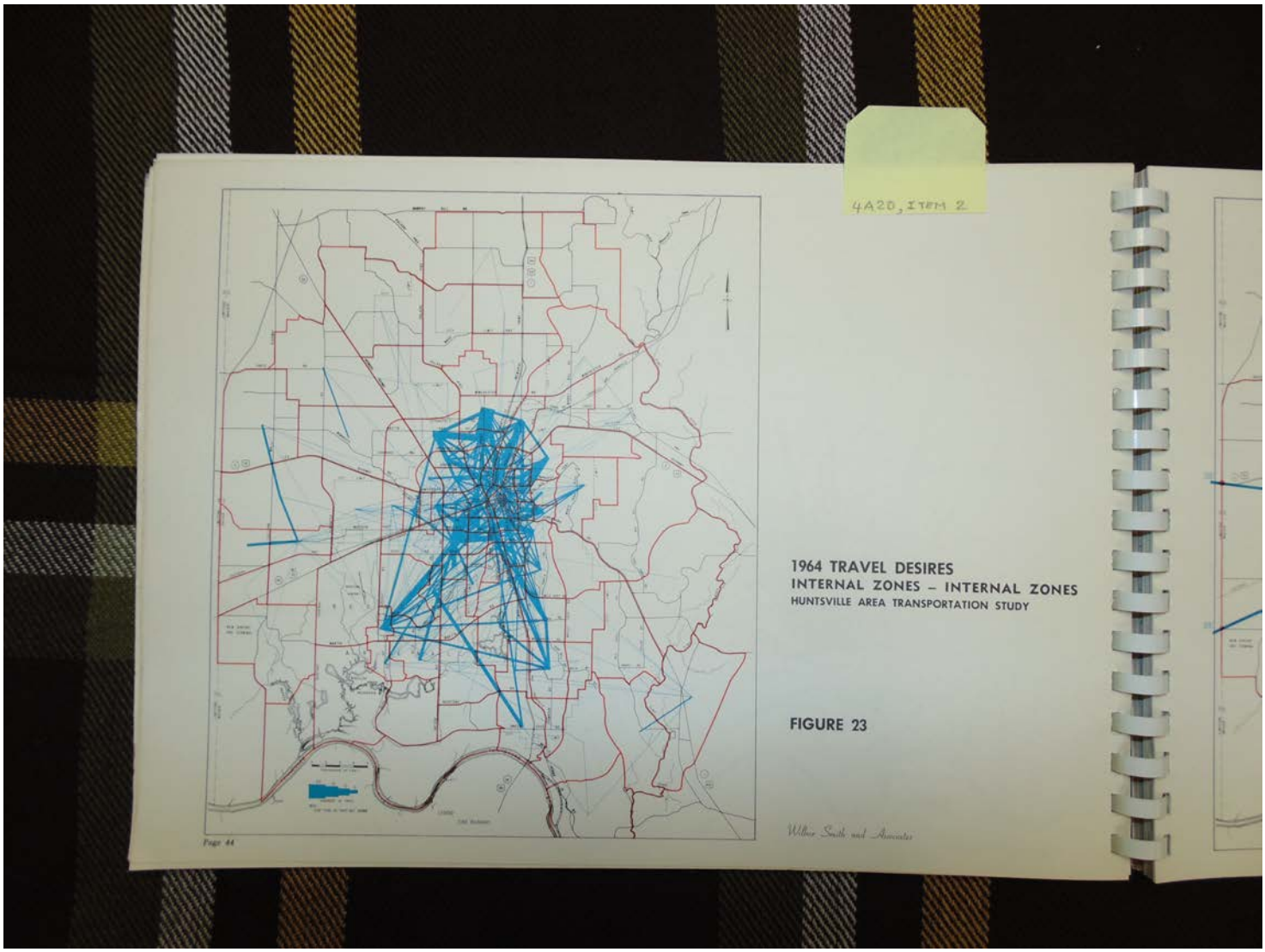


Names:
1964 Travel Desires
Internal Zones

Places:
Redstone Arsenal, AL

Types:
map

Dates:
1964

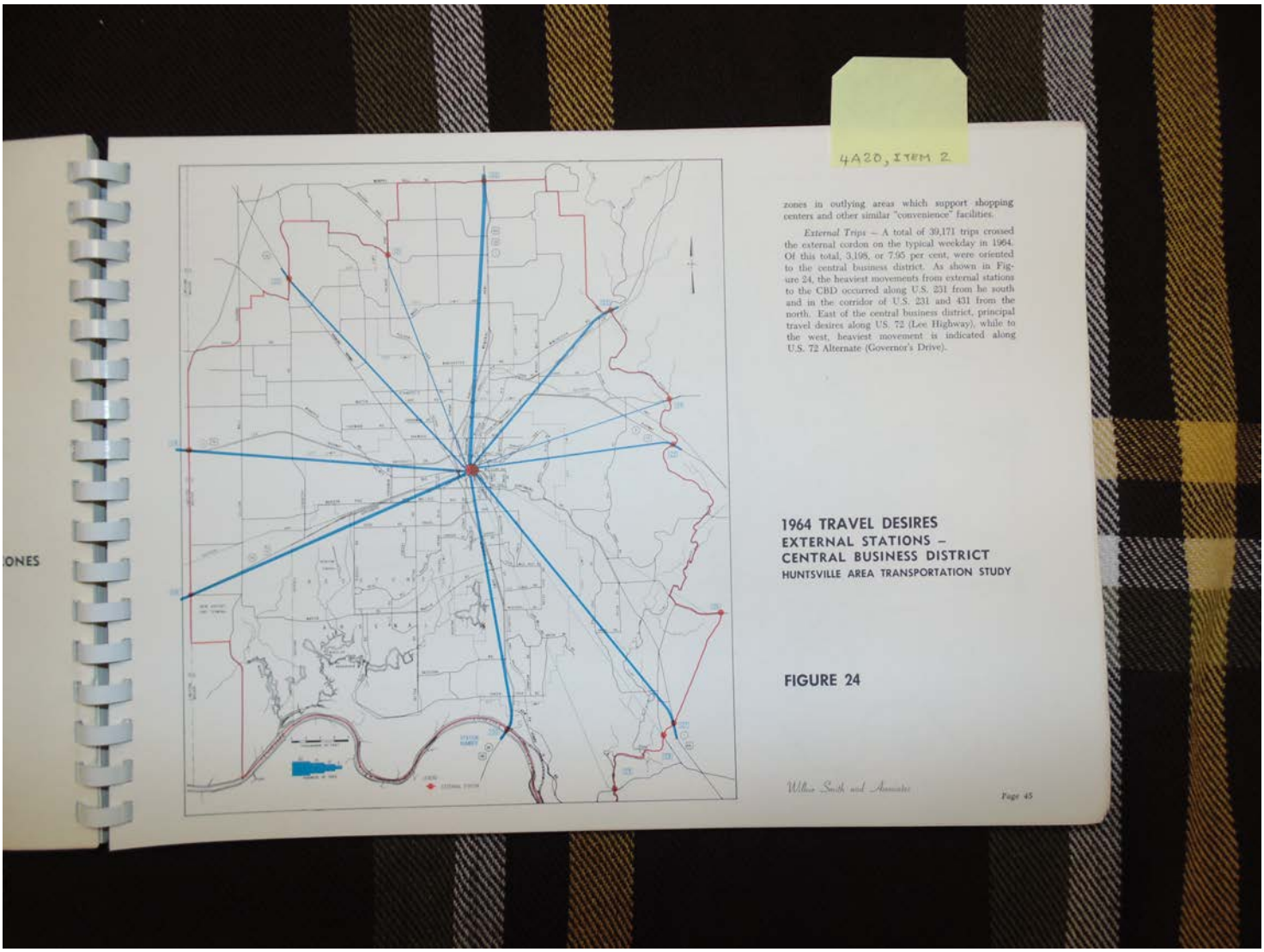


Names:
1964 Travel Desires
Internal Zones

Places:
Huntsville, AL

Types:
map

Dates:
1964

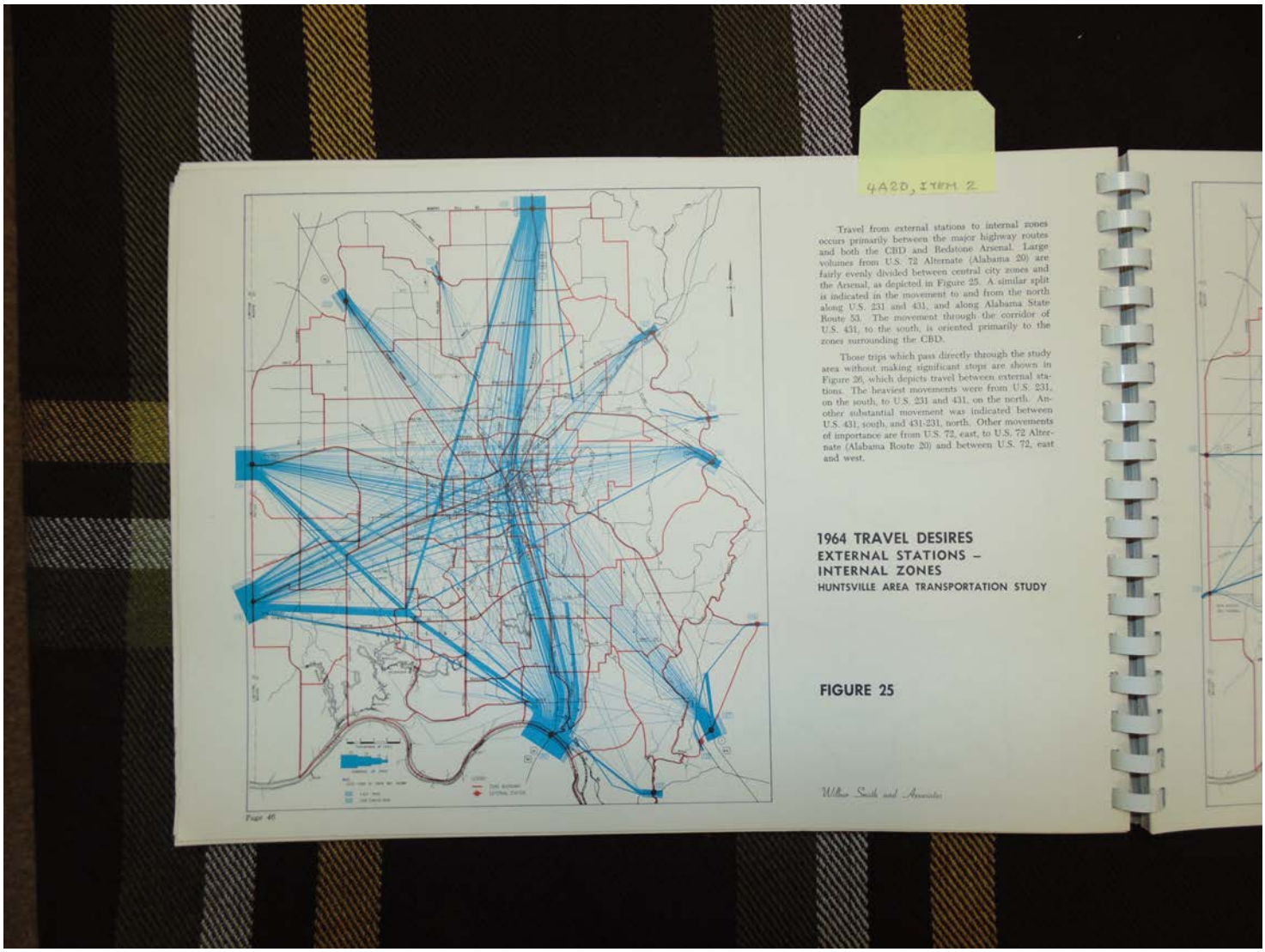


Names:
1964 Travel Desires
External Stations

Places:
Huntsville, AL

Types:
map

Dates:
1964

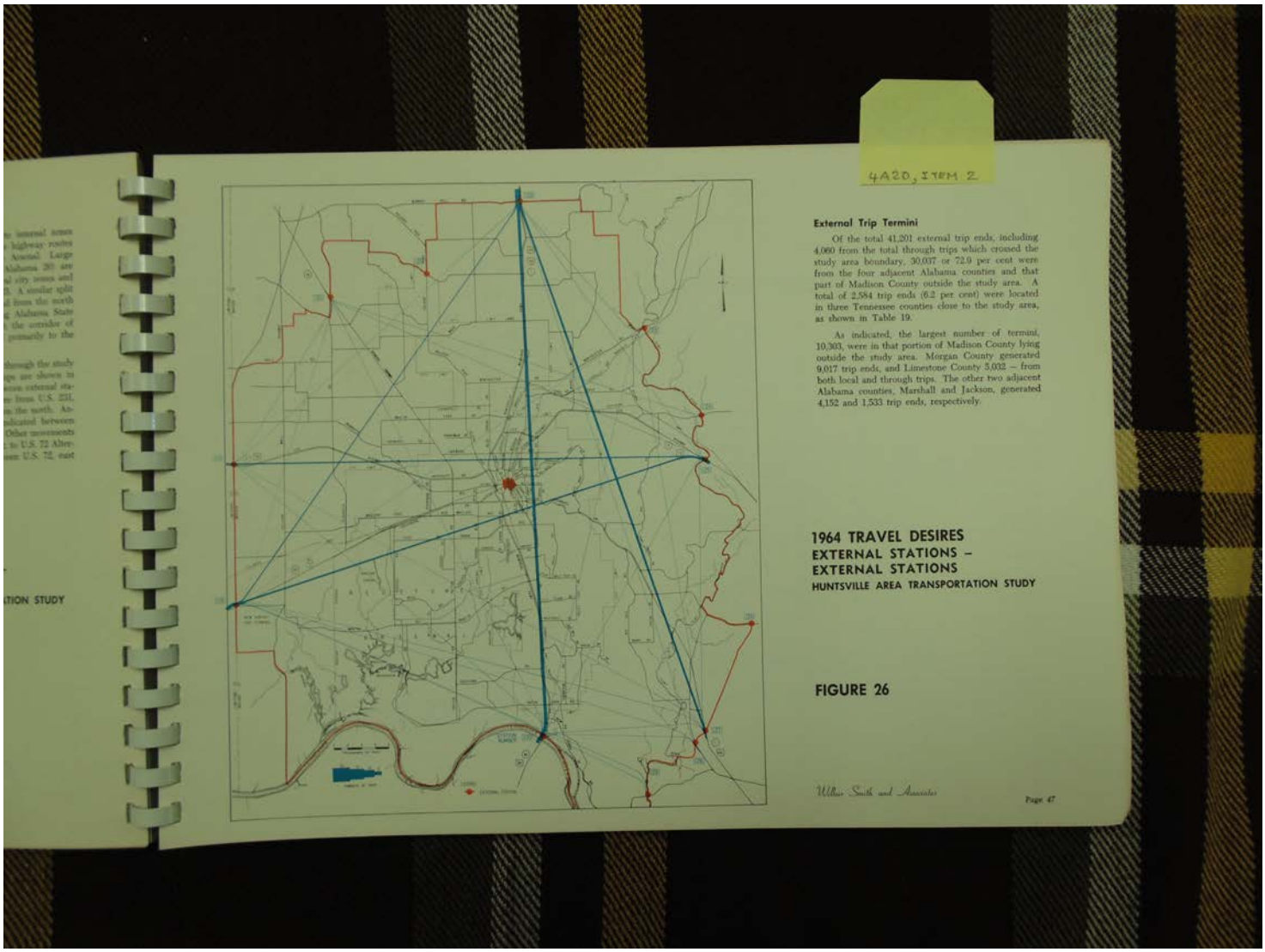


Names:
1964 Travel Desires
External Stations

Places:
Huntsville, AL area

Types:
map

Dates:
1964



Names:
1964 External Trip Termini

Places:
Huntsville, AL area

Types:
map

Dates:
1964

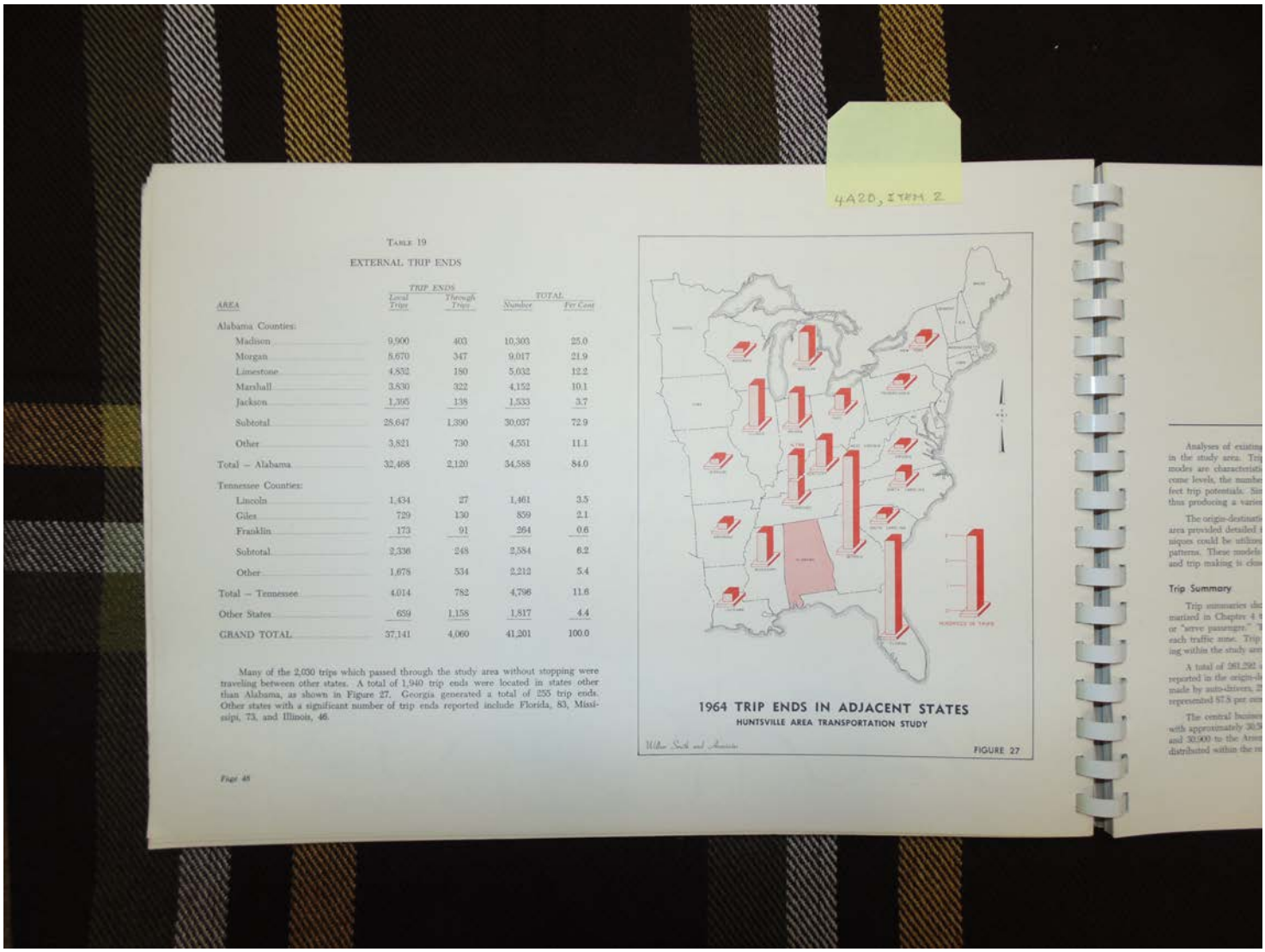


TABLE 19

EXTERNAL TRIP ENDS

AREA	TRIP ENDS: Local Trips	TRIP ENDS: Through Trips	TOTAL: Number	TOTAL: Per Cent
Alabama Counties:				
Madison	9,900	403	10,303	25.0
Morgan	8,670	347	9,017	21.9
Limestone	4,832	180	5,032	12.2
Marshall	3,830	322	4,152	10.1
Jackson	1,395	138	1,533	3.7
Subtotal	28,647	1,390	30,037	72.9
Other	3,821	730	4,551	11.1
Total — Alabama	32,468	2,120	34,588	84.0
Tennessee Counties:				
Lincoln	1,434	27	1,461	3.5
Giles	729	130	859	2.1
Franklin	173	91	264	0.6
Subtotal	2,336	248	2,584	6.2
Other	1,678	534	2,212	5.4
Total — Tennessee	4,014	782	4,796	11.6
Other States	659	1,158	1,817	4.4
GRAND TOTAL	37,141	4,060	41,201	100.0

Many of the 2,030 trips which passed through the study area without stopping were traveling between other states. A total of 1,940 trip ends were located in states other than Alabama, as shown in Figure 27. Georgia generated a total of 255 trip ends. Other states with a significant number of trip ends reported include Florida, 83, Mississippi, 73, and Illinois, 46.

Page 48

1964 TRIP ENDS IN ADJACENT STATES
HUNTSVILLE AREA TRANSPORTATION STUDY

Wilbur Smith and Associates

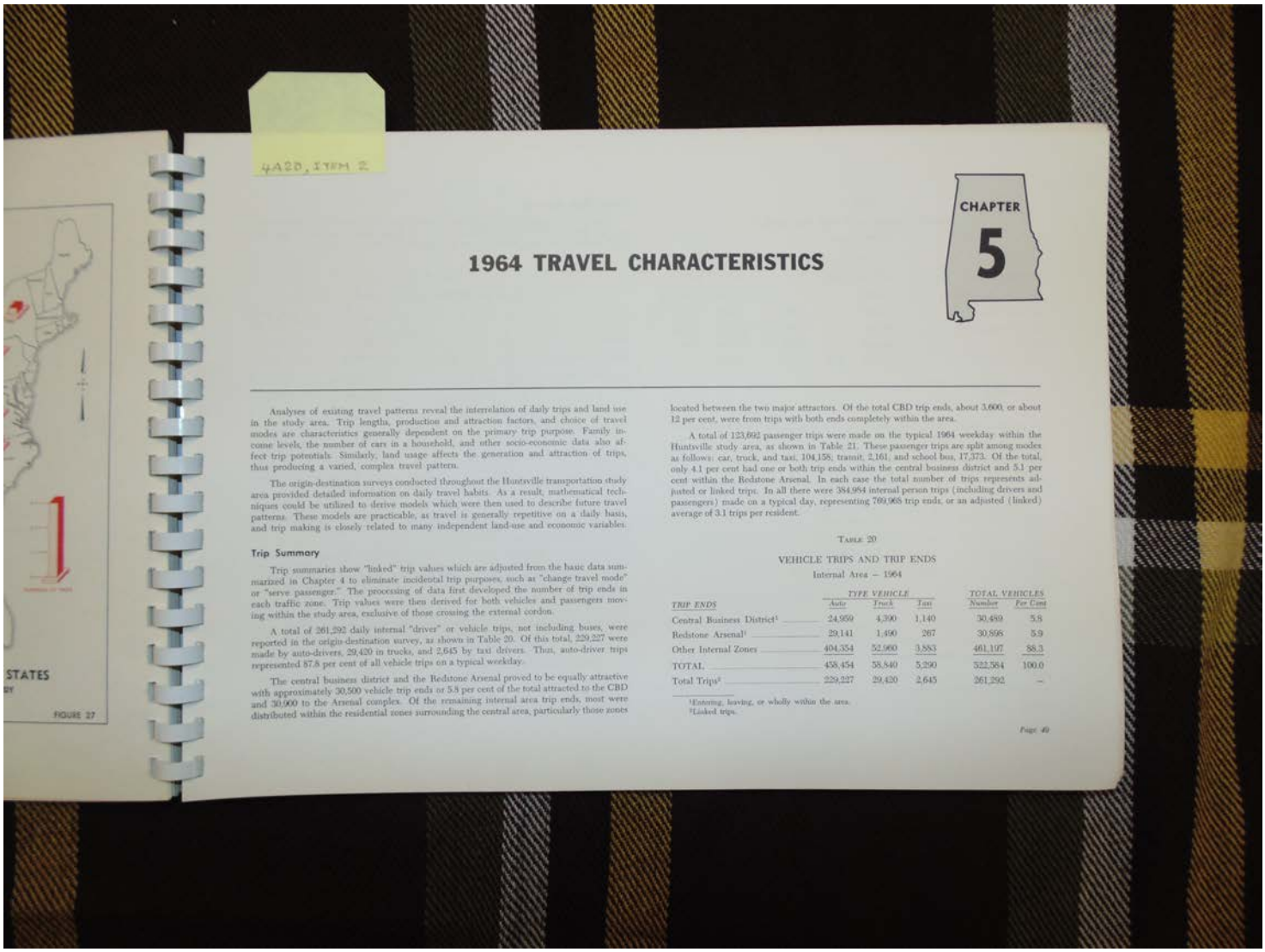
FIGURE 27

Trip Summary

Names:
External Trip Ends

Types:
table illustration

Dates:
1964



4A2D, ITEM 2

CHAPTER 5

1964 TRAVEL CHARACTERISTICS

Analyses of existing travel patterns reveal the interrelation of daily trips and land use in the study area. Trip lengths, production and attraction factors, and choice of travel modes are characteristics generally dependent on the primary trip purpose. Family income levels, the number of cars in a household, and other socio-economic data also affect trip potentials. Similarly, land usage affects the generation and attraction of trips, thus producing a varied, complex travel pattern.

The origin-destination surveys conducted throughout the Huntsville transportation study area provided detailed information on daily travel habits. As a result, mathematical techniques could be utilized to derive models which were then used to describe future travel patterns. These models are practicable, as travel is generally repetitive on a daily basis, and trip making is closely related to many independent land-use and economic variables.

Trip Summary

Trip summaries show "linked" trip values which are adjusted from the basic data summarized in Chapter 4 to eliminate incidental trip purposes, such as "change travel mode" or "serve passenger." The processing of data first developed the number of trip ends in each traffic zone. Trip values were then derived for both vehicles and passengers moving within the study area, exclusive of those crossing the external cordon.

A total of 261,292 daily internal "driver" or vehicle trips, not including buses, were reported in the origin-destination survey, as shown in Table 20. Of this total, 229,227 were made by auto drivers, 29,420 in trucks, and 2,645 by taxi drivers. Thus, auto-driver trips represented 87.8 per cent of all vehicle trips on a typical weekday.

The central business district and the Redstone Arsenal proved to be equally attractive with approximately 30,500 vehicle trip ends or 5.8 per cent of the total attracted to the CBD and 30,900 to the Arsenal complex. Of the remaining internal area trip ends, most were distributed within the residential zones surrounding the central area, particularly those zones located between the two major attractors. Of the total CBD trip ends, about 3,600, or about 12 per cent, were from trips with both ends completely within the area.

A total of 123,692 passenger trips were made on the typical 1964 weekday within the Huntsville study area, as shown in Table 21. These passenger trips are split among modes as follows: car, truck, and taxi, 104,158; transit, 2,161; and school bus, 17,373. Of the total, only 4.1 per cent had one or both trip ends within the central business district and 5.1 per cent within the Redstone Arsenal. In each case the total number of trips represents adjusted or linked trips. In all there were 384,984 internal person trips (including drivers and passengers) made on a typical day, representing 769,968 trip ends, or an adjusted (linked) average of 3.1 trips per resident.

TABLE 20

VEHICLE TRIPS AND TRIP ENDS

Internal Area — 1964

TRIP ENDS	TYPE VEHICLE			TOTAL VEHICLES	
	Auto	Truck	Taxi	Number	Per Cent
Central Business District[1]	24,959	4,390	1,140	30,489	5.8
Redstone Arsenal[1]	29,141	1,490	267	30,898	5.9
Other Internal Zones	404,354	52,960	3,883	461,197	88.3
TOTAL	458,454	58,840	5,290	522,584	100.0
Total Trips[2]	229,227	29,420	2,645	261,292	–

[1]Entering, leaving, or wholly within the area.
[2]Linked trips.

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FIGURE 27

Names:
1964 Travel Characteristics
Trip Summary

Places:
Huntsville, AL

Types:
booklet
booklet
table

Dates:
1964
1966

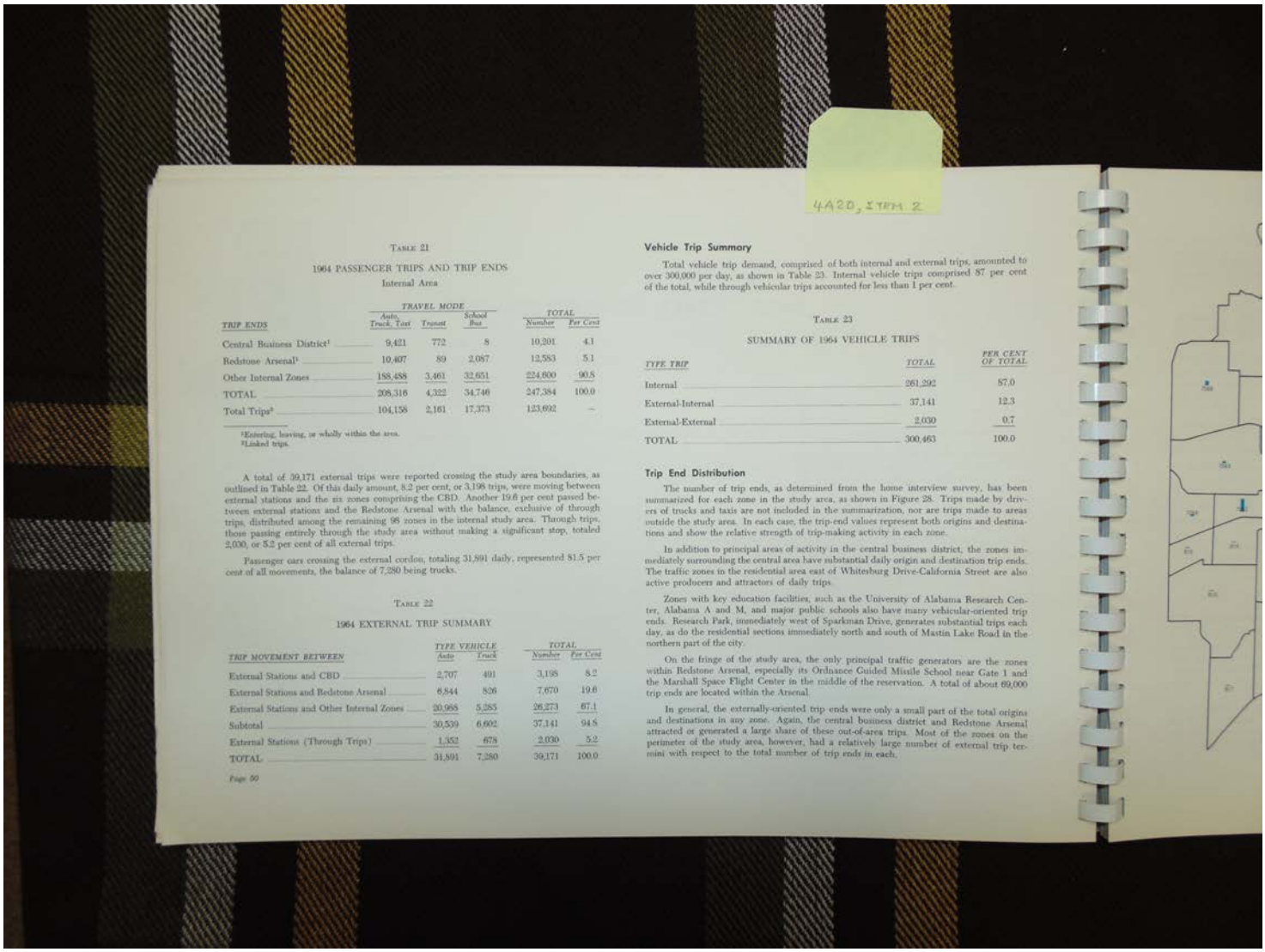

TABLE 21

1964 PASSENGER TRIPS AND TRIP ENDS
Internal Area

TRIP ENDS	TRAVEL MODE: Auto, Truck, Taxi	Transit	School Bus	TOTAL: Number	Per Cent
Central Business District[1]	9,421	772	8	10,201	4.1
Redstone Arsenal[1]	10,407	89	2,087	12,583	5.1
Other Internal Zones	188,488	3,461	32,651	224,600	90.5
TOTAL	208,316	4,322	34,746	247,384	100.0
Total Trips[2]	104,158	2,161	17,373	123,692	—

[1]Entering, leaving, or wholly within the area.
[2]Linked trips.

A total of 39,171 external trips were reported crossing the study area boundaries, as outlined in Table 22. Of this daily amount, 8.2 per cent, or 3,198 trips, were moving between external stations and the six zones comprising the CBD. Another 19.6 per cent passed between external stations and the Redstone Arsenal with the balance, exclusive of through trips, distributed among the remaining 98 zones in the internal study area. Through trips, those passing entirely through the study area without making a significant stop, totaled 2,030, or 5.2 per cent of all external trips.

Passenger cars crossing the external cordon, totaling 31,891 daily, represented 81.5 per cent of all movements, the balance of 7,280 being trucks.

TABLE 22

1964 EXTERNAL TRIP SUMMARY

TRIP MOVEMENT BETWEEN	TYPE VEHICLE: Auto	Truck	TOTAL: Number	Per Cent
External Stations and CBD	2,707	491	3,198	8.2
External Stations and Redstone Arsenal	6,844	826	7,670	19.6
External Stations and Other Internal Zones	20,988	5,285	26,273	67.1
Subtotal	30,539	6,602	37,141	94.8
External Stations (Through Trips)	1,352	678	2,030	5.2
TOTAL	31,891	7,280	39,171	100.0

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Vehicle Trip Summary

Total vehicle trip demand, comprised of both internal and external trips, amounted to over 300,000 per day, as shown in Table 23. Internal vehicle trips comprised 87 per cent of the total, while through vehicular trips accounted for less than 1 per cent.

TABLE 23

SUMMARY OF 1964 VEHICLE TRIPS

TYPE TRIP	TOTAL	PER CENT OF TOTAL
Internal	261,292	87.0
External-Internal	37,141	12.3
External-External	2,030	0.7
TOTAL	300,463	100.0

Trip End Distribution

The number of trip ends, as determined from the home interview survey, has been summarized for each zone in the study area, as shown in Figure 28. Trips made by drivers of trucks and taxis are not included in the summarization, nor are trips made to areas outside the study area. In each case, the trip-end values represent both origins and destinations and show the relative strength of trip-making activity in each zone.

In addition to principal areas of activity in the central business district, the zones immediately surrounding the central area have substantial daily origin and destination trip ends. The traffic zones in the residential area east of Whitesburg Drive-California Street are also active producers and attractors of daily trips.

Zones with key education facilities, such as the University of Alabama Research Center, Alabama A and M, and major public schools also have many vehicular-oriented trip ends. Research Park, immediately west of Sparkman Drive, generates substantial trips each day, as do the residential sections immediately north and south of Mastin Lake Road in the northern part of the city.

On the fringe of the study area, the only principal traffic generators are the zones within Redstone Arsenal, especially its Ordnance Guided Missile School near Gate 1 and the Marshall Space Flight Center in the middle of the reservation. A total of about 69,000 trip ends are located within the Arsenal.

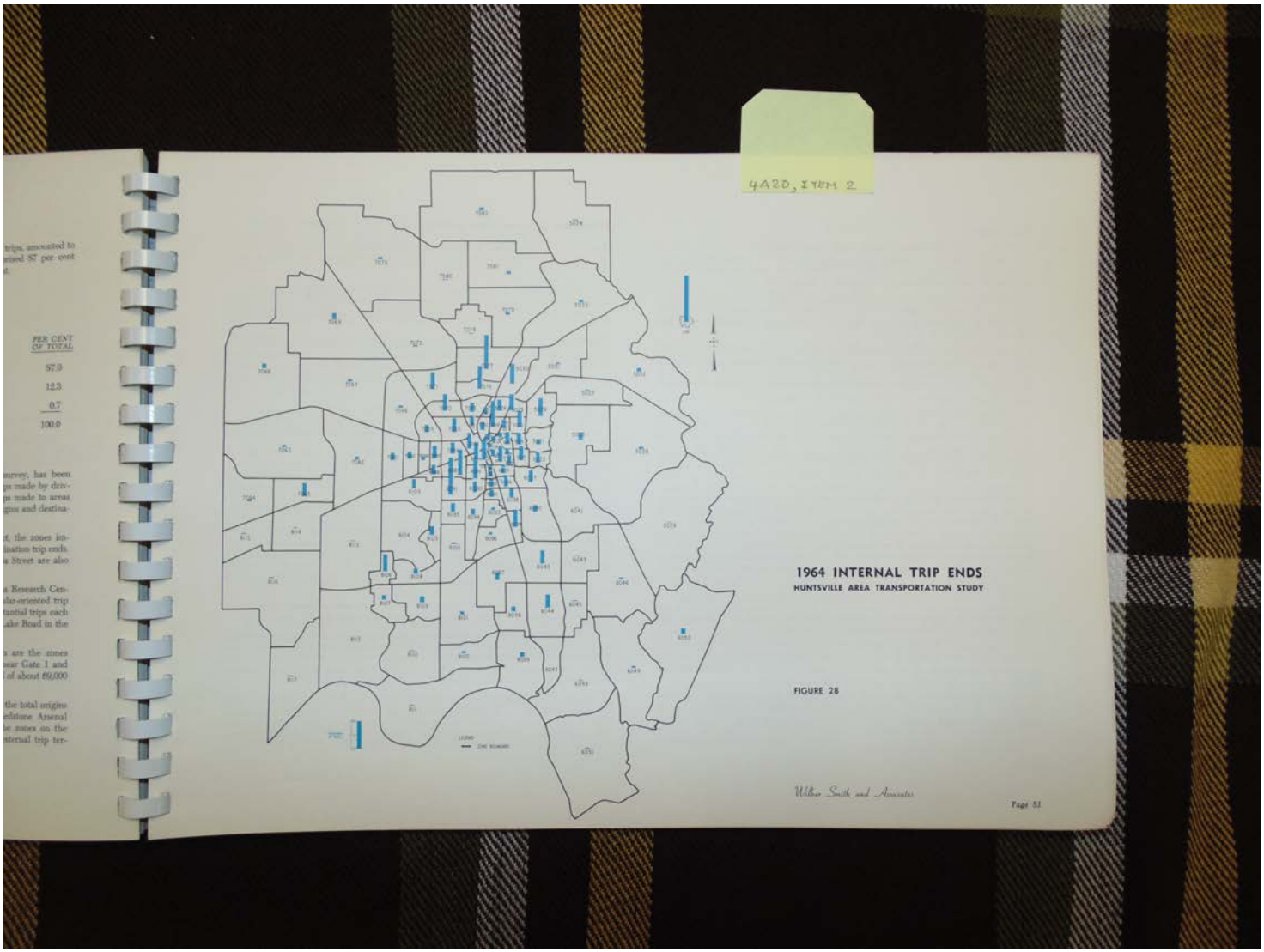
In general, the externally-oriented trip ends were only a small part of the total origins and destinations in any zone. Again, the central business district and Redstone Arsenal attracted or generated a large share of these out-of-area trips. Most of the zones on the perimeter of the study area, however, had a relatively large number of external trip terminí with respect to the total number of trip ends in each.

Names:
1964 Passenger Trips
Trip End Distribution
Vehicular Trip
Summary

Places:
Huntsville, AL

Types:
booklet booklet table table

Dates:
1964

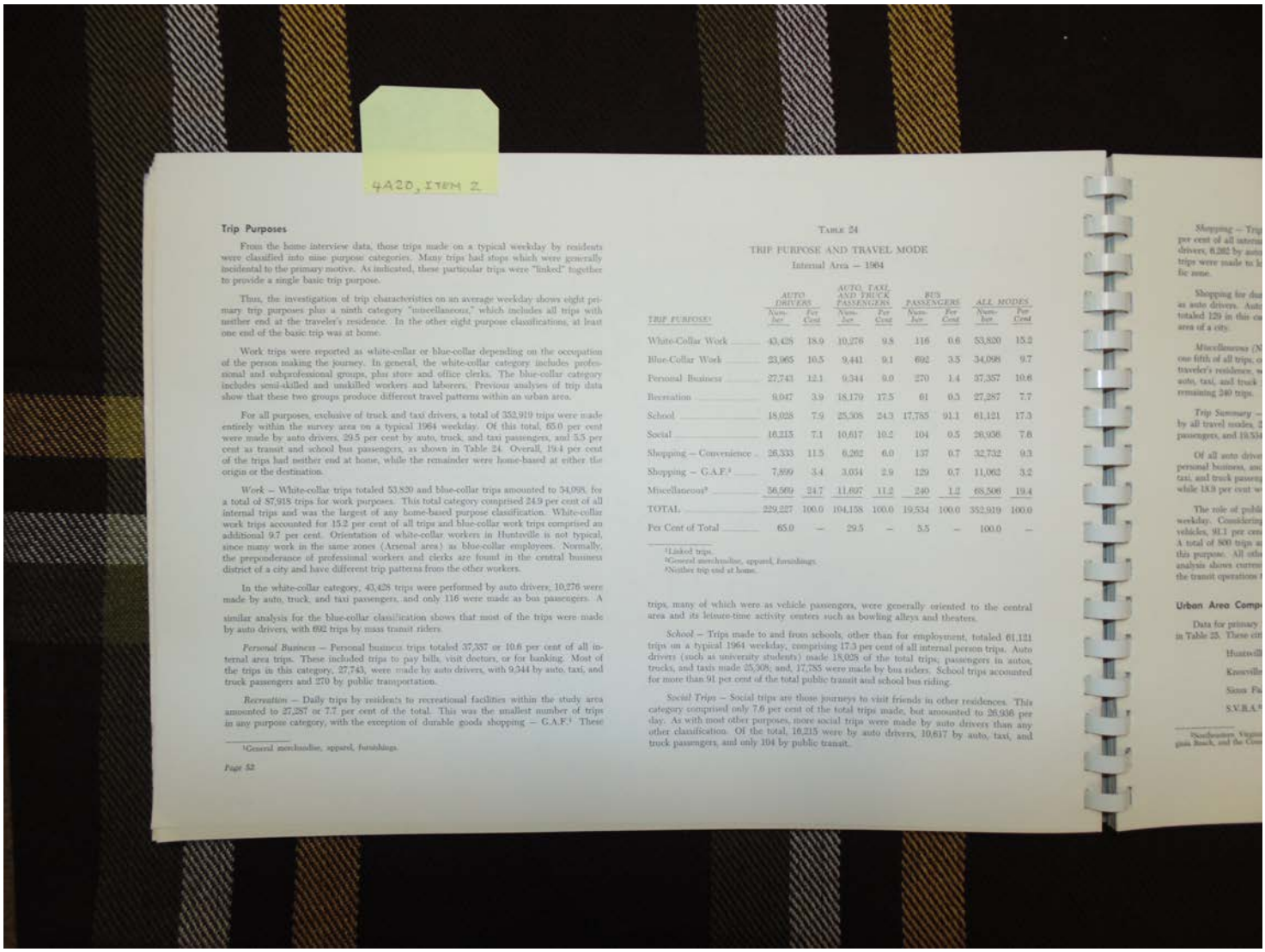


Names:
1964 Internal Trip Ends

Places:
Huntsville, AL

Types:
illustration

Dates:
1964



Trip Purposes

From the home interview data, those trips made on a typical weekday by residents were classified into nine purpose categories. Many trips had stops which were generally incidental to the primary motive. As indicated, these particular trips were "linked" together to provide a single basic trip purpose.

Thus, the investigation of trip characteristics on an average weekday shows eight primary trip purposes plus a ninth category "miscellaneous," which includes all trips with neither end at the traveler's residence. In the other eight purpose classifications, at least one end of the basic trip was at home.

Work trips were reported as white-collar or blue-collar depending on the occupation of the person making the journey. In general, the white-collar category includes professional and subprofessional groups, plus store and office clerks. The blue-collar category includes semi-skilled and unskilled workers and laborers. Previous analyses of trip data show that these two groups produce different travel patterns within an urban area.

For all purposes, exclusive of truck and taxi drivers, a total of 352,919 trips were made entirely within the survey area on a typical 1964 weekday. Of this total, 65.0 per cent were made by auto drivers, 29.5 per cent by auto, truck, and taxi passengers, and 5.5 per cent as transit and school bus passengers, as shown in Table 24. Overall, 19.4 per cent of the trips had neither end at home, while the remainder were home-based at either the origin or the destination.

Work – White-collar trips totaled 53,820 and blue-collar trips amounted to 34,098, for a total of 87,918 trips for work purposes. This total category comprised 24.9 per cent of all internal trips and was the largest of any home-based purpose classification. White-collar work trips accounted for 15.2 per cent of all trips and blue-collar work trips comprised an additional 9.7 per cent. Orientation of white-collar workers in Huntsville is not typical, since many work in the same zones (Arsenal area) as blue-collar employees. Normally, the preponderance of professional workers and clerks are found in the central business district of a city and have different trip patterns from the other workers.

In the white-collar category, 43,428 trips were performed by auto drivers; 10,276 were made by auto, truck, and taxi passengers, and only 116 were made as bus passengers. A similar analysis for the blue-collar classification shows that most of the trips were made by auto drivers, with 692 trips by mass transit riders.

Personal Business – Personal business trips totaled 37,357 or 10.6 per cent of all internal area trips. These included trips to pay bills, visit doctors, or for banking. Most of the trips in this category, 27,743, were made by auto drivers, with 9,344 by auto, taxi, and truck passengers and 270 by public transportation.

Recreation – Daily trips by residents to recreational facilities within the study area amounted to 27,287 or 7.7 per cent of the total. This was the smallest number of trips in any purpose category, with the exception of durable goods shopping – G.A.F.[1] These

[1]General merchandise, apparel, furnishings.

TABLE 24

TRIP PURPOSE AND TRAVEL MODE

Internal Area – 1964

TRIP PURPOSE[1]	AUTO DRIVERS Number	AUTO DRIVERS Per Cent	AUTO, TAXI, AND TRUCK PASSENGERS Number	AUTO, TAXI, AND TRUCK PASSENGERS Per Cent	BUS PASSENGERS Number	BUS PASSENGERS Per Cent	ALL MODES Number	ALL MODES Per Cent
White-Collar Work	43,428	18.9	10,276	9.8	116	0.6	53,820	15.2
Blue-Collar Work	23,965	10.5	9,441	9.1	692	3.5	34,098	9.7
Personal Business	27,743	12.1	9,344	9.0	270	1.4	37,357	10.6
Recreation	9,047	3.9	18,179	17.5	61	0.3	27,287	7.7
School	18,028	7.9	25,308	24.3	17,785	91.1	61,121	17.3
Social	10,215	7.1	10,617	10.2	104	0.5	26,936	7.6
Shopping – Convenience	26,333	11.5	6,262	6.0	137	0.7	32,732	9.3
Shopping – G.A.F.[2]	7,899	3.4	3,054	2.9	129	0.7	11,082	3.2
Miscellaneous[3]	36,569	24.7	11,897	11.2	240	1.2	68,506	19.4
TOTAL	229,227	100.0	104,158	100.0	19,534	100.0	352,919	100.0
Per Cent of Total	65.0	–	29.5	–	5.5	–	100.0	–

[1]Linked trips.
[2]General merchandise, apparel, furnishings.
[3]Neither trip end at home.

trips, many of which were as vehicle passengers, were generally oriented to the central area and its leisure-time activity centers such as bowling alleys and theaters.

School – Trips made to and from schools, other than for employment, totaled 61,121 trips on a typical 1964 weekday, comprising 17.3 per cent of all internal person trips. Auto drivers (such as university students) made 18,028 of the total trips; passengers in autos, trucks, and taxis made 25,308; and, 17,785 were made by bus riders. School trips accounted for more than 91 per cent of the total public transit and school bus riding.

Social Trips – Social trips are those journeys to visit friends in other residences. This category comprised only 7.6 per cent of the total trips made, but amounted to 26,936 per day. As with most other purposes, more social trips were made by auto drivers than any other classification. Of the total, 10,215 were by auto drivers, 10,617 by auto, taxi, and truck passengers, and only 104 by public transit.

Names:

Trip Purpose & Travel Mode

Trip Purposes

Places:

Huntsville, AL

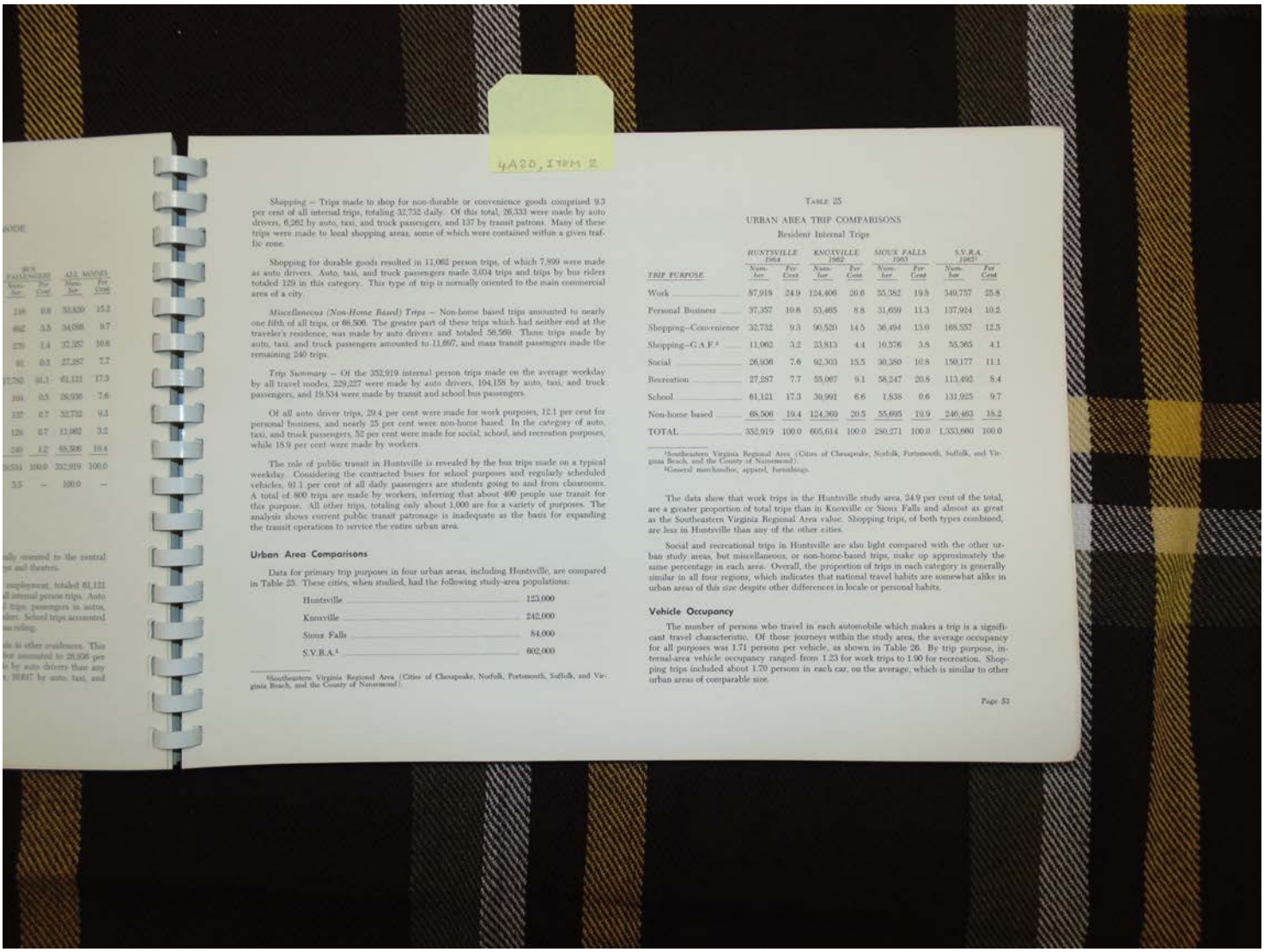
Types:

booklet

table

Dates:

1964



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Shopping — Trips made to shop for non-durable or convenience goods comprised 9.3 per cent of all internal trips, totaling 32,732 daily. Of this total, 26,333 were made by auto drivers, 6,262 by auto, taxi, and truck passengers, and 137 by transit patrons. Many of these trips were made to local shopping areas, some of which were contained within a given traffic zone.

Shopping for durable goods resulted in 11,062 person trips, of which 7,899 were made as auto drivers. Auto, taxi, and truck passengers made 3,034 trips and trips by bus riders totaled 129 in this category. This type of trip is normally oriented to the main commercial area of a city.

Miscellaneous (Non-Home Based) Trips — Non-home based trips amounted to nearly one fifth of all trips, or 68,506. The greater part of these trips which had neither end at the traveler's residence, was made by auto drivers and totaled 56,569. Those trips made by auto, taxi, and truck passengers amounted to 11,697, and mass transit passengers made the remaining 240 trips.

Trip Summary — Of the 352,919 internal person trips made on the average weekday by all travel modes, 229,227 were made by auto drivers, 104,158 by auto, taxi, and truck passengers, and 19,534 were made by transit and school bus passengers.

Of all auto driver trips, 29.4 per cent were made for work purposes, 12.1 per cent for personal business, and nearly 25 per cent were non-home based. In the category of auto, taxi, and truck passengers, 52 per cent were made for social, school, and recreation purposes, while 18.9 per cent were made by workers.

The role of public transit in Huntsville is revealed by the bus trips made on a typical weekday. Considering the contracted buses for school purposes and regularly scheduled vehicles, 91.1 per cent of all daily passengers are students going to and from classrooms. A total of 800 trips are made by workers, inferring that about 400 people use transit for this purpose. All other trips, totaling only about 1,000 are for a variety of purposes. The analysis shows current public transit patronage is inadequate as the basis for expanding the transit operations to service the entire urban area.

Urban Area Comparisons

Data for primary trip purposes in four urban areas, including Huntsville, are compared in Table 25. These cities, when studied, had the following study-area populations:

Huntsville	123,000
Knoxville	242,000
Sioux Falls	84,000
S.V.B.A.[1]	602,000

[1]Southeastern Virginia Regional Area (Cities of Chesapeake, Norfolk, Portsmouth, Suffolk, and Virginia Beach, and the County of Nansemond).

TABLE 25

URBAN AREA TRIP COMPARISONS

Resident Internal Trips

TRIP PURPOSE	HUNTSVILLE 1964 Number	HUNTSVILLE 1964 Per Cent	KNOXVILLE 1962 Number	KNOXVILLE 1962 Per Cent	SIOUX FALLS 1963 Number	SIOUX FALLS 1963 Per Cent	S.V.B.A. 1962[1] Number	S.V.B.A. 1962[1] Per Cent
Work	87,918	24.9	124,406	20.6	55,382	19.8	349,757	25.8
Personal Business	37,357	10.6	53,465	8.8	31,659	11.3	137,924	10.2
Shopping—Convenience	32,732	9.3	90,520	14.5	36,494	13.0	169,557	12.5
Shopping—G.A.F.[2]	11,062	3.2	23,813	4.4	10,576	3.8	55,365	4.1
Social	26,936	7.6	92,303	15.5	30,380	10.8	150,177	11.1
Recreation	27,287	7.7	55,067	9.1	58,247	20.8	113,492	8.4
School	61,121	17.3	39,991	6.6	1,838	0.6	131,925	9.7
Non-home based	68,506	19.4	124,369	20.5	55,695	19.9	246,463	18.2
TOTAL	352,919	100.0	605,614	100.0	280,271	100.0	1,353,660	100.0

[1]Southeastern Virginia Regional Area (Cities of Chesapeake, Norfolk, Portsmouth, Suffolk, and Virginia Beach, and the County of Nansemond).
[2]General merchandise, apparel, furnishings.

The data show that work trips in the Huntsville study area, 24.9 per cent of the total, are a greater proportion of total trips than in Knoxville or Sioux Falls and almost as great as the Southeastern Virginia Regional Area value. Shopping trips, of both types combined, are less in Huntsville than any of the other cities.

Social and recreational trips in Huntsville are also light compared with the other urban study areas, but miscellaneous, or non-home-based trips, make up approximately the same percentage in each area. Overall, the proportion of trips in each category is generally similar in all four regions, which indicates that national travel habits are somewhat alike in urban areas of this size despite other differences in locale or personal habits.

Vehicle Occupancy

The number of persons who travel in each automobile which makes a trip is a significant travel characteristic. Of those journeys within the study area, the average occupancy for all purposes was 1.71 persons per vehicle, as shown in Table 26. By trip purpose, internal-area vehicle occupancy ranged from 1.23 for work trips to 1.90 for recreation. Shopping trips included about 1.70 persons in each car, on the average, which is similar to other urban areas of comparable size.

Names:
Urban Area Comparisons
Vehicle Occupancy

Places:
Huntsville, AL

Types:
booklet

Dates:
1966

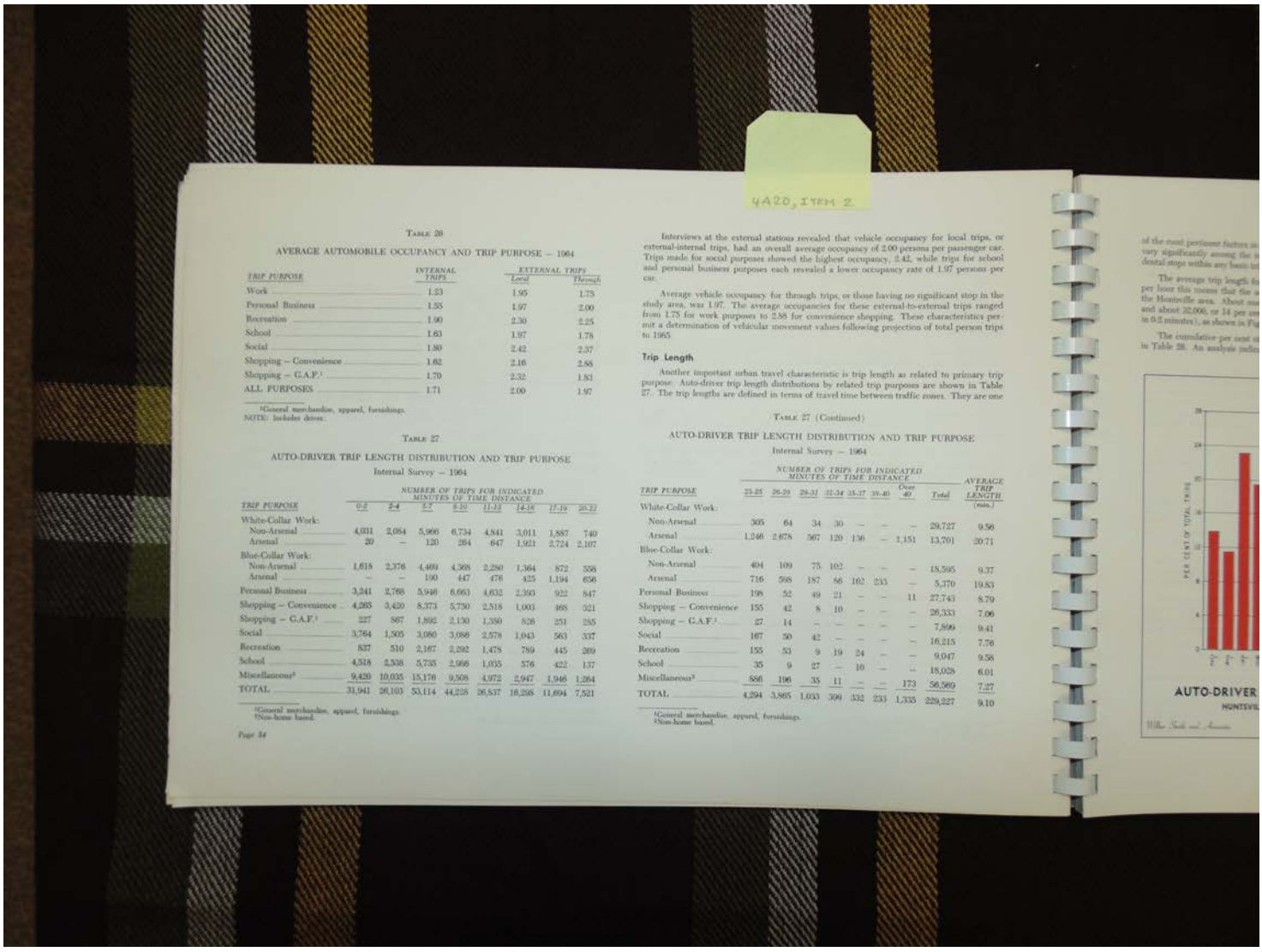

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TABLE 26

AVERAGE AUTOMOBILE OCCUPANCY AND TRIP PURPOSE — 1964

TRIP PURPOSE	INTERNAL TRIPS	EXTERNAL TRIPS Local	EXTERNAL TRIPS Through
Work	1.23	1.95	1.75
Personal Business	1.55	1.97	2.00
Recreation	1.90	2.30	2.25
School	1.63	1.97	1.78
Social	1.80	2.42	2.37
Shopping — Convenience	1.62	2.16	2.88
Shopping — G.A.F.[1]	1.70	2.32	1.83
ALL PURPOSES	1.71	2.00	1.97

[1]General merchandise, apparel, furnishings.
NOTE: Includes driver.

TABLE 27

AUTO-DRIVER TRIP LENGTH DISTRIBUTION AND TRIP PURPOSE

Internal Survey — 1964

TRIP PURPOSE	NUMBER OF TRIPS FOR INDICATED MINUTES OF TIME DISTANCE 0-2	2-4	5-7	8-10	11-13	14-16	17-19	20-22
White-Collar Work:								
Non-Arsenal	4,031	2,084	5,966	6,734	4,841	3,011	1,887	740
Arsenal	20	–	120	264	647	1,921	2,724	2,107
Blue-Collar Work:								
Non-Arsenal	1,618	2,376	4,469	4,368	2,280	1,364	872	556
Arsenal	–	–	190	447	476	425	1,194	656
Personal Business	3,241	2,768	5,946	6,663	4,632	2,393	922	547
Shopping — Convenience	4,285	3,420	8,373	5,750	2,518	1,003	468	321
Shopping — G.A.F.[1]	227	567	1,892	2,130	1,380	828	251	255
Social	3,764	1,505	3,080	3,088	2,578	1,043	563	337
Recreation	837	510	2,167	2,292	1,478	789	445	269
School	4,518	2,538	5,735	2,966	1,035	576	422	137
Miscellaneous[2]	9,420	10,035	15,176	9,508	4,972	2,947	1,946	1,264
TOTAL	31,941	26,103	53,114	44,228	26,837	16,298	11,694	7,521

[1]General merchandise, apparel, furnishings.
[2]Non-home based.

Page 54

Interviews at the external stations revealed that vehicle occupancy for local trips, or external-internal trips, had an overall average occupancy of 2.00 persons per passenger car. Trips made for social purposes showed the highest occupancy, 2.42, while trips for school and personal business purposes each revealed a lower occupancy rate of 1.97 persons per car.

Average vehicle occupancy for through trips, or those having no significant stop in the study area, was 1.97. The average occupancies for these external-to-external trips ranged from 1.75 for work purposes to 2.88 for convenience shopping. These characteristics permit a determination of vehicular movement values following projection of total person trips to 1985.

Trip Length

Another important urban travel characteristic is trip length as related to primary trip purpose. Auto-driver trip length distributions by related trip purposes are shown in Table 27. The trip lengths are defined in terms of travel time between traffic zones. They are one

TABLE 27 (Continued)

AUTO-DRIVER TRIP LENGTH DISTRIBUTION AND TRIP PURPOSE

Internal Survey — 1964

TRIP PURPOSE	NUMBER OF TRIPS FOR INDICATED MINUTES OF TIME DISTANCE 23-25	26-28	29-31	32-34	35-37	38-40	Over 40	Total	AVERAGE TRIP LENGTH (min.)
White-Collar Work:									
Non-Arsenal	305	64	34	30	–	–	–	29,727	9.58
Arsenal	1,246	2,678	567	120	136	–	1,151	13,701	20.71
Blue-Collar Work:									
Non-Arsenal	404	109	75	102	–	–	–	18,595	9.37
Arsenal	716	598	187	86	162	233	–	5,370	19.83
Personal Business	198	52	49	21	–	–	11	27,743	8.79
Shopping — Convenience	155	42	8	10	–	–	–	26,333	7.06
Shopping — G.A.F.[1]	27	14	–	–	–	–	–	7,899	9.41
Social	167	50	42	–	–	–	–	16,215	7.76
Recreation	155	53	9	19	24	–	–	9,047	9.58
School	35	9	27	–	10	–	–	18,028	6.01
Miscellaneous[2]	886	196	35	11	–	–	173	56,569	7.27
TOTAL	4,294	3,865	1,033	399	332	233	1,335	229,227	9.10

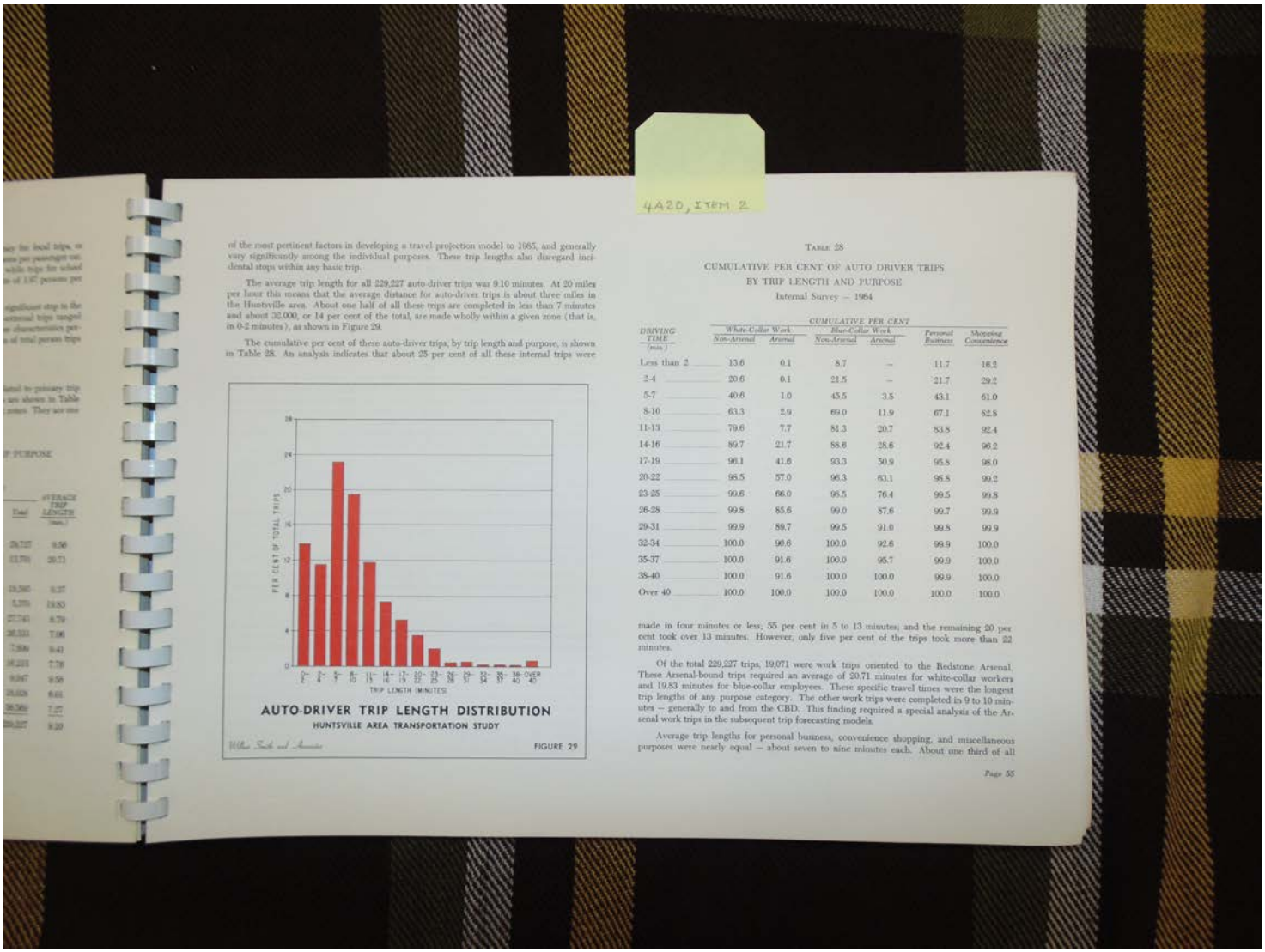
[1]General merchandise, apparel, furnishings.
[2]Non-home based.

Names:
Trip Length
Vehicle Occupancy & Trip Purpose

Places:
Huntsville, AL

Types:
booklet
table
table

Dates:
1964



of the most pertinent factors in developing a travel projection model to 1965, and generally very significantly among the individual purposes. These trip lengths also disregard incidental stops within any basic trip.

The average trip length for all 229,227 auto-driver trips was 9.10 minutes. At 20 miles per hour this means that the average distance for auto-driver trips is about three miles in the Huntsville area. About one half of all these trips are completed in less than 7 minutes and about 32,000, or 14 per cent of the total, are made wholly within a given zone (that is, in 0-2 minutes), as shown in Figure 29.

The cumulative per cent of these auto-driver trips, by trip length and purpose, is shown in Table 28. An analysis indicates that about 25 per cent of all these internal trips were

AUTO-DRIVER TRIP LENGTH DISTRIBUTION
HUNTSVILLE AREA TRANSPORTATION STUDY

FIGURE 29

TABLE 28

CUMULATIVE PER CENT OF AUTO DRIVER TRIPS
BY TRIP LENGTH AND PURPOSE
Internal Survey — 1964

DRIVING TIME (min.)	CUMULATIVE PER CENT					
	White-Collar Work		Blue-Collar Work		Personal Business	Shopping Convenience
	Non-Arsenal	Arsenal	Non-Arsenal	Arsenal		
Less than 2	13.6	0.1	8.7	–	11.7	16.2
2-4	20.6	0.1	21.5	–	21.7	29.2
5-7	40.6	1.0	45.5	3.5	43.1	61.0
8-10	63.3	2.9	69.0	11.9	67.1	82.8
11-13	79.6	7.7	81.3	20.7	83.8	92.4
14-16	89.7	21.7	88.6	28.6	92.4	96.2
17-19	96.1	41.6	93.3	50.9	95.8	98.0
20-22	98.5	57.0	96.3	63.1	98.8	99.2
23-25	99.6	66.0	98.5	76.4	99.5	99.8
26-28	99.8	85.6	99.0	87.6	99.7	99.9
29-31	99.9	89.7	99.5	91.0	99.8	99.9
32-34	100.0	90.6	100.0	92.6	99.9	100.0
35-37	100.0	91.6	100.0	95.7	99.9	100.0
38-40	100.0	91.6	100.0	100.0	99.9	100.0
Over 40	100.0	100.0	100.0	100.0	100.0	100.0

made in four minutes or less; 55 per cent in 5 to 13 minutes; and the remaining 20 per cent took over 13 minutes. However, only five per cent of the trips took more than 22 minutes.

Of the total 229,227 trips, 19,071 were work trips oriented to the Redstone Arsenal. These Arsenal-bound trips required an average of 20.71 minutes for white-collar workers and 19.83 minutes for blue-collar employees. These specific travel times were the longest trip lengths of any purpose category. The other work trips were completed in 9 to 10 minutes — generally to and from the CBD. This finding required a special analysis of the Arsenal work trips in the subsequent trip forecasting models.

Average trip lengths for personal business, convenience shopping, and miscellaneous purposes were nearly equal — about seven to nine minutes each. About one third of all

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Names:
Trip Length
Distribution

Places:
Huntsville, AL

Types:
table
illustration

Dates:
1964

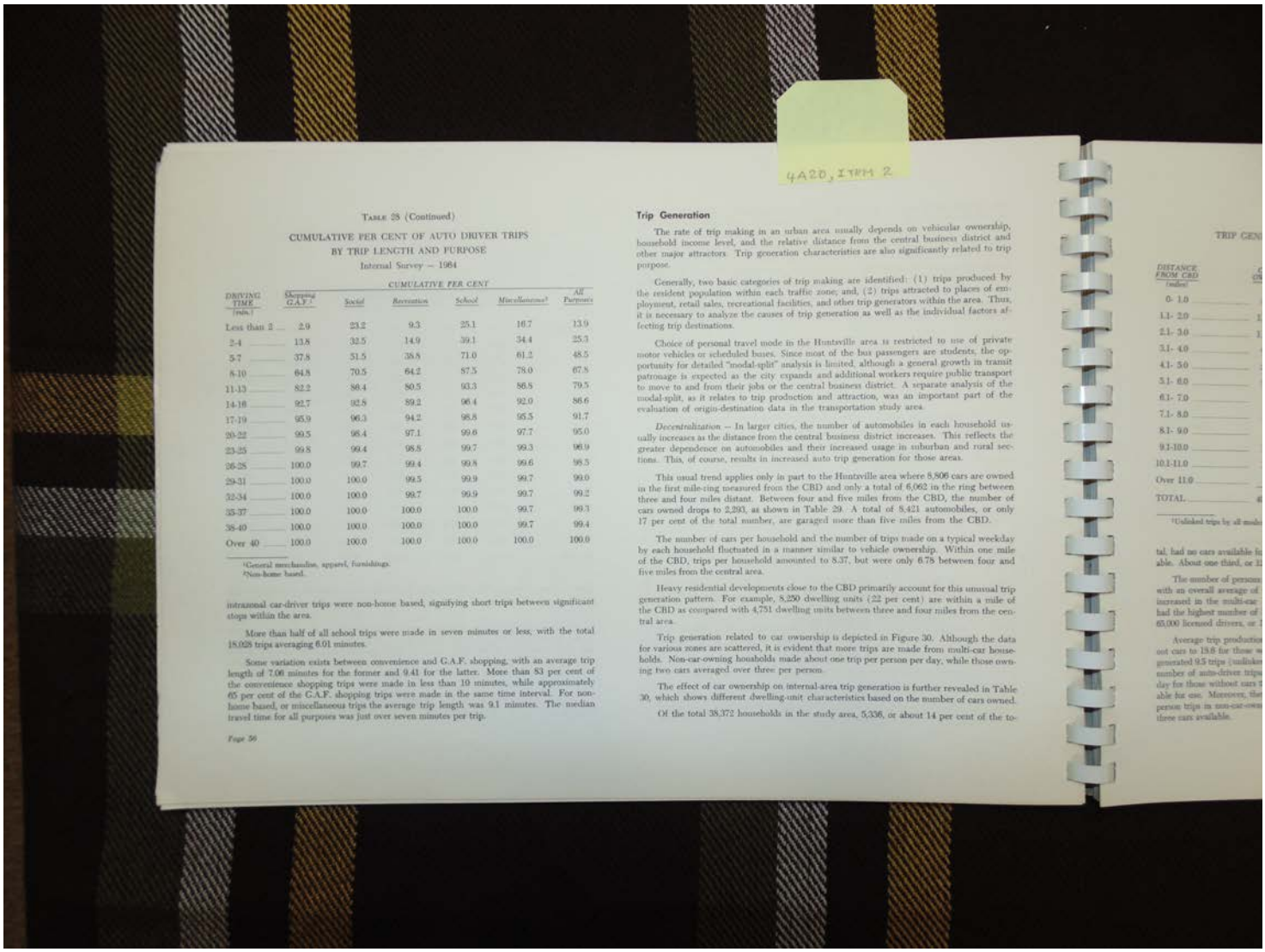

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TABLE 28 (Continued)

CUMULATIVE PER CENT OF AUTO DRIVER TRIPS
BY TRIP LENGTH AND PURPOSE
Internal Survey — 1964

DRIVING TIME (min.)	CUMULATIVE PER CENT					
	Shopping G.A.F.[1]	Social	Recreation	School	Miscellaneous[2]	All Purposes
Less than 2	2.9	23.2	9.3	25.1	16.7	13.9
2-4	13.8	32.5	14.9	39.1	34.4	25.3
5-7	37.8	51.5	38.8	71.0	61.2	48.5
8-10	64.8	70.5	64.2	87.5	78.0	67.8
11-13	82.2	86.4	80.5	93.3	86.5	79.5
14-16	92.7	92.8	89.2	96.4	92.0	86.6
17-19	95.9	96.3	94.2	98.8	95.5	91.7
20-22	99.5	98.4	97.1	99.6	97.7	95.0
23-25	99.8	99.4	98.8	99.7	99.3	96.9
26-28	100.0	99.7	99.4	99.8	99.6	98.5
29-31	100.0	100.0	99.5	99.9	99.7	99.0
32-34	100.0	100.0	99.7	99.9	99.7	99.2
35-37	100.0	100.0	100.0	100.0	99.7	99.3
38-40	100.0	100.0	100.0	100.0	99.7	99.4
Over 40	100.0	100.0	100.0	100.0	100.0	100.0

[1]General merchandise, apparel, furnishings.
[2]Non-home based.

intrazonal car-driver trips were non-home based, signifying short trips between significant stops within the area.

More than half of all school trips were made in seven minutes or less, with the total 18,028 trips averaging 6.01 minutes.

Some variation exists between convenience and G.A.F. shopping, with an average trip length of 7.06 minutes for the former and 9.41 for the latter. More than 83 per cent of the convenience shopping trips were made in less than 10 minutes, while approximately 65 per cent of the G.A.F. shopping trips were made in the same time interval. For non-home based, or miscellaneous trips the average trip length was 9.1 minutes. The median travel time for all purposes was just over seven minutes per trip.

Trip Generation

The rate of trip making in an urban area usually depends on vehicular ownership, household income level, and the relative distance from the central business district and other major attractors. Trip generation characteristics are also significantly related to trip purpose.

Generally, two basic categories of trip making are identified: (1) trips produced by the resident population within each traffic zone; and, (2) trips attracted to places of employment, retail sales, recreational facilities, and other trip generators within the area. Thus, it is necessary to analyze the causes of trip generation as well as the individual factors affecting trip destinations.

Choice of personal travel mode in the Huntsville area is restricted to use of private motor vehicles or scheduled buses. Since most of the bus passengers are students, the opportunity for detailed "modal-split" analysis is limited, although a general growth in transit patronage is expected as the city expands and additional workers require public transport to move to and from their jobs or the central business district. A separate analysis of the modal-split, as it relates to trip production and attraction, was an important part of the evaluation of origin-destination data in the transportation study area.

Decentralization — In larger cities, the number of automobiles in each household usually increases as the distance from the central business district increases. This reflects the greater dependence on automobiles and their increased usage in suburban and rural sections. This, of course, results in increased auto trip generation for those areas.

This usual trend applies only in part to the Huntsville area where 8,806 cars are owned in the first mile-ring measured from the CBD and only a total of 6,062 in the ring between three and four miles distant. Between four and five miles from the CBD, the number of cars owned drops to 2,293, as shown in Table 29. A total of 8,421 automobiles, or only 17 per cent of the total number, are garaged more than five miles from the CBD.

The number of cars per household and the number of trips made on a typical weekday by each household fluctuated in a manner similar to vehicle ownership. Within one mile of the CBD, trips per household amounted to 8.37, but were only 6.78 between four and five miles from the central area.

Heavy residential developments close to the CBD primarily account for this unusual trip generation pattern. For example, 8,250 dwelling units (22 per cent) are within a mile of the CBD as compared with 4,751 dwelling units between three and four miles from the central area.

Trip generation related to car ownership is depicted in Figure 30. Although the data for various zones are scattered, it is evident that more trips are made from multi-car households. Non-car-owning households made about one trip per person per day, while those owning two cars averaged over three per person.

The effect of car ownership on internal-area trip generation is further revealed in Table 30, which shows different dwelling-unit characteristics based on the number of cars owned.

Of the total 38,372 households in the study area, 5,336, or about 14 per cent of the to-

TRIP GEN

DISTANCE FROM CBD (miles)	
0- 1.0	
1.1- 2.0	
2.1- 3.0	
3.1- 4.0	
4.1- 5.0	
5.1- 6.0	
6.1- 7.0	
7.1- 8.0	
8.1- 9.0	
9.1-10.0	
10.1-11.0	
Over 11.0	
TOTAL	

[1]Unlinked trips by all mode

tal, had no cars available fo
able. About one third, or 1

The number of persons
with an overall average of
increased in the multi-car
had the highest number of
65,000 licensed drivers, or

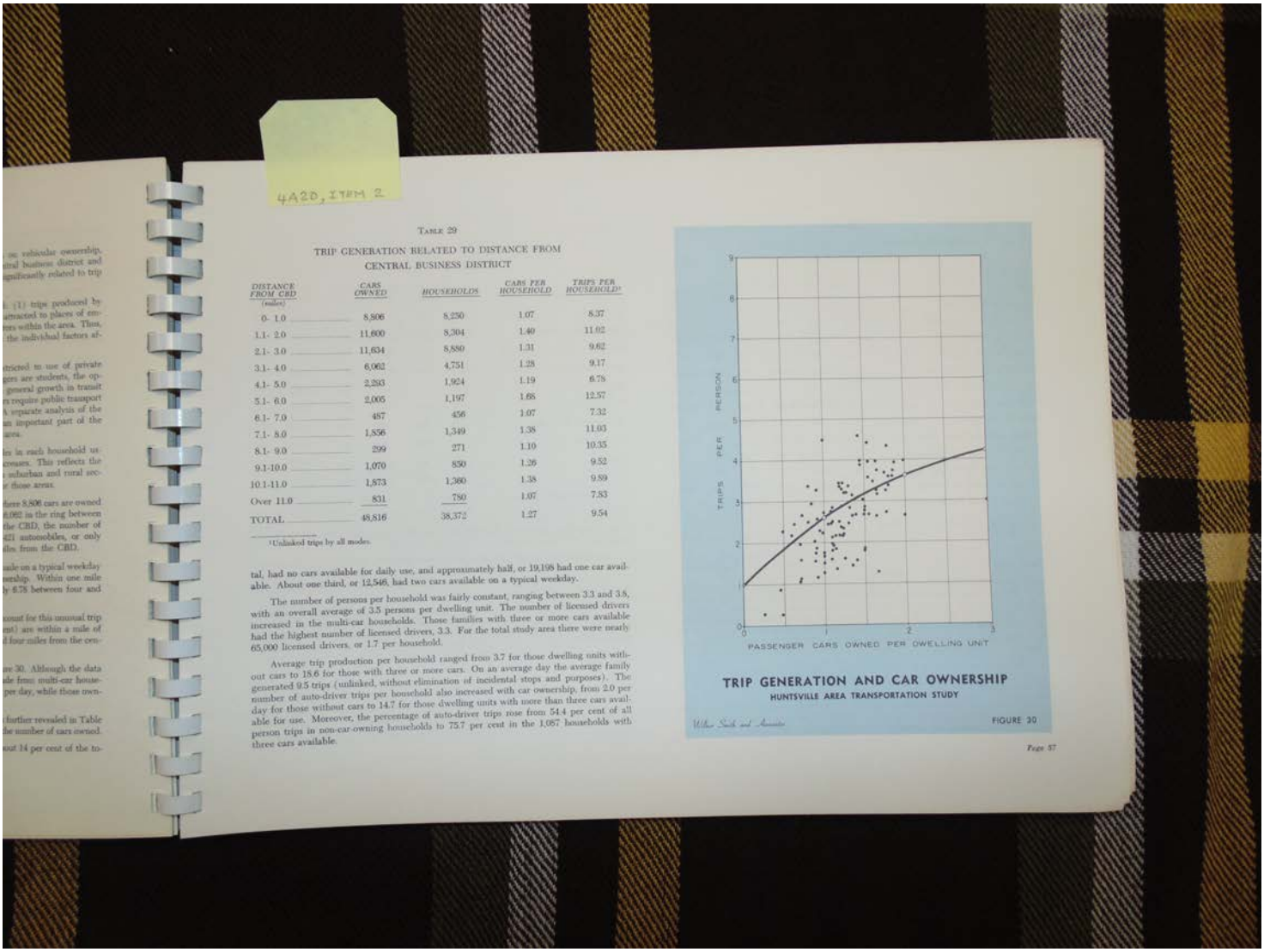
Average trip productio
ost cars to 13.6 for those w
generated 9.5 trips (unlinke
number of auto-driver trips
day for those without cars
able for use. Moreover, the
person trips in non-car-own
three cars available.

Names:
Trip Generation

Places:
Huntsville, AL

Types:
table

Dates:
1964



Names:
Trip Generation

Places:
Huntsville, AL

Types:
table illustration

Dates:
1966

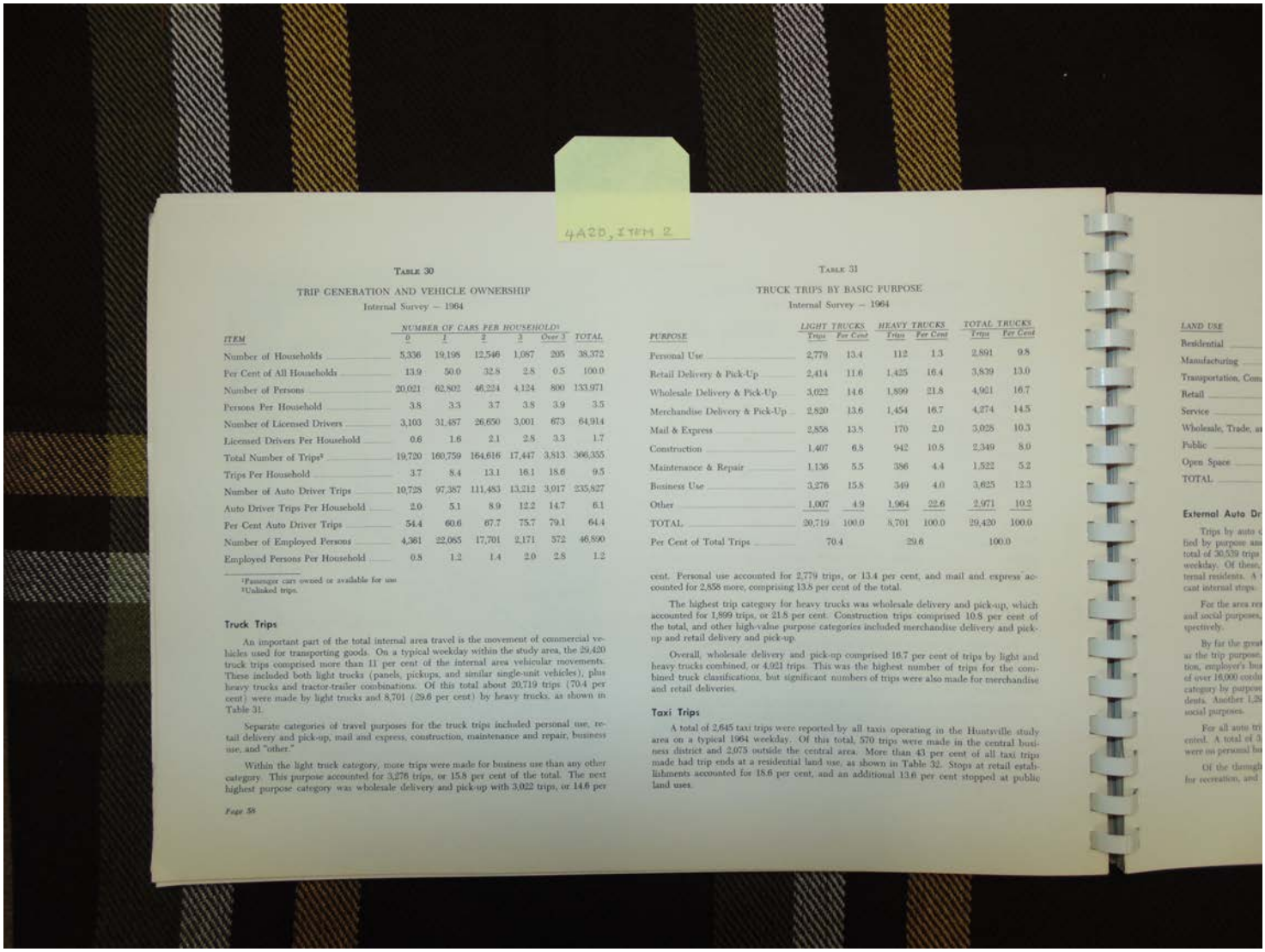


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TABLE 30

TRIP GENERATION AND VEHICLE OWNERSHIP

Internal Survey — 1964

ITEM	NUMBER OF CARS PER HOUSEHOLD[1] 0	1	2	3	Over 3	TOTAL
Number of Households	5,336	19,198	12,546	1,087	205	38,372
Per Cent of All Households	13.9	50.0	32.8	2.8	0.5	100.0
Number of Persons	20,021	62,802	46,224	4,124	800	133,971
Persons Per Household	3.8	3.3	3.7	3.8	3.9	3.5
Number of Licensed Drivers	3,103	31,487	26,650	3,001	673	64,914
Licensed Drivers Per Household	0.6	1.6	2.1	2.8	3.3	1.7
Total Number of Trips[2]	19,720	160,759	164,616	17,447	3,813	366,355
Trips Per Household	3.7	8.4	13.1	16.1	18.6	9.5
Number of Auto Driver Trips	10,728	97,387	111,483	13,212	3,017	235,827
Auto Driver Trips Per Household	2.0	5.1	8.9	12.2	14.7	6.1
Per Cent Auto Driver Trips	54.4	60.6	67.7	75.7	79.1	64.4
Number of Employed Persons	4,361	22,065	17,701	2,171	572	46,890
Employed Persons Per Household	0.8	1.2	1.4	2.0	2.8	1.2

[1]Passenger cars owned or available for use
[2]Unlinked trips.

Truck Trips

An important part of the total internal area travel is the movement of commercial vehicles used for transporting goods. On a typical weekday within the study area, the 29,420 truck trips comprised more than 11 per cent of the internal area vehicular movements. These included both light trucks (panels, pickups, and similar single-unit vehicles), plus heavy trucks and tractor-trailer combinations. Of this total about 20,719 trips (70.4 per cent) were made by light trucks and 8,701 (29.6 per cent) by heavy trucks, as shown in Table 31.

Separate categories of travel purposes for the truck trips included personal use, retail delivery and pick-up, mail and express, construction, maintenance and repair, business use, and "other."

Within the light truck category, more trips were made for business use than any other category. This purpose accounted for 3,276 trips, or 15.8 per cent of the total. The next highest purpose category was wholesale delivery and pick-up with 3,022 trips, or 14.6 per

TABLE 31

TRUCK TRIPS BY BASIC PURPOSE

Internal Survey — 1964

PURPOSE	LIGHT TRUCKS Trips	Per Cent	HEAVY TRUCKS Trips	Per Cent	TOTAL TRUCKS Trips	Per Cent
Personal Use	2,779	13.4	112	1.3	2,891	9.8
Retail Delivery & Pick-Up	2,414	11.6	1,425	16.4	3,839	13.0
Wholesale Delivery & Pick-Up	3,022	14.6	1,899	21.8	4,921	16.7
Merchandise Delivery & Pick-Up	2,820	13.6	1,454	16.7	4,274	14.5
Mail & Express	2,858	13.8	170	2.0	3,028	10.3
Construction	1,407	6.8	942	10.8	2,349	8.0
Maintenance & Repair	1,136	5.5	386	4.4	1,522	5.2
Business Use	3,276	15.8	349	4.0	3,625	12.3
Other	1,007	4.9	1,964	22.6	2,971	10.2
TOTAL	20,719	100.0	8,701	100.0	29,420	100.0
Per Cent of Total Trips	70.4		29.6		100.0	

cent. Personal use accounted for 2,779 trips, or 13.4 per cent, and mail and express accounted for 2,858 more, comprising 13.8 per cent of the total.

The highest trip category for heavy trucks was wholesale delivery and pick-up, which accounted for 1,899 trips, or 21.8 per cent. Construction trips comprised 10.8 per cent of the total, and other high-value purpose categories included merchandise delivery and pick-up and retail delivery and pick-up.

Overall, wholesale delivery and pick-up comprised 16.7 per cent of trips by light and heavy trucks combined, or 4,921 trips. This was the highest number of trips for the combined truck classifications, but significant numbers of trips were also made for merchandise and retail deliveries.

Taxi Trips

A total of 2,645 taxi trips were reported by all taxis operating in the Huntsville study area on a typical 1964 weekday. Of this total, 570 trips were made in the central business district and 2,075 outside the central area. More than 43 per cent of all taxi trips made had trip ends at a residential land use, as shown in Table 32. Stops at retail establishments accounted for 18.6 per cent, and an additional 13.6 per cent stopped at public land uses.

LAND USE

Residential
Manufacturing
Transportation, Com
Retail
Service
Wholesale, Trade, a
Public
Open Space
TOTAL

External Auto Dr

Trips by auto
fied by purpose an
total of 30,539 trips
weekday. Of these,
ternal residents. A
cant internal stops.

For the area re
and social purposes,
spectively.

By far the great
as the trip purpose,
tion, employer's bus
of over 16,000 conf
category by purpose
dents. Another 1,2
social purposes.

For all auto tr
ented. A total of 5
were on personal bu

Of the through
for recreation, and

Names:

Taxi Trips
Trip Generation & Vehicle Ownership
Truck Trips

Places:

Huntsville, AL

Types:

booklet
table

Dates:

1964

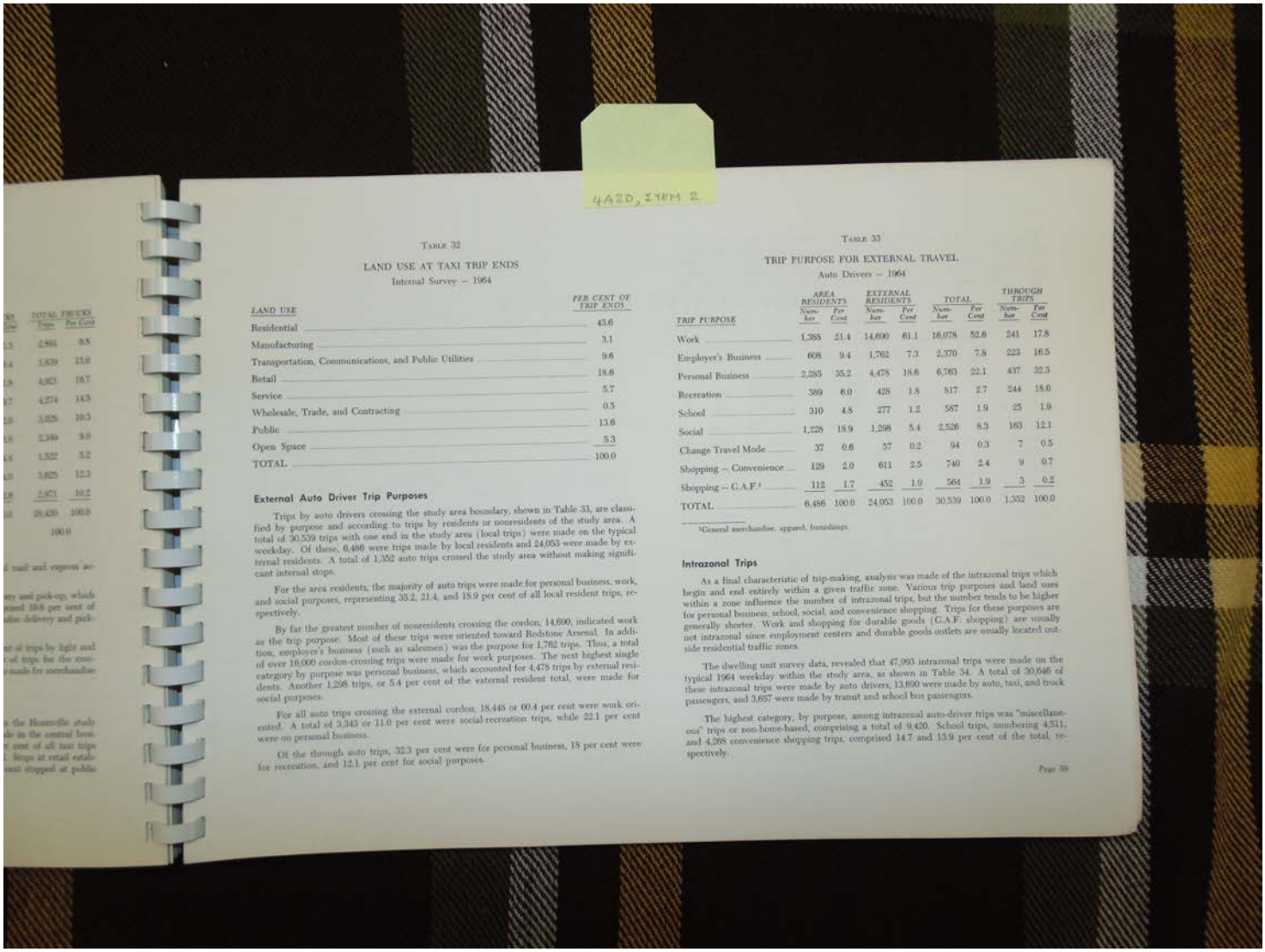

TABLE 32

LAND USE AT TAXI TRIP ENDS
Internal Survey – 1964

LAND USE	PER CENT OF TRIP ENDS
Residential	43.6
Manufacturing	3.1
Transportation, Communications, and Public Utilities	9.6
Retail	18.6
Service	5.7
Wholesale, Trade, and Contracting	0.5
Public	13.6
Open Space	5.3
TOTAL	100.0

External Auto Driver Trip Purposes

Trips by auto drivers crossing the study area boundary, shown in Table 33, are classified by purpose and according to trips by residents or nonresidents of the study area. A total of 30,539 trips with one end in the study area (local trips) were made on the typical weekday. Of these, 6,486 were trips made by local residents and 24,053 were made by external residents. A total of 1,352 auto trips crossed the study area without making significant internal stops.

For the area residents, the majority of auto trips were made for personal business, work, and social purposes, representing 35.2, 21.4, and 18.9 per cent of all local resident trips, respectively.

By far the greatest number of nonresidents crossing the cordon, 14,690, indicated work as the trip purpose. Most of these trips were oriented toward Redstone Arsenal. In addition, employer's business (such as salesmen) was the purpose for 1,762 trips. Thus, a total of over 16,000 cordon-crossing trips were made for work purposes. The next highest single category by purpose was personal business, which accounted for 4,478 trips by external residents. Another 1,298 trips, or 5.4 per cent of the external resident total, were made for social purposes.

For all auto trips crossing the external cordon, 18,445 or 60.4 per cent were work oriented. A total of 3,343 or 11.0 per cent were social-recreation trips, while 22.1 per cent were on personal business.

Of the through auto trips, 32.3 per cent were for personal business, 18 per cent were for recreation, and 12.1 per cent for social purposes.

TABLE 33

TRIP PURPOSE FOR EXTERNAL TRAVEL
Auto Drivers – 1964

TRIP PURPOSE	AREA RESIDENTS Number	AREA RESIDENTS Per Cent	EXTERNAL RESIDENTS Number	EXTERNAL RESIDENTS Per Cent	TOTAL Number	TOTAL Per Cent	THROUGH TRIPS Number	THROUGH TRIPS Per Cent
Work	1,385	21.4	14,690	61.1	16,078	52.6	241	17.8
Employer's Business	608	9.4	1,762	7.3	2,370	7.8	223	16.5
Personal Business	2,285	35.2	4,478	18.6	6,763	22.1	437	32.3
Recreation	389	6.0	428	1.8	817	2.7	244	18.0
School	310	4.8	277	1.2	587	1.9	25	1.9
Social	1,228	18.9	1,298	5.4	2,526	8.3	163	12.1
Change Travel Mode	37	0.6	57	0.2	94	0.3	7	0.5
Shopping – Convenience	129	2.0	611	2.5	740	2.4	9	0.7
Shopping – G.A.F.[1]	112	1.7	452	1.9	564	1.9	3	0.2
TOTAL	6,486	100.0	24,053	100.0	30,539	100.0	1,352	100.0

[1]General merchandise, apparel, furnishings.

Intrazonal Trips

As a final characteristic of trip-making, analysis was made of the intrazonal trips which begin and end entirely within a given traffic zone. Various trip purposes and land uses within a zone influence the number of intrazonal trips, but the number tends to be higher for personal business, school, social, and convenience shopping. Trips for these purposes are generally shorter. Work and shopping for durable goods (G.A.F. shopping) are usually not intrazonal since employment centers and durable goods outlets are usually located outside residential traffic zones.

The dwelling unit survey data, revealed that 47,993 intrazonal trips were made on the typical 1964 weekday within the study area, as shown in Table 34. A total of 30,646 of these intrazonal trips were made by auto drivers, 13,690 were made by auto, taxi, and truck passengers, and 3,657 were made by transit and school bus passengers.

The highest category, by purpose, among intrazonal auto-driver trips was "miscellaneous" trips or non-home-based, comprising a total of 9,420. School trips, numbering 4,511, and 4,268 convenience shopping trips, comprised 14.7 and 13.9 per cent of the total, respectively.

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Names:

External Auto Driver Trip Purposes
Intrazonal Trips Trip Purposes

Places:

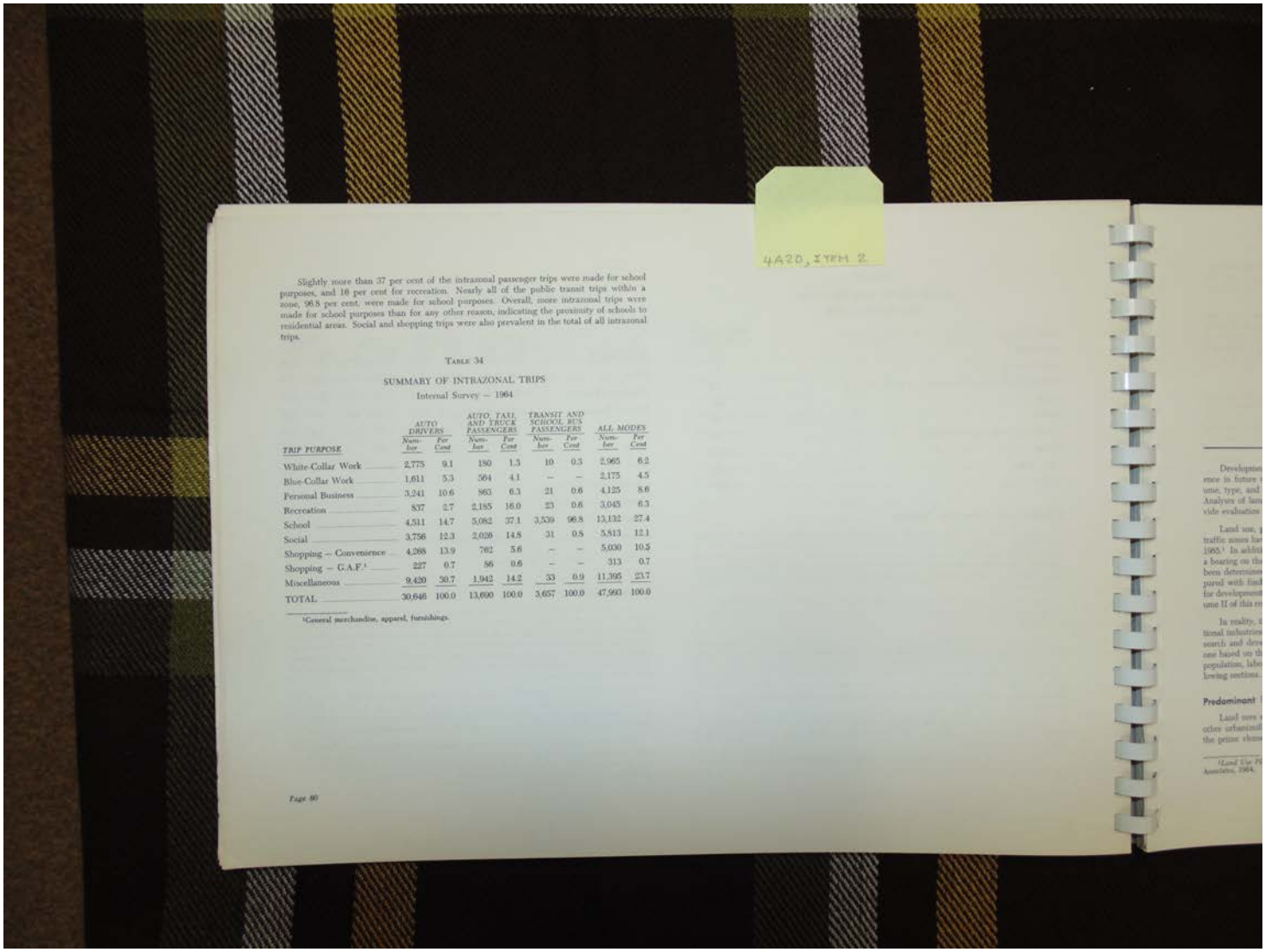
Huntsville, AL

Types:

booklet
table

Dates:

1964



Slightly more than 37 per cent of the intrazonal passenger trips were made for school purposes, and 16 per cent for recreation. Nearly all of the public transit trips within a zone, 96.8 per cent, were made for school purposes. Overall, more intrazonal trips were made for school purposes than for any other reason, indicating the proximity of schools to residential areas. Social and shopping trips were also prevalent in the total of all intrazonal trips.

TABLE 34

SUMMARY OF INTRAZONAL TRIPS

Internal Survey — 1964

TRIP PURPOSE	AUTO DRIVERS		AUTO, TAXI AND TRUCK PASSENGERS		TRANSIT AND SCHOOL BUS PASSENGERS		ALL MODES	
	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent
White-Collar Work	2,775	9.1	180	1.3	10	0.3	2,965	6.2
Blue-Collar Work	1,611	5.3	564	4.1	–	–	2,175	4.5
Personal Business	3,241	10.6	863	6.3	21	0.6	4,125	8.6
Recreation	837	2.7	2,185	16.0	23	0.6	3,045	6.3
School	4,511	14.7	5,082	37.1	3,539	96.8	13,132	27.4
Social	3,756	12.3	2,026	14.8	31	0.8	5,813	12.1
Shopping – Convenience	4,288	13.9	762	5.6	–	–	5,030	10.5
Shopping – G.A.F.[1]	227	0.7	86	0.6	–	–	313	0.7
Miscellaneous	9,420	30.7	1,942	14.2	33	0.9	11,395	23.7
TOTAL	30,646	100.0	13,690	100.0	3,657	100.0	47,993	100.0

[1]General merchandise, apparel, furnishings.

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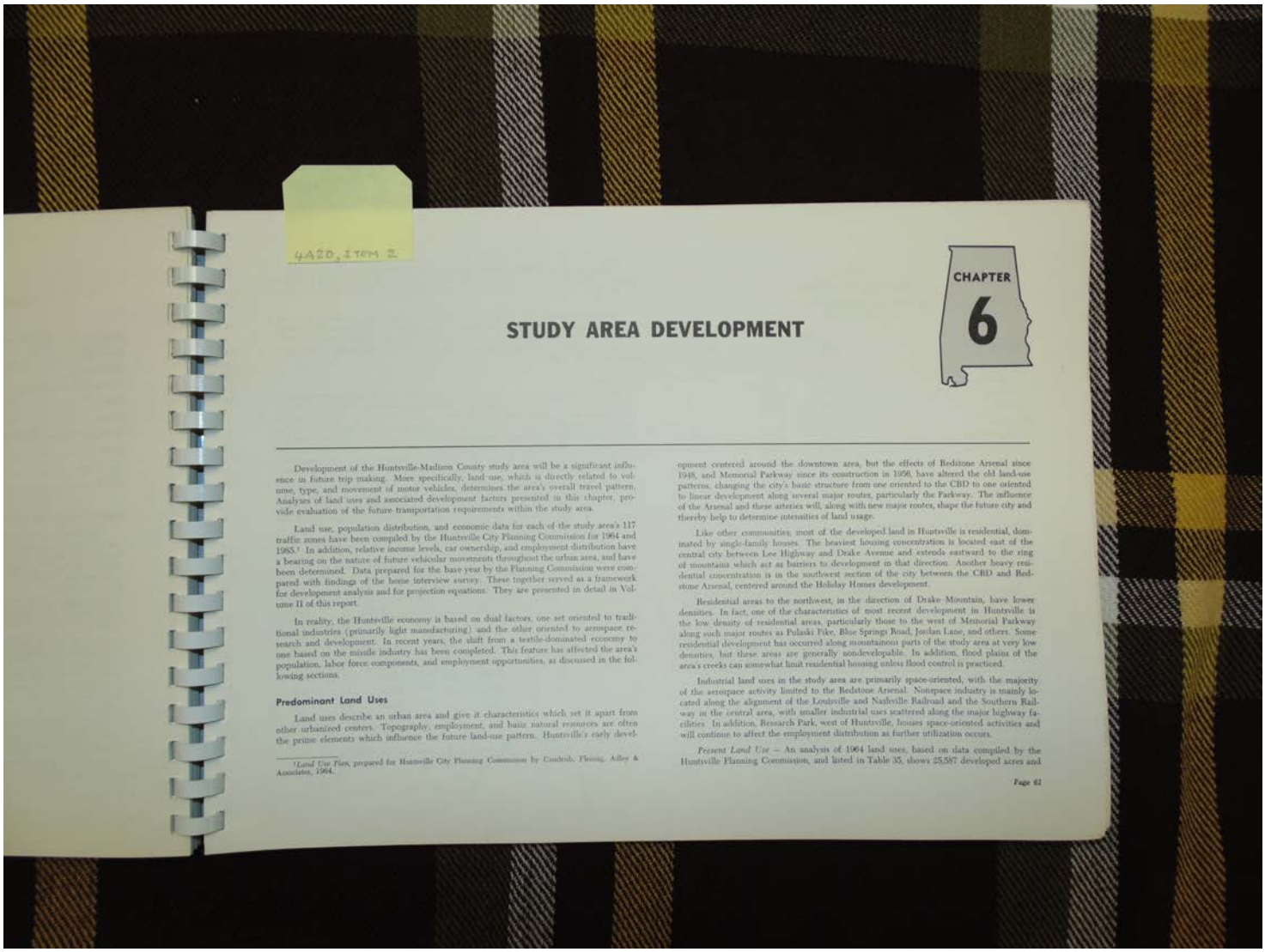
Names:
Intrazonal Trips

Places:
Huntsville, AL

Types:
table

Dates:
1964



Names:
Predominant Land Uses
Study Area Development -
Chapter 6

Places:
Huntsville, AL

Types:
booklet

Dates:
1966

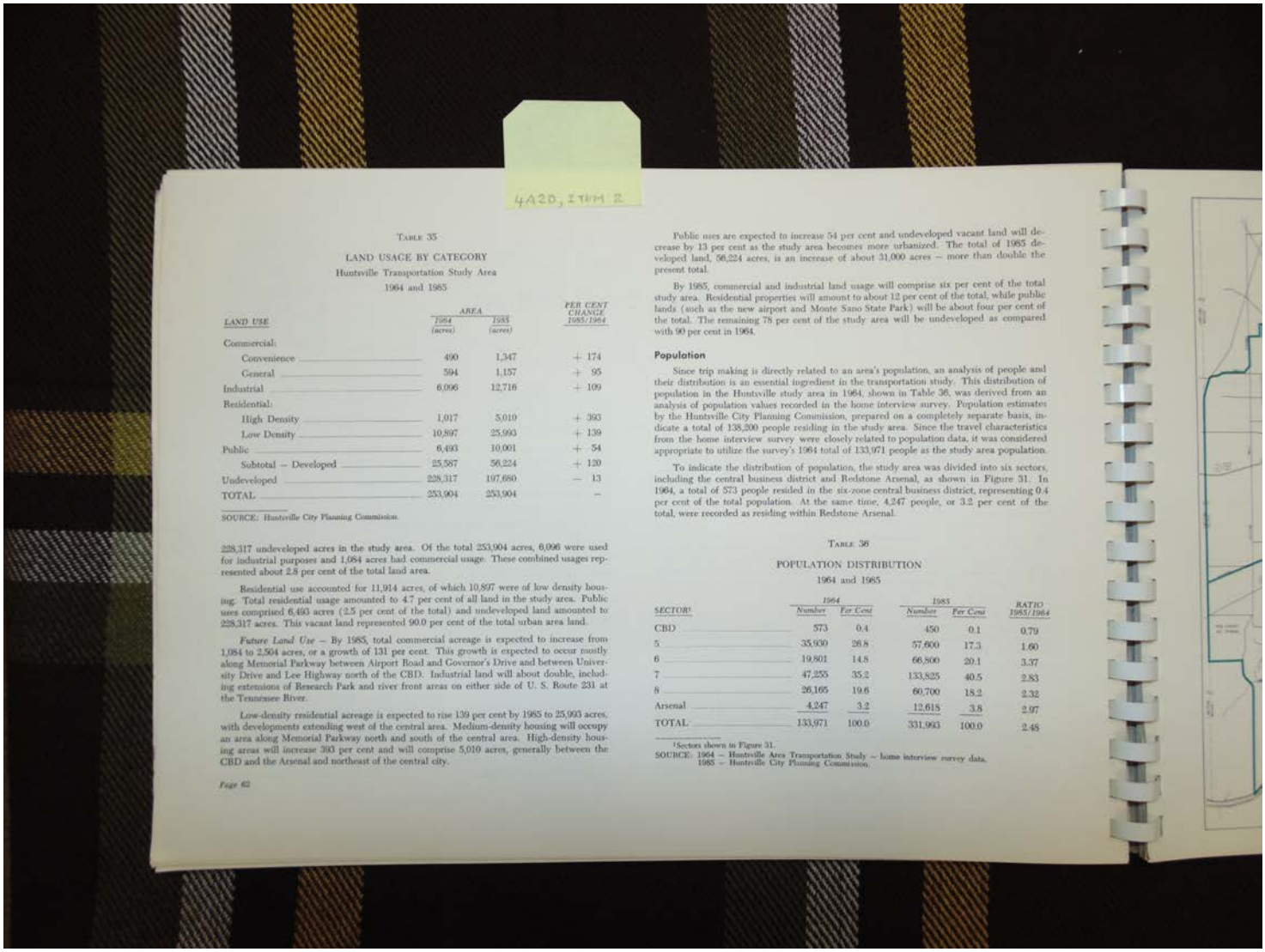


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TABLE 35

LAND USAGE BY CATEGORY
Huntsville Transportation Study Area
1964 and 1985

LAND USE	AREA 1964 (acres)	AREA 1985 (acres)	PER CENT CHANGE 1985/1964
Commercial:			
Convenience	490	1,347	+ 174
General	594	1,157	+ 95
Industrial	6,096	12,716	+ 109
Residential:			
High Density	1,017	5,010	+ 393
Low Density	10,897	25,993	+ 139
Public	6,493	10,001	+ 54
Subtotal – Developed	25,587	56,224	+ 120
Undeveloped	228,317	197,680	– 13
TOTAL	253,904	253,904	–

SOURCE: Huntsville City Planning Commission.

228,317 undeveloped acres in the study area. Of the total 253,904 acres, 6,096 were used for industrial purposes and 1,084 acres had commercial usage. These combined usages represented about 2.8 per cent of the total land area.

Residential use accounted for 11,914 acres, of which 10,897 were of low density housing. Total residential usage amounted to 4.7 per cent of all land in the study area. Public uses comprised 6,493 acres (2.5 per cent of the total) and undeveloped land amounted to 228,317 acres. This vacant land represented 90.0 per cent of the total urban area land.

Future Land Use – By 1985, total commercial acreage is expected to increase from 1,084 to 2,504 acres, or a growth of 131 per cent. This growth is expected to occur mostly along Memorial Parkway between Airport Road and Governor's Drive and between University Drive and Lee Highway north of the CBD. Industrial land will about double, including extensions of Research Park and river front areas on either side of U. S. Route 231 at the Tennessee River.

Low-density residential acreage is expected to rise 139 per cent by 1985 to 25,993 acres, with developments extending west of the central area. Medium-density housing will occupy an area along Memorial Parkway north and south of the central area. High-density housing areas will increase 393 per cent and will comprise 5,010 acres, generally between the CBD and the Arsenal and northeast of the central city.

Page 62

Public uses are expected to increase 54 per cent and undeveloped vacant land will decrease by 13 per cent as the study area becomes more urbanized. The total of 1985 developed land, 56,224 acres, is an increase of about 31,000 acres – more than double the present total.

By 1985, commercial and industrial land usage will comprise six per cent of the total study area. Residential properties will amount to about 12 per cent of the total, while public lands (such as the new airport and Monte Sano State Park) will be about four per cent of the total. The remaining 78 per cent of the study area will be undeveloped as compared with 90 per cent in 1964.

Population

Since trip making is directly related to an area's population, an analysis of people and their distribution is an essential ingredient in the transportation study. This distribution of population in the Huntsville study area in 1964, shown in Table 36, was derived from an analysis of population values recorded in the home interview survey. Population estimates by the Huntsville City Planning Commission, prepared on a completely separate basis, indicate a total of 138,200 people residing in the study area. Since the travel characteristics from the home interview survey were closely related to population data, it was considered appropriate to utilize the survey's 1964 total of 133,971 people as the study area population.

To indicate the distribution of population, the study area was divided into six sectors, including the central business district and Redstone Arsenal, as shown in Figure 31. In 1964, a total of 573 people resided in the six-zone central business district, representing 0.4 per cent of the total population. At the same time, 4,247 people, or 3.2 per cent of the total, were recorded as residing within Redstone Arsenal.

TABLE 36

POPULATION DISTRIBUTION
1964 and 1985

SECTOR[1]	1964 Number	1964 Per Cent	1985 Number	1985 Per Cent	RATIO 1985/1964
CBD	573	0.4	450	0.1	0.79
5	35,930	26.8	57,600	17.3	1.60
6	19,801	14.8	66,800	20.1	3.37
7	47,255	35.2	133,525	40.5	2.83
8	26,165	19.6	60,700	18.2	2.32
Arsenal	4,247	3.2	12,618	3.8	2.97
TOTAL	133,971	100.0	331,993	100.0	2.48

[1]Sectors shown in Figure 31.
SOURCE: 1964 – Huntsville Area Transportation Study – home interview survey data.
1985 – Huntsville City Planning Commission.

Names:

Land Uses
Population
Population
Distribution

Places:

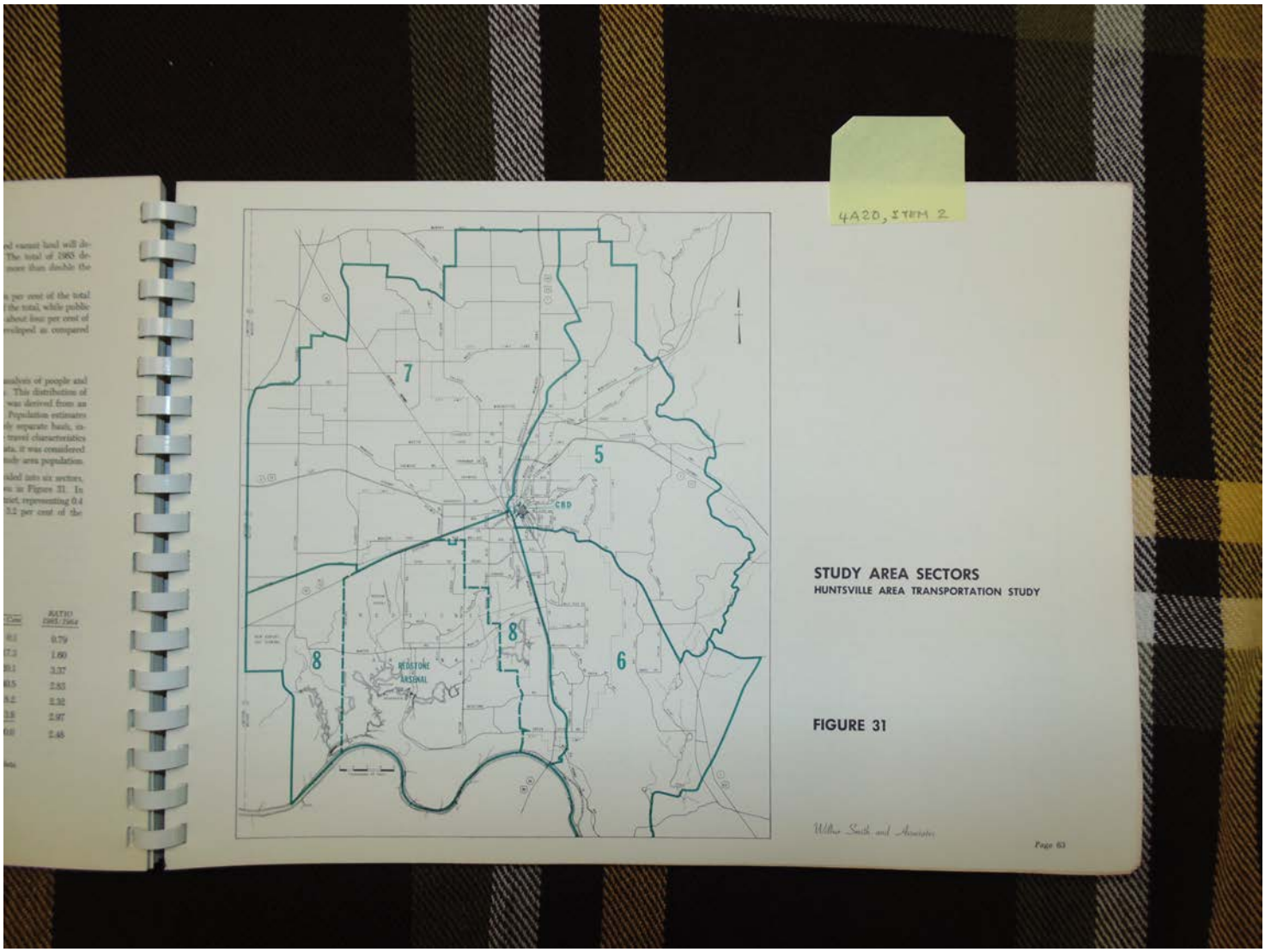
Huntsville, AL

Types:

booklet
table

Dates:

1964-1965
1966

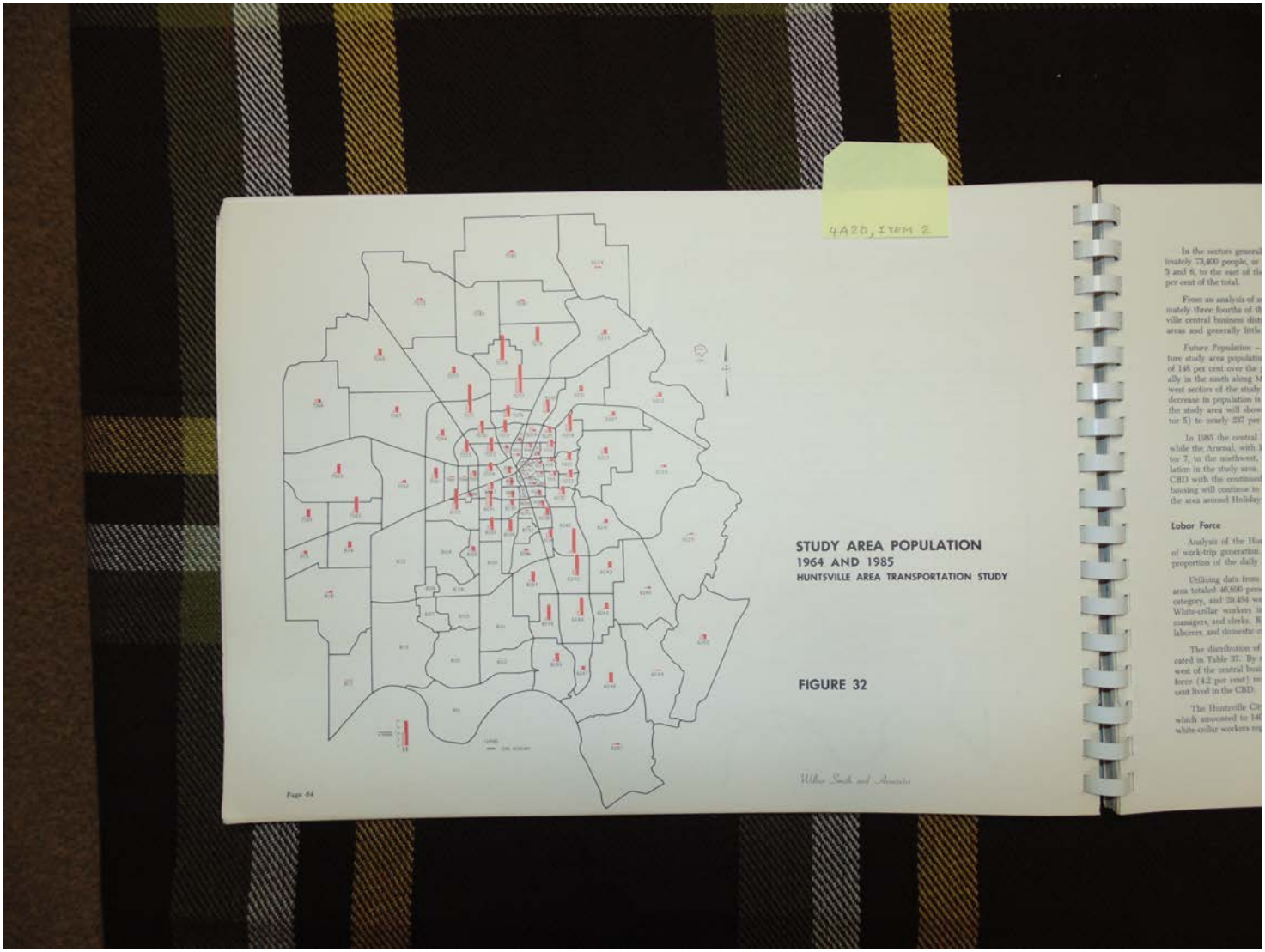


Names:
Study Area Sectors

Places:
Huntsville, AL

Types:
map

Dates:
1966

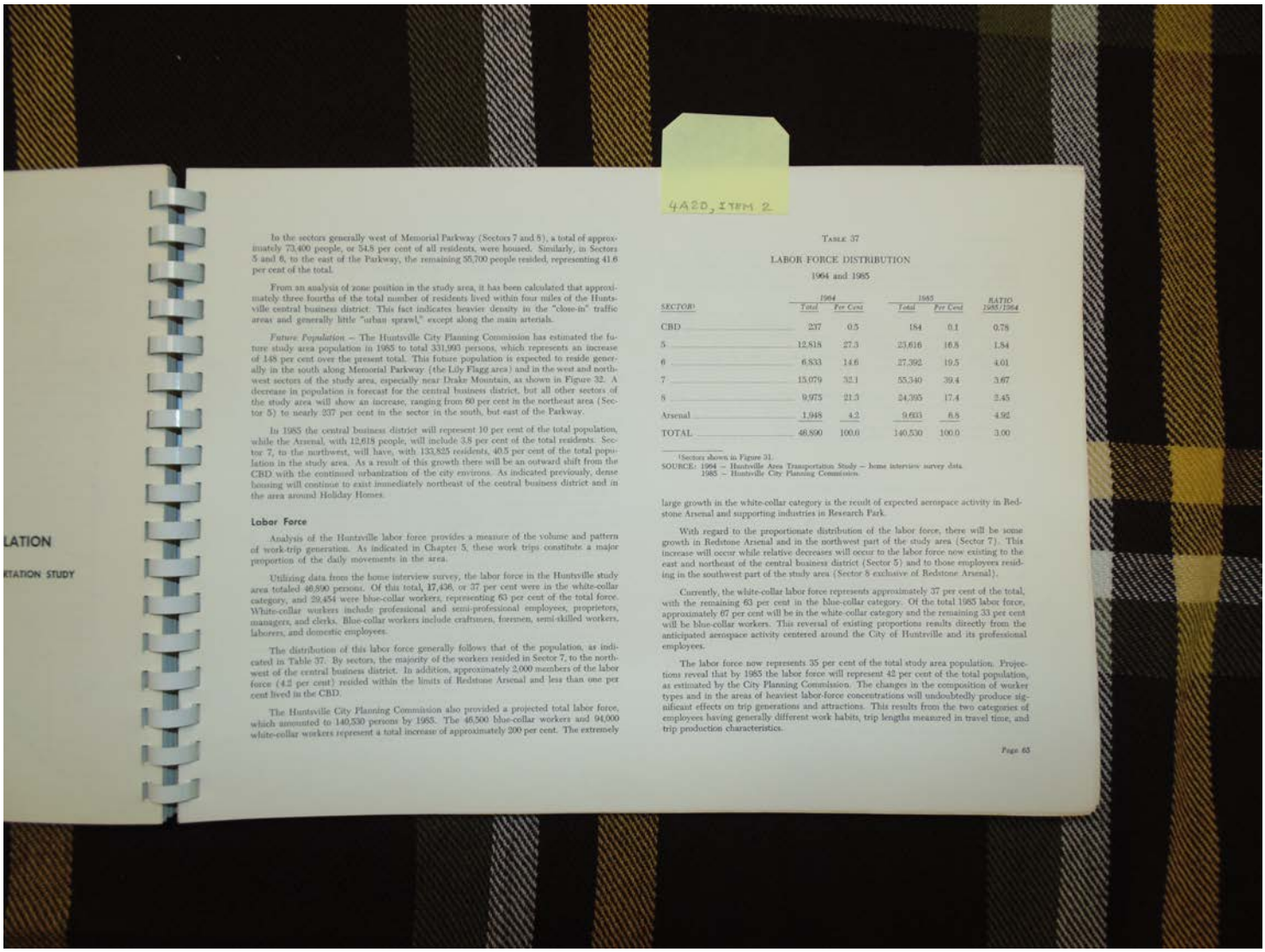


Names:
Study Area
Population

Places:
Huntsville, AL

Types:
illustration

Dates:
1964-1965



4A20, ITEM 2

In the sectors generally west of Memorial Parkway (Sectors 7 and 8), a total of approximately 73,400 people, or 54.8 per cent of all residents, were housed. Similarly, in Sectors 5 and 6, to the east of the Parkway, the remaining 55,700 people resided, representing 41.6 per cent of the total.

From an analysis of zone position in the study area, it has been calculated that approximately three fourths of the total number of residents lived within four miles of the Huntsville central business district. This fact indicates heavier density in the "close-in" traffic areas and generally little "urban sprawl," except along the main arterials.

Future Population – The Huntsville City Planning Commission has estimated the future study area population in 1985 to total 331,993 persons, which represents an increase of 148 per cent over the present total. This future population is expected to reside generally in the south along Memorial Parkway (the Lily Flagg area) and in the west and northwest sectors of the study area, especially near Drake Mountain, as shown in Figure 32. A decrease in population is forecast for the central business district, but all other sectors of the study area will show an increase, ranging from 60 per cent in the northeast area (Sector 5) to nearly 237 per cent in the sector in the south, but east of the Parkway.

In 1985 the central business district will represent 10 per cent of the total population, while the Arsenal, with 12,618 people, will include 3.8 per cent of the total residents. Sector 7, to the northwest, will have, with 133,825 residents, 40.5 per cent of the total population in the study area. As a result of this growth there will be an outward shift from the CBD with the continued urbanization of the city environs. As indicated previously, dense housing will continue to exist immediately northeast of the central business district and in the area around Holiday Homes.

Labor Force

Analysis of the Huntsville labor force provides a measure of the volume and pattern of work-trip generation. As indicated in Chapter 5, these work trips constitute a major proportion of the daily movements in the area.

Utilizing data from the home interview survey, the labor force in the Huntsville study area totaled 46,890 persons. Of this total, 17,436, or 37 per cent were in the white-collar category, and 29,454 were blue-collar workers, representing 63 per cent of the total force. White-collar workers include professional and semi-professional employees, proprietors, managers, and clerks. Blue-collar workers include craftsmen, foremen, semi-skilled workers, laborers, and domestic employees.

The distribution of this labor force generally follows that of the population, as indicated in Table 37. By sectors, the majority of the workers resided in Sector 7, to the northwest of the central business district. In addition, approximately 2,000 members of the labor force (4.2 per cent) resided within the limits of Redstone Arsenal and less than one per cent lived in the CBD.

The Huntsville City Planning Commission also provided a projected total labor force, which amounted to 140,530 persons by 1985. The 46,500 blue-collar workers and 94,000 white-collar workers represent a total increase of approximately 200 per cent. The extremely

TABLE 37

LABOR FORCE DISTRIBUTION

1964 and 1985

SECTOR[1]	1964 Total	1964 Per Cent	1985 Total	1985 Per Cent	RATIO 1985/1964
CBD	237	0.5	184	0.1	0.78
5	12,818	27.3	23,616	16.8	1.84
6	6,833	14.6	27,392	19.5	4.01
7	15,079	32.1	55,340	39.4	3.67
8	9,975	21.3	24,395	17.4	2.45
Arsenal	1,948	4.2	9,603	6.8	4.92
TOTAL	46,890	100.0	140,530	100.0	3.00

[1]Sectors shown in Figure 31.
SOURCE: 1964 – Huntsville Area Transportation Study – home interview survey data.
1985 – Huntsville City Planning Commission.

large growth in the white-collar category is the result of expected aerospace activity in Redstone Arsenal and supporting industries in Research Park.

With regard to the proportionate distribution of the labor force, there will be some growth in Redstone Arsenal and in the northwest part of the study area (Sector 7). This increase will occur while relative decreases will occur to the labor force now existing to the east and northeast of the central business district (Sector 5) and to those employees residing in the southwest part of the study area (Sector 8 exclusive of Redstone Arsenal).

Currently, the white-collar labor force represents approximately 37 per cent of the total, with the remaining 63 per cent in the blue-collar category. Of the total 1985 labor force, approximately 67 per cent will be in the white-collar category and the remaining 33 per cent will be blue-collar workers. This reversal of existing proportions results directly from the anticipated aerospace activity centered around the City of Huntsville and its professional employees.

The labor force now represents 35 per cent of the total study area population. Projections reveal that by 1985 the labor force will represent 42 per cent of the total population, as estimated by the City Planning Commission. The changes in the composition of worker types and in the areas of heaviest labor-force concentrations will undoubtedly produce significant effects on trip generations and attractions. This results from the two categories of employees having generally different work habits, trip lengths measured in travel time, and trip production characteristics.

Page 65

Names:

Labor Force
Labor Force Distribution

Places:

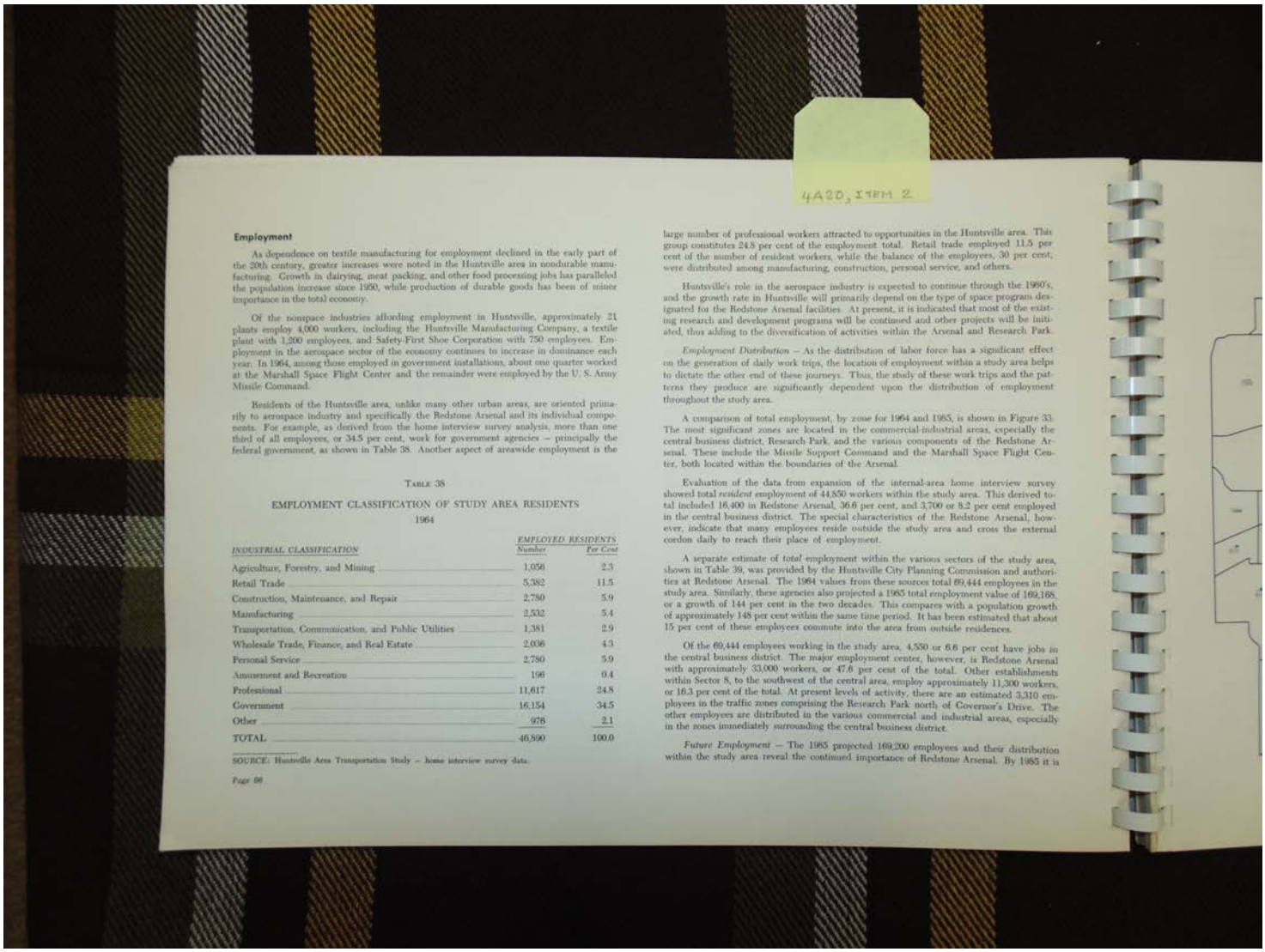
Huntsville, AL

Types:

booklet
table

Dates:

1964-1965



4A20, ITEM 2

Employment

As dependence on textile manufacturing for employment declined in the early part of the 20th century, greater increases were noted in the Huntsville area in nondurable manufacturing. Growth in dairying, meat packing, and other food processing jobs has paralleled the population increase since 1950, while production of durable goods has been of minor importance in the total economy.

Of the nonspace industries affording employment in Huntsville, approximately 21 plants employ 4,000 workers, including the Huntsville Manufacturing Company, a textile plant with 1,200 employees, and Safety-First Shoe Corporation with 750 employees. Employment in the aerospace sector of the economy continues to increase in dominance each year. In 1964, among those employed in government installations, about one quarter worked at the Marshall Space Flight Center and the remainder were employed by the U. S. Army Missile Command.

Residents of the Huntsville area, unlike many other urban areas, are oriented primarily to aerospace industry and specifically the Redstone Arsenal and its individual components. For example, as derived from the home interview survey analysis, more than one third of all employees, or 34.5 per cent, work for government agencies – principally the federal government, as shown in Table 38. Another aspect of areawide employment is the large number of professional workers attracted to opportunities in the Huntsville area. This group constitutes 24.8 per cent of the employment total. Retail trade employed 11.5 per cent of the number of resident workers, while the balance of the employees, 30 per cent, were distributed among manufacturing, construction, personal service, and others.

TABLE 38

EMPLOYMENT CLASSIFICATION OF STUDY AREA RESIDENTS
1964

INDUSTRIAL CLASSIFICATION	EMPLOYED RESIDENTS Number	Per Cent
Agriculture, Forestry, and Mining	1,056	2.3
Retail Trade	5,382	11.5
Construction, Maintenance, and Repair	2,780	5.9
Manufacturing	2,532	5.4
Transportation, Communication, and Public Utilities	1,381	2.9
Wholesale Trade, Finance, and Real Estate	2,036	4.3
Personal Service	2,780	5.9
Amusement and Recreation	196	0.4
Professional	11,617	24.8
Government	16,154	34.5
Other	976	2.1
TOTAL	46,890	100.0

SOURCE: Huntsville Area Transportation Study – home interview survey data.

Page 66

Huntsville's role in the aerospace industry is expected to continue through the 1980's, and the growth rate in Huntsville will primarily depend on the type of space program designated for the Redstone Arsenal facilities. At present, it is indicated that most of the existing research and development programs will be continued and other projects will be initiated, thus adding to the diversification of activities within the Arsenal and Research Park.

Employment Distribution – As the distribution of labor force has a significant effect on the generation of daily work trips, the location of employment within a study area helps to dictate the other end of these journeys. Thus, the study of these work trips and the patterns they produce are significantly dependent upon the distribution of employment throughout the study area.

A comparison of total employment, by zone for 1964 and 1985, is shown in Figure 33. The most significant zones are located in the commercial-industrial areas, especially the central business district, Research Park, and the various components of the Redstone Arsenal. These include the Missile Support Command and the Marshall Space Flight Center, both located within the boundaries of the Arsenal.

Evaluation of the data from expansion of the internal-area home interview survey showed total *resident* employment of 44,850 workers within the study area. This derived total included 16,400 in Redstone Arsenal, 36.6 per cent, and 3,700 or 8.2 per cent employed in the central business district. The special characteristics of the Redstone Arsenal, however, indicate that many employees reside outside the study area and cross the external cordon daily to reach their place of employment.

A separate estimate of *total* employment within the various sectors of the study area, shown in Table 39, was provided by the Huntsville City Planning Commission and authorities at Redstone Arsenal. The 1964 values from these sources total 69,444 employees in the study area. Similarly, these agencies also projected a 1985 total employment value of 169,168, or a growth of 144 per cent in the two decades. This compares with a population growth of approximately 148 per cent within the same time period. It has been estimated that about 15 per cent of these employees commute into the area from outside residences.

Of the 69,444 employees working in the study area, 4,550 or 6.6 per cent have jobs in the central business district. The major employment center, however, is Redstone Arsenal with approximately 33,000 workers, or 47.6 per cent of the total. Other establishments within Sector 8, to the southwest of the central area, employ approximately 11,300 workers, or 16.3 per cent of the total. At present levels of activity, there are an estimated 3,310 employees in the traffic zones comprising the Research Park north of Governor's Drive. The other employees are distributed in the various commercial and industrial areas, especially in the zones immediately surrounding the central business district.

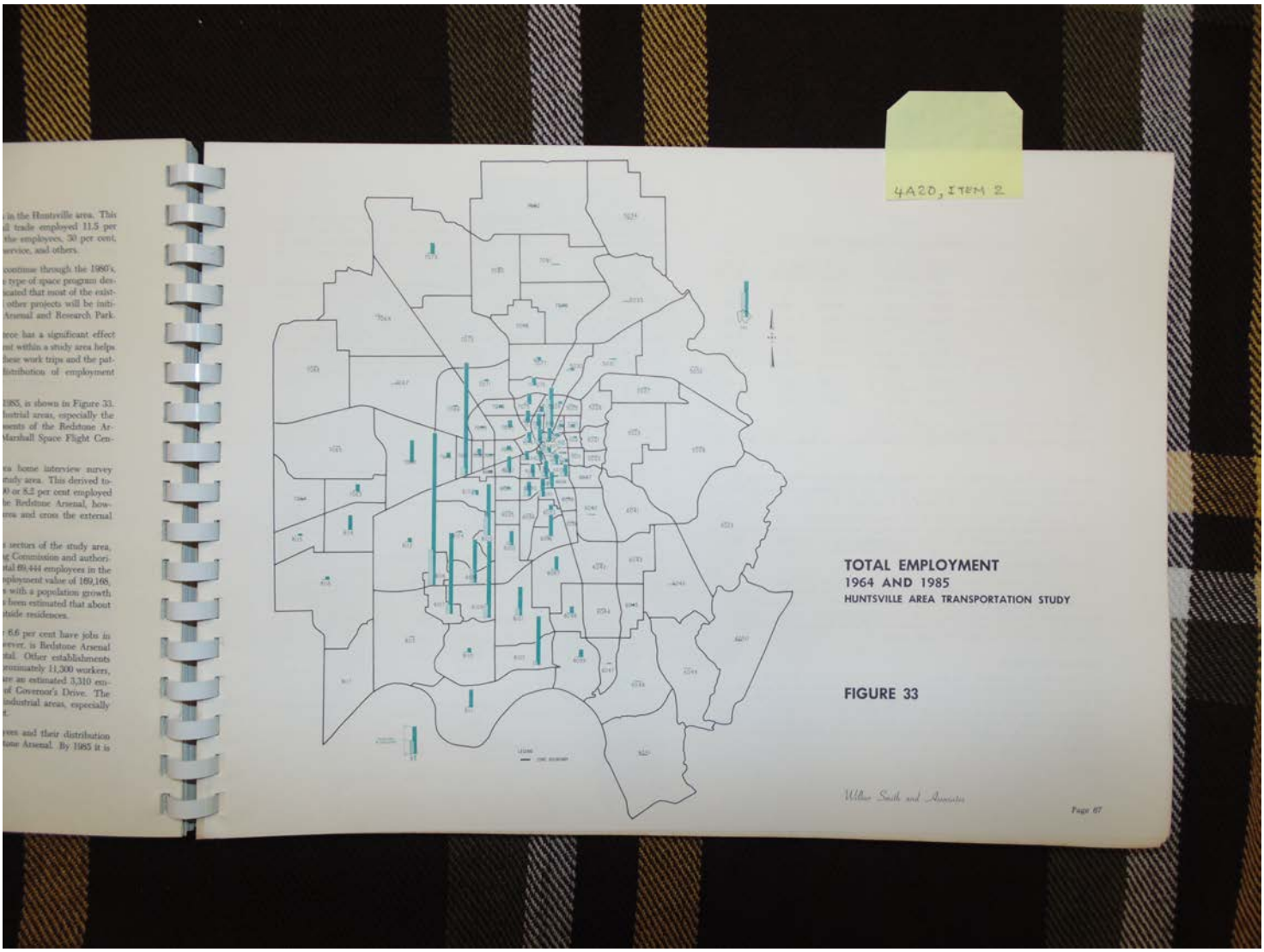
Future Employment – The 1985 projected 169,200 employees and their distribution within the study area reveal the continued importance of Redstone Arsenal. By 1985 it is

Names:
Employment

Places:
Huntsville, AL

Types:
booklet table

Dates:
1964



Names:
Total Employment

Places:
Huntsville, AL area

Types:
illustration

Dates:
1964 1985

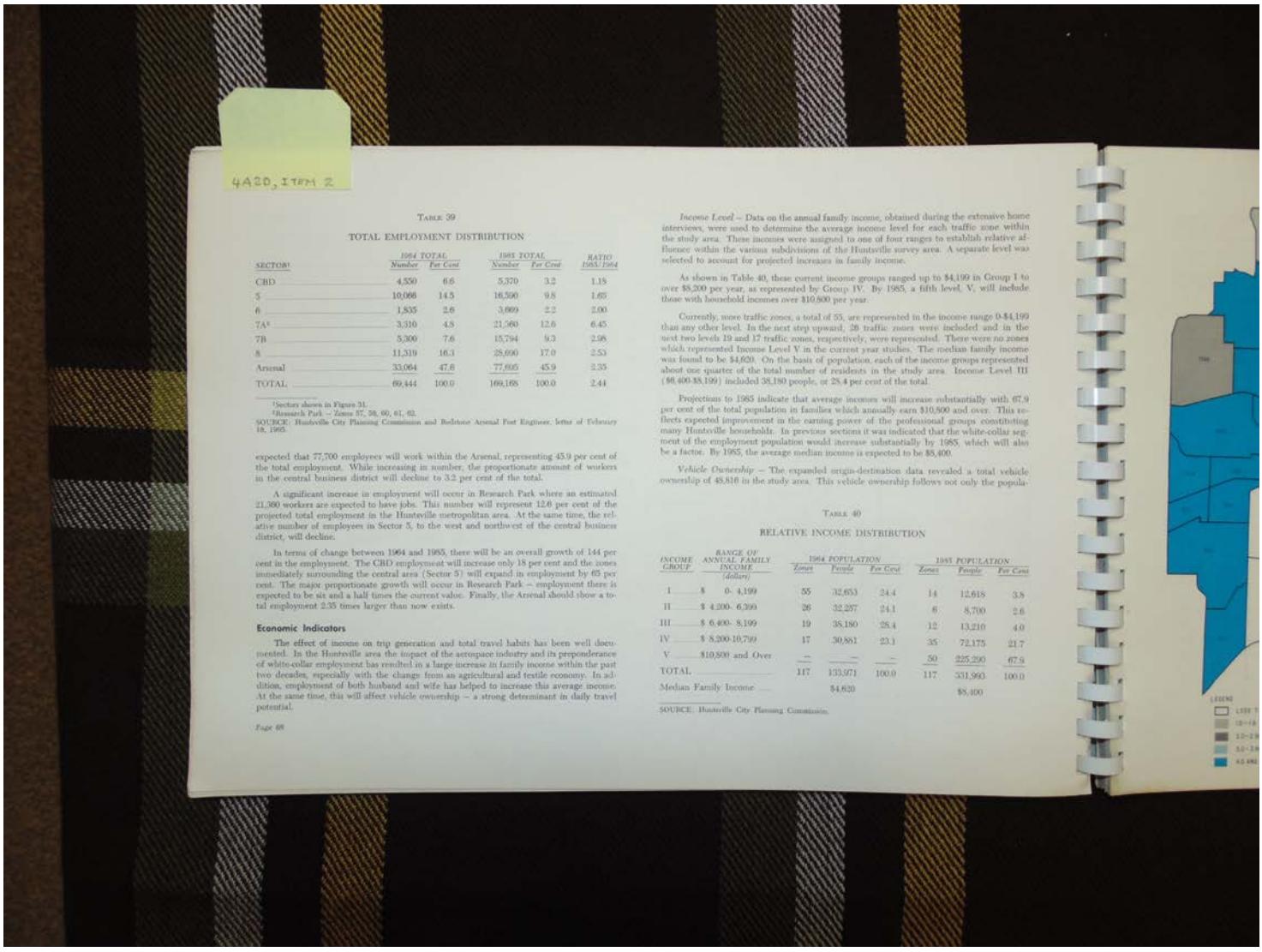


TABLE 39

TOTAL EMPLOYMENT DISTRIBUTION

SECTOR[1]	1964 TOTAL Number	1964 TOTAL Per Cent	1985 TOTAL Number	1985 TOTAL Per Cent	RATIO 1985/1964
CBD	4,550	6.6	5,370	3.2	1.18
5	10,066	14.5	16,590	9.8	1.65
6	1,835	2.6	3,669	2.2	2.00
7A[2]	3,310	4.8	21,360	12.6	6.45
7B	5,309	7.6	15,794	9.3	2.98
8	11,319	16.3	28,690	17.0	2.53
Arsenal	33,064	47.6	77,695	45.9	2.35
TOTAL	69,444	100.0	169,168	100.0	2.44

[1]Sectors shown in Figure 31.
[2]Research Park -- Zones 57, 58, 60, 61, 62.
SOURCE: Huntsville City Planning Commission and Redstone Arsenal Post Engineer, letter of February 18, 1965.

expected that 77,700 employees will work within the Arsenal, representing 45.9 per cent of the total employment. While increasing in number, the proportionate amount of workers in the central business district will decline to 3.2 per cent of the total.

A significant increase in employment will occur in Research Park where an estimated 21,360 workers are expected to have jobs. This number will represent 12.6 per cent of the projected total employment in the Huntsville metropolitan area. At the same time, the relative number of employees in Sector 5, to the west and northwest of the central business district, will decline.

In terms of change between 1964 and 1985, there will be an overall growth of 144 per cent in the employment. The CBD employment will increase only 18 per cent and the zones immediately surrounding the central area (Sector 5) will expand in employment by 65 per cent. The major proportionate growth will occur in Research Park -- employment there is expected to be six and a half times the current value. Finally, the Arsenal should show a total employment 2.35 times larger than now exists.

Economic Indicators

The effect of income on trip generation and total travel habits has been well documented. In the Huntsville area the impact of the aerospace industry and its preponderance of white-collar employment has resulted in a large increase in family income within the past two decades, especially with the change from an agricultural and textile economy. In addition, employment of both husband and wife has helped to increase this average income. At the same time, this will affect vehicle ownership -- a strong determinant in daily travel potential.

Income Level -- Data on the annual family income, obtained during the extensive home interviews, were used to determine the average income level for each traffic zone within the study area. These incomes were assigned to one of four ranges to establish relative affluence within the various subdivisions of the Huntsville survey area. A separate level was selected to account for projected increases in family income.

As shown in Table 40, these current income groups ranged up to $4,199 in Group I to over $8,200 per year, as represented by Group IV. By 1985, a fifth level, V, will include those with household incomes over $10,800 per year.

Currently, more traffic zones, a total of 55, are represented in the income range 0-$4,199 than any other level. In the next step upward, 26 traffic zones were included and in the next two levels 19 and 17 traffic zones, respectively, were represented. There were no zones which represented Income Level V in the current year studies. The median family income was found to be $4,620. On the basis of population, each of the income groups represented about one quarter of the total number of residents in the study area. Income Level III ($6,400-$8,199) included 38,180 people, or 28.4 per cent of the total.

Projections to 1985 indicate that average incomes will increase substantially with 67.9 per cent of the total population in families which annually earn $10,800 and over. This reflects expected improvement in the earning power of the professional groups constituting many Huntsville households. In previous sections it was indicated that the white-collar segment of the employment population would increase substantially by 1985, which will also be a factor. By 1985, the average median income is expected to be $8,400.

Vehicle Ownership -- The expanded origin-destination data revealed a total vehicle ownership of 48,816 in the study area. This vehicle ownership follows not only the popula-

TABLE 40

RELATIVE INCOME DISTRIBUTION

INCOME GROUP	RANGE OF ANNUAL FAMILY INCOME (dollars)	1964 POPULATION Zones	1964 POPULATION People	1964 POPULATION Per Cent	1985 POPULATION Zones	1985 POPULATION People	1985 POPULATION Per Cent
I	$ 0- 4,199	55	32,653	24.4	14	12,618	3.8
II	$ 4,200- 6,399	26	32,257	24.1	6	8,700	2.6
III	$ 6,400- 8,199	19	38,180	28.4	12	13,210	4.0
IV	$ 8,200-10,799	17	30,881	23.1	35	72,175	21.7
V	$10,800 and Over	--	--	--	50	225,290	67.9
TOTAL		117	133,971	100.0	117	331,993	100.0
Median Family Income			$4,620			$8,400	

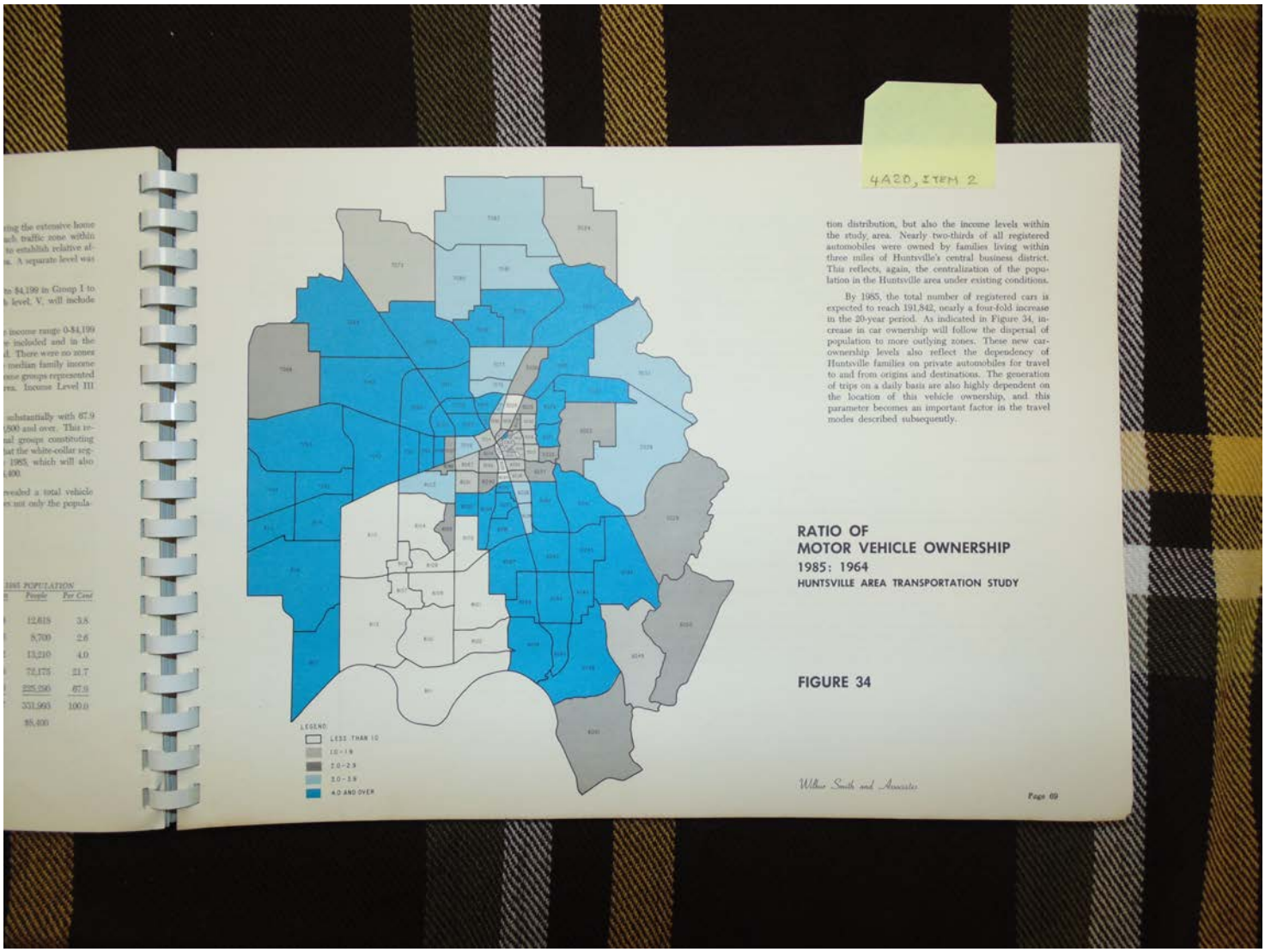
SOURCE: Huntsville City Planning Commission.

Names:
Economic Indicators
Income Distribution
Total Employment Distribution

Places:
Huntsville, AL

Types:
booklet
table

Dates:
1966

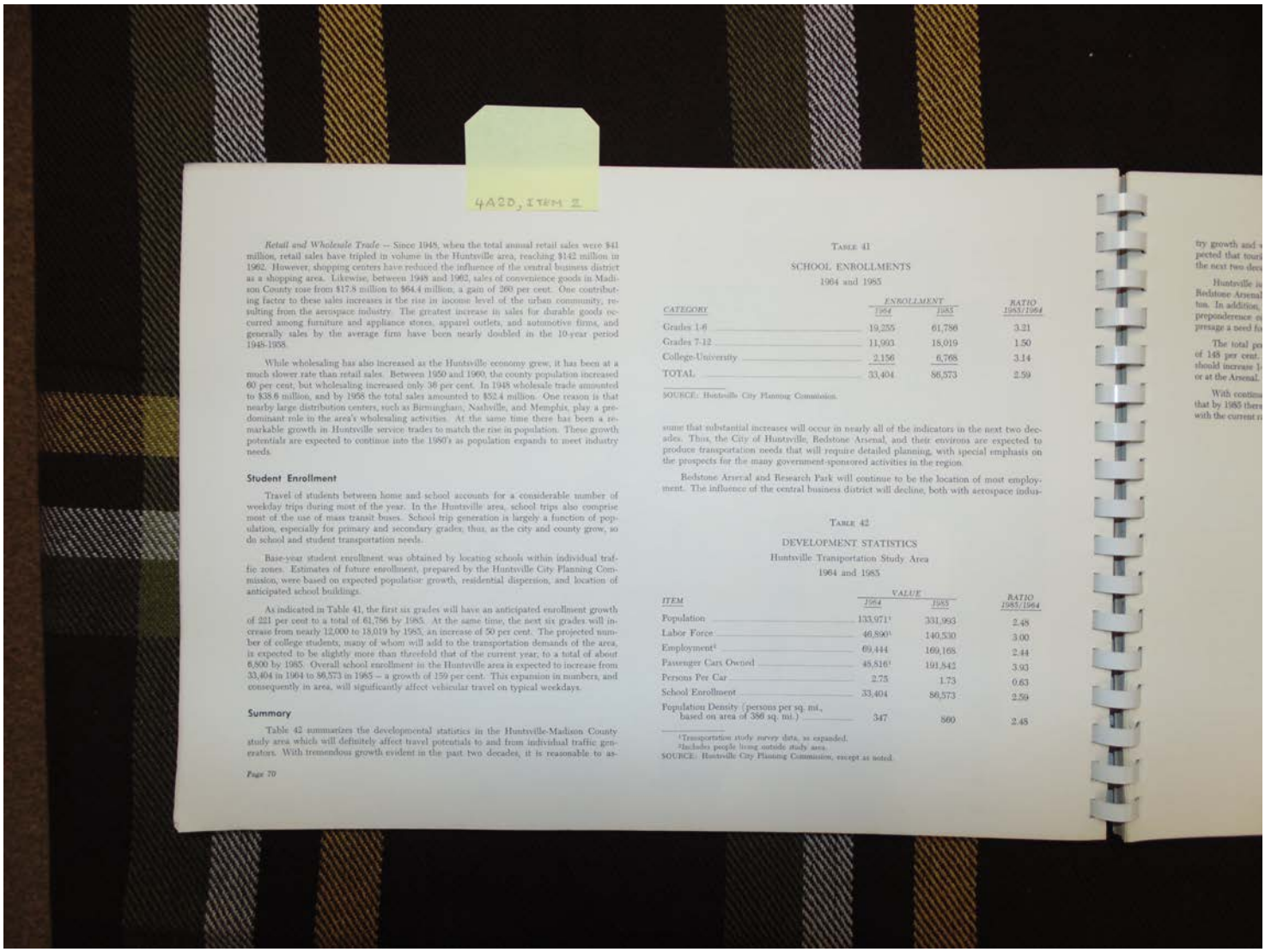


Names:
Motor Vehicle
Ownership

Places:
Huntsville, AL area

Types:
illustration

Dates:
1985 1964



4A2D, ITEM 2

Retail and Wholesale Trade -- Since 1948, when the total annual retail sales were $41 million, retail sales have tripled in volume in the Huntsville area, reaching $142 million in 1962. However, shopping centers have reduced the influence of the central business district as a shopping area. Likewise, between 1948 and 1962, sales of convenience goods in Madison County rose from $17.8 million to $64.4 million, a gain of 260 per cent. One contributing factor to these sales increases is the rise in income level of the urban community, resulting from the aerospace industry. The greatest increase in sales for durable goods occurred among furniture and appliance stores, apparel outlets, and automotive firms, and generally sales by the average firm have been nearly doubled in the 10-year period 1948-1958.

While wholesaling has also increased as the Huntsville economy grew, it has been at a much slower rate than retail sales. Between 1950 and 1960, the county population increased 60 per cent, but wholesaling increased only 36 per cent. In 1948 wholesale trade amounted to $38.6 million, and by 1958 the total sales amounted to $52.4 million. One reason is that nearby large distribution centers, such as Birmingham, Nashville, and Memphis, play a predominant role in the area's wholesaling activities. At the same time there has been a remarkable growth in Huntsville service trades to match the rise in population. These growth potentials are expected to continue into the 1980's as population expands to meet industry needs.

Student Enrollment

Travel of students between home and school accounts for a considerable number of weekday trips during most of the year. In the Huntsville area, school trips also comprise most of the use of mass transit buses. School trip generation is largely a function of population, especially for primary and secondary grades; thus, as the city and county grow, so do school and student transportation needs.

Base-year student enrollment was obtained by locating schools within individual traffic zones. Estimates of future enrollment, prepared by the Huntsville City Planning Commission, were based on expected population growth, residential dispersion, and location of anticipated school buildings.

As indicated in Table 41, the first six grades will have an anticipated enrollment growth of 221 per cent to a total of 61,786 by 1985. At the same time, the next six grades will increase from nearly 12,000 to 18,019 by 1965, an increase of 50 per cent. The projected number of college students, many of whom will add to the transportation demands of the area, is expected to be slightly more than threefold that of the current year, to a total of about 6,800 by 1985. Overall school enrollment in the Huntsville area is expected to increase from 33,404 in 1964 to 86,573 in 1985 -- a growth of 159 per cent. This expansion in numbers, and consequently in area, will significantly affect vehicular travel on typical weekdays.

Summary

Table 42 summarizes the developmental statistics in the Huntsville-Madison County study area which will definitely affect travel potentials to and from individual traffic generators. With tremendous growth evident in the past two decades, it is reasonable to assume that substantial increases will occur in nearly all of the indicators in the next two decades. Thus, the City of Huntsville, Redstone Arsenal, and their environs are expected to produce transportation needs that will require detailed planning, with special emphasis on the prospects for the many government-sponsored activities in the region.

Redstone Arsenal and Research Park will continue to be the location of most employment. The influence of the central business district will decline, both with aerospace indus-

TABLE 41

SCHOOL ENROLLMENTS
1964 and 1985

CATEGORY	ENROLLMENT 1964	ENROLLMENT 1985	RATIO 1985/1964
Grades 1-6	19,255	61,786	3.21
Grades 7-12	11,993	18,019	1.50
College-University	2,156	6,768	3.14
TOTAL	33,404	86,573	2.59

SOURCE: Huntsville City Planning Commission.

TABLE 42

DEVELOPMENT STATISTICS
Huntsville Transportation Study Area
1964 and 1985

ITEM	VALUE 1964	VALUE 1985	RATIO 1985/1964
Population	133,971[1]	331,993	2.48
Labor Force	46,890[1]	140,530	3.00
Employment[2]	69,444	169,168	2.44
Passenger Cars Owned	48,816[1]	191,842	3.93
Persons Per Car	2.75	1.73	0.63
School Enrollment	33,404	86,573	2.59
Population Density (persons per sq. mi., based on area of 386 sq. mi.)	347	860	2.48

[1]Transportation study survey data, as expanded.
[2]Includes people living outside study area.
SOURCE: Huntsville City Planning Commission, except as noted.

Names:

Development Statistics

Student Enrollment

Places:

Huntsville, AL

Types:

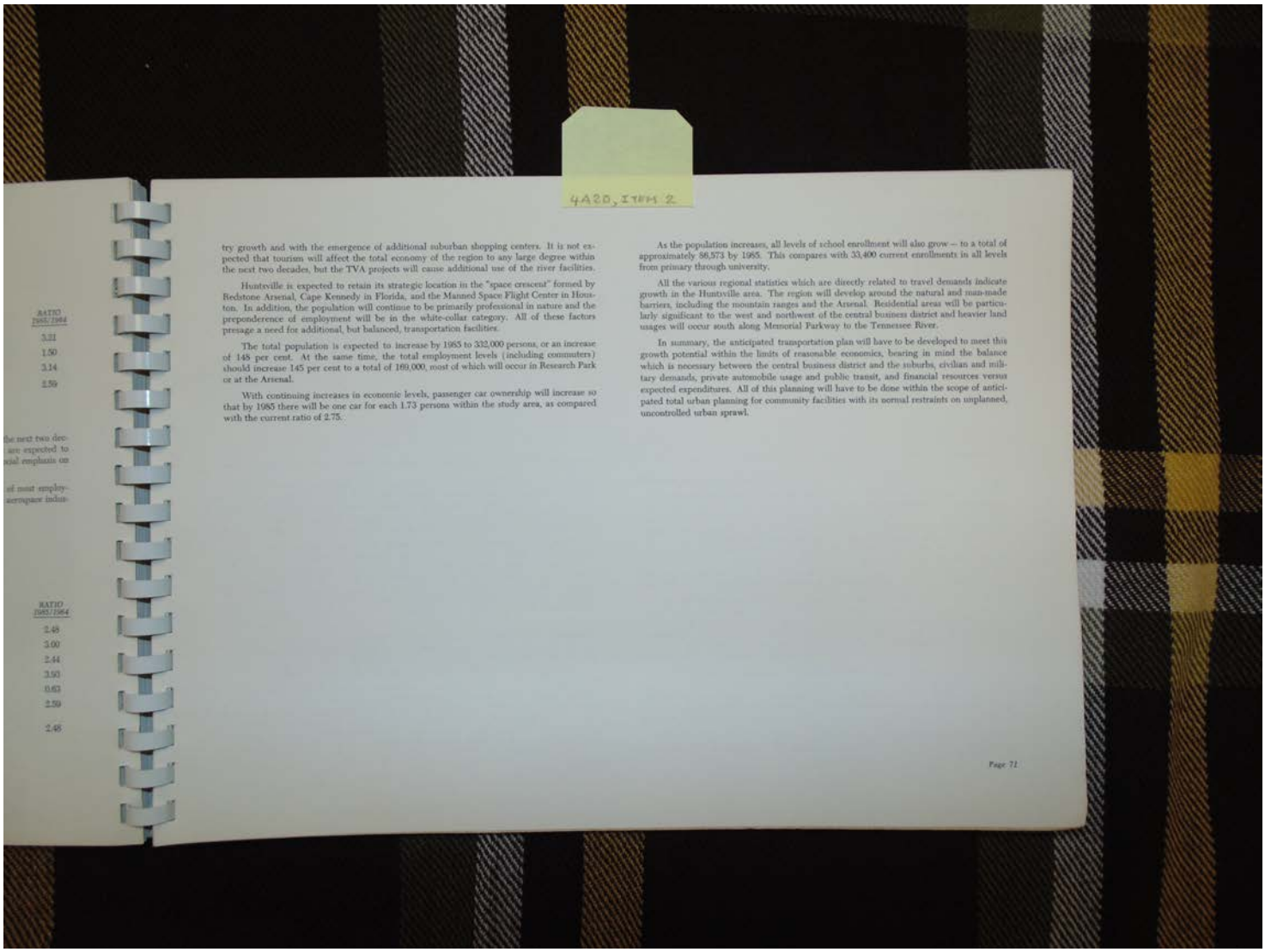
booklet

table

Dates:

1964-1965

1966

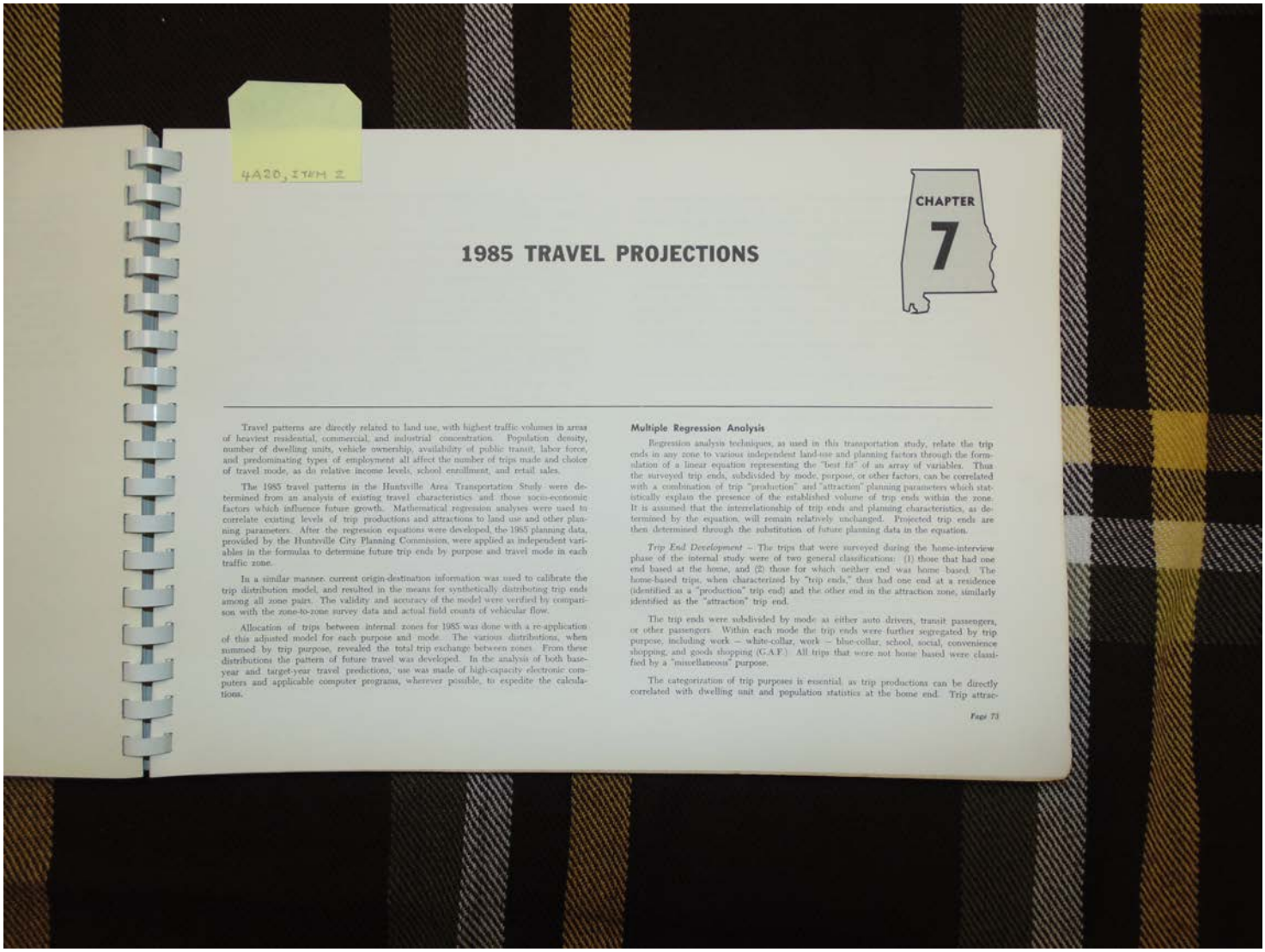


Names:
Population Growth

Places:
Huntsville, AL

Types:
booklet

Dates:
1966

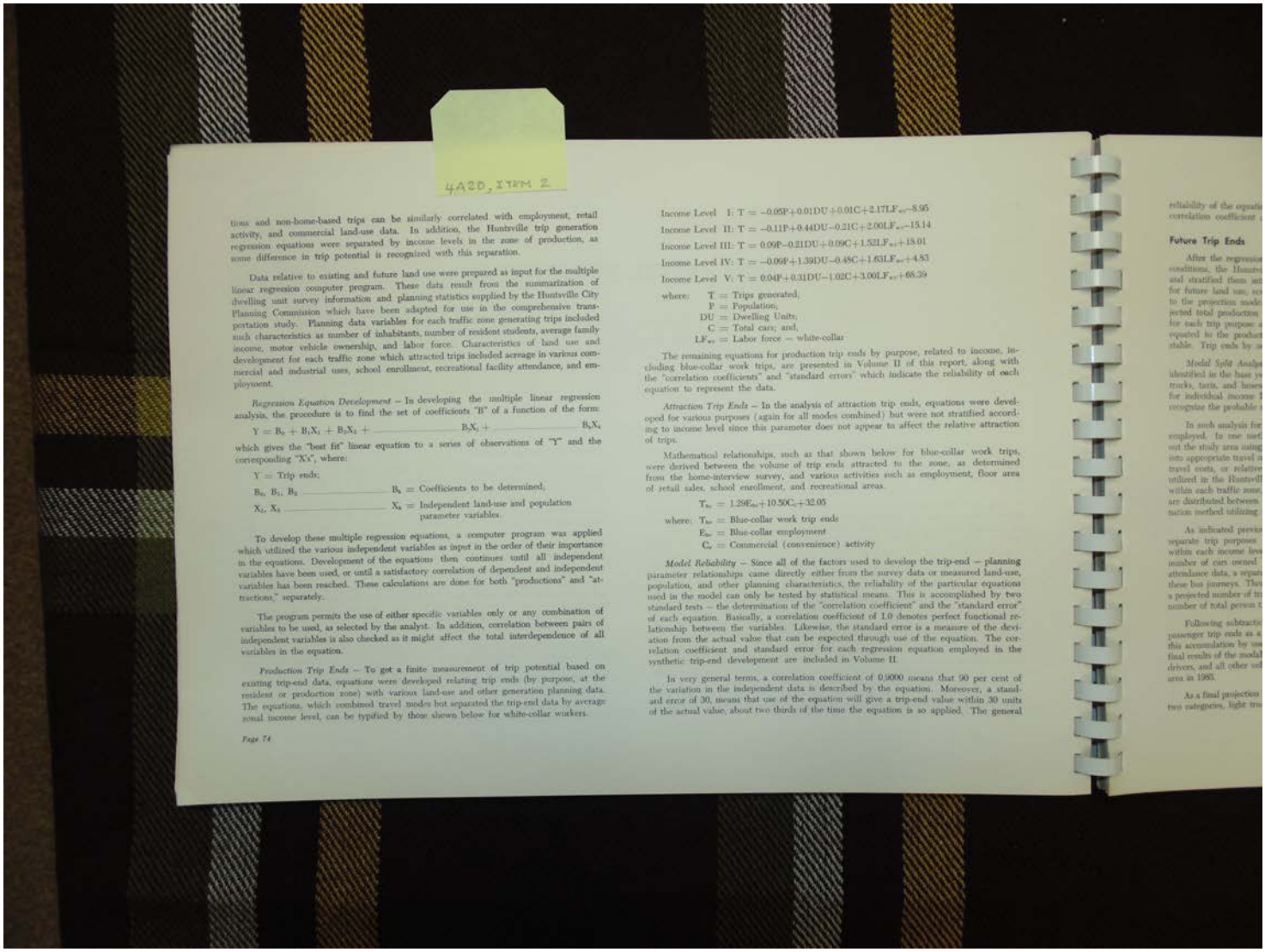


Names:
1985 Travel Projections -
Chapter 7
Multiple Regression Analysis

Places:
Huntsville, AL

Types:
booklet

Dates:
1966



tions and non-home-based trips can be similarly correlated with employment, retail activity, and commercial land-use data. In addition, the Huntsville trip generation regression equations were separated by income levels in the zone of production, as some difference in trip potential is recognized with this separation.

Data relative to existing and future land use were prepared as input for the multiple linear regression computer program. These data result from the summarization of dwelling unit survey information and planning statistics supplied by the Huntsville City Planning Commission which have been adapted for use in the comprehensive transportation study. Planning data variables for each traffic zone generating trips included such characteristics as number of inhabitants, number of resident students, average family income, motor vehicle ownership, and labor force. Characteristics of land use and development for each traffic zone which attracted trips included acreage in various commercial and industrial uses, school enrollment, recreational facility attendance, and employment.

Regression Equation Development – In developing the multiple linear regression analysis, the procedure is to find the set of coefficients "B" of a function of the form:

$$Y = B_o + B_1X_1 + B_2X_2 + \_\_\_\_\_ B_nX_n + \_\_\_\_\_ B_sX_s$$

which gives the "best fit" linear equation to a series of observations of "Y" and the corresponding "Xs", where:

Y = Trip ends;

$B_o, B_1, B_2 \_\_\_\_\_ B_n$ = Coefficients to be determined;

$X_1, X_n \_\_\_\_\_ X_s$ = Independent land-use and population parameter variables.

To develop these multiple regression equations, a computer program was applied which utilized the various independent variables as input in the order of their importance in the equations. Development of the equations then continues until all independent variables have been used, or until a satisfactory correlation of dependent and independent variables has been reached. These calculations are done for both "productions" and "attractions," separately.

The program permits the use of either specific variables only or any combination of variables to be used, as selected by the analyst. In addition, correlation between pairs of independent variables is also checked as it might affect the total interdependence of all variables in the equation.

Production Trip Ends – To get a finite measurement of trip potential based on existing trip-end data, equations were developed relating trip ends (by purpose, at the resident or production zone) with various land-use and other generation planning data. The equations, which combined travel modes but separated the trip-end data by average zonal income level, can be typified by those shown below for white-collar workers.

Income Level I: $T = -0.05P + 0.01DU + 0.01C + 2.17LF_{wc} - 8.95$

Income Level II: $T = -0.11P + 0.44DU - 0.21C + 2.00LF_{wc} - 15.14$

Income Level III: $T = 0.09P - 0.21DU + 0.09C + 1.52LF_{wc} + 18.01$

Income Level IV: $T = -0.09P + 1.39DU - 0.48C + 1.83LF_{wc} + 4.83$

Income Level V: $T = 0.04P + 0.31DU - 1.02C + 3.00LF_{wc} + 68.39$

where: T = Trips generated;
P = Population;
DU = Dwelling Units;
C = Total cars; and,
LF_{wc} = Labor force – white-collar

The remaining equations for production trip ends by purpose, related to income, including blue-collar work trips, are presented in Volume II of this report, along with the "correlation coefficients" and "standard errors" which indicate the reliability of each equation to represent the data.

Attraction Trip Ends – In the analysis of attraction trip ends, equations were developed for various purposes (again for all modes combined) but were not stratified according to income level since this parameter does not appear to affect the relative attraction of trips.

Mathematical relationships, such as that shown below for blue-collar work trips, were derived between the volume of trip ends attracted to the zone, as determined from the home-interview survey, and various activities such as employment, floor area of retail sales, school enrollment, and recreational areas.

$$T_{bc} = 1.29E_{bc} + 10.50C_c + 32.05$$

where: T_{bc} = Blue-collar work trip ends
E_{bc} = Blue-collar employment
C_c = Commercial (convenience) activity

Model Reliability – Since all of the factors used to develop the trip-end – planning parameter relationships came directly either from the survey data or measured land-use, population, and other planning characteristics, the reliability of the particular equations used in the model can only be tested by statistical means. This is accomplished by two standard tests – the determination of the "correlation coefficient" and the "standard error" of each equation. Basically, a correlation coefficient of 1.0 denotes perfect functional relationship between the variables. Likewise, the standard error is a measure of the deviation from the actual value that can be expected through use of the equation. The correlation coefficient and standard error for each regression equation employed in the synthetic trip-end development are included in Volume II.

In very general terms, a correlation coefficient of 0.9000 means that 90 per cent of the variation in the independent data is described by the equation. Moreover, a standard error of 30, means that use of the equation will give a trip-end value within 30 units of the actual value, about two thirds of the time the equation is so applied. The general

reliability of the equati
correlation coefficient

Future Trip Ends

After the regressio
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Names:

Multiple Regression Analysis

Places:

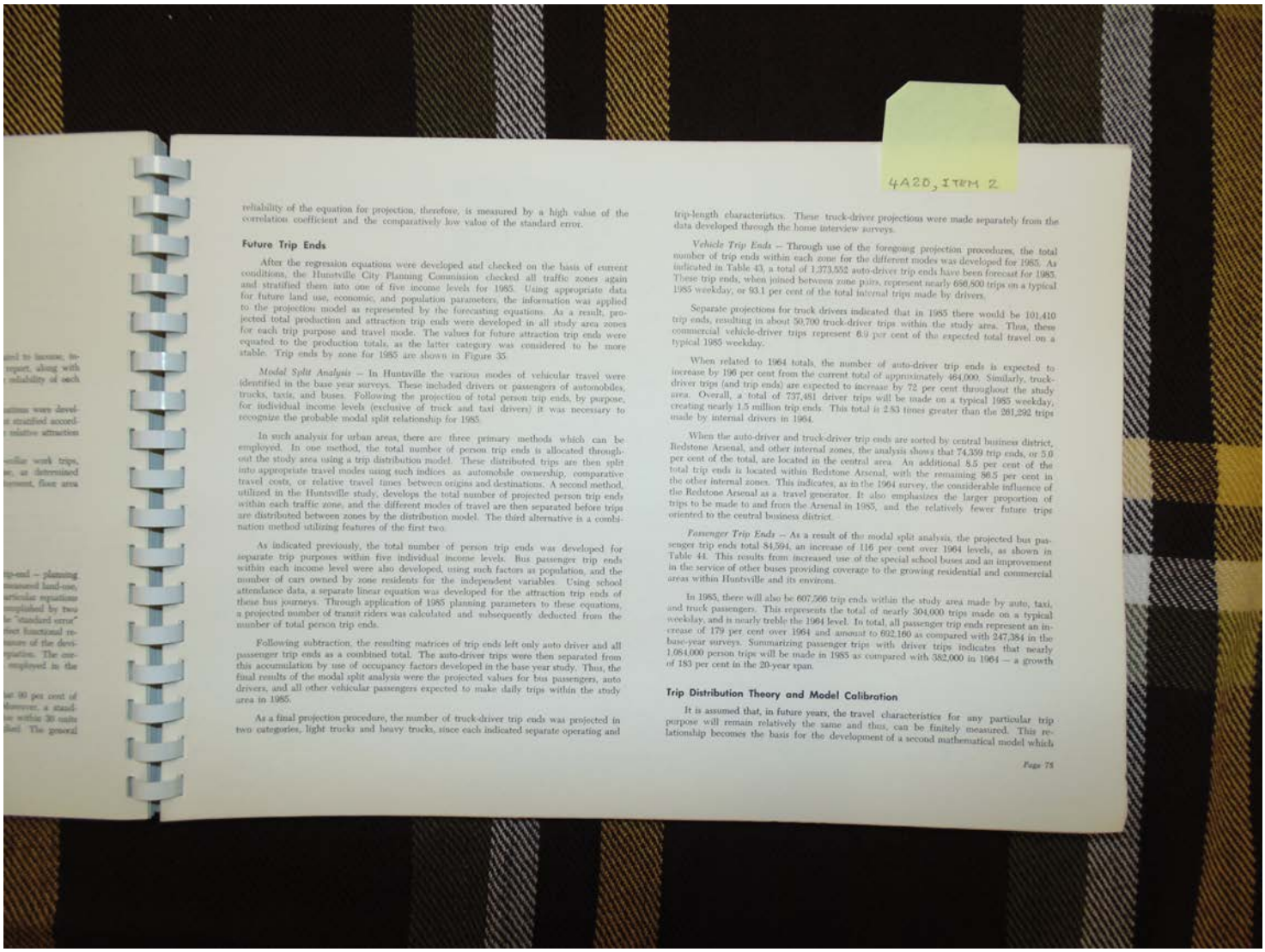
Huntsville, AL

Types:

booklet

Dates:

1966



reliability of the equation for projection, therefore, is measured by a high value of the correlation coefficient and the comparatively low value of the standard error.

Future Trip Ends

After the regression equations were developed and checked on the basis of current conditions, the Huntsville City Planning Commission checked all traffic zones again and stratified them into one of five income levels for 1985. Using appropriate data for future land use, economic, and population parameters, the information was applied to the projection model as represented by the forecasting equations. As a result, projected total production and attraction trip ends were developed in all study area zones for each trip purpose and travel mode. The values for future attraction trip ends were equated to the production totals, as the latter category was considered to be more stable. Trip ends by zone for 1985 are shown in Figure 35.

Modal Split Analysis — In Huntsville the various modes of vehicular travel were identified in the base year surveys. These included drivers or passengers of automobiles, trucks, taxis, and buses. Following the projection of total person trip ends, by purpose, for individual income levels (exclusive of truck and taxi drivers) it was necessary to recognize the probable modal split relationship for 1985.

In such analysis for urban areas, there are three primary methods which can be employed. In one method, the total number of person trip ends is allocated throughout the study area using a trip distribution model. These distributed trips are then split into appropriate travel modes using such indices as automobile ownership, comparative travel costs, or relative travel times between origins and destinations. A second method, utilized in the Huntsville study, develops the total number of projected person trip ends within each traffic zone, and the different modes of travel are then separated before trips are distributed between zones by the distribution model. The third alternative is a combination method utilizing features of the first two.

As indicated previously, the total number of person trip ends was developed for separate trip purposes within five individual income levels. Bus passenger trip ends within each income level were also developed, using such factors as population, and the number of cars owned by zone residents for the independent variables. Using school attendance data, a separate linear equation was developed for the attraction trip ends of these bus journeys. Through application of 1985 planning parameters to these equations, a projected number of transit riders was calculated and subsequently deducted from the number of total person trip ends.

Following subtraction, the resulting matrices of trip ends left only auto driver and all passenger trip ends as a combined total. The auto-driver trips were then separated from this accumulation by use of occupancy factors developed in the base year study. Thus, the final results of the modal split analysis were the projected values for bus passengers, auto drivers, and all other vehicular passengers expected to make daily trips within the study area in 1985.

As a final projection procedure, the number of truck-driver trip ends was projected in two categories, light trucks and heavy trucks, since each indicated separate operating and trip-length characteristics. These truck-driver projections were made separately from the data developed through the home interview surveys.

Vehicle Trip Ends — Through use of the foregoing projection procedures, the total number of trip ends within each zone for the different modes was developed for 1985. As indicated in Table 43, a total of 1,373,552 auto-driver trip ends have been forecast for 1985. These trip ends, when joined between zone pairs, represent nearly 686,800 trips on a typical 1985 weekday, or 93.1 per cent of the total internal trips made by drivers.

Separate projections for truck drivers indicated that in 1985 there would be 101,410 trip ends, resulting in about 50,700 truck-driver trips within the study area. Thus, these commercial vehicle-driver trips represent 6.9 per cent of the expected total travel on a typical 1985 weekday.

When related to 1964 totals, the number of auto-driver trip ends is expected to increase by 196 per cent from the current total of approximately 464,000. Similarly, truck-driver trips (and trip ends) are expected to increase by 72 per cent throughout the study area. Overall, a total of 737,481 driver trips will be made on a typical 1985 weekday, creating nearly 1.5 million trip ends. This total is 2.83 times greater than the 261,292 trips made by internal drivers in 1964.

When the auto-driver and truck-driver trip ends are sorted by central business district, Redstone Arsenal, and other internal zones, the analysis shows that 74,359 trip ends, or 5.0 per cent of the total, are located in the central area. An additional 8.5 per cent of the total trip ends is located within Redstone Arsenal, with the remaining 86.5 per cent in the other internal zones. This indicates, as in the 1964 survey, the considerable influence of the Redstone Arsenal as a travel generator. It also emphasizes the larger proportion of trips to be made to and from the Arsenal in 1985, and the relatively fewer future trips oriented to the central business district.

Passenger Trip Ends — As a result of the modal split analysis, the projected bus passenger trip ends total 84,594, an increase of 116 per cent over 1964 levels, as shown in Table 44. This results from increased use of the special school buses and an improvement in the service of other buses providing coverage to the growing residential and commercial areas within Huntsville and its environs.

In 1985, there will also be 607,566 trip ends within the study area made by auto, taxi, and truck passengers. This represents the total of nearly 304,000 trips made on a typical weekday, and is nearly treble the 1964 level. In total, all passenger trip ends represent an increase of 179 per cent over 1964 and amount to 692,160 as compared with 247,384 in the base-year surveys. Summarizing passenger trips with driver trips indicates that nearly 1,084,000 person trips will be made in 1985 as compared with 382,000 in 1964 — a growth of 183 per cent in the 20-year span.

Trip Distribution Theory and Model Calibration

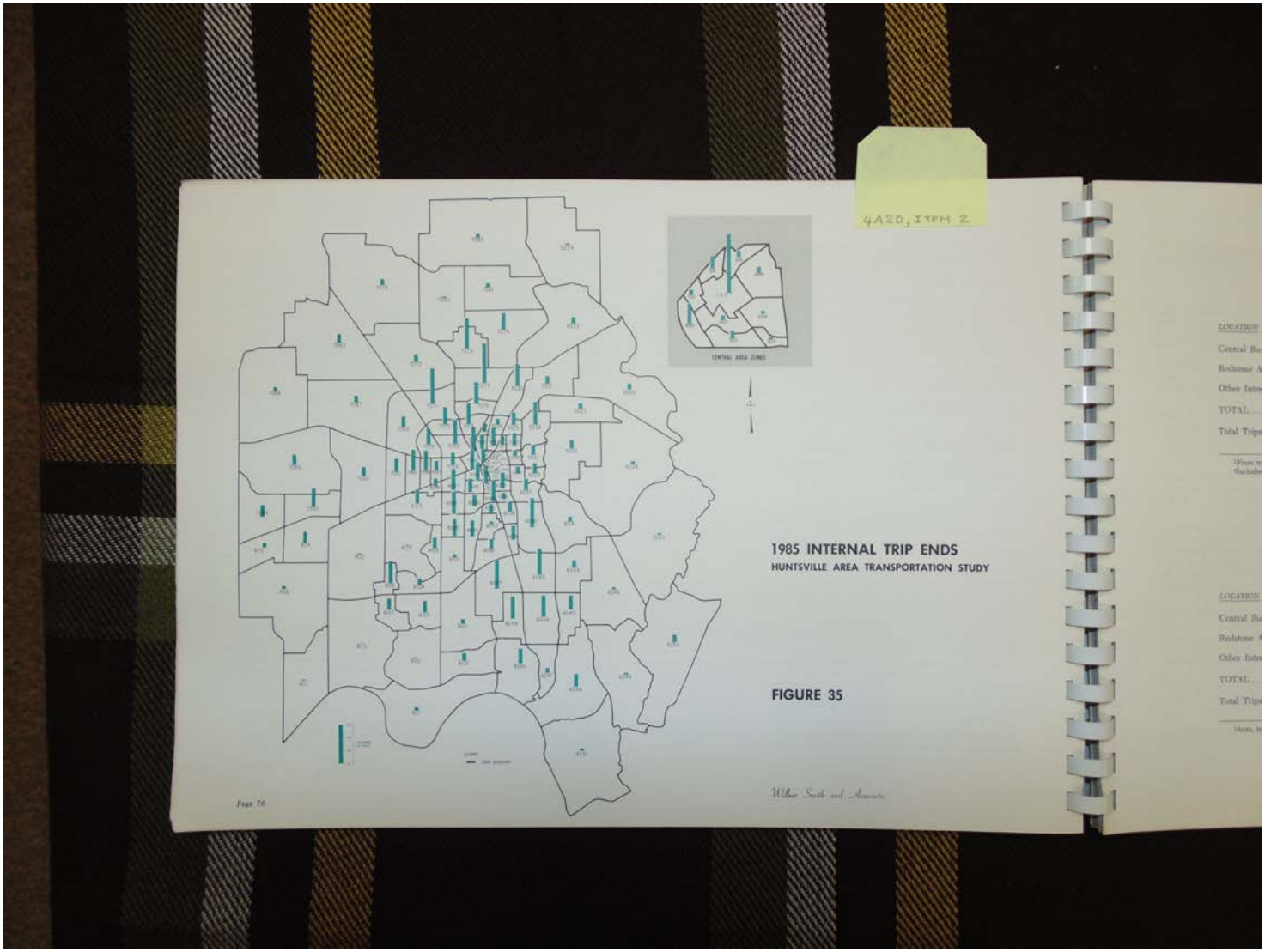
It is assumed that, in future years, the travel characteristics for any particular trip purpose will remain relatively the same and thus, can be finitely measured. This relationship becomes the basis for the development of a second mathematical model which

Names:
Future Trip Ends
Trip Distribution Theory & Model
Calibration

Places:
Huntsville, AL

Types:
booklet

Dates:
1966

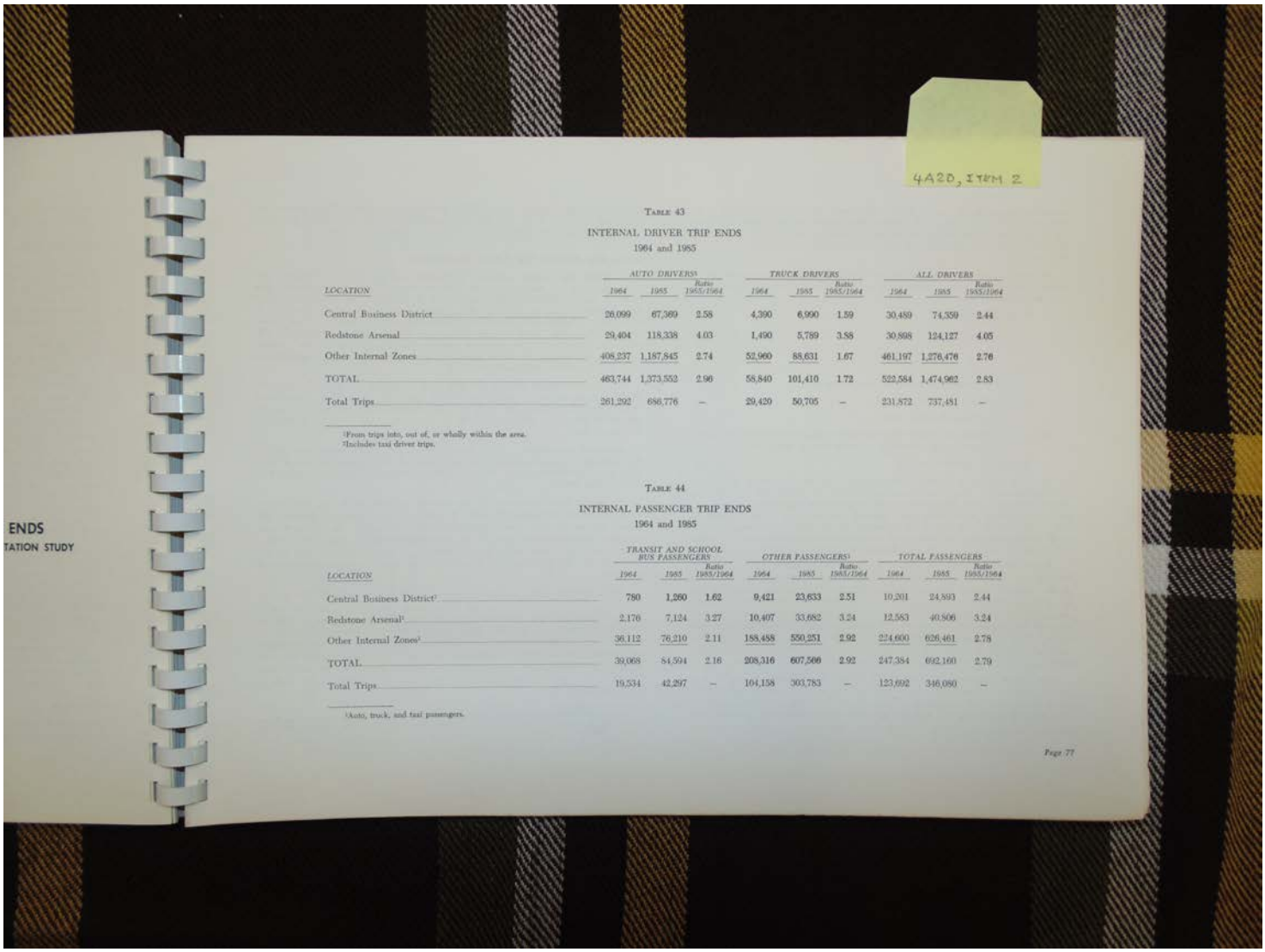


Names:
1985 Internal Trip Ends

Places:
Huntsville, AL area

Types:
illustration

Dates:
1966



4A20, ITEM 2

ENDS
TATION STUDY

TABLE 43

INTERNAL DRIVER TRIP ENDS
1964 and 1985

LOCATION	AUTO DRIVERS[1] 1964	AUTO DRIVERS[1] 1985	AUTO DRIVERS[1] Ratio 1985/1964	TRUCK DRIVERS 1964	TRUCK DRIVERS 1985	TRUCK DRIVERS Ratio 1985/1964	ALL DRIVERS 1964	ALL DRIVERS 1985	ALL DRIVERS Ratio 1985/1964
Central Business District	26,099	67,369	2.58	4,390	6,990	1.59	30,489	74,359	2.44
Redstone Arsenal	29,404	118,338	4.03	1,490	5,789	3.88	30,898	124,127	4.05
Other Internal Zones	408,237	1,187,845	2.74	52,960	88,631	1.67	461,197	1,276,476	2.76
TOTAL	463,744	1,373,552	2.96	58,840	101,410	1.72	522,584	1,474,962	2.83
Total Trips	261,292	686,776	–	29,429	50,705	–	231,572	737,451	–

[1]From trips into, out of, or wholly within the area.
[2]Includes taxi driver trips.

TABLE 44

INTERNAL PASSENGER TRIP ENDS
1964 and 1985

LOCATION	TRANSIT AND SCHOOL BUS PASSENGERS 1964	TRANSIT AND SCHOOL BUS PASSENGERS 1985	TRANSIT AND SCHOOL BUS PASSENGERS Ratio 1985/1964	OTHER PASSENGERS[1] 1964	OTHER PASSENGERS[1] 1985	OTHER PASSENGERS[1] Ratio 1985/1964	TOTAL PASSENGERS 1964	TOTAL PASSENGERS 1985	TOTAL PASSENGERS Ratio 1985/1964
Central Business District[2]	780	1,260	1.62	9,421	23,633	2.51	10,201	24,893	2.44
Redstone Arsenal[2]	2,176	7,124	3.27	10,407	33,682	3.24	12,583	40,806	3.24
Other Internal Zones[2]	36,112	76,210	2.11	188,488	550,251	2.92	224,600	626,461	2.78
TOTAL	39,068	84,594	2.16	208,316	607,566	2.92	247,384	692,160	2.79
Total Trips	19,534	42,297	–	104,158	303,783	–	123,692	346,080	–

[1]Auto, truck, and taxi passengers.

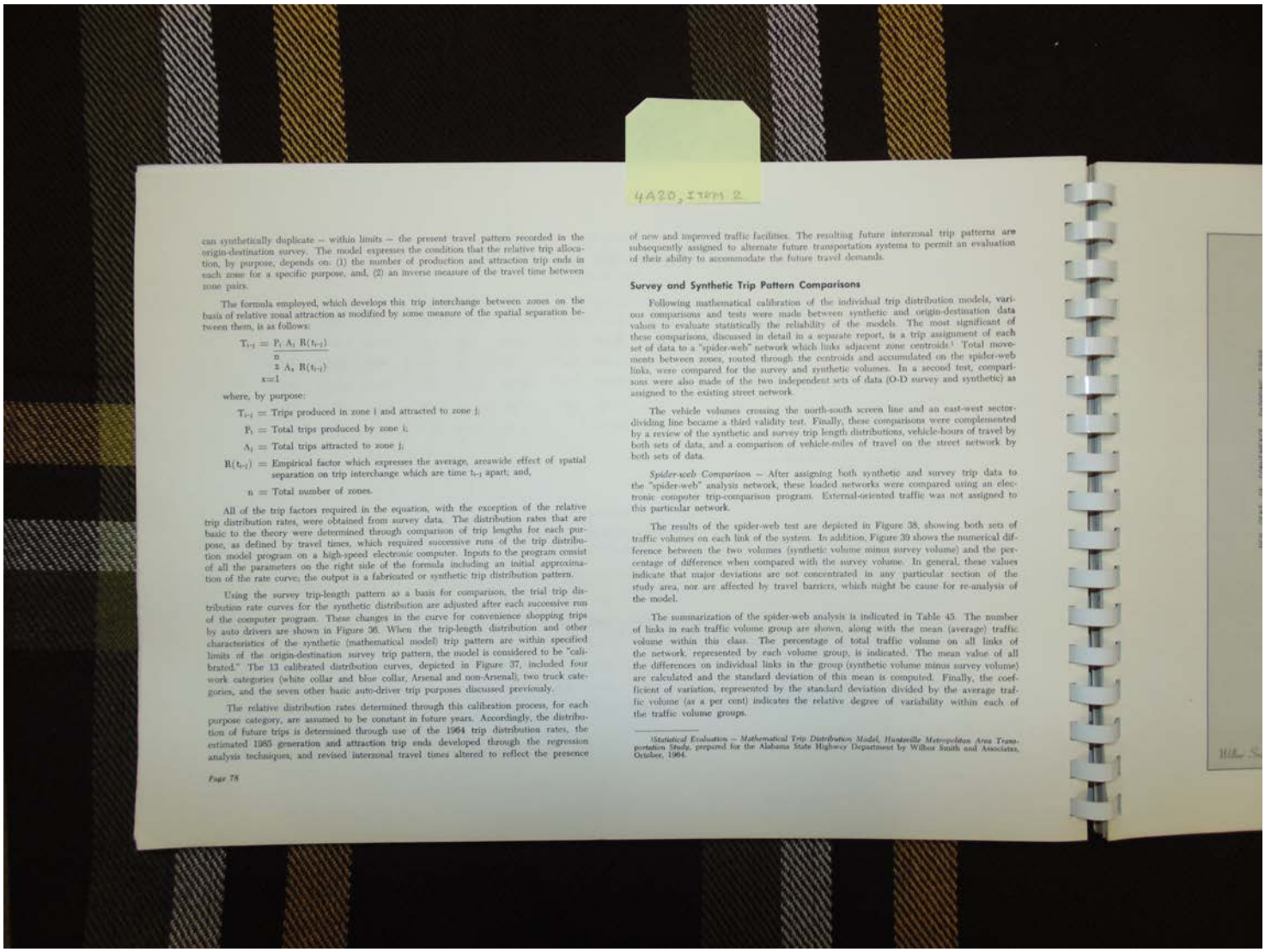
Page 77

Names:
Driver Trip Ends
Passenger Trip Ends

Places:
Huntsville, AL

Types:
table

Dates:
1964
1985



can synthetically duplicate – within limits – the present travel pattern recorded in the origin-destination survey. The model expresses the condition that the relative trip allocation, by purpose, depends on: (1) the number of production and attraction trip ends in each zone for a specific purpose, and, (2) an inverse measure of the travel time between zone pairs.

The formula employed, which develops this trip interchange between zones on the basis of relative zonal attraction as modified by some measure of the spatial separation between them, is as follows:

$$T_{i-j} = \frac{P_i A_j B(t_{i-j})}{\sum_{x=1}^{n} A_x B(t_{i-j})}$$

where, by purpose:

T_{i-j} = Trips produced in zone i and attracted to zone j;

P_i = Total trips produced by zone i;

A_j = Total trips attracted to zone j;

$B(t_{i-j})$ = Empirical factor which expresses the average, areawide effect of spatial separation on trip interchange which are time t_{i-j} apart; and,

n = Total number of zones.

All of the trip factors required in the equation, with the exception of the relative trip distribution rates, were obtained from survey data. The distribution rates that are basic to the theory were determined through comparison of trip lengths for each purpose, as defined by travel times, which required successive runs of the trip distribution model program on a high-speed electronic computer. Inputs to the program consist of all the parameters on the right side of the formula including an initial approximation of the rate curve; the output is a fabricated or synthetic trip distribution pattern.

Using the survey trip-length pattern as a basis for comparison, the trial trip distribution rate curves for the synthetic distribution are adjusted after each successive run of the computer program. These changes in the curve for convenience shopping trips by auto drivers are shown in Figure 36. When the trip-length distribution and other characteristics of the synthetic (mathematical model) trip pattern are within specified limits of the origin-destination survey trip pattern, the model is considered to be "calibrated." The 13 calibrated distribution curves, depicted in Figure 37, included four work categories (white collar and blue collar, Arsenal and non-Arsenal), two truck categories, and the seven other basic auto-driver trip purposes discussed previously.

The relative distribution rates determined through this calibration process, for each purpose category, are assumed to be constant in future years. Accordingly, the distribution of future trips is determined through use of the 1964 trip distribution rates, the estimated 1985 generation and attraction trip ends developed through the regression analysis techniques, and revised interzonal travel times altered to reflect the presence of new and improved traffic facilities. The resulting future interzonal trip patterns are subsequently assigned to alternate future transportation systems to permit an evaluation of their ability to accommodate the future travel demands.

Survey and Synthetic Trip Pattern Comparisons

Following mathematical calibration of the individual trip distribution models, various comparisons and tests were made between synthetic and origin-destination data values to evaluate statistically the reliability of the models. The most significant of these comparisons, discussed in detail in a separate report, is a trip assignment of each set of data to a "spider-web" network which links adjacent zone centroids.[1] Total movements between zones, routed through the centroids and accumulated on the spider-web links, were compared for the survey and synthetic volumes. In a second test, comparisons were also made of the two independent sets of data (O-D survey and synthetic) as assigned to the existing street network.

The vehicle volumes crossing the north-south screen line and an east-west sector-dividing line became a third validity test. Finally, these comparisons were complemented by a review of the synthetic and survey trip length distributions, vehicle-hours of travel by both sets of data, and a comparison of vehicle-miles of travel on the street network by both sets of data.

Spider-web Comparison – After assigning both synthetic and survey trip data to the "spider-web" analysis network, these loaded networks were compared using an electronic computer trip-comparison program. External-oriented traffic was not assigned to this particular network.

The results of the spider-web test are depicted in Figure 38, showing both sets of traffic volumes on each link of the system. In addition, Figure 39 shows the numerical difference between the two volumes (synthetic volume minus survey volume) and the percentage of difference when compared with the survey volume. In general, these values indicate that major deviations are not concentrated in any particular section of the study area, nor are affected by travel barriers, which might be cause for re-analysis of the model.

The summarization of the spider-web analysis is indicated in Table 45. The number of links in each traffic volume group are shown, along with the mean (average) traffic volume within this class. The percentage of total traffic volume on all links of the network, represented by each volume group, is indicated. The mean value of all the differences on individual links in the group (synthetic volume minus survey volume) are calculated and the standard deviation of this mean is computed. Finally, the coefficient of variation, represented by the standard deviation divided by the average traffic volume (as a per cent) indicates the relative degree of variability within each of the traffic volume groups.

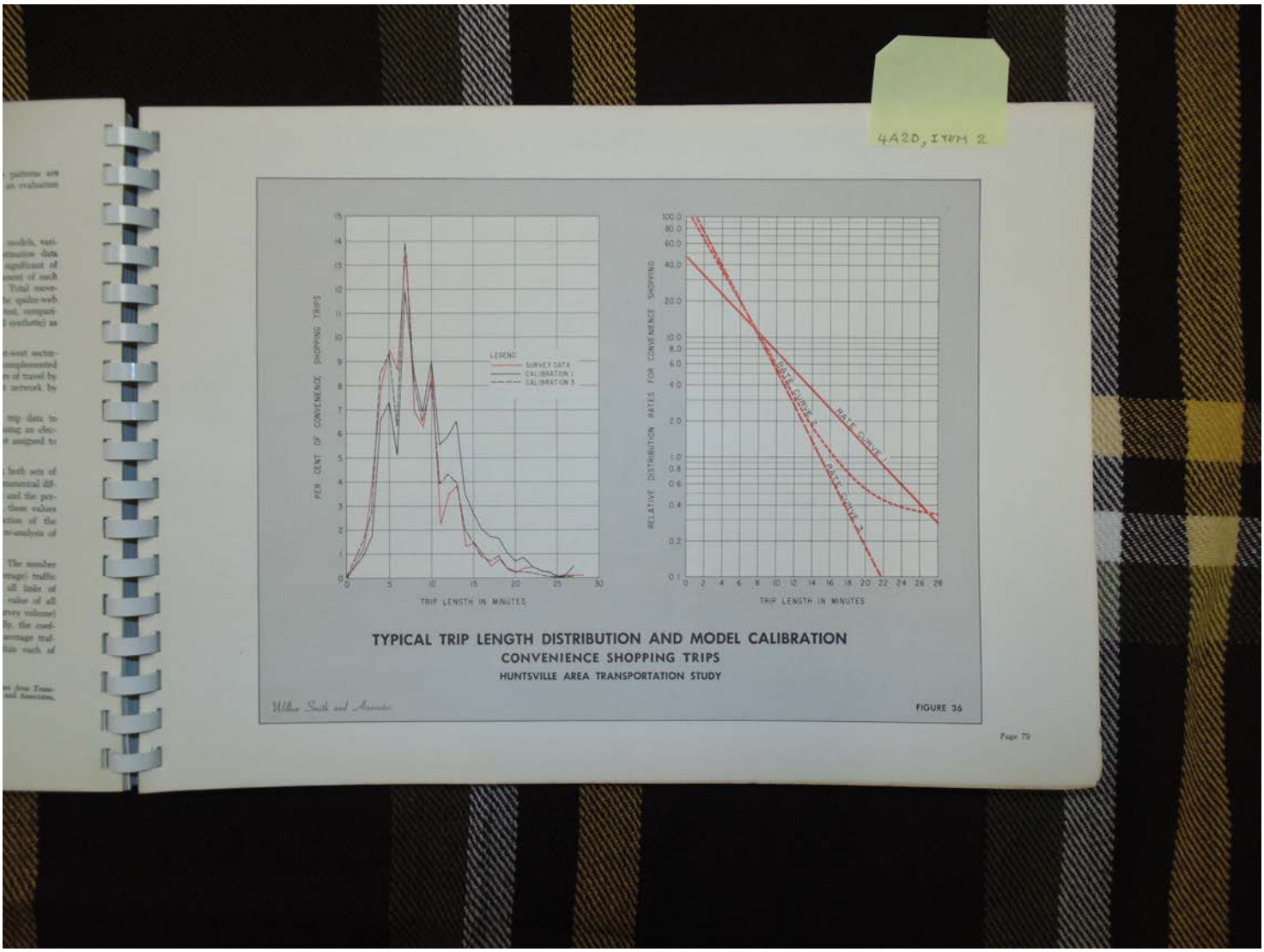
[1] *Statistical Evaluation – Mathematical Trip Distribution Model, Huntsville Metropolitan Area Transportation Study*, prepared for the Alabama State Highway Department by Wilbur Smith and Associates, October, 1964.

Names:
Trip Pattern Comparisons

Places:
Huntsville, AL

Types:
booklet

Dates:
1966

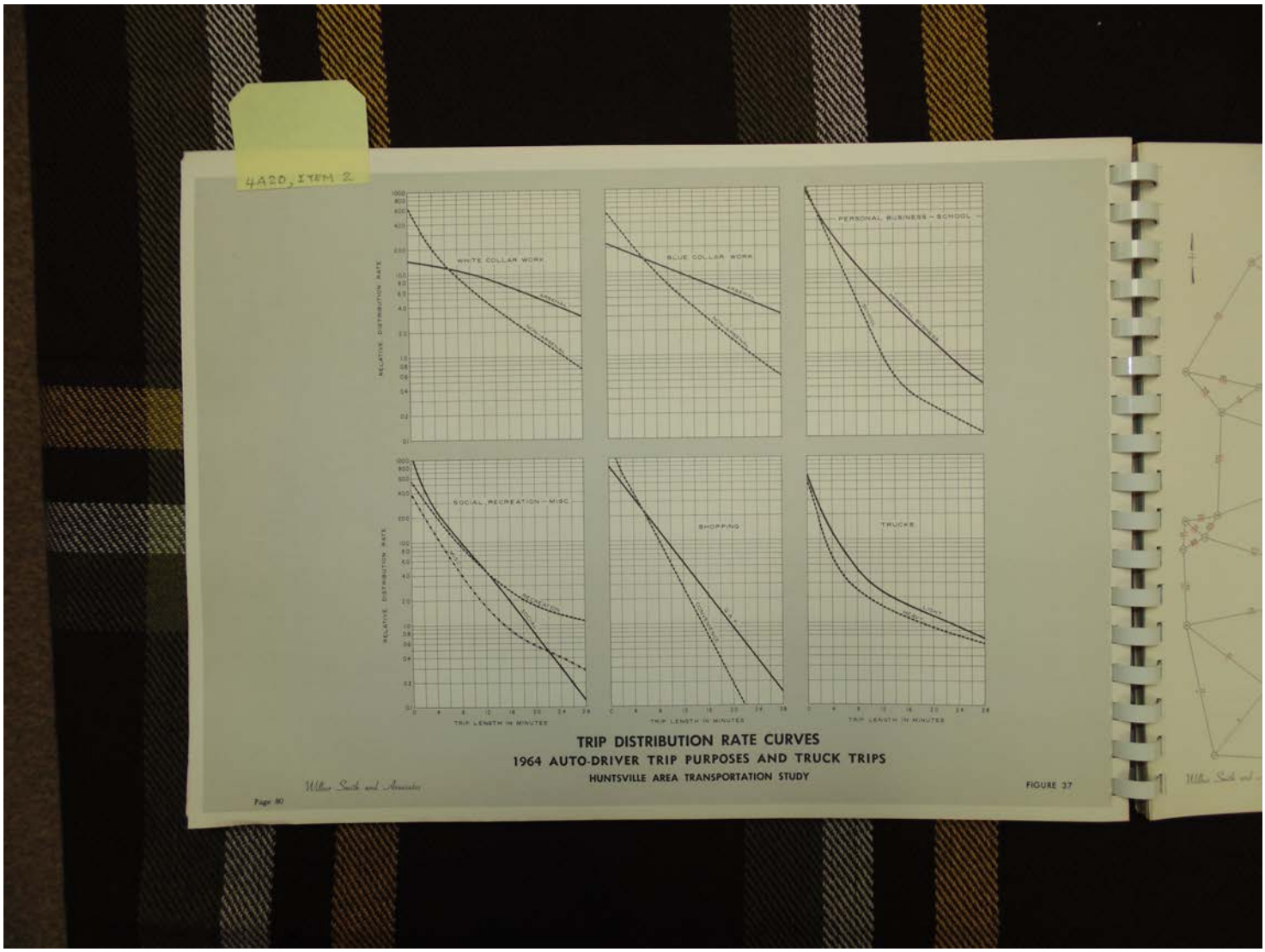


Names:
Typical Trip Length

Places:
Huntsville, AL area

Types:
illustration

Dates:
1966

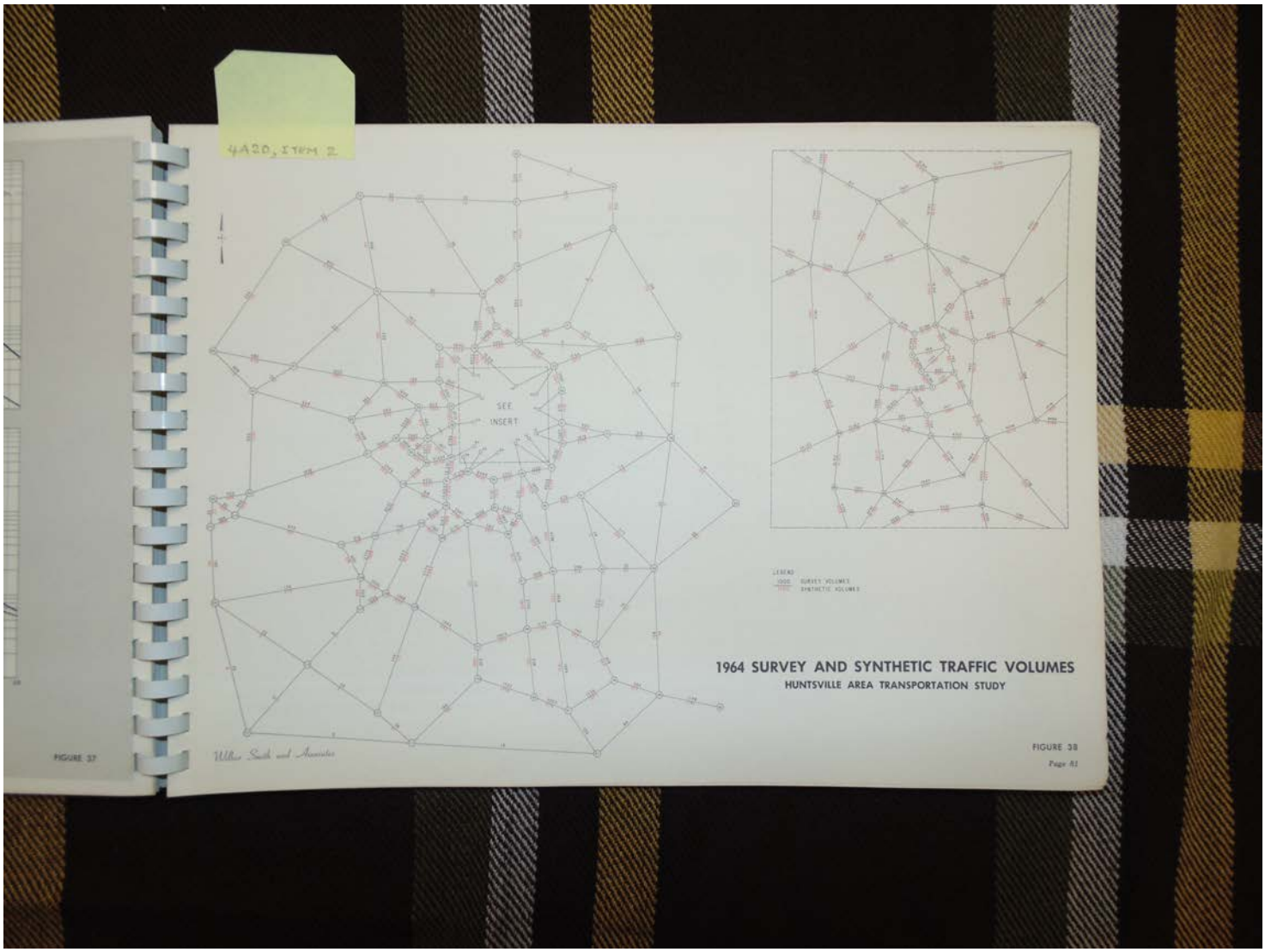


Names:
Trip Distribution Rate Curves

Places:
Huntsville, AL area

Types:
illustration

Dates:
1964

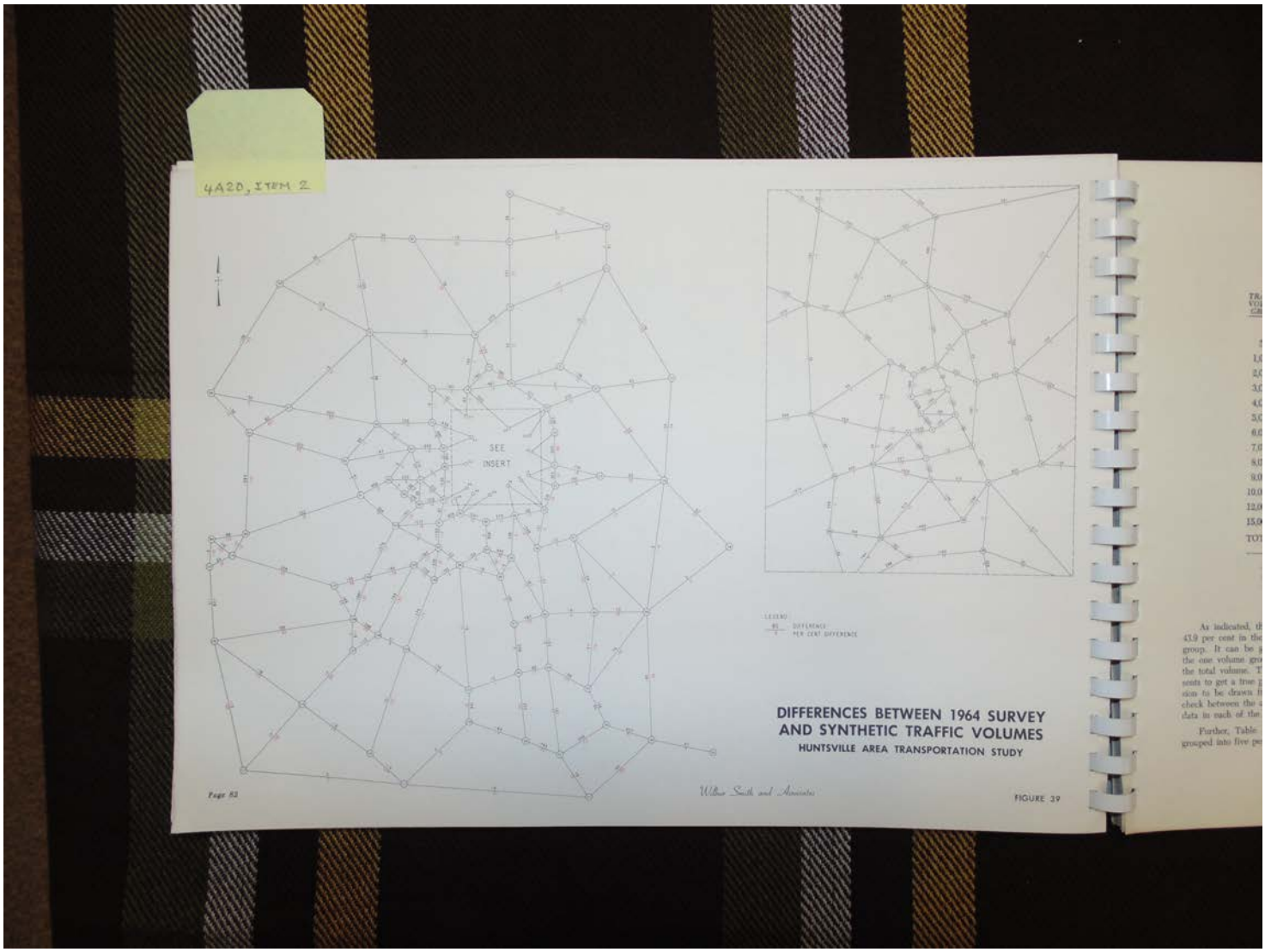


Names:
Survey & Synthetic Traffic Volumes

Places:
Huntsville, AL area

Types:
illustration

Dates:
1964

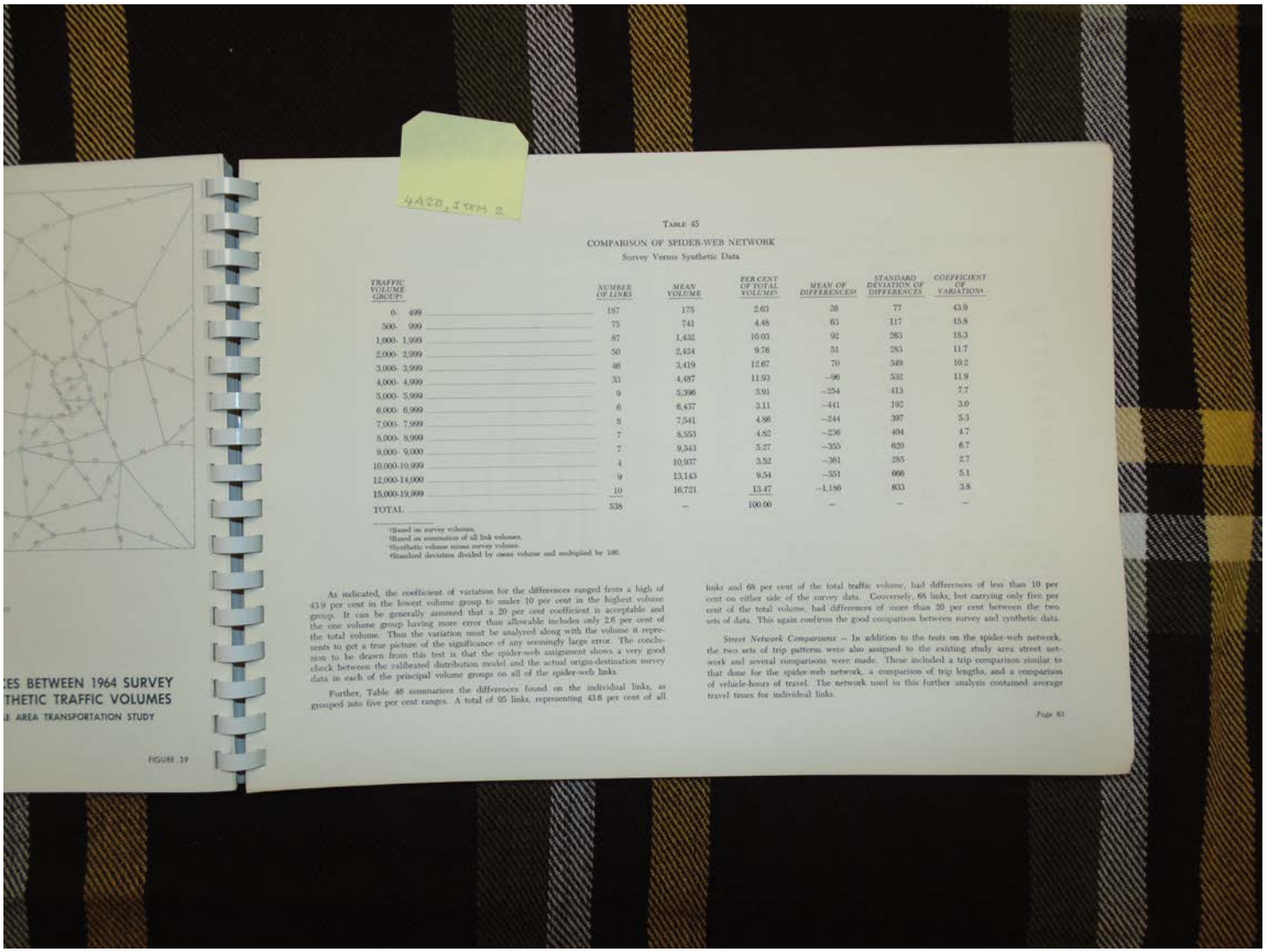


Names:
Survey & Synthetic Traffic Volumes

Places:
Huntsville, AL area

Types:
illustration

Dates:
1964



4A2D, ITEM 2

TABLE 45

COMPARISON OF SPIDER-WEB NETWORK
Survey Versus Synthetic Data

TRAFFIC VOLUME GROUP[1]	NUMBER OF LINKS	MEAN VOLUME	PER CENT OF TOTAL VOLUME[2]	MEAN OF DIFFERENCES[3]	STANDARD DEVIATION OF DIFFERENCES	COEFFICIENT OF VARIATION[4]
0- 499	187	175	2.63	28	77	43.9
500- 999	75	741	4.48	63	117	15.8
1,000- 1,999	87	1,432	10.03	92	263	18.3
2,000- 2,999	50	2,424	9.76	51	285	11.7
3,000- 3,999	46	3,419	12.67	70	349	10.2
4,000- 4,999	33	4,487	11.93	−96	532	11.9
5,000- 5,999	9	5,396	3.91	−254	413	7.7
6,000- 6,999	6	6,437	3.11	−441	192	3.0
7,000- 7,999	8	7,541	4.86	−244	397	5.3
8,000- 8,999	7	8,553	4.82	−236	404	4.7
9,000- 9,000	7	9,343	5.27	−355	620	6.7
10,000-10,999	4	10,937	3.52	−361	285	2.7
12,000-14,000	9	13,143	9.54	−551	666	5.1
15,000-19,999	10	16,721	13.47	−1,186	633	3.8
TOTAL	538	–	100.00	–	–	–

[1]Based on survey volumes.
[2]Based on summation of all link volumes.
[3]Synthetic volume minus survey volume.
[4]Standard deviation divided by mean volume and multiplied by 100.

As indicated, the coefficient of variation for the differences ranged from a high of 43.9 per cent in the lowest volume group to under 10 per cent in the highest volume group. It can be generally assumed that a 20 per cent coefficient is acceptable and the one volume group having more error than allowable includes only 2.6 per cent of the total volume. Thus the variation must be analyzed along with the volume it represents to get a true picture of the significance of any seemingly large error. The conclusion to be drawn from this test is that the spider-web assignment shows a very good check between the calibrated distribution model and the actual origin-destination survey data in each of the principal volume groups on all of the spider-web links.

Further, Table 46 summarizes the differences found on the individual links, as grouped into five per cent ranges. A total of 95 links, representing 43.6 per cent of all links and 68 per cent of the total traffic volume, had differences of less than 10 per cent on either side of the survey data. Conversely, 68 links, but carrying only five per cent of the total volume, had differences of more than 20 per cent between the two sets of data. This again confirms the good comparison between survey and synthetic data.

Street Network Comparisons – In addition to the tests on the spider-web network, the two sets of trip patterns were also assigned to the existing study area street network and several comparisons were made. These included a trip comparison similar to that done for the spider-web network, a comparison of trip lengths, and a comparison of vehicle-hours of travel. The network used in this further analysis contained average travel times for individual links.

Page 83

ES BETWEEN 1964 SURVEY
THETIC TRAFFIC VOLUMES
E AREA TRANSPORTATION STUDY

FIGURE 39

Names:
Traffic Volumes
Comparison

Places:
Huntsville, AL area

Types:
table

Dates:
1964

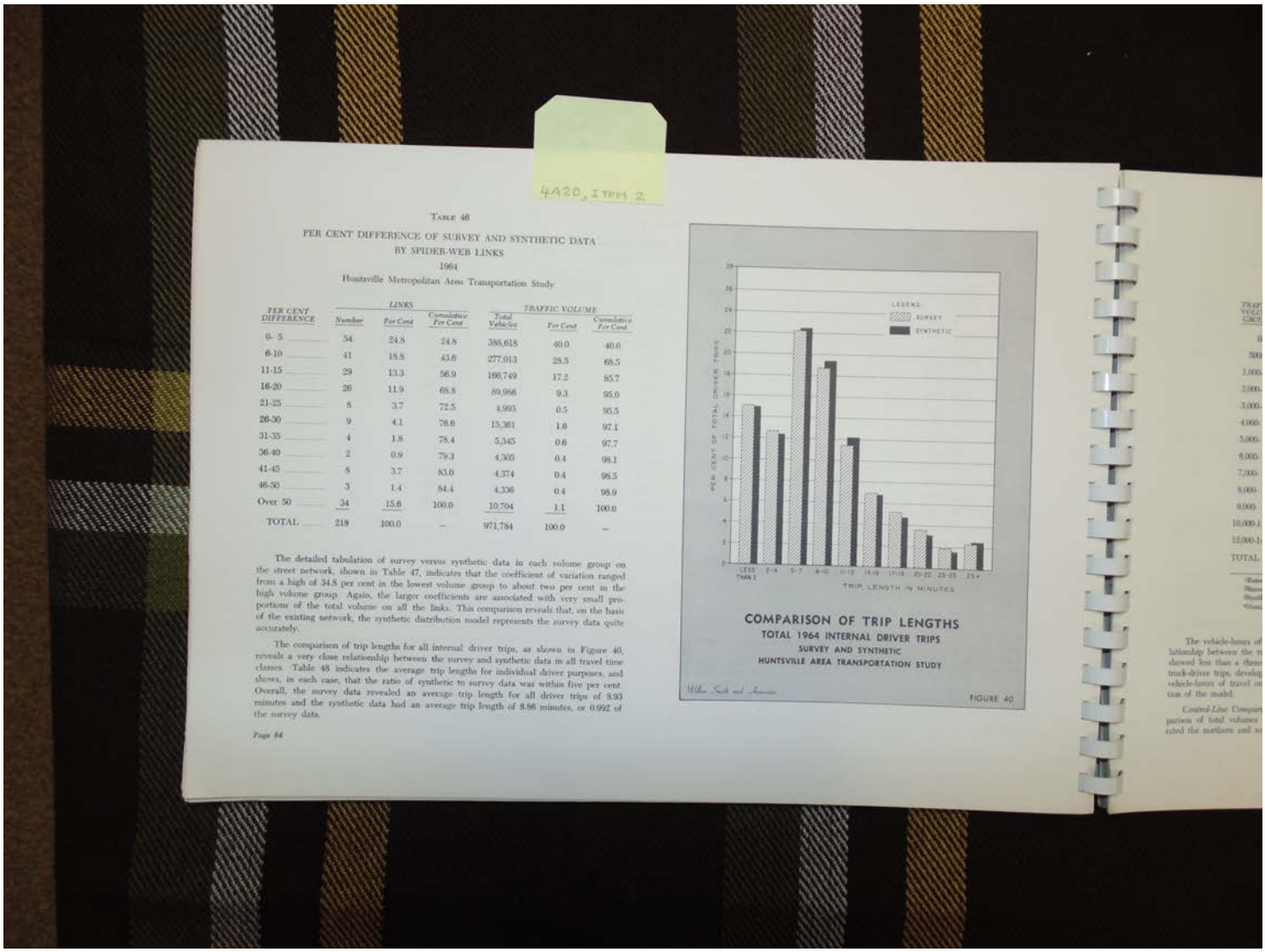


TABLE 46

PER CENT DIFFERENCE OF SURVEY AND SYNTHETIC DATA
BY SPIDER-WEB LINKS
1964
Huntsville Metropolitan Area Transportation Study

PER CENT DIFFERENCE	LINKS Number	LINKS Per Cent	LINKS Cumulative Per Cent	TRAFFIC VOLUME Total Vehicles	TRAFFIC VOLUME Per Cent	TRAFFIC VOLUME Cumulative Per Cent
0- 5	54	24.8	24.8	388,618	40.0	40.0
6-10	41	18.8	43.6	277,013	28.5	68.5
11-15	29	13.3	56.9	166,749	17.2	85.7
16-20	26	11.9	68.8	89,988	9.3	95.0
21-25	8	3.7	72.5	4,993	0.5	95.5
26-30	9	4.1	76.6	15,361	1.6	97.1
31-35	4	1.8	78.4	5,345	0.6	97.7
36-40	2	0.9	79.3	4,305	0.4	98.1
41-45	8	3.7	83.0	4,374	0.4	98.5
46-50	3	1.4	84.4	4,336	0.4	98.9
Over 50	34	15.6	100.0	10,704	1.1	100.0
TOTAL	218	100.0	–	971,784	100.0	–

The detailed tabulation of survey versus synthetic data in each volume group on the street network, shown in Table 47, indicates that the coefficient of variation ranged from a high of 34.8 per cent in the lowest volume group to about two per cent in the high volume group. Again, the larger coefficients are associated with very small proportions of the total volume on all the links. This comparison reveals that, on the basis of the existing network, the synthetic distribution model represents the survey data quite accurately.

The comparison of trip lengths for all internal driver trips, as shown in Figure 40, reveals a very close relationship between the survey and synthetic data in all travel time classes. Table 48 indicates the average trip lengths for individual driver purposes, and shows, in each case, that the ratio of synthetic to survey data was within five per cent. Overall, the survey data revealed an average trip length for all driver trips of 8.93 minutes and the synthetic data had an average trip length of 8.86 minutes, or 0.992 of the survey data.

Page 84

COMPARISON OF TRIP LENGTHS
TOTAL 1964 INTERNAL DRIVER TRIPS
SURVEY AND SYNTHETIC
HUNTSVILLE AREA TRANSPORTATION STUDY

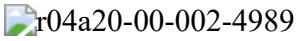
FIGURE 40

Names:
Comparison of Trip Lengths

Places:
Huntsville, AL area

Types:
table

Dates:
1964



Names:
Comparison of Street Network Link Assignments

Places:
Huntsville, AL area

Types:
table

Dates:
1964

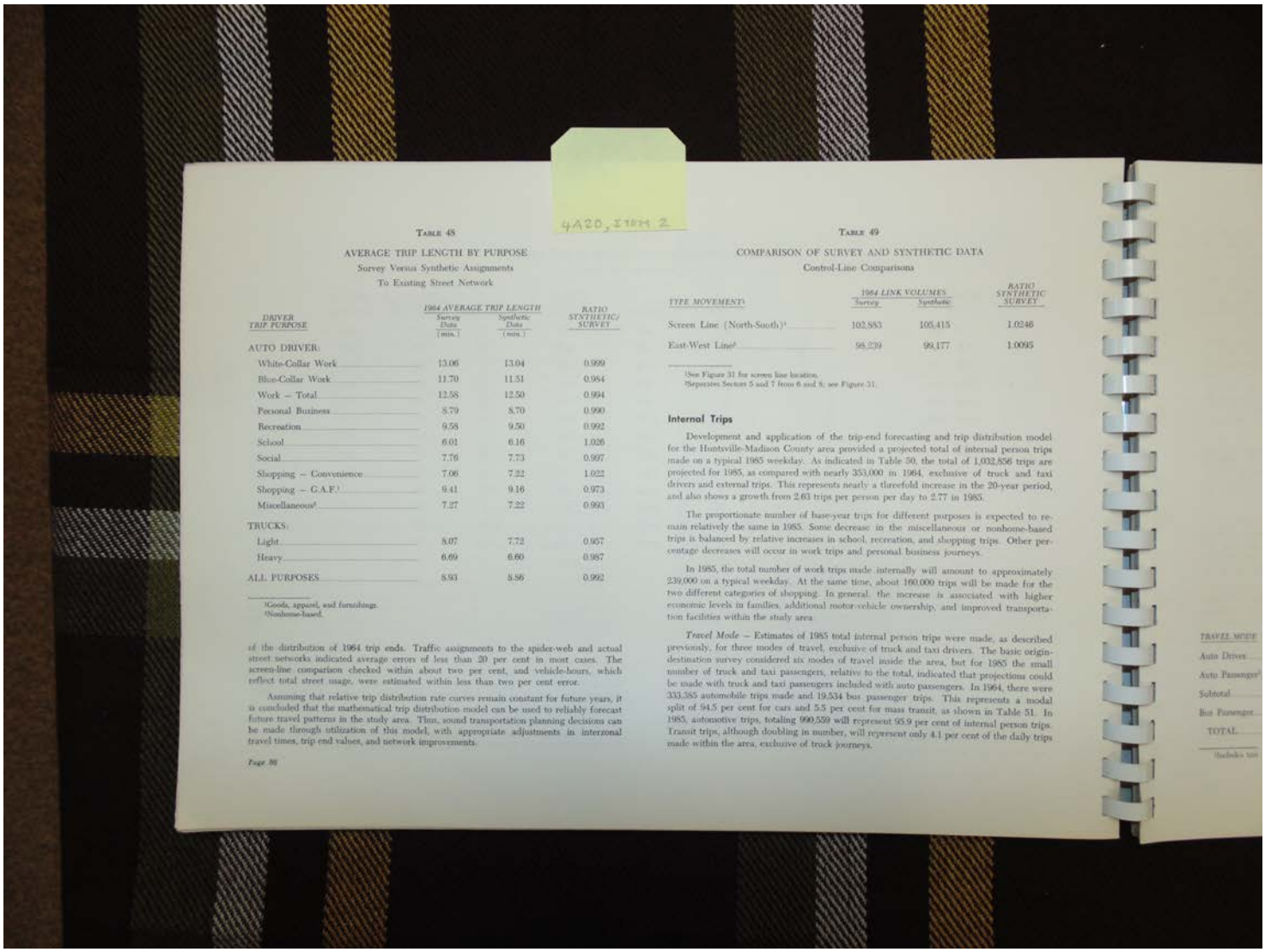


TABLE 48

AVERAGE TRIP LENGTH BY PURPOSE
Survey Versus Synthetic Assignments
To Existing Street Network

DRIVER TRIP PURPOSE	1964 AVERAGE TRIP LENGTH Survey Data (min.)	Synthetic Data (min.)	RATIO SYNTHETIC/ SURVEY
AUTO DRIVER:			
White-Collar Work	13.06	13.04	0.999
Blue-Collar Work	11.70	11.51	0.984
Work – Total	12.58	12.50	0.994
Personal Business	8.79	8.70	0.990
Recreation	9.58	9.50	0.992
School	6.01	6.16	1.026
Social	7.76	7.73	0.997
Shopping – Convenience	7.06	7.22	1.022
Shopping – G.A.F.[1]	9.41	9.16	0.973
Miscellaneous[2]	7.27	7.22	0.993
TRUCKS:			
Light	8.07	7.72	0.957
Heavy	6.69	6.60	0.987
ALL PURPOSES	8.93	8.86	0.992

[1]Goods, apparel, and furnishings.
[2]Nonhome-based.

of the distribution of 1964 trip ends. Traffic assignments to the spider-web and actual street networks indicated average errors of less than 20 per cent in most cases. The screen-line comparison checked within about two per cent, and vehicle-hours, which reflect total street usage, were estimated within less than two per cent error.

Assuming that relative trip distribution rate curves remain constant for future years, it is concluded that the mathematical trip distribution model can be used to reliably forecast future travel patterns in the study area. Thus, sound transportation planning decisions can be made through utilization of this model, with appropriate adjustments in interzonal travel times, trip end values, and network improvements.

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TABLE 49

COMPARISON OF SURVEY AND SYNTHETIC DATA
Control-Line Comparisons

TYPE MOVEMENT[1]	1964 LINK VOLUMES Survey	Synthetic	RATIO SYNTHETIC SURVEY
Screen Line (North-South)[1]	102,883	105,415	1.0246
East-West Line[2]	98,239	98,177	1.0095

[1]See Figure 31 for screen line location.
[2]Separates Sectors 5 and 7 from 6 and 8, see Figure 31.

Internal Trips

Development and application of the trip-end forecasting and trip distribution model for the Huntsville-Madison County area provided a projected total of internal person trips made on a typical 1985 weekday. As indicated in Table 50, the total of 1,032,856 trips are projected for 1985, as compared with nearly 353,000 in 1964, exclusive of truck and taxi drivers and external trips. This represents nearly a threefold increase in the 20-year period, and also shows a growth from 2.63 trips per person per day to 2.77 in 1985.

The proportionate number of base-year trips for different purposes is expected to remain relatively the same in 1985. Some decrease in the miscellaneous or nonhome-based trips is balanced by relative increases in school, recreation, and shopping trips. Other percentage decreases will occur in work trips and personal business journeys.

In 1985, the total number of work trips made internally will amount to approximately 239,000 on a typical weekday. At the same time, about 160,000 trips will be made for the two different categories of shopping. In general, the increase is associated with higher economic levels in families, additional motor-vehicle ownership, and improved transportation facilities within the study area.

Travel Mode – Estimates of 1985 total internal person trips were made, as described previously, for three modes of travel, exclusive of truck and taxi drivers. The basic origin-destination survey considered six modes of travel inside the area, but for 1985 the small number of truck and taxi passengers, relative to the total, indicated that projections could be made with truck and taxi passengers included with auto passengers. In 1964, there were 333,385 automobile trips made and 19,534 bus passenger trips. This represents a modal split of 94.5 per cent for cars and 5.5 per cent for mass transit, as shown in Table 51. In 1985, automotive trips, totaling 990,559 will represent 95.9 per cent of internal person trips. Transit trips, although doubling in number, will represent only 4.1 per cent of the daily trips made within the area, exclusive of truck journeys.

TRAVEL MODE
Auto Driver
Auto Passenger
Subtotal
Bus Passenger
TOTAL

Names:

Average Trip Length by Purpose
Internal Trips

Places:

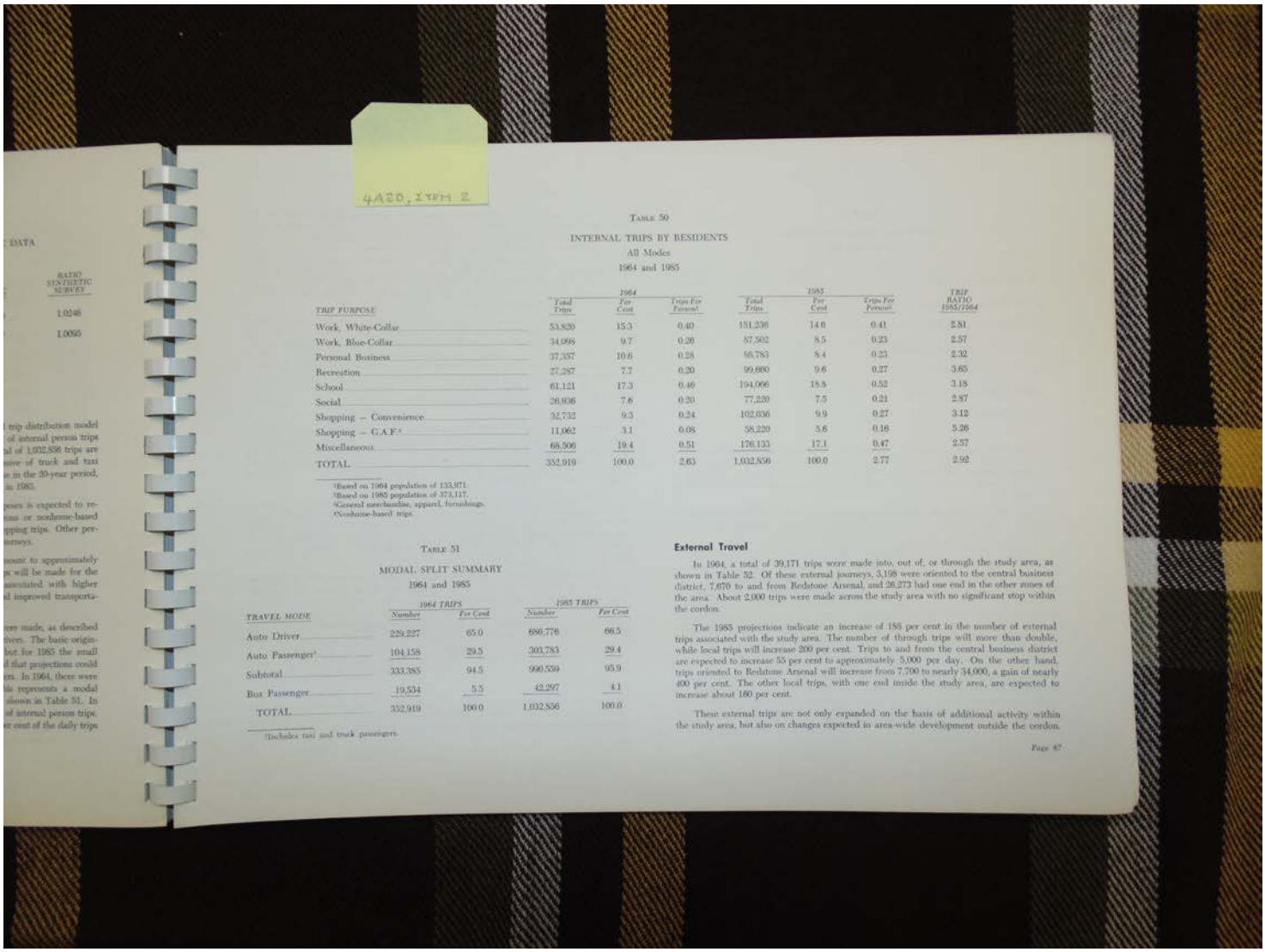
Huntsville, AL
Huntsville, AL area

Types:

booklet
table

Dates:

1964
1966



4A20, ITEM 2

TABLE 50

INTERNAL TRIPS BY RESIDENTS
All Modes
1964 and 1985

TRIP PURPOSE	1964 Total Trips	1964 Per Cent	1964 Trips Per Person[1]	1985 Total Trips	1985 Per Cent	1985 Trips Per Person[2]	TRIP RATIO 1985/1964
Work, White-Collar	53,820	15.3	0.40	151,236	14.6	0.41	2.81
Work, Blue-Collar	34,098	9.7	0.26	87,502	8.5	0.23	2.57
Personal Business	37,357	10.6	0.28	86,783	8.4	0.23	2.32
Recreation	27,287	7.7	0.20	99,680	9.6	0.27	3.65
School	61,121	17.3	0.46	194,066	18.8	0.52	3.18
Social	26,936	7.6	0.20	77,220	7.5	0.21	2.87
Shopping — Convenience	32,732	9.3	0.24	102,036	9.9	0.27	3.12
Shopping — G.A.F.[3]	11,062	3.1	0.08	58,220	5.6	0.16	5.26
Miscellaneous	68,506	19.4	0.51	176,133	17.1	0.47	2.57
TOTAL	352,919	100.0	2.63	1,032,856	100.0	2.77	2.92

[1]Based on 1964 population of 133,971.
[2]Based on 1985 population of 373,117.
[3]General merchandise, apparel, furnishings.
[4]Nonhome-based trips.

TABLE 51

MODAL SPLIT SUMMARY
1964 and 1985

TRAVEL MODE	1964 TRIPS Number	1964 TRIPS Per Cent	1985 TRIPS Number	1985 TRIPS Per Cent
Auto Driver	229,227	65.0	686,776	66.5
Auto Passenger[1]	104,158	29.5	303,783	29.4
Subtotal	333,385	94.5	990,559	95.9
Bus Passenger	19,534	5.5	42,297	4.1
TOTAL	352,919	100.0	1,032,856	100.0

[1]Includes taxi and truck passengers.

External Travel

In 1964, a total of 39,171 trips were made into, out of, or through the study area, as shown in Table 52. Of these external journeys, 3,198 were oriented to the central business district, 7,670 to and from Redstone Arsenal, and 26,273 had one end in the other zones of the area. About 2,000 trips were made across the study area with no significant stop within the cordon.

The 1985 projections indicate an increase of 185 per cent in the number of external trips associated with the study area. The number of through trips will more than double, while local trips will increase 200 per cent. Trips to and from the central business district are expected to increase 55 per cent to approximately 5,000 per day. On the other hand, trips oriented to Redstone Arsenal will increase from 7,700 to nearly 34,000, a gain of nearly 400 per cent. The other local trips, with one end inside the study area, are expected to increase about 160 per cent.

These external trips are not only expanded on the basis of additional activity within the study area, but also on changes expected in area-wide development outside the cordon.

Page 87

Names:
External Travel
Internal Trips by Residents

Places:
Huntsville, AL

Types:
booklet
table

Dates:
1964-1965
1966

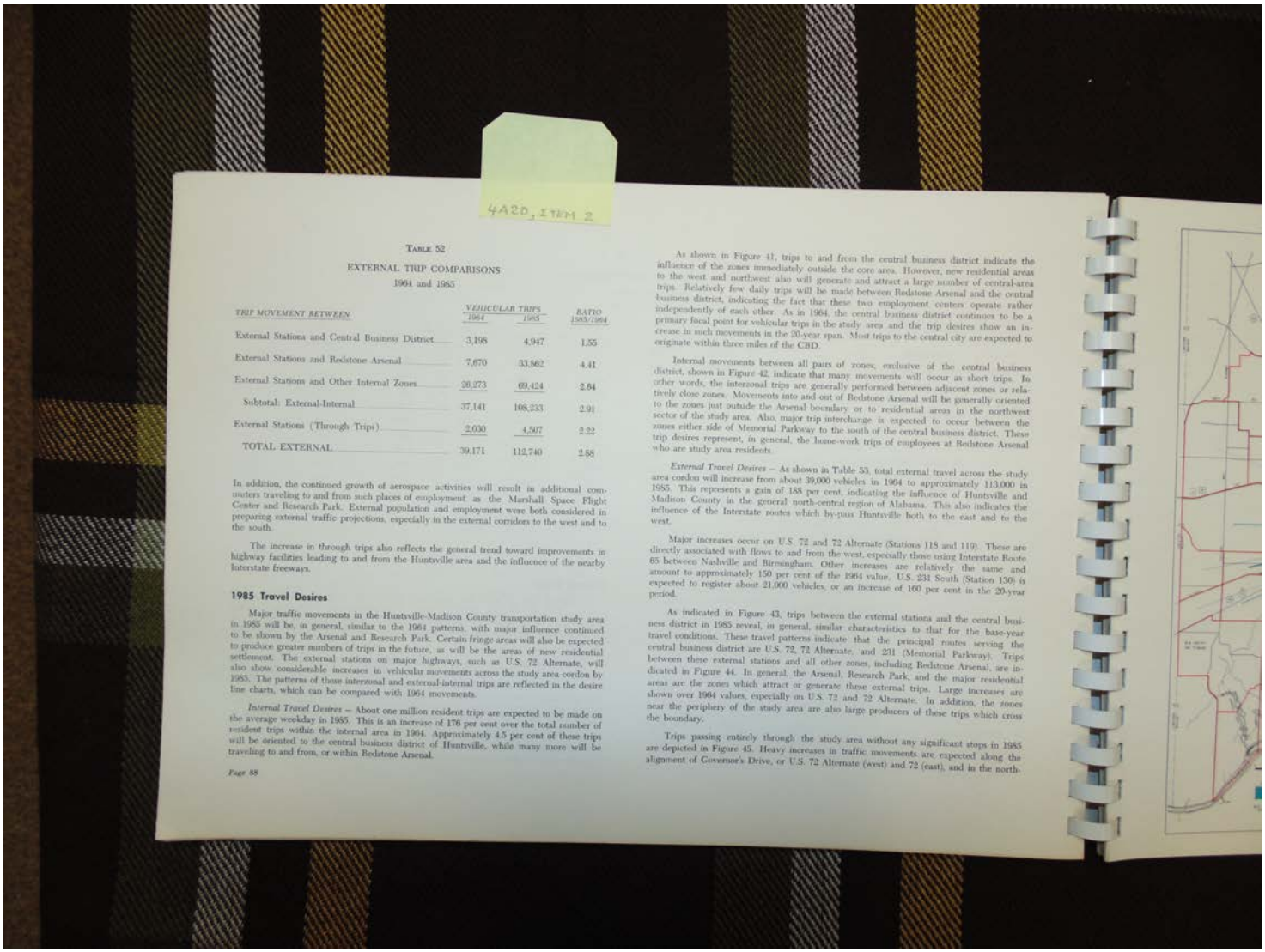


TABLE 52

EXTERNAL TRIP COMPARISONS
1964 and 1985

TRIP MOVEMENT BETWEEN	VEHICULAR TRIPS 1964	1985	RATIO 1985/1964
External Stations and Central Business District	3,198	4,947	1.55
External Stations and Redstone Arsenal	7,670	33,862	4.41
External Stations and Other Internal Zones	26,273	69,424	2.64
Subtotal: External-Internal	37,141	108,233	2.91
External Stations (Through Trips)	2,030	4,507	2.22
TOTAL EXTERNAL	39,171	112,740	2.88

In addition, the continued growth of aerospace activities will result in additional commuters traveling to and from such places of employment as the Marshall Space Flight Center and Research Park. External population and employment were both considered in preparing external traffic projections, especially in the external corridors to the west and to the south.

The increase in through trips also reflects the general trend toward improvements in highway facilities leading to and from the Huntsville area and the influence of the nearby Interstate freeways.

1985 Travel Desires

Major traffic movements in the Huntsville-Madison County transportation study area in 1985 will be, in general, similar to the 1964 patterns, with major influence continued to be shown by the Arsenal and Research Park. Certain fringe areas will also be expected to produce greater numbers of trips in the future, as will be the areas of new residential settlement. The external stations on major highways, such as U.S. 72 Alternate, will also show considerable increases in vehicular movements across the study area cordon by 1985. The patterns of these interzonal and external-internal trips are reflected in the desire line charts, which can be compared with 1964 movements.

Internal Travel Desires — About one million resident trips are expected to be made on the average weekday in 1985. This is an increase of 176 per cent over the total number of resident trips within the internal area in 1964. Approximately 4.5 per cent of these trips will be oriented to the central business district of Huntsville, while many more will be traveling to and from, or within Redstone Arsenal.

As shown in Figure 41, trips to and from the central business district indicate the influence of the zones immediately outside the core area. However, new residential areas to the west and northwest also will generate and attract a large number of central-area trips. Relatively few daily trips will be made between Redstone Arsenal and the central business district, indicating the fact that these two employment centers operate rather independently of each other. As in 1964, the central business district continues to be a primary focal point for vehicular trips in the study area and the trip desires show an increase in such movements in the 20-year span. Most trips to the central city are expected to originate within three miles of the CBD.

Internal movements between all pairs of zones, exclusive of the central business district, shown in Figure 42, indicate that many movements will occur as short trips. In other words, the interzonal trips are generally performed between adjacent zones or relatively close zones. Movements into and out of Redstone Arsenal will be generally oriented to the zones just outside the Arsenal boundary or to residential areas in the northwest sector of the study area. Also, major trip interchange is expected to occur between the zones either side of Memorial Parkway to the south of the central business district. These trip desires represent, in general, the home-work trips of employees at Redstone Arsenal who are study area residents.

External Travel Desires — As shown in Table 53, total external travel across the study area cordon will increase from about 39,000 vehicles in 1964 to approximately 113,000 in 1985. This represents a gain of 188 per cent, indicating the influence of Huntsville and Madison County in the general north-central region of Alabama. This also indicates the influence of the Interstate routes which by-pass Huntsville both to the east and to the west.

Major increases occur on U.S. 72 and 72 Alternate (Stations 118 and 119). These are directly associated with flows to and from the west, especially those using Interstate Route 65 between Nashville and Birmingham. Other increases are relatively the same and amount to approximately 150 per cent of the 1964 value. U.S. 231 South (Station 130) is expected to register about 21,000 vehicles, or an increase of 160 per cent in the 20-year period.

As indicated in Figure 43, trips between the external stations and the central business district in 1985 reveal, in general, similar characteristics to that for the base-year travel conditions. These travel patterns indicate that the principal routes serving the central business district are U.S. 72, 72 Alternate, and 231 (Memorial Parkway). Trips between these external stations and all other zones, including Redstone Arsenal, are indicated in Figure 44. In general, the Arsenal, Research Park, and the major residential areas are the zones which attract or generate these external trips. Large increases are shown over 1964 values, especially on U.S. 72 and 72 Alternate. In addition, the zones near the periphery of the study area are also large producers of these trips which cross the boundary.

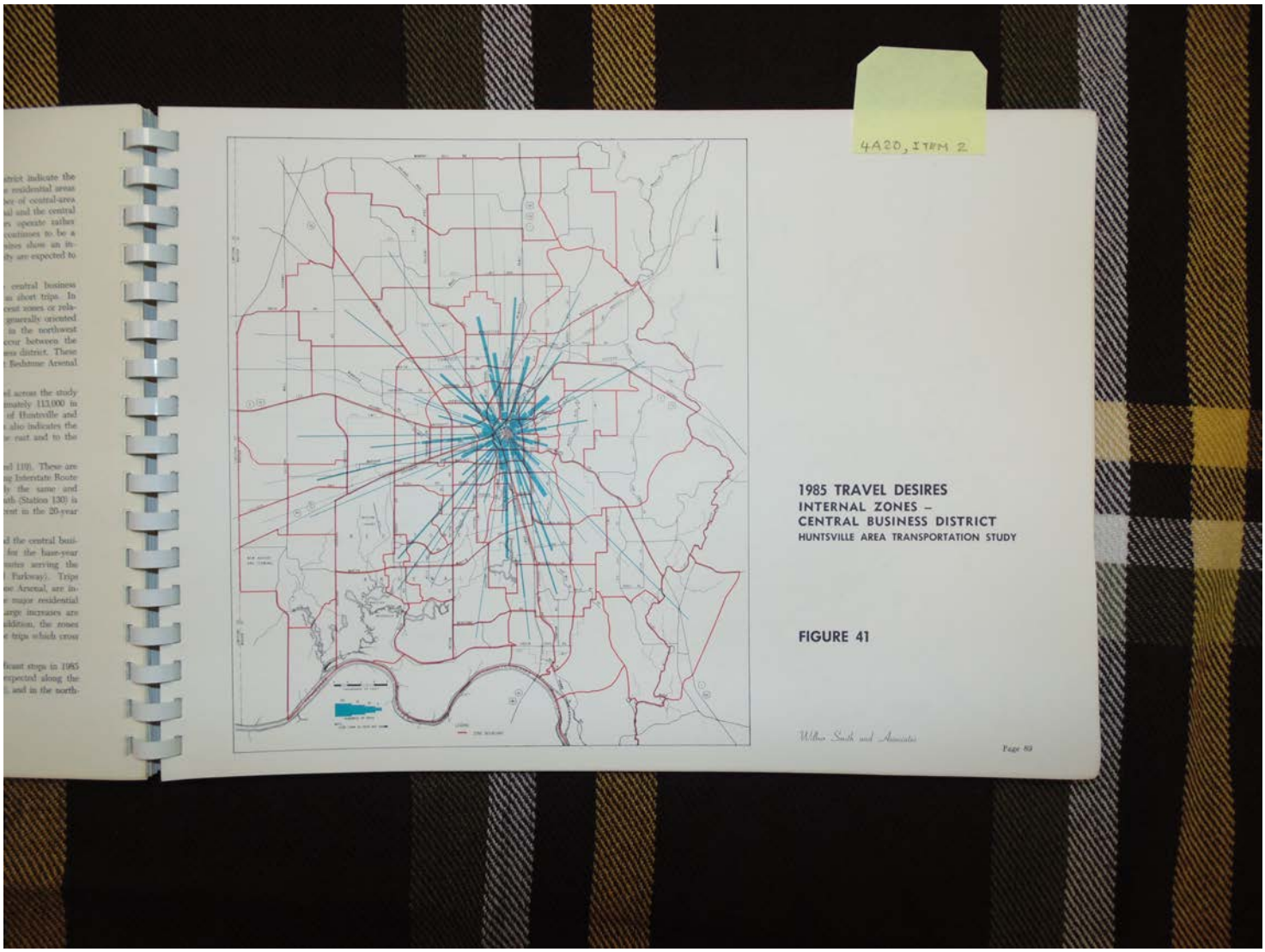
Trips passing entirely through the study area without any significant stops in 1985 are depicted in Figure 45. Heavy increases in traffic movements are expected along the alignment of Governor's Drive, or U.S. 72 Alternate (west) and 72 (east), and in the north-

Names:
1985 Travel Desires
External Trip Comparisons

Places:
Huntsville, AL

Types:
booklet
table

Dates:
1964-1965
1966

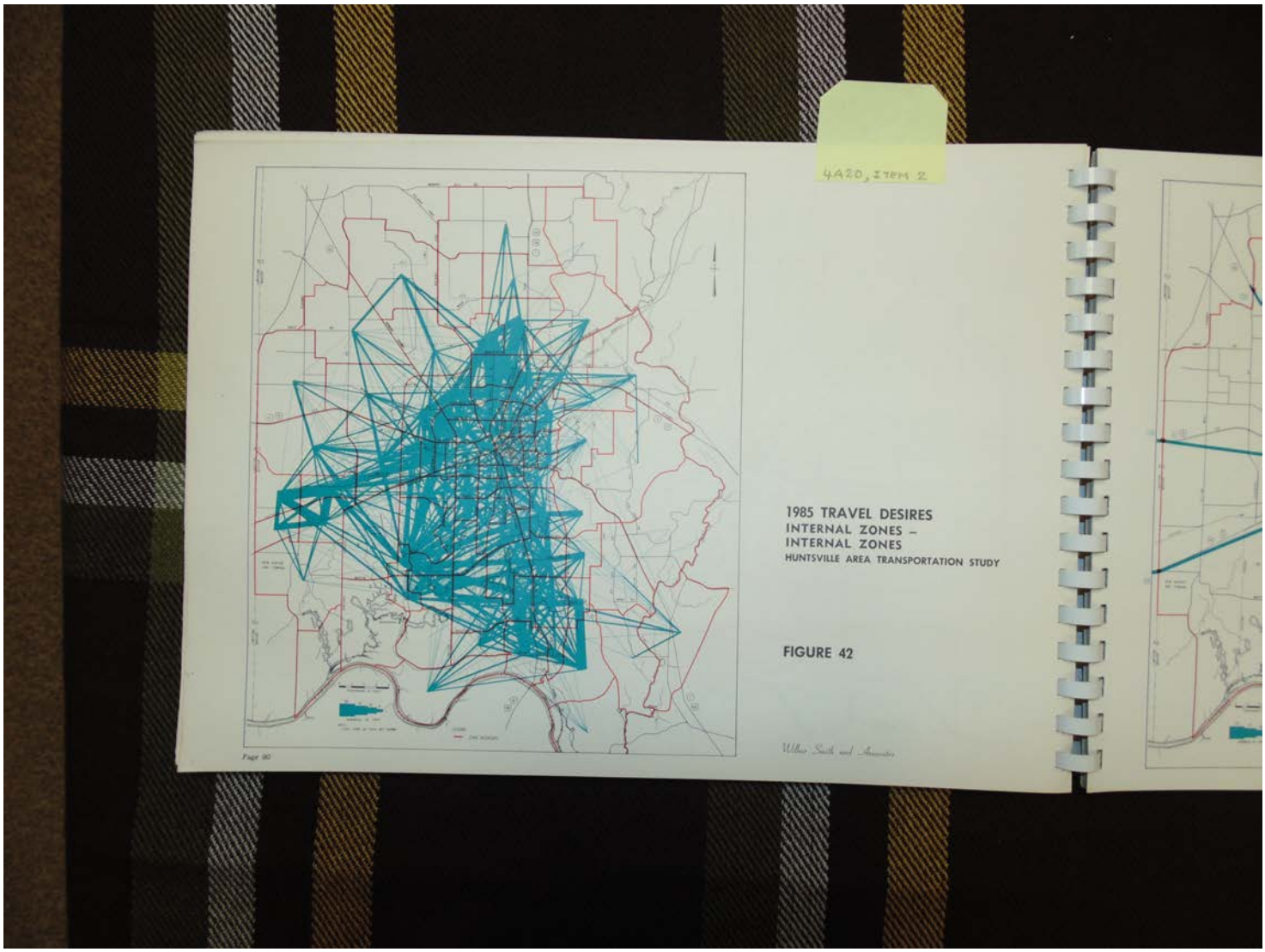


Names:
1985 Travel Desires - Central Business District

Places:
Huntsville, AL area

Types:
illustration

Dates:
1966

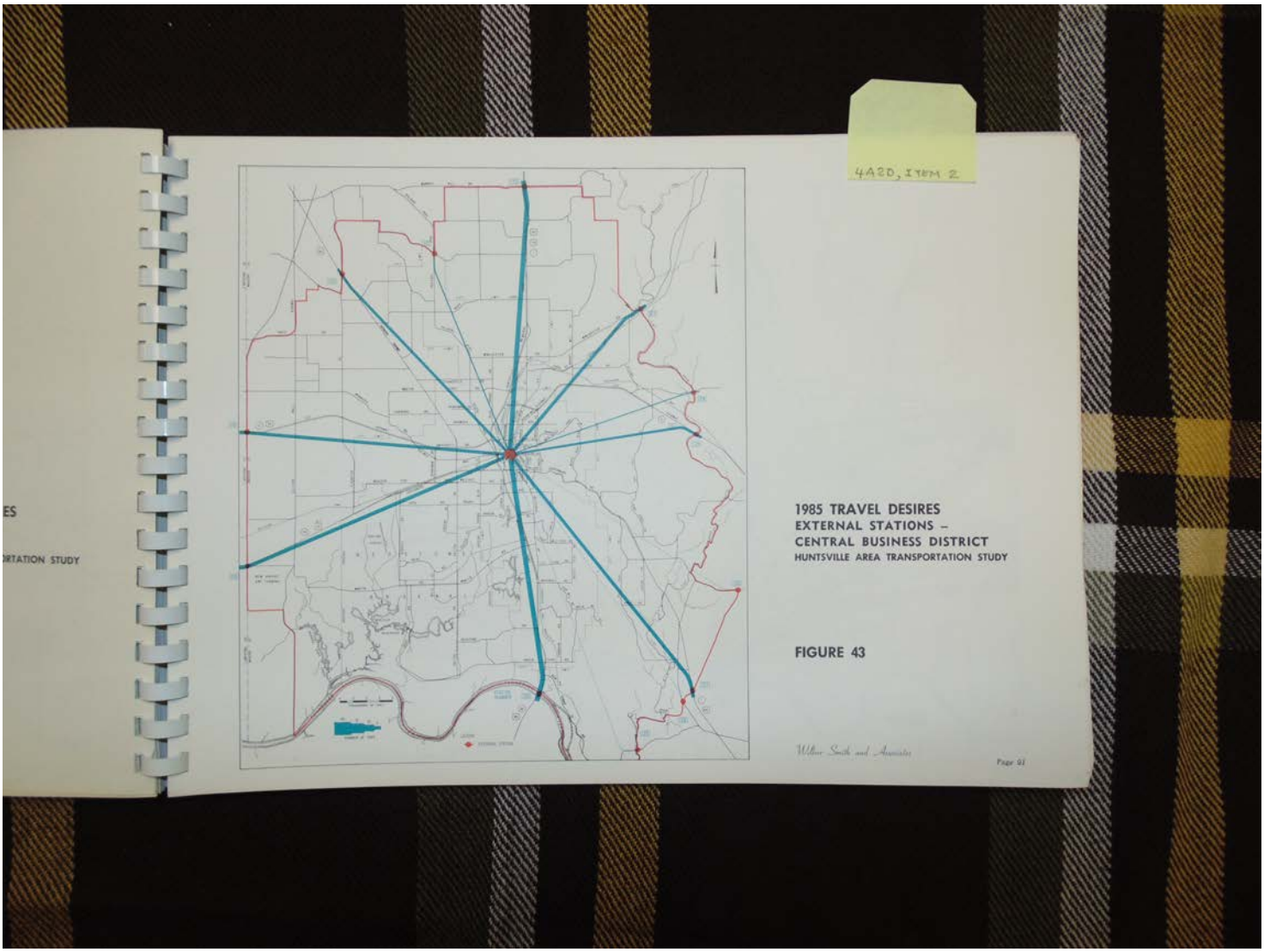


Names:
1985 Travel Desires - Internal Zones

Places:
Huntsville, AL area

Types:
illustration

Dates:
1966

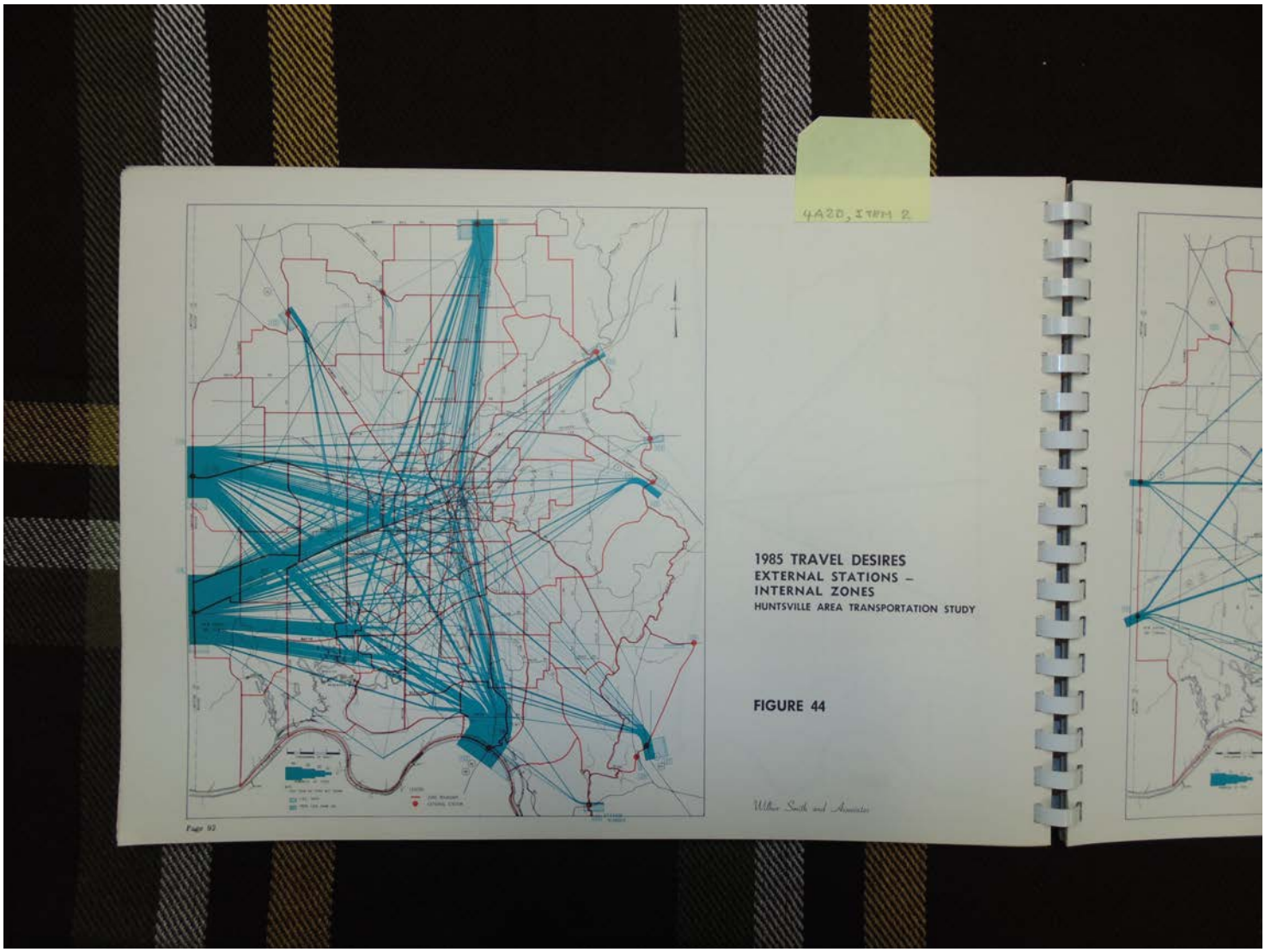


Names:
1985 Travel Desires - Central Business District

Places:
Huntsville, AL area

Types:
illustration

Dates:
1966

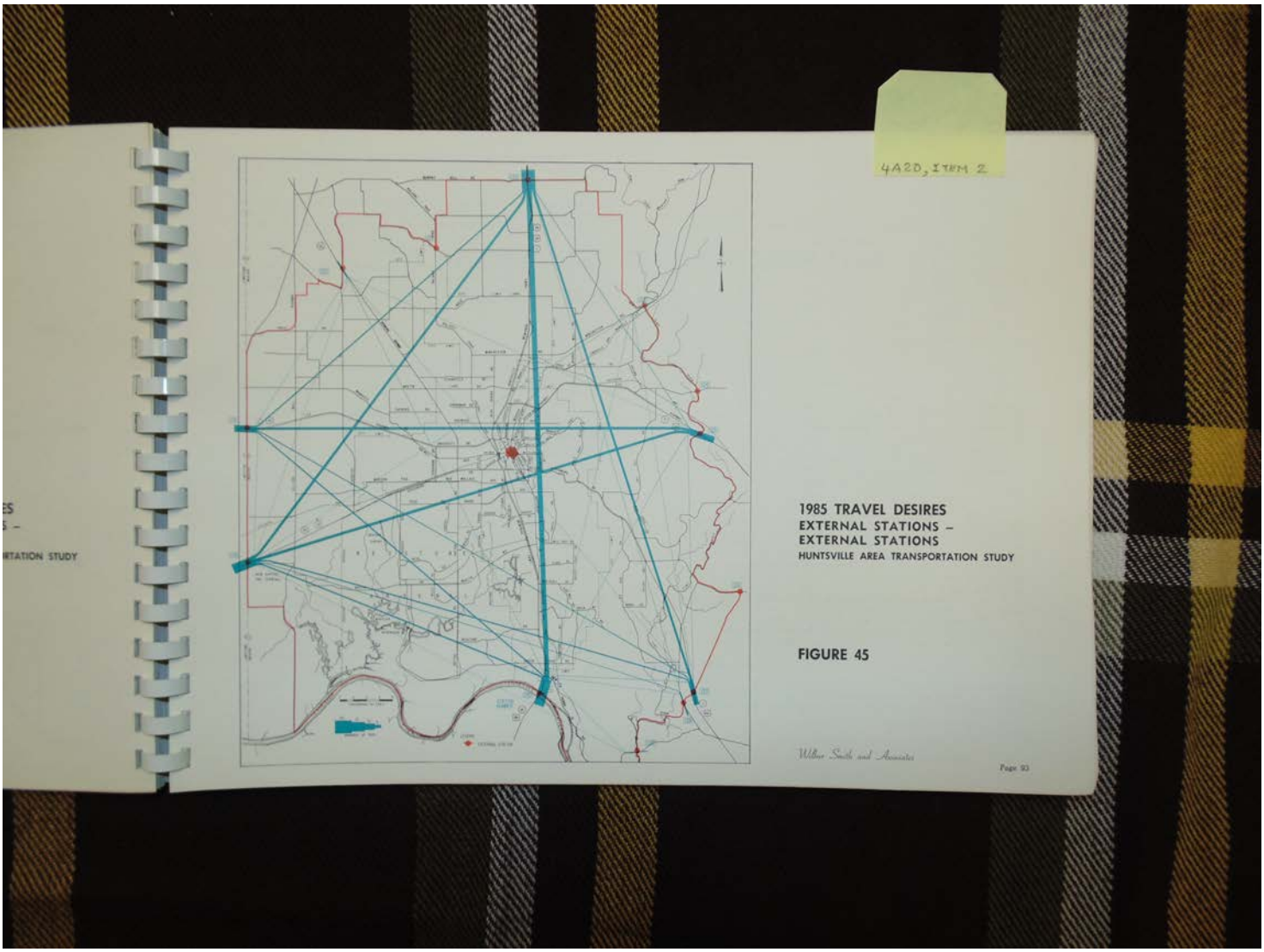


Names:
1985 Travel Desires - Internal Zones

Places:
Huntsville, AL area

Types:
illustration

Dates:
1966



Names:
1985 Travel Desires - External Stations

Places:
Huntsville, AL area

Types:
illustration

Dates:
1966

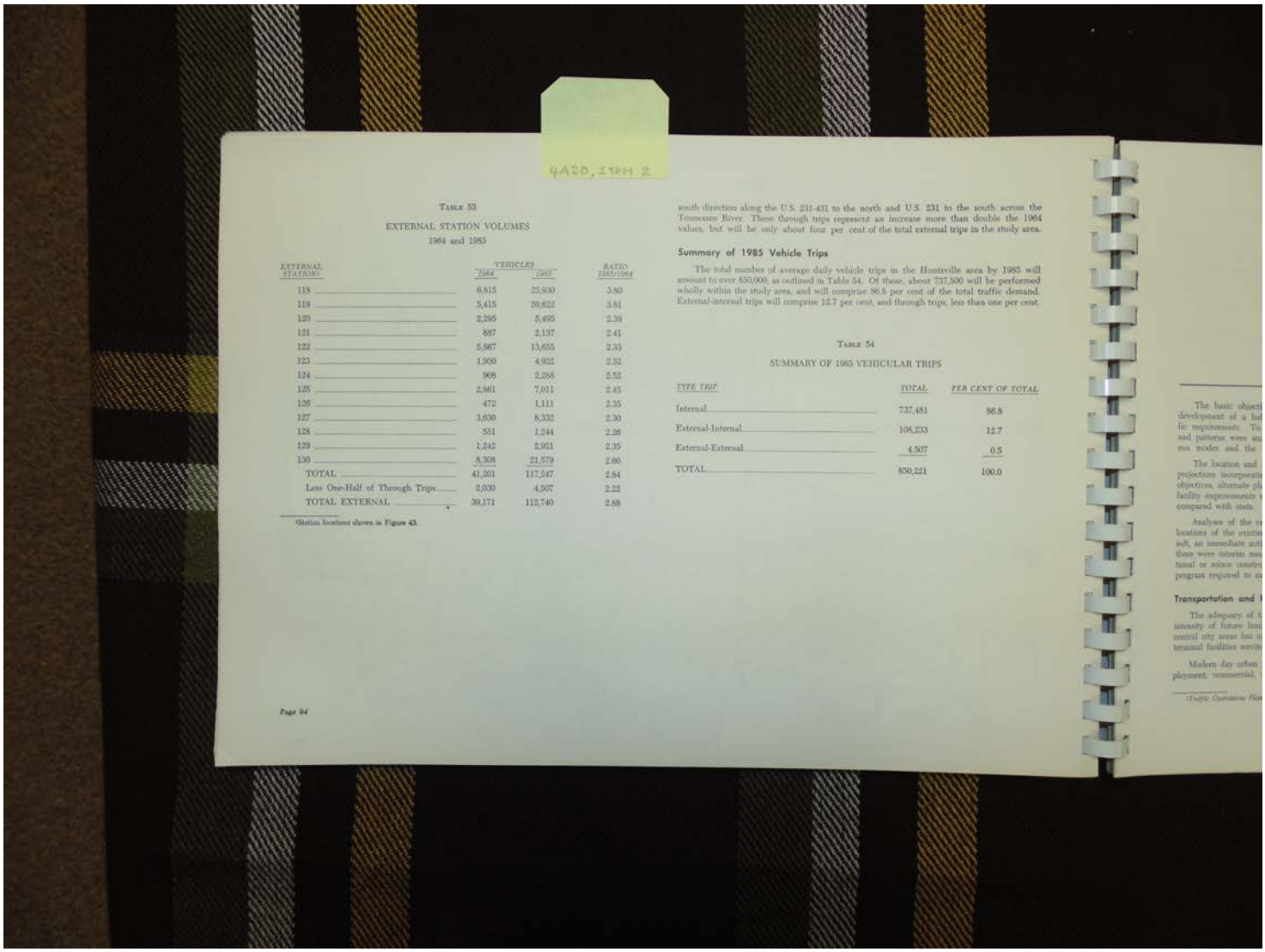


TABLE 53

EXTERNAL STATION VOLUMES
1964 and 1985

EXTERNAL STATIONS[1]	VEHICLES 1964	VEHICLES 1985	RATIO 1985/1964
118	6,815	25,930	3.80
119	5,415	20,622	3.81
120	2,295	5,495	2.39
121	887	2,137	2.41
122	5,867	13,655	2.33
123	1,950	4,922	2.52
124	908	2,288	2.52
125	2,861	7,011	2.45
126	472	1,111	2.35
127	3,630	8,332	2.30
128	551	1,244	2.26
129	1,242	2,921	2.35
130	8,308	21,579	2.60
TOTAL	41,201	117,247	2.84
Less One-Half of Through Trips	2,030	4,507	2.22
TOTAL EXTERNAL	39,171	112,740	2.88

[1]Station locations shown in Figure 43.

south direction along the U.S. 231-431 to the north and U.S. 231 to the south across the Tennessee River. These through trips represent an increase more than double the 1964 values, but will be only about four per cent of the total external trips in the study area.

Summary of 1985 Vehicle Trips

The total number of average daily vehicle trips in the Huntsville area by 1985 will amount to over 850,000, as outlined in Table 54. Of these, about 737,500 will be performed wholly within the study area, and will comprise 86.8 per cent of the total traffic demand. External-internal trips will comprise 12.7 per cent, and through trips, less than one per cent.

TABLE 54

SUMMARY OF 1985 VEHICULAR TRIPS

TYPE TRIP	TOTAL	PER CENT OF TOTAL
Internal	737,481	86.8
External-Internal	108,233	12.7
External-External	4,507	0.5
TOTAL	850,221	100.0

Page 94

Names:

1985 Vehicle Trips
External Station Volumes

Places:

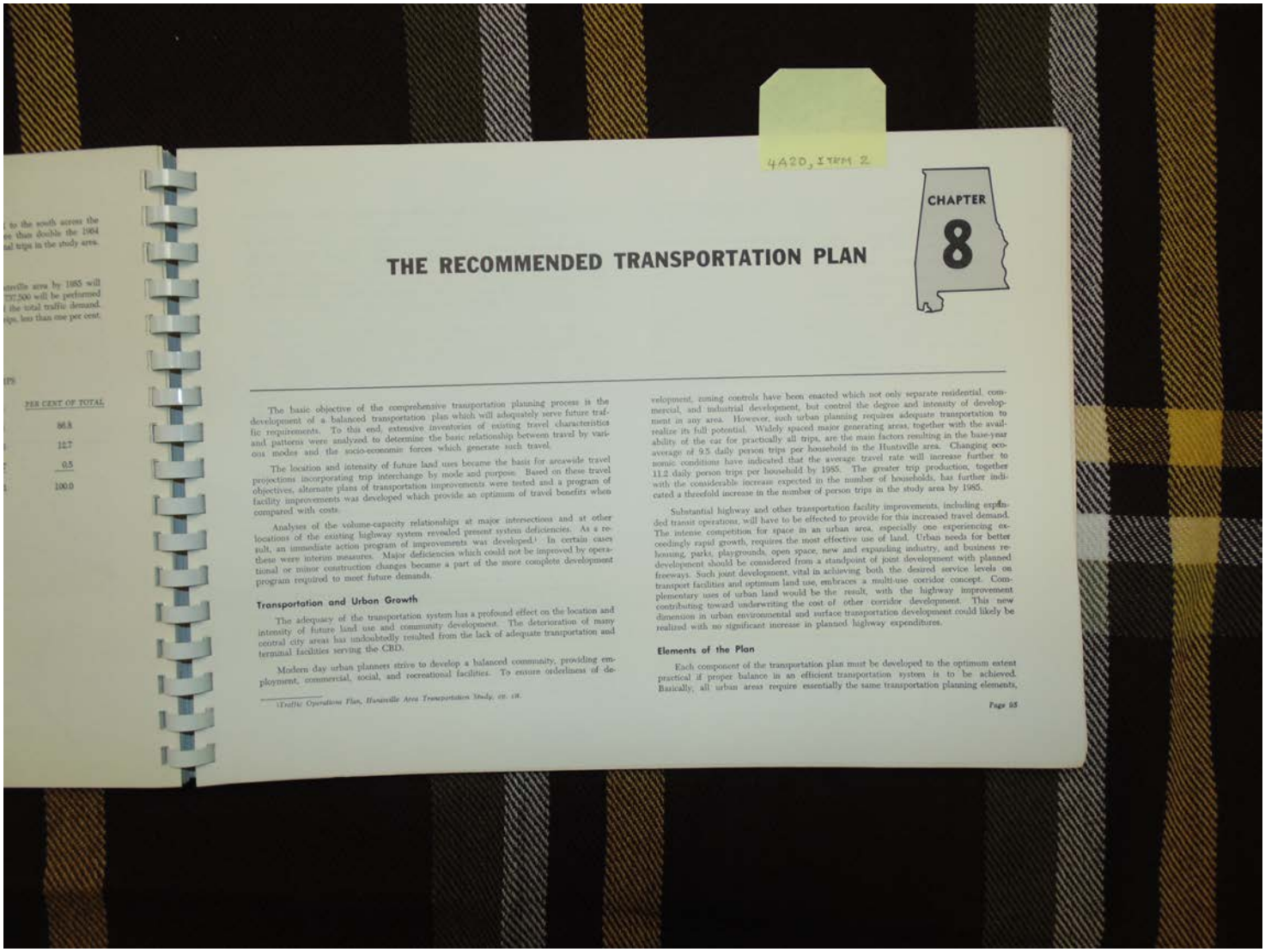
Huntsville, AL
Huntsville, AL area

Types:

booklet
illustration
table

Dates:

1964-1965
1966



Names:

Elements of Transportation Plan
Recommended Transportation Plan
- Chapter 8
Transportation & Urban Growth

Places:

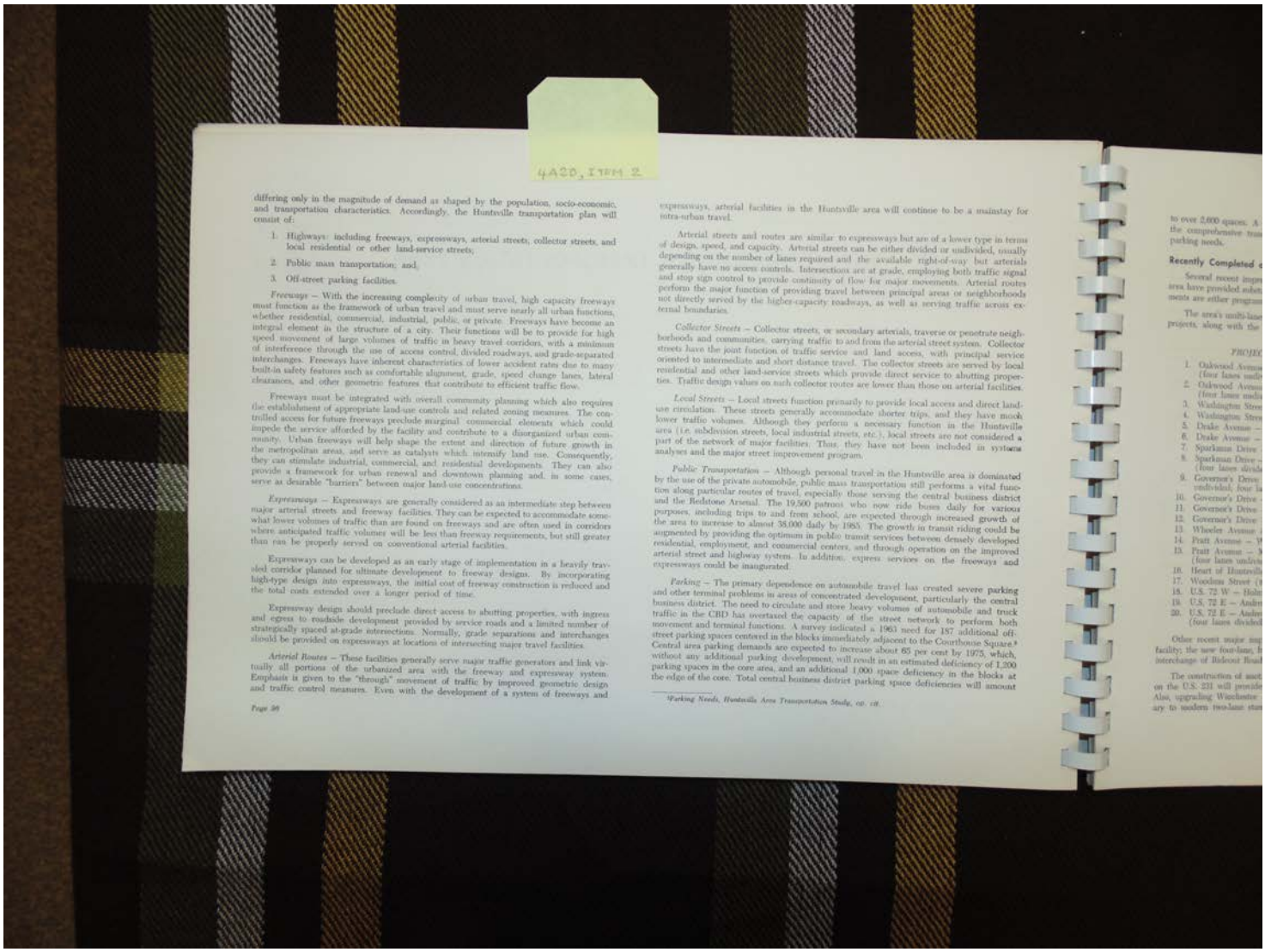
Huntsville, AL

Types:

booklet

Dates:

1966



differing only in the magnitude of demand as shaped by the population, socio-economic, and transportation characteristics. Accordingly, the Huntsville transportation plan will consist of:

1. Highways: including freeways, expressways, arterial streets, collector streets, and local residential or other land-service streets;
2. Public mass transportation; and,
3. Off-street parking facilities.

Freeways – With the increasing complexity of urban travel, high capacity freeways must function as the framework of urban travel and must serve nearly all urban functions, whether residential, commercial, industrial, public, or private. Freeways have become an integral element in the structure of a city. Their functions will be to provide for high speed movement of large volumes of traffic in heavy travel corridors, with a minimum of interference through the use of access control, divided roadways, and grade-separated interchanges. Freeways have inherent characteristics of lower accident rates due to many built-in safety features such as comfortable alignment, grade, speed change lanes, lateral clearances, and other geometric features that contribute to efficient traffic flow.

Freeways must be integrated with overall community planning which also requires the establishment of appropriate land-use controls and related zoning measures. The controlled access for future freeways preclude marginal commercial elements which could impede the service afforded by the facility and contribute to a disorganized urban community. Urban freeways will help shape the extent and direction of future growth in the metropolitan areas, and serve as catalysts which intensify land use. Consequently, they can stimulate industrial, commercial, and residential developments. They can also provide a framework for urban renewal and downtown planning and, in some cases, serve as desirable "barriers" between major land-use concentrations.

Expressways – Expressways are generally considered as an intermediate step between major arterial streets and freeway facilities. They can be expected to accommodate somewhat lower volumes of traffic than are found on freeways and are often used in corridors where anticipated traffic volumes will be less than freeway requirements, but still greater than can be properly served on conventional arterial facilities.

Expressways can be developed as an early stage of implementation in a heavily traveled corridor planned for ultimate development to freeway designs. By incorporating high-type design into expressways, the initial cost of freeway construction is reduced and the total costs extended over a longer period of time.

Expressway design should preclude direct access to abutting properties, with ingress and egress to roadside development provided by service roads and a limited number of strategically spaced at-grade intersections. Normally, grade separations and interchanges should be provided on expressways at locations of intersecting major travel facilities.

Arterial Routes – These facilities generally serve major traffic generators and link virtually all portions of the urbanized area with the freeway and expressway system. Emphasis is given to the "through" movement of traffic by improved geometric design and traffic control measures. Even with the development of a system of freeways and expressways, arterial facilities in the Huntsville area will continue to be a mainstay for intra-urban travel.

Arterial streets and routes are similar to expressways but are of a lower type in terms of design, speed, and capacity. Arterial streets can be either divided or undivided, usually depending on the number of lanes required and the available right-of-way but arterials generally have no access controls. Intersections are at grade, employing both traffic signal and stop sign control to provide continuity of flow for major movements. Arterial routes perform the major function of providing travel between principal areas or neighborhoods not directly served by the higher-capacity roadways, as well as serving traffic across external boundaries.

Collector Streets – Collector streets, or secondary arterials, traverse or penetrate neighborhoods and communities, carrying traffic to and from the arterial street system. Collector streets have the joint function of traffic service and land access, with principal service oriented to intermediate and short distance travel. The collector streets are served by local residential and other land-service streets which provide direct service to abutting properties. Traffic design values on such collector routes are lower than those on arterial facilities.

Local Streets – Local streets function primarily to provide local access and direct land-use circulation. These streets generally accommodate shorter trips, and they have much lower traffic volumes. Although they perform a necessary function in the Huntsville area (i.e. subdivision streets, local industrial streets, etc.), local streets are not considered a part of the network of major facilities. Thus, they have not been included in systems analyses and the major street improvement program.

Public Transportation – Although personal travel in the Huntsville area is dominated by the use of the private automobile, public mass transportation still performs a vital function along particular routes of travel, especially those serving the central business district and the Redstone Arsenal. The 19,500 patrons who now ride buses daily for various purposes, including trips to and from school, are expected through increased growth of the area to increase to almost 38,000 daily by 1985. The growth in transit riding could be augmented by providing the optimum in public transit services between densely developed residential, employment, and commercial centers, and through operation on the improved arterial street and highway system. In addition, express services on the freeways and expressways could be inaugurated.

Parking – The primary dependence on automobile travel has created severe parking and other terminal problems in areas of concentrated development, particularly the central business district. The need to circulate and store heavy volumes of automobile and truck traffic in the CBD has overtaxed the capacity of the street network to perform both movement and terminal functions. A survey indicated a 1965 need for 187 additional off-street parking spaces centered in the blocks immediately adjacent to the Courthouse Square.* Central area parking demands are expected to increase about 65 per cent by 1975, which, without any additional parking development, will result in an estimated deficiency of 1,200 parking spaces in the core area, and an additional 1,000 space deficiency in the blocks at the edge of the core. Total central business district parking space deficiencies will amount

Parking Needs, Huntsville Area Transportation Study, op. cit.

Page 30

to over 2,600 spaces. A
the comprehensive tran
parking needs.

Recently Completed

Several recent impr
area have provided subst
ments are either program

The area's multi-lane
projects, along with the

PROJE

1. Oakwood Avenue
(four lanes undiv
2. Oakwood Avenue
(four lanes undiv
3. Washington Stree
4. Washington Stree
5. Drake Avenue –
6. Drake Avenue –
7. Sparkman Drive
8. Sparkman Drive –
(four lanes divide
9. Governor's Drive
undivided; four la
10. Governor's Drive
11. Governor's Drive
12. Governor's Drive
13. Wheeler Avenue
14. Pratt Avenue – W
15. Pratt Avenue – W
(four lanes undivi
16. Heart of Huntsvill
17. Woodall Street (
18. U.S. 72 W – Holm
19. U.S. 72 E – Andre
20. U.S. 72 E – Andre
(four lanes divided

Other recent major im
facility; the new four-lane, h
interchange of Bideout Road

The construction of sect
on the U.S. 231 will provide
Also, upgrading Winchester
ary to modern two-lane stan

Names:

Elements of
Transportation Plan

Places:

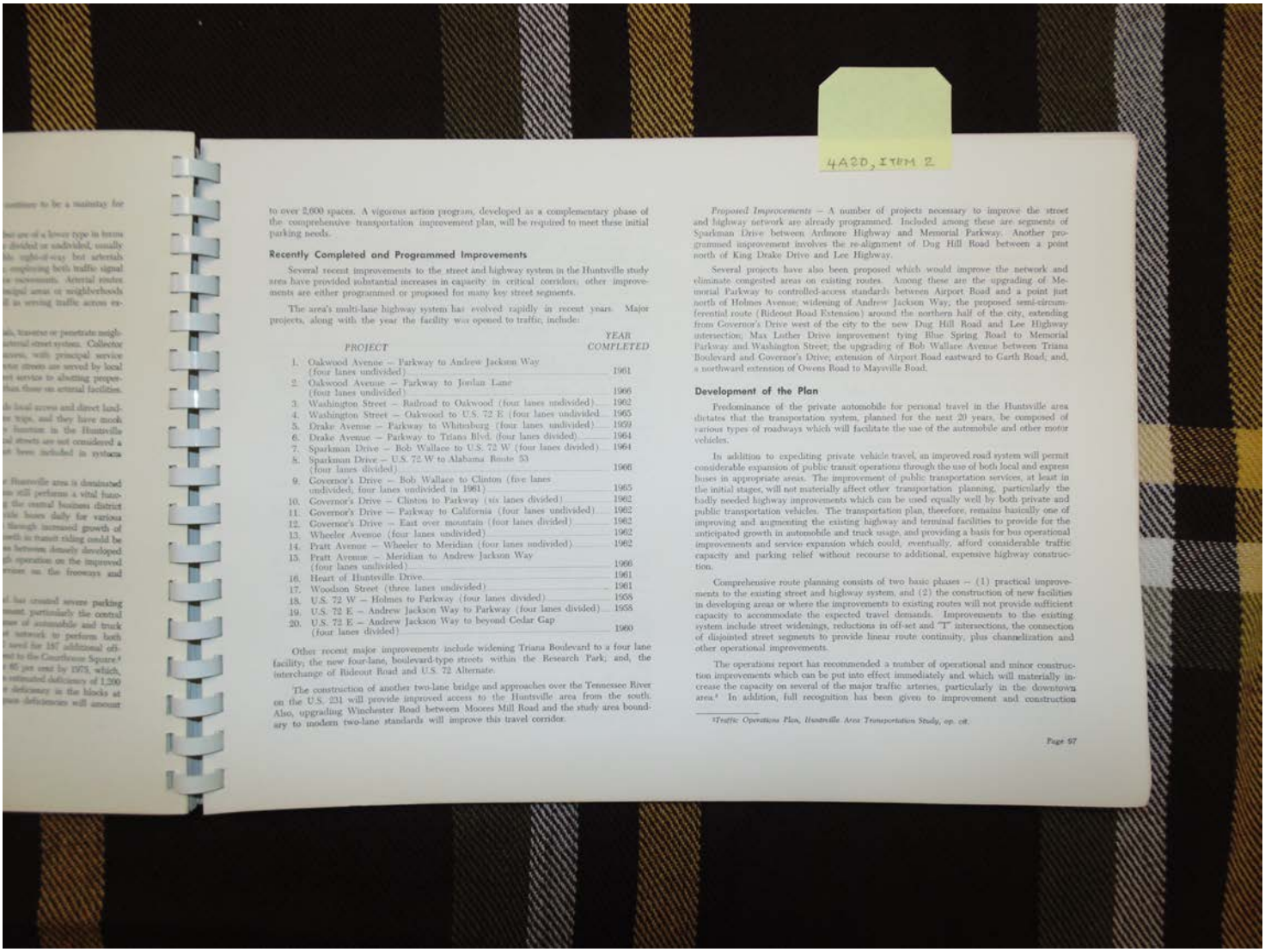
Huntsville, AL

Types:

booklet

Dates:

1966



to over 2,600 spaces. A vigorous action program, developed as a complementary phase of the comprehensive transportation improvement plan, will be required to meet these initial parking needs.

Recently Completed and Programmed Improvements

Several recent improvements to the street and highway system in the Huntsville study area have provided substantial increases in capacity in critical corridors; other improvements are either programmed or proposed for many key street segments.

The area's multi-lane highway system has evolved rapidly in recent years. Major projects, along with the year the facility was opened to traffic, include:

	PROJECT	YEAR COMPLETED
1.	Oakwood Avenue — Parkway to Andrew Jackson Way (four lanes undivided)	1961
2.	Oakwood Avenue — Parkway to Jordan Lane (four lanes undivided)	1966
3.	Washington Street — Railroad to Oakwood (four lanes undivided)	1962
4.	Washington Street — Oakwood to U.S. 72 E (four lanes undivided)	1965
5.	Drake Avenue — Parkway to Whitesburg (four lanes undivided)	1959
6.	Drake Avenue — Parkway to Trians Blvd. (four lanes divided)	1964
7.	Sparkman Drive — Bob Wallace to U.S. 72 W (four lanes divided)	1964
8.	Sparkman Drive — U.S. 72 W to Alabama Route 53 (four lanes divided)	1966
9.	Governor's Drive — Bob Wallace to Clinton (five lanes undivided, four lanes undivided in 1961)	1965
10.	Governor's Drive — Clinton to Parkway (six lanes divided)	1962
11.	Governor's Drive — Parkway to California (four lanes undivided)	1962
12.	Governor's Drive — East over mountain (four lanes divided)	1962
13.	Wheeler Avenue (four lanes undivided)	1962
14.	Pratt Avenue — Wheeler to Meridian (four lanes undivided)	1962
15.	Pratt Avenue — Meridian to Andrew Jackson Way (four lanes undivided)	1966
16.	Heart of Huntsville Drive	1961
17.	Woodson Street (three lanes undivided)	1961
18.	U.S. 72 W — Holmes to Parkway (four lanes divided)	1958
19.	U.S. 72 E — Andrew Jackson Way to Parkway (four lanes divided)	1958
20.	U.S. 72 E — Andrew Jackson Way to beyond Cedar Gap (four lanes divided)	1960

Other recent major improvements include widening Triana Boulevard to a four lane facility; the new four-lane, boulevard-type streets within the Research Park; and, the interchange of Rideout Road and U.S. 72 Alternate.

The construction of another two-lane bridge and approaches over the Tennessee River on the U.S. 231 will provide improved access to the Huntsville area from the south. Also, upgrading Winchester Road between Moores Mill Road and the study area boundary to modern two-lane standards will improve this travel corridor.

Proposed Improvements — A number of projects necessary to improve the street and highway network are already programmed. Included among these are segments of Sparkman Drive between Ardmore Highway and Memorial Parkway. Another programmed improvement involves the re-alignment of Dug Hill Road between a point north of King Drake Drive and Lee Highway.

Several projects have also been proposed which would improve the network and eliminate congested areas on existing routes. Among these are the upgrading of Memorial Parkway to controlled-access standards between Airport Road and a point just north of Holmes Avenue; widening of Andrew Jackson Way; the proposed semi-circumferential route (Rideout Road Extension) around the northern half of the city, extending from Governor's Drive west of the city to the new Dug Hill Road and Lee Highway intersection; Max Luther Drive improvement tying Blue Spring Road to Memorial Parkway and Washington Street; the upgrading of Bob Wallace Avenue between Triana Boulevard and Governor's Drive; extension of Airport Road eastward to Garth Road; and, a northward extension of Owens Road to Mayaville Road.

Development of the Plan

Predominance of the private automobile for personal travel in the Huntsville area dictates that the transportation system, planned for the next 20 years, be composed of various types of roadways which will facilitate the use of the automobile and other motor vehicles.

In addition to expediting private vehicle travel, an improved road system will permit considerable expansion of public transit operations through the use of both local and express buses in appropriate areas. The improvement of public transportation services, at least in the initial stages, will not materially affect other transportation planning, particularly the badly needed highway improvements which can be used equally well by both private and public transportation vehicles. The transportation plan, therefore, remains basically one of improving and augmenting the existing highway and terminal facilities to provide for the anticipated growth in automobile and truck usage, and providing a basis for bus operational improvements and service expansion which could, eventually, afford considerable traffic capacity and parking relief without recourse to additional, expensive highway construction.

Comprehensive route planning consists of two basic phases — (1) practical improvements to the existing street and highway system, and (2) the construction of new facilities in developing areas or where the improvements to existing routes will not provide sufficient capacity to accommodate the expected travel demands. Improvements to the existing system include street widenings, reductions in off-set and "T" intersections, the connection of disjointed street segments to provide linear route continuity, plus channelization and other operational improvements.

The operations report has recommended a number of operational and minor construction improvements which can be put into effect immediately and which will materially increase the capacity on several of the major traffic arteries, particularly in the downtown area.[7] In addition, full recognition has been given to improvement and construction

[7]*Traffic Operations Plan, Huntsville Area Transportation Study, op. cit.*

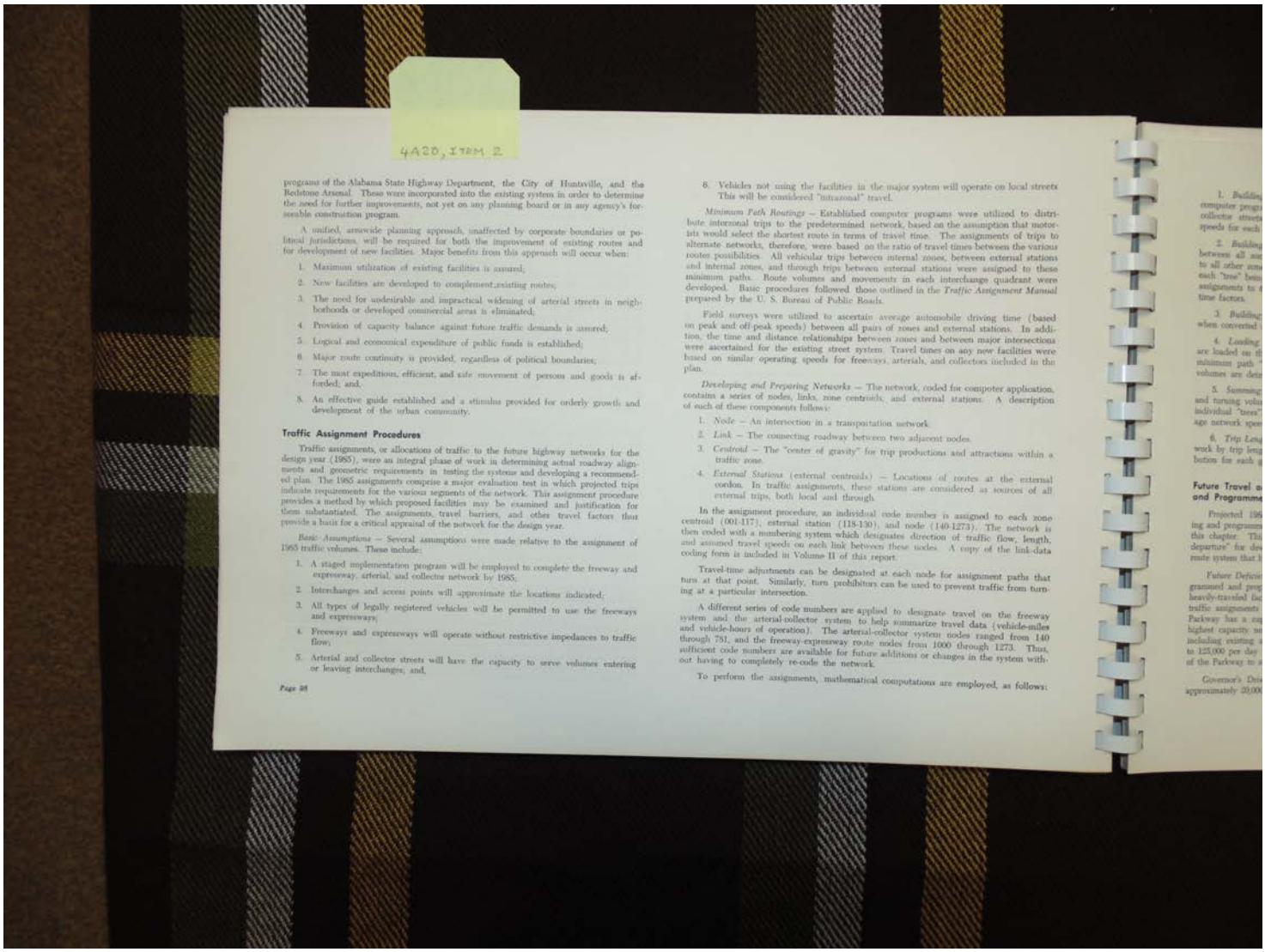
Page 97

Names:
Completed & Programed
Improvements
Development of the Transportation Plan

Places:
Huntsville, AL

Types:
booklet

Dates:
1966



programs of the Alabama State Highway Department, the City of Huntsville, and the Redstone Arsenal. These were incorporated into the existing system in order to determine the need for further improvements, not yet on any planning board or in any agency's foreseeable construction program.

A unified, areawide planning approach, unaffected by corporate boundaries or political jurisdictions, will be required for both the improvement of existing routes and for development of new facilities. Major benefits from this approach will occur when:

1. Maximum utilization of existing facilities is assured;
2. New facilities are developed to complement existing routes;
3. The need for undesirable and impractical widening of arterial streets in neighborhoods or developed commercial areas is eliminated;
4. Provision of capacity balance against future traffic demands is assured;
5. Logical and economical expenditure of public funds is established;
6. Major route continuity is provided, regardless of political boundaries;
7. The most expeditious, efficient, and safe movement of persons and goods is afforded; and,
8. An effective guide established and a stimulus provided for orderly growth and development of the urban community.

Traffic Assignment Procedures

Traffic assignments, or allocations of traffic to the future highway networks for the design year (1985), were an integral phase of work in determining actual roadway alignments and geometric requirements in testing the systems and developing a recommended plan. The 1985 assignments comprise a major evaluation test in which projected trips indicate requirements for the various segments of the network. This assignment procedure provides a method by which proposed facilities may be examined and justification for them substantiated. The assignments, travel barriers, and other travel factors thus provide a basis for a critical appraisal of the network for the design year.

Basic Assumptions — Several assumptions were made relative to the assignment of 1985 traffic volumes. These include:

1. A staged implementation program will be employed to complete the freeway and expressway, arterial, and collector network by 1985;
2. Interchanges and access points will approximate the locations indicated;
3. All types of legally registered vehicles will be permitted to use the freeways and expressways;
4. Freeways and expressways will operate without restrictive impedances to traffic flow;
5. Arterial and collector streets will have the capacity to serve volumes entering or leaving interchanges; and,
6. Vehicles not using the facilities in the major system will operate on local streets. This will be considered "intrazonal" travel.

Minimum Path Routings — Established computer programs were utilized to distribute interzonal trips to the predetermined network, based on the assumption that motorists would select the shortest route in terms of travel time. The assignments of trips to alternate networks, therefore, were based on the ratio of travel times between the various routes possibilities. All vehicular trips between internal zones, between external stations and internal zones, and through trips between external stations were assigned to these minimum paths. Route volumes and movements in each interchange quadrant were developed. Basic procedures followed those outlined in the *Traffic Assignment Manual* prepared by the U. S. Bureau of Public Roads.

Field surveys were utilized to ascertain average automobile driving time (based on peak and off-peak speeds) between all pairs of zones and external stations. In addition, the time and distance relationships between zones and between major intersections were ascertained for the existing street system. Travel times on any new facilities were based on similar operating speeds for freeways, arterials, and collectors included in the plan.

Developing and Preparing Networks — The network, coded for computer application, contains a series of nodes, links, zone centroids, and external stations. A description of each of these components follows:

1. *Node* — An intersection in a transportation network.
2. *Link* — The connecting roadway between two adjacent nodes.
3. *Centroid* — The "center of gravity" for trip productions and attractions within a traffic zone.
4. *External Stations* (external centroids) — Locations of routes at the external cordon. In traffic assignments, these stations are considered as sources of all external trips, both local and through.

In the assignment procedure, an individual code number is assigned to each zone centroid (001-117), external station (118-130), and node (140-1273). The network is then coded with a numbering system which designates direction of traffic flow, length, and assumed travel speeds on each link between these nodes. A copy of the link-data coding form is included in Volume II of this report.

Travel-time adjustments can be designated at each node for assignment paths that turn at that point. Similarly, turn prohibitors can be used to prevent traffic from turning at a particular intersection.

A different series of code numbers are applied to designate travel on the freeway system and the arterial-collector system to help summarize travel data (vehicle-miles and vehicle-hours of operation). The arterial-collector system nodes ranged from 140 through 781, and the freeway-expressway route nodes from 1000 through 1273. Thus, sufficient code numbers are available for future additions or changes in the system without having to completely re-code the network.

To perform the assignments, mathematical computations are employed, as follows:

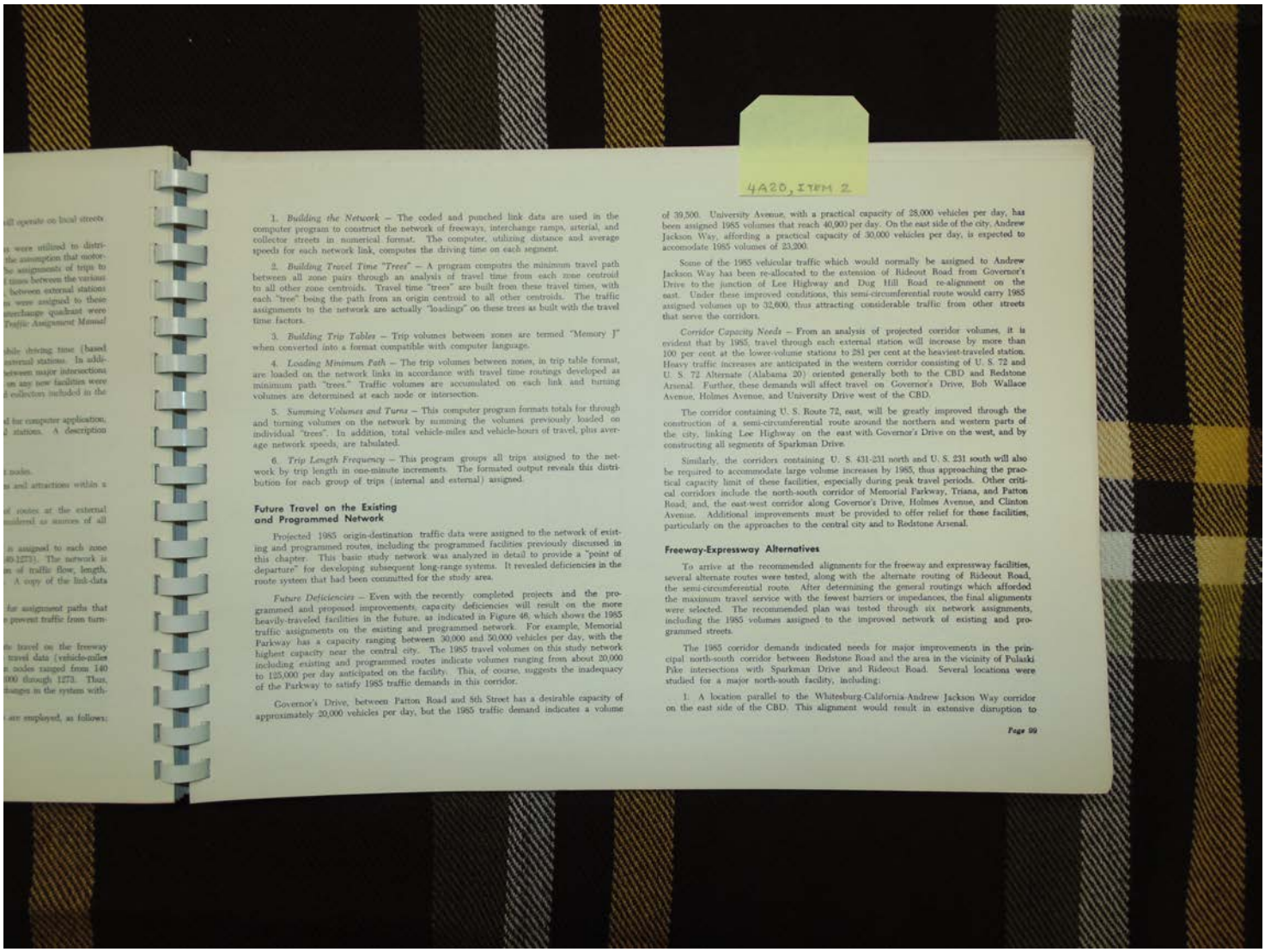
Page 98

Names:
Traffic Assignment Procedures

Places:
Huntsville, AL

Types:
booklet

Dates:
1966



1. *Building the Network* – The coded and punched link data are used in the computer program to construct the network of freeways, interchange ramps, arterial, and collector streets in numerical format. The computer, utilizing distance and average speeds for each network link, computes the driving time on each segment.

2. *Building Travel Time "Trees"* – A program computes the minimum travel path between all zone pairs through an analysis of travel time from each zone centroid to all other zone centroids. Travel time "trees" are built from these travel times, with each "tree" being the path from an origin centroid to all other centroids. The traffic assignments to the network are actually "loadings" on these trees as built with the travel time factors.

3. *Building Trip Tables* – Trip volumes between zones are termed "Memory J" when converted into a format compatible with computer language.

4. *Loading Minimum Path* – The trip volumes between zones, in trip table format, are loaded on the network links in accordance with travel time routings developed as minimum path "trees." Traffic volumes are accumulated on each link and turning volumes are determined at each node or intersection.

5. *Summing Volumes and Turns* – This computer program formats totals for through and turning volumes on the network by summing the volumes previously loaded on individual "trees". In addition, total vehicle-miles and vehicle-hours of travel, plus average network speeds, are tabulated.

6. *Trip Length Frequency* – This program groups all trips assigned to the network by trip length in one-minute increments. The formated output reveals this distribution for each group of trips (internal and external) assigned.

Future Travel on the Existing and Programmed Network

Projected 1985 origin-destination traffic data were assigned to the network of existing and programmed routes, including the programmed facilities previously discussed in this chapter. This basic study network was analyzed in detail to provide a "point of departure" for developing subsequent long-range systems. It revealed deficiencies in the route system that had been committed for the study area.

Future Deficiencies – Even with the recently completed projects and the programmed and proposed improvements, capacity deficiencies will result on the more heavily-traveled facilities in the future, as indicated in Figure 48, which shows the 1985 traffic assignments on the existing and programmed network. For example, Memorial Parkway has a capacity ranging between 30,000 and 50,000 vehicles per day, with the highest capacity near the central city. The 1985 travel volumes on this study network including existing and programmed routes indicate volumes ranging from about 20,000 to 125,000 per day anticipated on the facility. This, of course, suggests the inadequacy of the Parkway to satisfy 1985 traffic demands in this corridor.

Governor's Drive, between Patton Road and 5th Street has a desirable capacity of approximately 20,000 vehicles per day, but the 1985 traffic demand indicates a volume of 39,500. University Avenue, with a practical capacity of 28,000 vehicles per day, has been assigned 1985 volumes that reach 40,900 per day. On the east side of the city, Andrew Jackson Way, affording a practical capacity of 30,000 vehicles per day, is expected to accomodate 1985 volumes of 23,200.

Some of the 1985 vehicular traffic which would normally be assigned to Andrew Jackson Way has been re-allocated to the extension of Rideout Road from Governor's Drive to the junction of Lee Highway and Dug Hill Road re-alignment on the east. Under these improved conditions, this semi-circumferential route would carry 1985 assigned volumes up to 32,600, thus attracting considerable traffic from other streets that serve the corridors.

Corridor Capacity Needs – From an analysis of projected corridor volumes, it is evident that by 1985, travel through each external station will increase by more than 100 per cent at the lower-volume stations to 281 per cent at the heaviest-traveled station. Heavy traffic increases are anticipated in the western corridor consisting of U. S. 72 and U. S. 72 Alternate (Alabama 20) oriented generally both to the CBD and Redstone Arsenal. Further, these demands will affect travel on Governor's Drive, Bob Wallace Avenue, Holmes Avenue, and University Drive west of the CBD.

The corridor containing U. S. Route 72, east, will be greatly improved through the construction of a semi-circumferential route around the northern and western parts of the city, linking Lee Highway on the east with Governor's Drive on the west, and by constructing all segments of Sparkman Drive.

Similarly, the corridors containing U. S. 431-231 north and U. S. 231 south will also be required to accommodate large volume increases by 1985, thus approaching the practical capacity limit of these facilities, especially during peak travel periods. Other critical corridors include the north-south corridor of Memorial Parkway, Triana, and Patton Road; and, the east-west corridor along Governor's Drive, Holmes Avenue, and Clinton Avenue. Additional improvements must be provided to offer relief for these facilities, particularly on the approaches to the central city and to Redstone Arsenal.

Freeway-Expressway Alternatives

To arrive at the recommended alignments for the freeway and expressway facilities, several alternate routes were tested, along with the alternate routing of Rideout Road, the semi-circumferential route. After determining the general routings which afforded the maximum travel service with the fewest barriers or impedances, the final alignments were selected. The recommended plan was tested through six network assignments, including the 1985 volumes assigned to the improved network of existing and programmed streets.

The 1985 corridor demands indicated needs for major improvements in the principal north-south corridor between Redstone Road and the area in the vicinity of Pulaski Pike intersections with Sparkman Drive and Rideout Road. Several locations were studied for a major north-south facility, including:

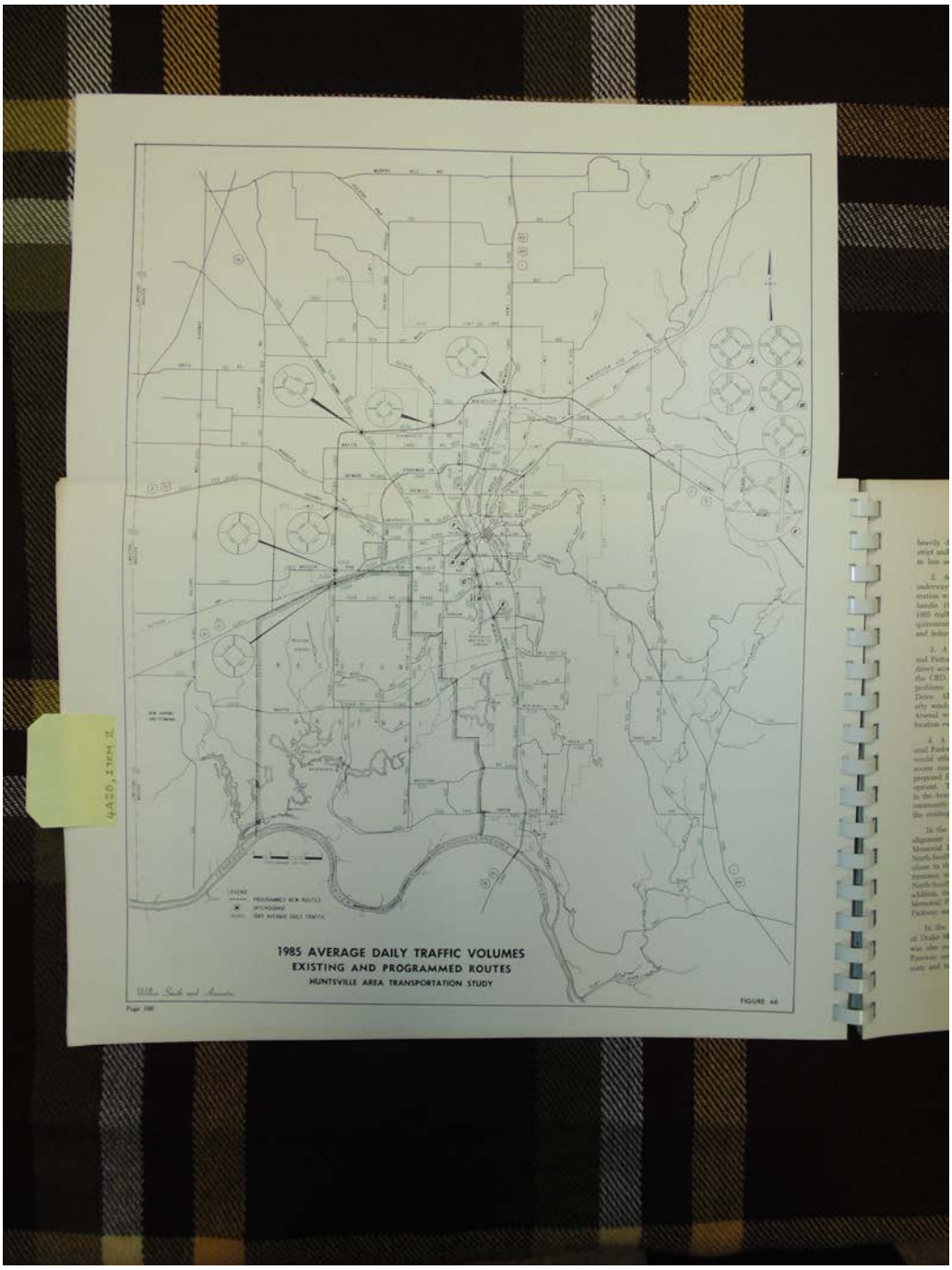
1. A location parallel to the Whitesburg-California-Andrew Jackson Way corridor on the east side of the CBD. This alignment would result in extensive disruption to

Names:
Freeway - Expressway
Alternatives
Future Travel

Places:
Huntsville, AL

Types:
booklet

Dates:
1966

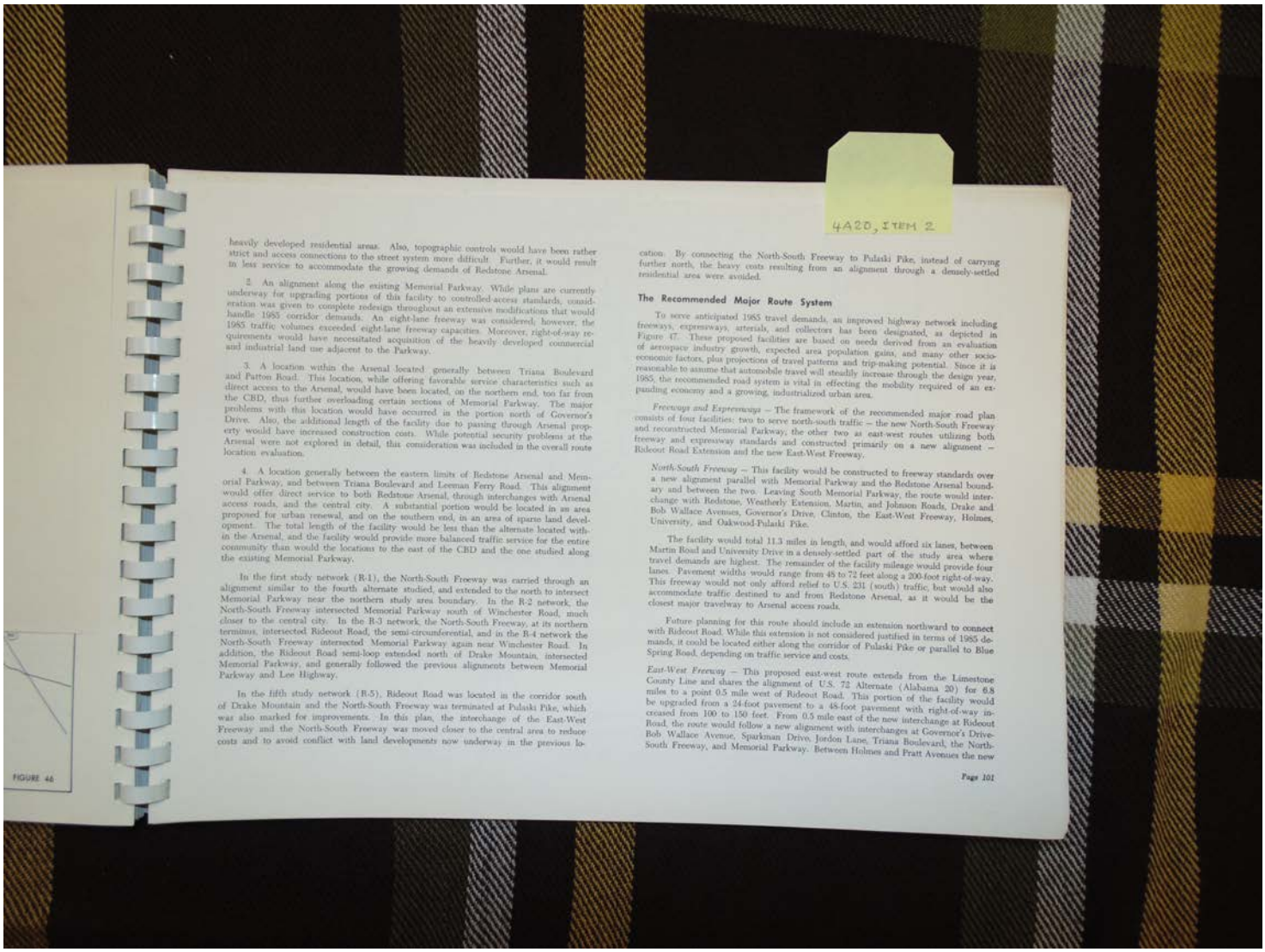


Names:
1985 Average Daily Traffic Volumes

Places:
Huntsville, AL area

Types:
map

Dates:
1966



Names:
Recommended Major
Route System

Places:
Huntsville, AL

Types:
booklet

Dates:
1966

Names:

Recommended Highway
Transportation System

Places:

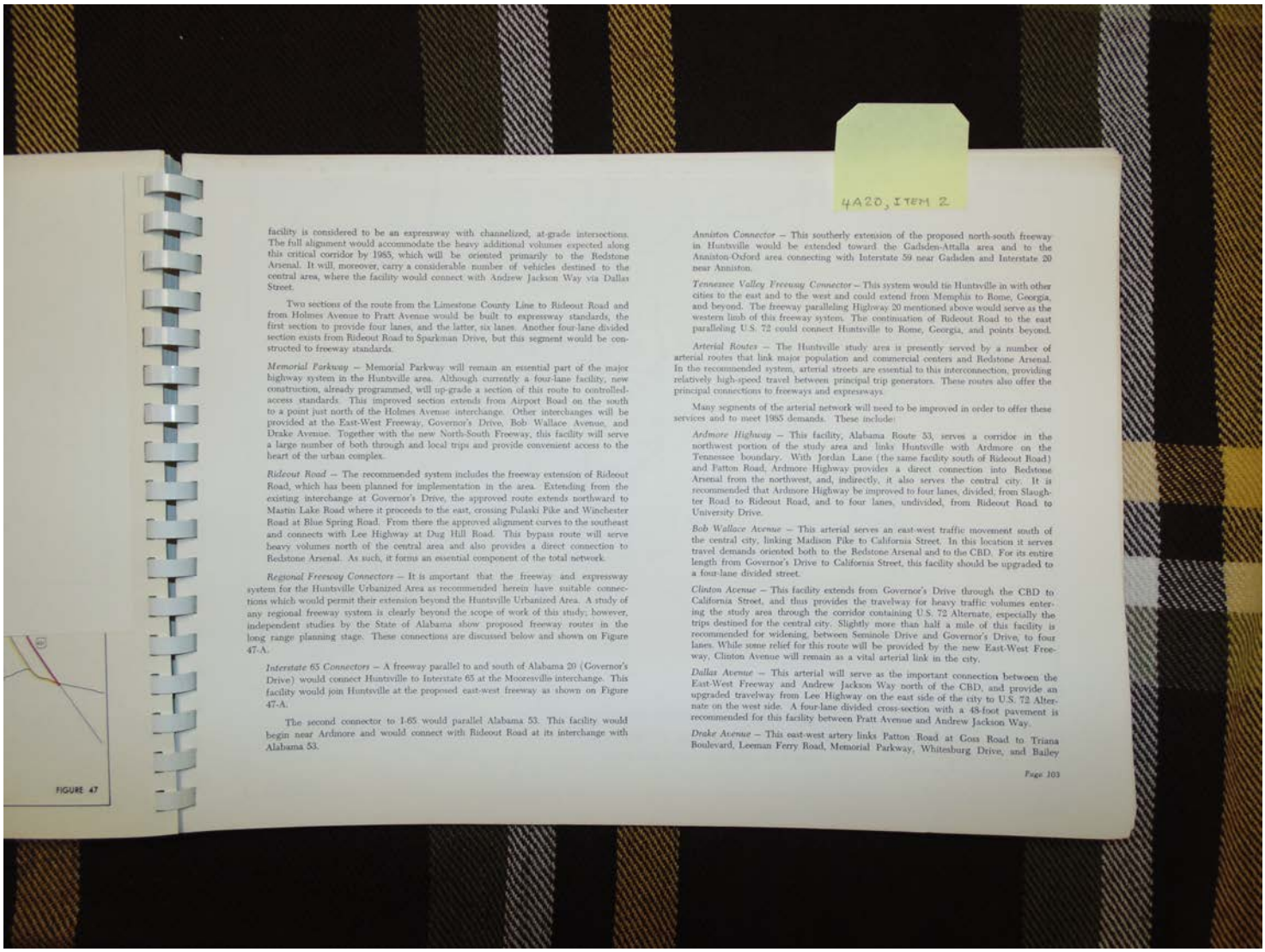
Huntsville, AL area

Types:

map

Dates:

1966



facility is considered to be an expressway with channelized, at-grade intersections. The full alignment would accommodate the heavy additional volumes expected along this critical corridor by 1985, which will be oriented primarily to the Redstone Arsenal. It will, moreover, carry a considerable number of vehicles destined to the central area, where the facility would connect with Andrew Jackson Way via Dallas Street.

Two sections of the route from the Limestone County Line to Rideout Road and from Holmes Avenue to Pratt Avenue would be built to expressway standards, the first section to provide four lanes, and the latter, six lanes. Another four-lane divided section exists from Rideout Road to Sparkman Drive, but this segment would be constructed to freeway standards.

Memorial Parkway — Memorial Parkway will remain an essential part of the major highway system in the Huntsville area. Although currently a four-lane facility, new construction, already programmed, will up-grade a section of this route to controlled-access standards. This improved section extends from Airport Road on the south to a point just north of the Holmes Avenue interchange. Other interchanges will be provided at the East-West Freeway, Governor's Drive, Bob Wallace Avenue, and Drake Avenue. Together with the new North-South Freeway, this facility will serve a large number of both through and local trips and provide convenient access to the heart of the urban complex.

Rideout Road — The recommended system includes the freeway extension of Rideout Road, which has been planned for implementation in the area. Extending from the existing interchange at Governor's Drive, the approved route extends northward to Mastin Lake Road where it proceeds to the east, crossing Pulaski Pike and Winchester Road at Blue Spring Road. From there the approved alignment curves to the southeast and connects with Lee Highway at Dug Hill Road. This bypass route will serve heavy volumes north of the central area and also provides a direct connection to Redstone Arsenal. As such, it forms an essential component of the total network.

Regional Freeway Connectors — It is important that the freeway and expressway system for the Huntsville Urbanized Area as recommended herein have suitable connections which would permit their extension beyond the Huntsville Urbanized Area. A study of any regional freeway system is clearly beyond the scope of work of this study; however, independent studies by the State of Alabama show proposed freeway routes in the long range planning stage. These connections are discussed below and shown on Figure 47-A.

Interstate 65 Connectors — A freeway parallel to and south of Alabama 20 (Governor's Drive) would connect Huntsville to Interstate 65 at the Mooresville interchange. This facility would join Huntsville at the proposed east-west freeway as shown on Figure 47-A.

The second connector to I-65 would parallel Alabama 53. This facility would begin near Ardmore and would connect with Rideout Road at its interchange with Alabama 53.

Anniston Connector — This southerly extension of the proposed north-south freeway in Huntsville would be extended toward the Gadsden-Attalla area and to the Anniston-Oxford area connecting with Interstate 59 near Gadsden and Interstate 20 near Anniston.

Tennessee Valley Freeway Connector — This system would tie Huntsville in with other cities to the east and to the west and could extend from Memphis to Rome, Georgia, and beyond. The freeway paralleling Highway 20 mentioned above would serve as the western limb of this freeway system. The continuation of Rideout Road to the east paralleling U.S. 72 could connect Huntsville to Rome, Georgia, and points beyond.

Arterial Routes — The Huntsville study area is presently served by a number of arterial routes that link major population and commercial centers and Redstone Arsenal. In the recommended system, arterial streets are essential to this interconnection, providing relatively high-speed travel between principal trip generators. These routes also offer the principal connections to freeways and expressways.

Many segments of the arterial network will need to be improved in order to offer these services and to meet 1985 demands. These include:

Ardmore Highway — This facility, Alabama Route 53, serves a corridor in the northwest portion of the study area and links Huntsville with Ardmore on the Tennessee boundary. With Jordan Lane (the same facility south of Rideout Road) and Patton Road, Ardmore Highway provides a direct connection into Redstone Arsenal from the northwest, and, indirectly, it also serves the central city. It is recommended that Ardmore Highway be improved to four lanes, divided, from Slaughter Road to Rideout Road, and to four lanes, undivided, from Rideout Road to University Drive.

Bob Wallace Avenue — This arterial serves an east-west traffic movement south of the central city, linking Madison Pike to California Street. In this location it serves travel demands oriented both to the Redstone Arsenal and to the CBD. For its entire length from Governor's Drive to California Street, this facility should be upgraded to a four-lane divided street.

Clinton Avenue — This facility extends from Governor's Drive through the CBD to California Street, and thus provides the travelway for heavy traffic volumes entering the study area through the corridor containing U.S. 72 Alternate, especially the trips destined for the central city. Slightly more than half a mile of this facility is recommended for widening, between Seminole Drive and Governor's Drive, to four lanes. While some relief for this route will be provided by the new East-West Freeway, Clinton Avenue will remain as a vital arterial link in the city.

Dallas Avenue — This arterial will serve as the important connection between the East-West Freeway and Andrew Jackson Way north of the CBD, and provide an upgraded travelway from Lee Highway on the east side of the city to U.S. 72 Alternate on the west side. A four-lane divided cross-section with a 48-foot pavement is recommended for this facility between Pratt Avenue and Andrew Jackson Way.

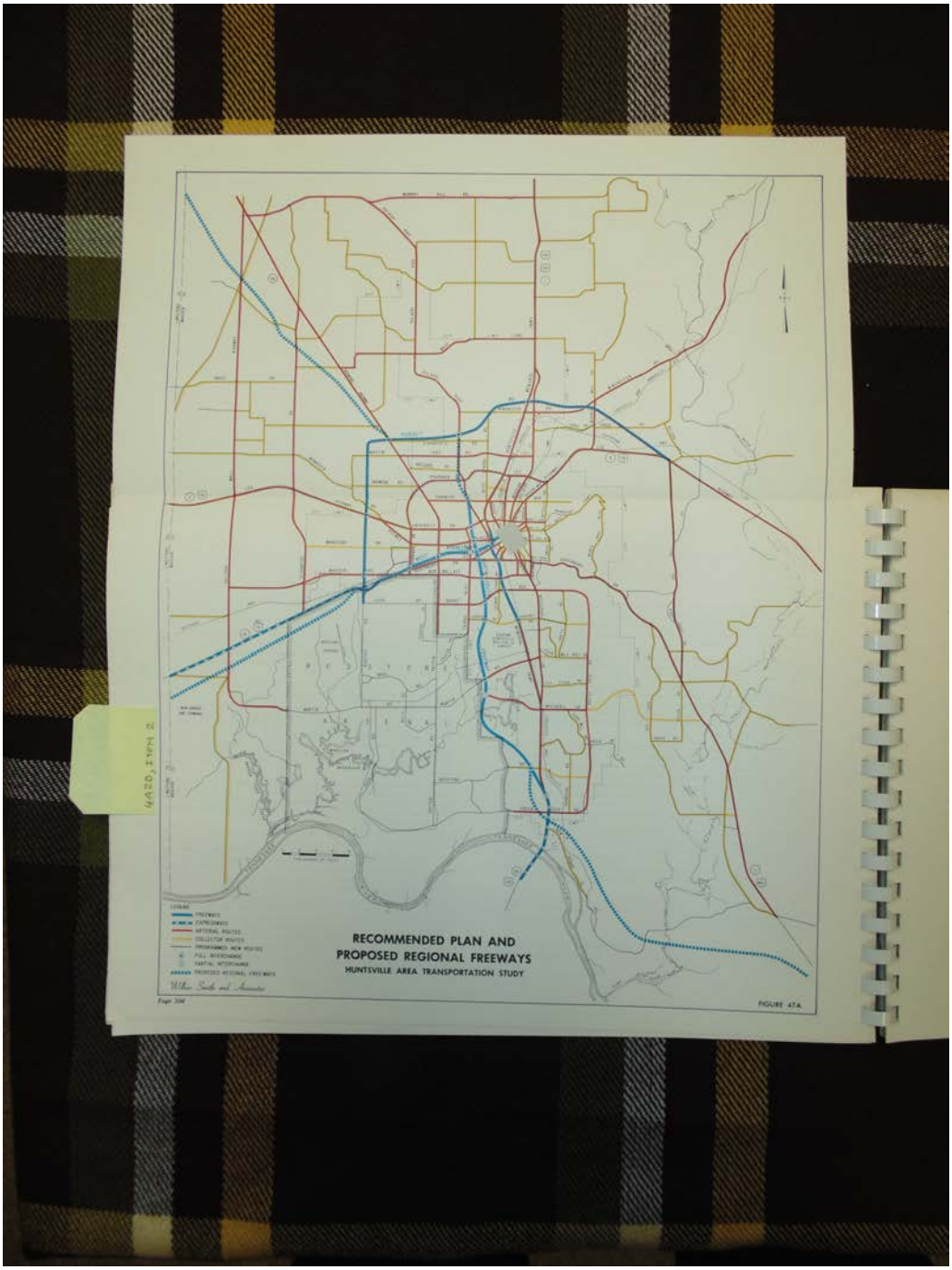
Drake Avenue — This east-west artery links Patton Road at Goss Road to Triana Boulevard, Leeman Ferry Road, Memorial Parkway, Whitesburg Drive, and Bailey

Names:
Recommended Major Route System

Places:
Huntsville, AL

Types:
booklet

Dates:
1966

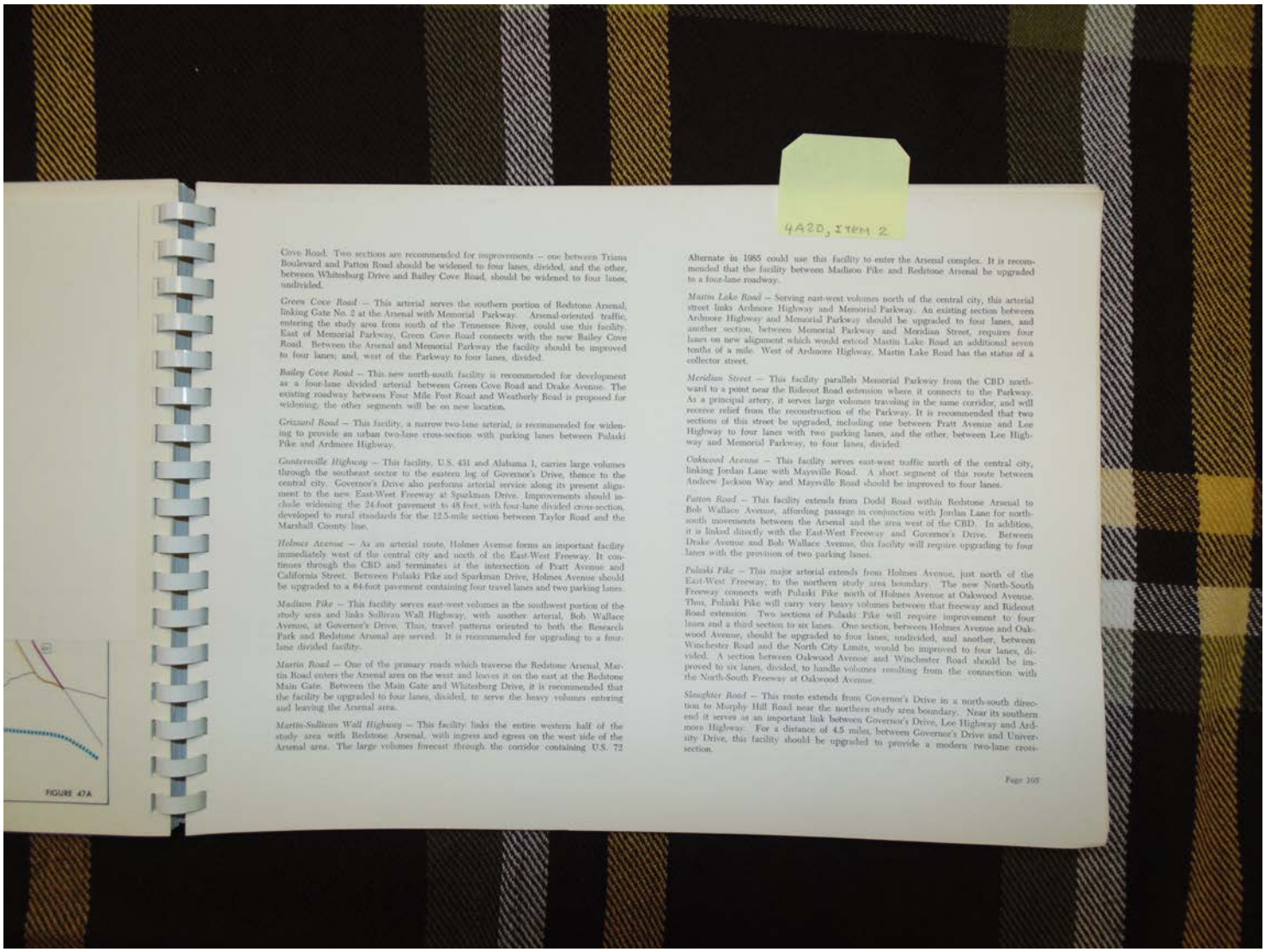


Names:
Recommended Plan & Regional
Freeways

Places:
Huntsville, AL area

Types:
map

Dates:
1966



Cove Road: Two sections are recommended for improvements -- one between Triana Boulevard and Patton Road should be widened to four lanes, divided, and the other, between Whitesburg Drive and Bailey Cove Road, should be widened to four lanes, undivided.

Green Cove Road -- This arterial serves the southern portion of Redstone Arsenal, linking Gate No. 2 at the Arsenal with Memorial Parkway. Arsenal-oriented traffic, entering the study area from south of the Tennessee River, could use this facility. East of Memorial Parkway, Green Cove Road connects with the new Bailey Cove Road. Between the Arsenal and Memorial Parkway the facility should be improved to four lanes; and, west of the Parkway to four lanes, divided.

Bailey Cove Road -- This new north-south facility is recommended for development as a four-lane divided arterial between Green Cove Road and Drake Avenue. The existing roadway between Four Mile Post Road and Weatherly Road is proposed for widening; the other segments will be on new location.

Grizzard Road -- This facility, a narrow two-lane arterial, is recommended for widening to provide an urban two-lane cross-section with parking lanes between Pulaski Pike and Ardmore Highway.

Guntersville Highway -- This facility, U.S. 431 and Alabama 1, carries large volumes through the southeast sector to the eastern leg of Governor's Drive, thence to the central city. Governor's Drive also performs arterial service along its present alignment to the new East-West Freeway at Sparkman Drive. Improvements should include widening the 24-foot pavement to 48 feet, with four-lane divided cross-section, developed to rural standards for the 12.5-mile section between Taylor Road and the Marshall County line.

Holmes Avenue -- As an arterial route, Holmes Avenue forms an important facility immediately west of the central city and north of the East-West Freeway. It continues through the CBD and terminates at the intersection of Pratt Avenue and California Street. Between Pulaski Pike and Sparkman Drive, Holmes Avenue should be upgraded to a 64-foot pavement containing four travel lanes and two parking lanes.

Madison Pike -- This facility serves east-west volumes in the southwest portion of the study area and links Sullivan Wall Highway, with another arterial, Bob Wallace Avenue, at Governor's Drive. Thus, travel patterns oriented to both the Research Park and Redstone Arsenal are served. It is recommended for upgrading to a four-lane divided facility.

Martin Road -- One of the primary roads which traverse the Redstone Arsenal, Martin Road enters the Arsenal area on the west and leaves it on the east at the Redstone Main Gate. Between the Main Gate and Whitesburg Drive, it is recommended that the facility be upgraded to four lanes, divided, to serve the heavy volumes entering and leaving the Arsenal area.

Martin-Sullivan Wall Highway -- This facility links the entire western half of the study area with Redstone Arsenal, with ingress and egress on the west side of the Arsenal area. The large volumes forecast through the corridor containing U.S. 72 Alternate in 1985 could use this facility to enter the Arsenal complex. It is recommended that the facility between Madison Pike and Redstone Arsenal be upgraded to a four-lane roadway.

Mastin Lake Road -- Serving east-west volumes north of the central city, this arterial street links Ardmore Highway and Memorial Parkway. An existing section between Ardmore Highway and Memorial Parkway should be upgraded to four lanes, and another section, between Memorial Parkway and Meridian Street, requires four lanes on new alignment which would extend Mastin Lake Road an additional seven tenths of a mile. West of Ardmore Highway, Mastin Lake Road has the status of a collector street.

Meridian Street -- This facility parallels Memorial Parkway from the CBD northward to a point near the Rideout Road extension where it connects to the Parkway. As a principal artery, it serves large volumes traveling in the same corridor, and will receive relief from the reconstruction of the Parkway. It is recommended that two sections of this street be upgraded, including one between Pratt Avenue and Lee Highway to four lanes with two parking lanes, and the other, between Lee Highway and Memorial Parkway, to four lanes, divided.

Oakwood Avenue -- This facility serves east-west traffic north of the central city, linking Jordan Lane with Maysville Road. A short segment of this route between Andrew Jackson Way and Maysville Road should be improved to four lanes.

Patton Road -- This facility extends from Dodd Road within Redstone Arsenal to Bob Wallace Avenue, affording passage in conjunction with Jordan Lane for north-south movements between the Arsenal and the area west of the CBD. In addition, it is linked directly with the East-West Freeway and Governor's Drive. Between Drake Avenue and Bob Wallace Avenue, this facility will require upgrading to four lanes with the provision of two parking lanes.

Pulaski Pike -- This major arterial extends from Holmes Avenue, just north of the East-West Freeway, to the northern study area boundary. The new North-South Freeway connects with Pulaski Pike north of Holmes Avenue at Oakwood Avenue. Thus, Pulaski Pike will carry very heavy volumes between that freeway and Rideout Road extension. Two sections of Pulaski Pike will require improvement to four lanes and a third section to six lanes. One section, between Holmes Avenue and Oakwood Avenue, should be upgraded to four lanes, undivided, and another, between Winchester Road and the North City Limits, would be improved to four lanes, divided. A section between Oakwood Avenue and Winchester Road should be improved to six lanes, divided, to handle volumes resulting from the connection with the North-South Freeway at Oakwood Avenue.

Slaughter Road -- This route extends from Governor's Drive in a north-south direction to Murphy Hill Road near the northern study area boundary. Near its southern end it serves as an important link between Governor's Drive, Lee Highway and Ardmore Highway. For a distance of 4.5 miles, between Governor's Drive and University Drive, this facility should be upgraded to provide a modern two-lane cross-section.

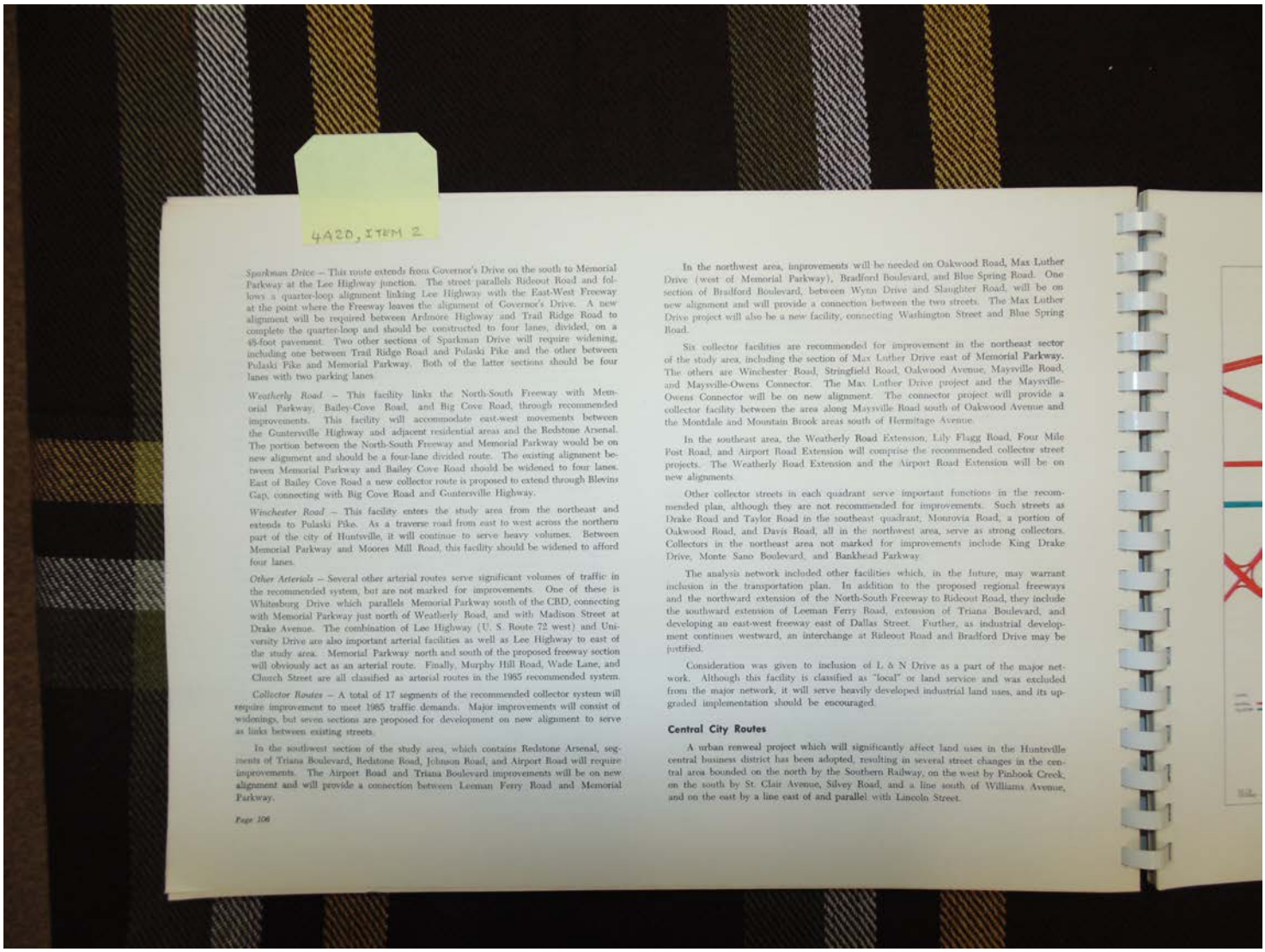
Page 105

Names:
Recommended System
Transportation

Places:
Huntsville, AL

Types:
booklet

Dates:
1966

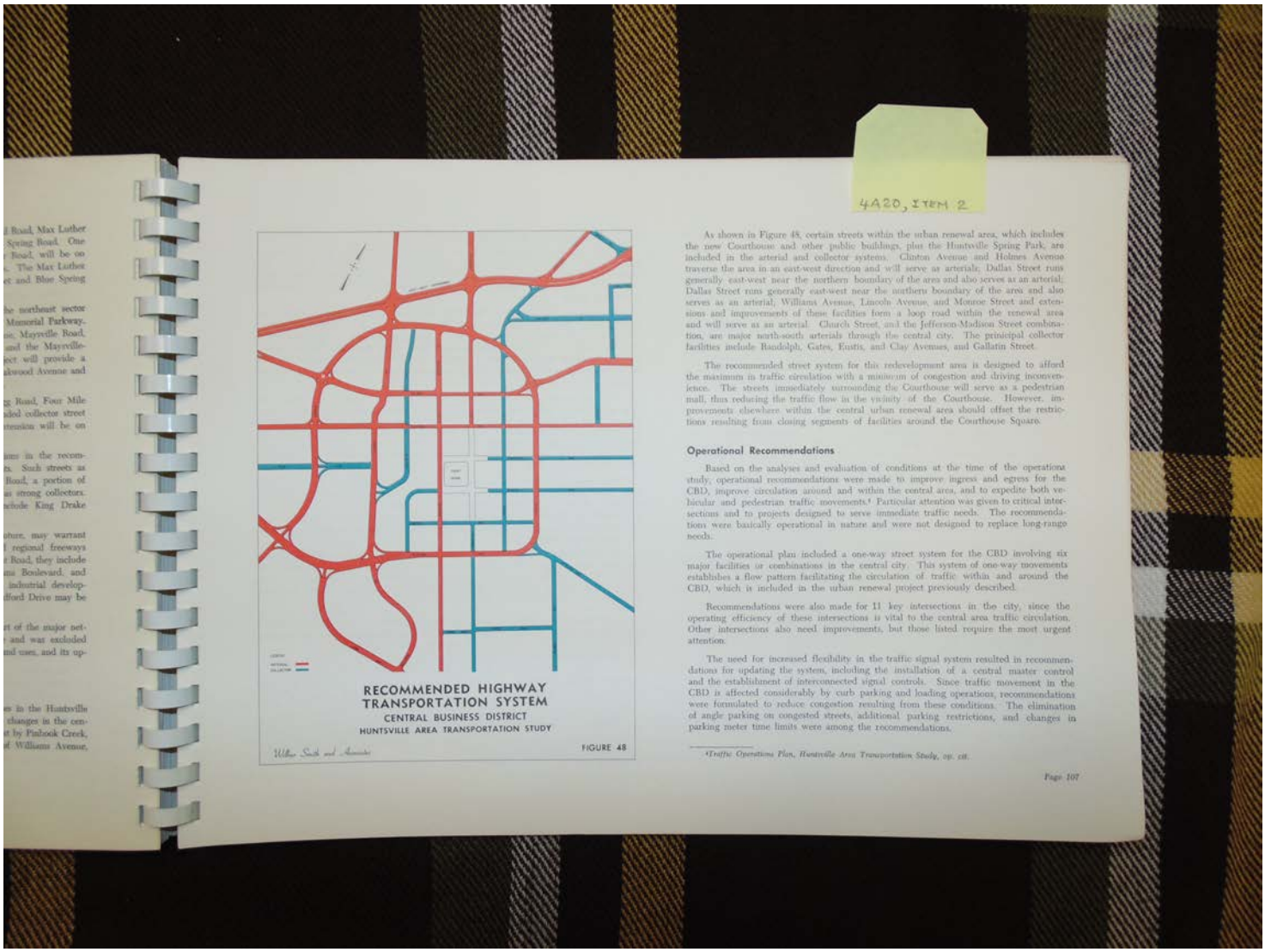


Names:
Central City Routes

Places:
Huntsville, AL

Types:
booklet

Dates:
1966



Names:

Central Business District
Recommendations
Operational Recommendations

Places:

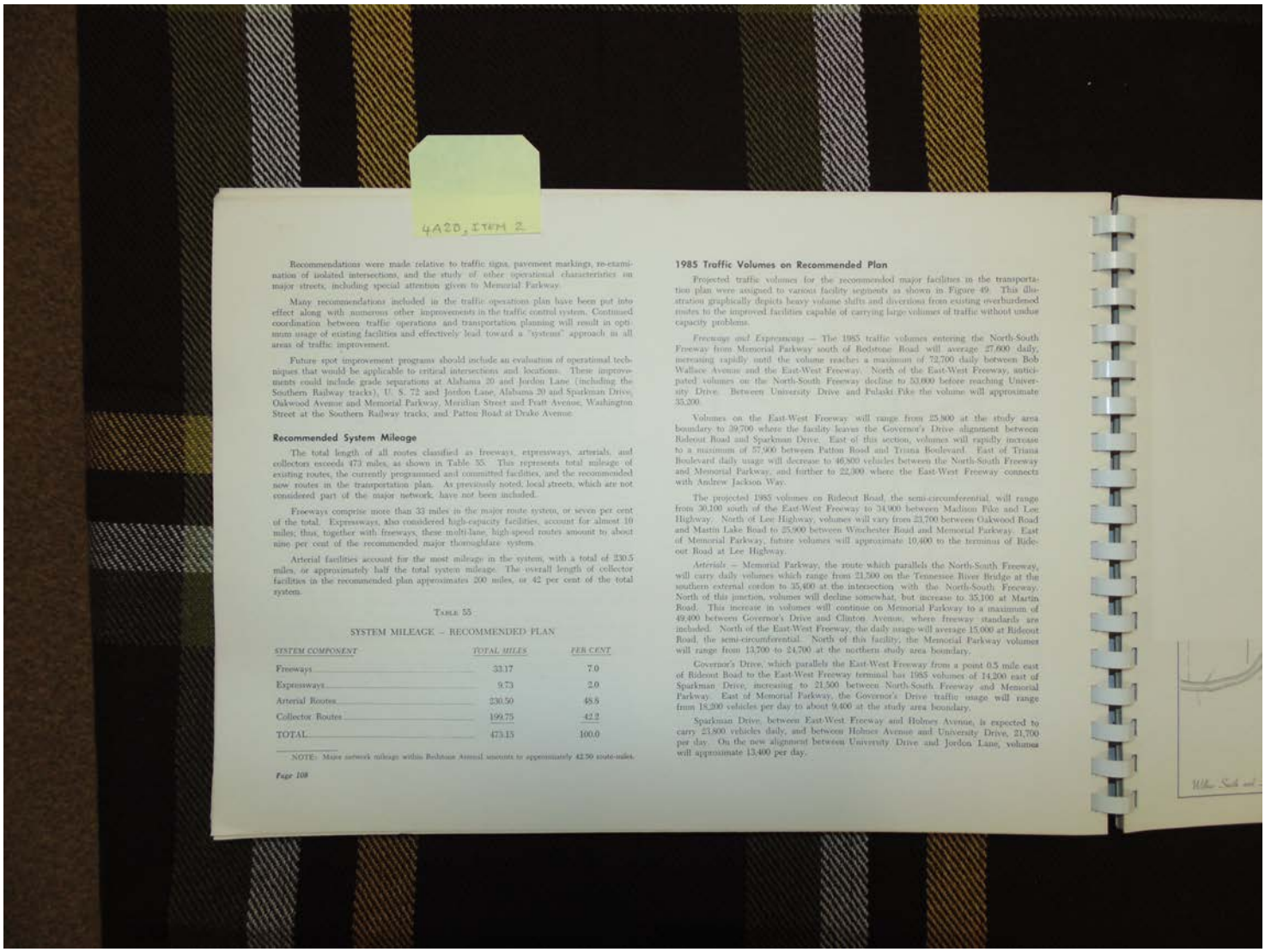
Huntsville, AL

Types:

booklet
illustration

Dates:

1966



Recommendations were made relative to traffic signs, pavement markings, re-examination of isolated intersections, and the study of other operational characteristics on major streets, including special attention given to Memorial Parkway.

Many recommendations included in the traffic operations plan have been put into effect along with numerous other improvements in the traffic control system. Continued coordination between traffic operations and transportation planning will result in optimum usage of existing facilities and effectively lead toward a "systems" approach in all areas of traffic improvement.

Future spot improvement programs should include an evaluation of operational techniques that would be applicable to critical intersections and locations. These improvements could include grade separations at Alabama 20 and Jordon Lane (including the Southern Railway tracks), U. S. 72 and Jordon Lane, Alabama 20 and Sparkman Drive, Oakwood Avenue and Memorial Parkway, Meridian Street and Pratt Avenue, Washington Street at the Southern Railway tracks, and Patton Road at Drake Avenue.

Recommended System Mileage

The total length of all routes classified as freeways, expressways, arterials, and collectors exceeds 473 miles, as shown in Table 55. This represents total mileage of existing routes, the currently programmed and committed facilities, and the recommended new routes in the transportation plan. As previously noted, local streets, which are not considered part of the major network, have not been included.

Freeways comprise more than 33 miles in the major route system, or seven per cent of the total. Expressways, also considered high-capacity facilities, account for almost 10 miles; thus, together with freeways, these multi-lane, high-speed routes amount to about nine per cent of the recommended major thoroughfare system.

Arterial facilities account for the most mileage in the system, with a total of 230.5 miles, or approximately half the total system mileage. The overall length of collector facilities in the recommended plan approximates 200 miles, or 42 per cent of the total system.

TABLE 55

SYSTEM MILEAGE — RECOMMENDED PLAN

SYSTEM COMPONENT	TOTAL MILES	PER CENT
Freeways	33.17	7.0
Expressways	9.73	2.0
Arterial Routes	230.50	48.8
Collector Routes	199.75	42.2
TOTAL	473.15	100.0

NOTE: Major network mileage within Redstone Arsenal amounts to approximately 42.50 route-miles.

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1985 Traffic Volumes on Recommended Plan

Projected traffic volumes for the recommended major facilities in the transportation plan were assigned to various facility segments as shown in Figure 49. This illustration graphically depicts heavy volume shifts and diversions from existing overburdened routes to the improved facilities capable of carrying large volumes of traffic without undue capacity problems.

Freeways and Expressways — The 1985 traffic volumes entering the North-South Freeway from Memorial Parkway south of Redstone Road will average 27,600 daily, increasing rapidly until the volume reaches a maximum of 72,700 daily between Bob Wallace Avenue and the East-West Freeway. North of the East-West Freeway, anticipated volumes on the North-South Freeway decline to 53,000 before reaching University Drive. Between University Drive and Pulaski Pike the volume will approximate 35,200.

Volumes on the East-West Freeway will range from 25,800 at the study area boundary to 59,700 where the facility leaves the Governor's Drive alignment between Rideout Road and Sparkman Drive. East of this section, volumes will rapidly increase to a maximum of 57,900 between Patton Road and Triana Boulevard. East of Triana Boulevard daily usage will decrease to 46,800 vehicles between the North-South Freeway and Memorial Parkway, and further to 22,300 where the East-West Freeway connects with Andrew Jackson Way.

The projected 1985 volumes on Rideout Road, the semi-circumferential, will range from 30,100 south of the East-West Freeway to 34,900 between Madison Pike and Lee Highway. North of Lee Highway, volumes will vary from 23,700 between Oakwood Road and Martin Lake Road to 25,900 between Winchester Road and Memorial Parkway. East of Memorial Parkway, future volumes will approximate 10,400 to the terminus of Rideout Road at Lee Highway.

Arterials — Memorial Parkway, the route which parallels the North-South Freeway, will carry daily volumes which range from 21,200 on the Tennessee River Bridge at the southern external cordon to 35,400 at the intersection with the North-South Freeway. North of this junction, volumes will decline somewhat, but increase to 35,100 at Martin Road. This increase in volumes will continue on Memorial Parkway to a maximum of 49,400 between Governor's Drive and Clinton Avenue, where freeway standards are included. North of the East-West Freeway, the daily usage will average 15,000 at Rideout Road, the semi-circumferential. North of this facility, the Memorial Parkway volumes will range from 13,700 to 24,700 at the northern study area boundary.

Governor's Drive, which parallels the East-West Freeway from a point 0.5 mile east of Rideout Road to the East-West Freeway terminal has 1985 volumes of 14,200 east of Sparkman Drive, increasing to 21,500 between North-South Freeway and Memorial Parkway. East of Memorial Parkway, the Governor's Drive traffic usage will range from 18,200 vehicles per day to about 9,400 at the study area boundary.

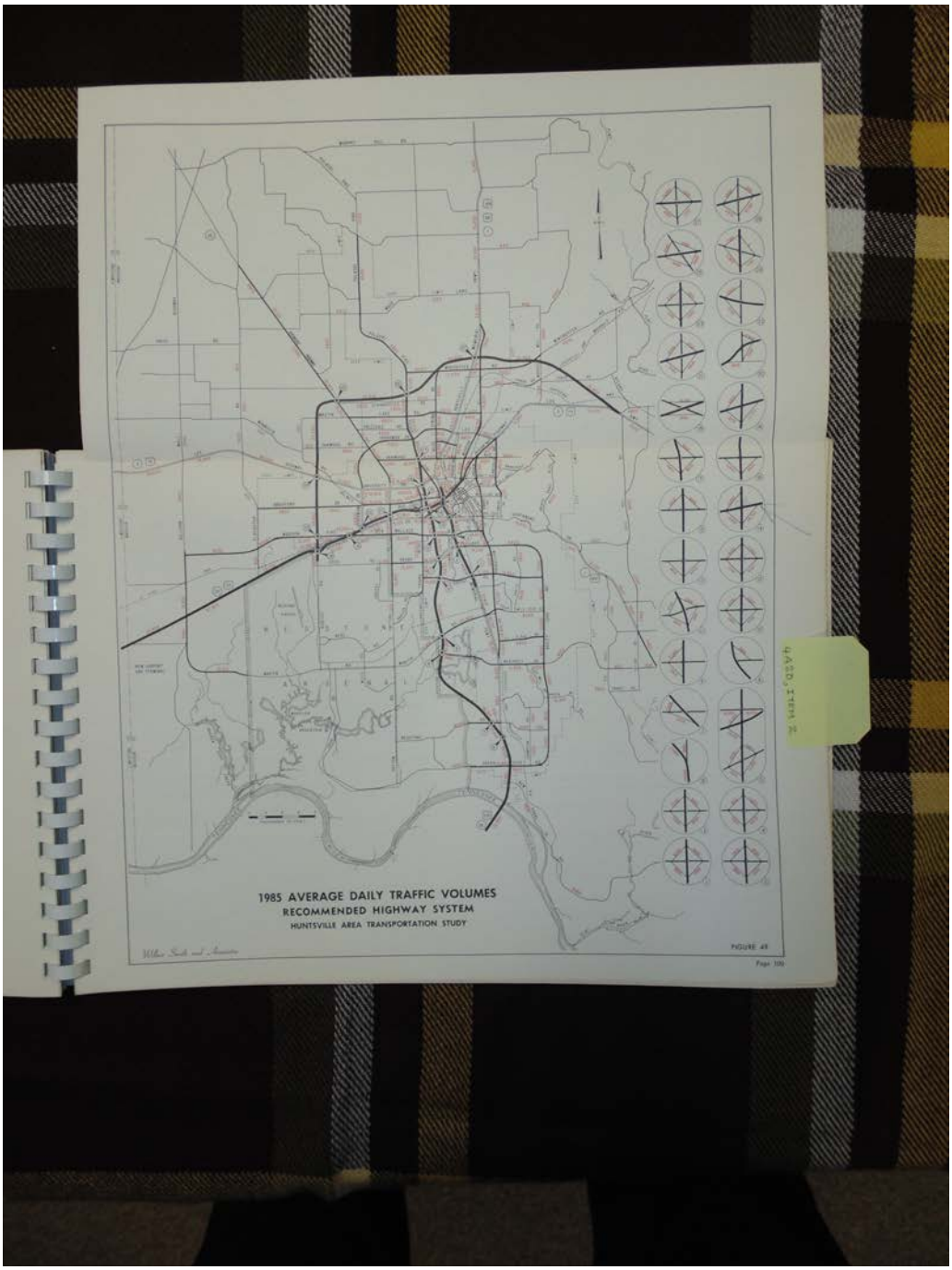
Sparkman Drive, between East-West Freeway and Holmes Avenue, is expected to carry 23,800 vehicles daily, and between Holmes Avenue and University Drive, 21,700 per day. On the new alignment between University Drive and Jordon Lane, volumes will approximate 13,400 per day.

Names:
1985 Traffic Volumes Recommended
Recommended System Mileage

Places:
Huntsville, AL

Types:
booklet

Dates:
1966

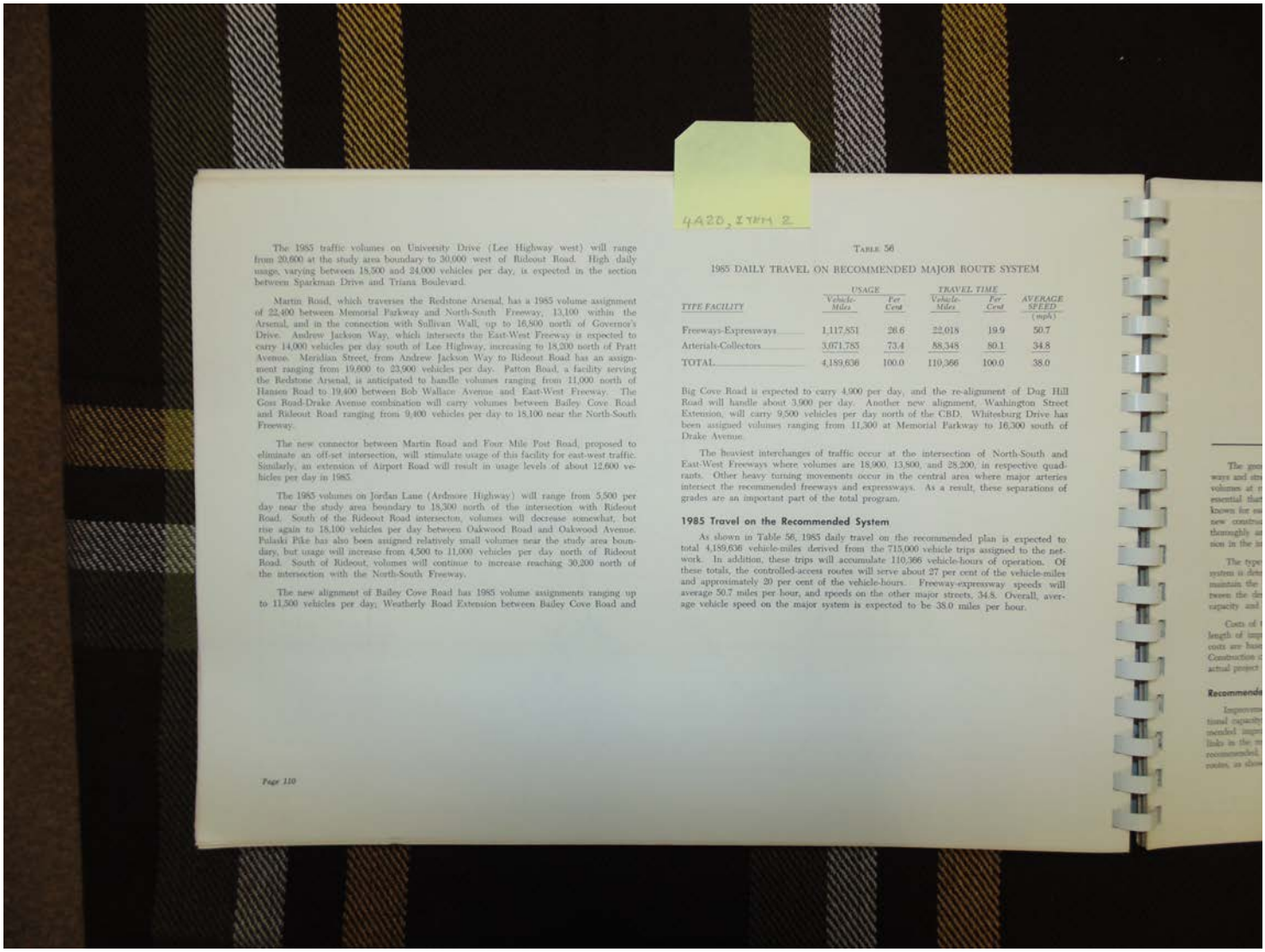


Names:
1985 Average Daily Traffic Volumes

Places:
Huntsville, AL area

Types:
map

Dates:
1966



The 1985 traffic volumes on University Drive (Lee Highway west) will range from 20,600 at the study area boundary to 30,000 west of Rideout Road. High daily usage, varying between 18,500 and 24,000 vehicles per day, is expected in the section between Sparkman Drive and Triana Boulevard.

Martin Road, which traverses the Redstone Arsenal, has a 1985 volume assignment of 22,400 between Memorial Parkway and North-South Freeway, 13,100 within the Arsenal, and in the connection with Sullivan Wall, up to 16,500 north of Governor's Drive. Andrew Jackson Way, which intersects the East-West Freeway is expected to carry 14,000 vehicles per day south of Lee Highway, increasing to 18,200 north of Pratt Avenue. Meridian Street, from Andrew Jackson Way to Rideout Road has an assignment ranging from 19,600 to 23,900 vehicles per day. Patton Road, a facility serving the Redstone Arsenal, is anticipated to handle volumes ranging from 11,000 north of Hansen Road to 19,400 between Bob Wallace Avenue and East-West Freeway. The Goss Road-Drake Avenue combination will carry volumes between Bailey Cove Road and Rideout Road ranging from 9,400 vehicles per day to 18,100 near the North-South Freeway.

The new connector between Martin Road and Four Mile Post Road, proposed to eliminate an off-set intersection, will stimulate usage of this facility for east-west traffic. Similarly, an extension of Airport Road will result in usage levels of about 12,600 vehicles per day in 1985.

The 1985 volumes on Jordan Lane (Ardmore Highway) will range from 5,500 per day near the study area boundary to 18,300 north of the intersection with Rideout Road. South of the Rideout Road intersecton, volumes will decrease somewhat, but rise again to 18,100 vehicles per day between Oakwood Road and Oakwood Avenue. Pulaski Pike has also been assigned relatively small volumes near the study area boundary, but usage will increase from 4,500 to 11,000 vehicles per day north of Rideout Road. South of Rideout, volumes will continue to increase reaching 30,200 north of the intersection with the North-South Freeway.

The new alignment of Bailey Cove Road has 1985 volume assignments ranging up to 11,500 vehicles per day; Weatherly Road Extension between Bailey Cove Road and

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TABLE 56

1985 DAILY TRAVEL ON RECOMMENDED MAJOR ROUTE SYSTEM

TYPE FACILITY	USAGE Vehicle-Miles	USAGE Per Cent	TRAVEL TIME Vehicle-Hours	TRAVEL TIME Per Cent	AVERAGE SPEED (mph)
Freeways-Expressways	1,117,851	26.6	22,018	19.9	50.7
Arterials-Collectors	3,071,785	73.4	88,348	80.1	34.8
TOTAL	4,189,636	100.0	110,366	100.0	38.0

Big Cove Road is expected to carry 4,900 per day, and the re-alignment of Dug Hill Road will handle about 3,900 per day. Another new alignment, Washington Street Extension, will carry 9,500 vehicles per day north of the CBD. Whitesburg Drive has been assigned volumes ranging from 11,300 at Memorial Parkway to 16,300 south of Drake Avenue.

The heaviest interchanges of traffic occur at the intersection of North-South and East-West Freeways where volumes are 18,900, 13,800, and 28,200, in respective quadrants. Other heavy turning movements occur in the central area where major arteries intersect the recommended freeways and expressways. As a result, these separations of grades are an important part of the total program.

1985 Travel on the Recommended System

As shown in Table 56, 1985 daily travel on the recommended plan is expected to total 4,189,636 vehicle-miles derived from the 715,000 vehicle trips assigned to the network. In addition, these trips will accumulate 110,366 vehicle-hours of operation. Of these totals, the controlled-access routes will serve about 27 per cent of the vehicle-miles and approximately 20 per cent of the vehicle-hours. Freeway-expressway speeds will average 50.7 miles per hour, and speeds on the other major streets, 34.8. Overall, average vehicle speed on the major system is expected to be 38.0 miles per hour.

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Names:
1985 Travel on Recommended System

Places:
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Types:
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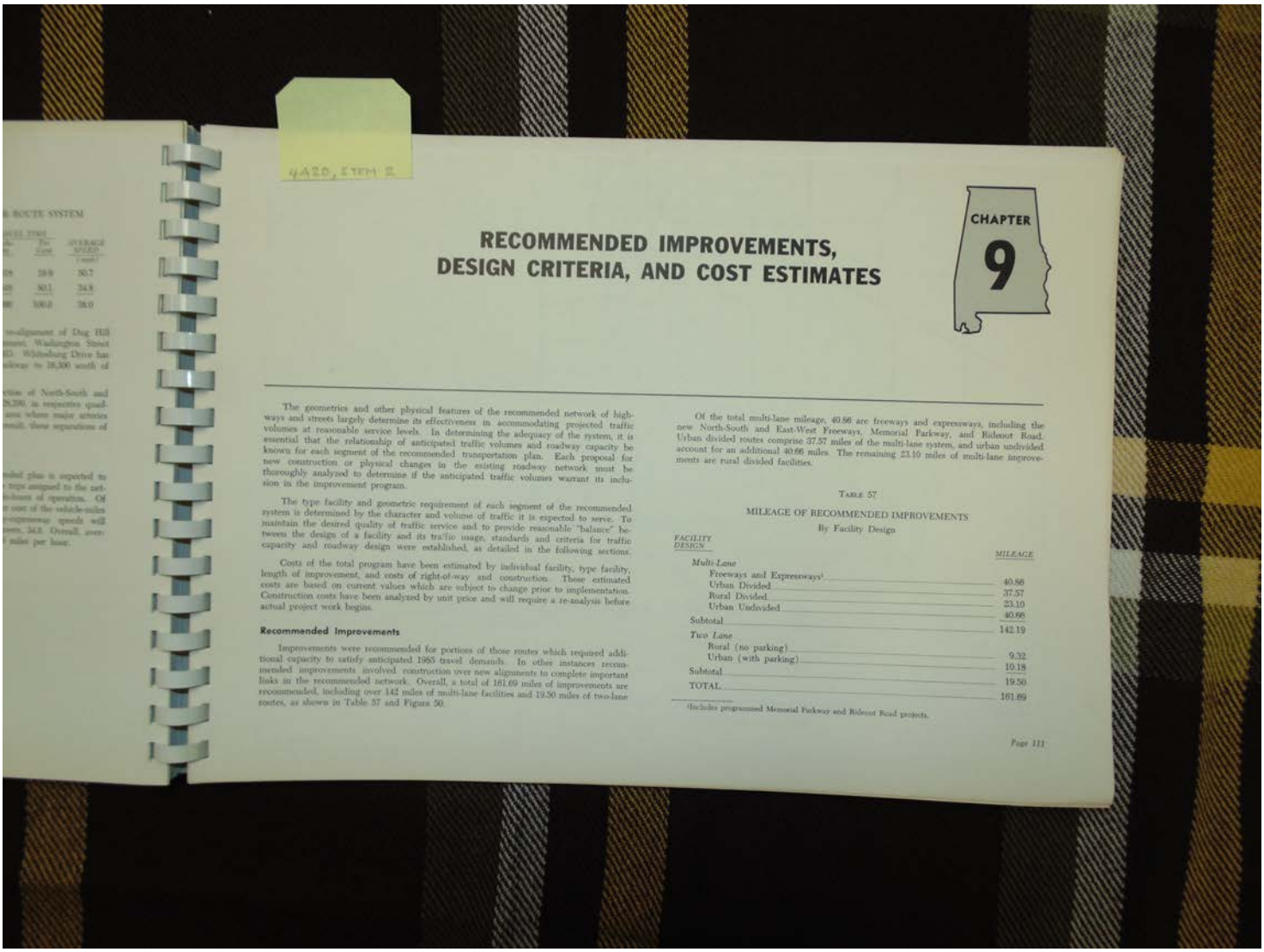

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CHAPTER 9

RECOMMENDED IMPROVEMENTS, DESIGN CRITERIA, AND COST ESTIMATES

The geometrics and other physical features of the recommended network of highways and streets largely determine its effectiveness in accommodating projected traffic volumes at reasonable service levels. In determining the adequacy of the system, it is essential that the relationship of anticipated traffic volumes and roadway capacity be known for each segment of the recommended transportation plan. Each proposal for new construction or physical changes in the existing roadway network must be thoroughly analyzed to determine if the anticipated traffic volumes warrant its inclusion in the improvement program.

The type facility and geometric requirement of each segment of the recommended system is determined by the character and volume of traffic it is expected to serve. To maintain the desired quality of traffic service and to provide reasonable "balance" between the design of a facility and its traffic usage, standards and criteria for traffic capacity and roadway design were established, as detailed in the following sections.

Costs of the total program have been estimated by individual facility, type facility, length of improvement, and costs of right-of-way and construction. These estimated costs are based on current values which are subject to change prior to implementation. Construction costs have been analyzed by unit price and will require a re-analysis before actual project work begins.

Recommended Improvements

Improvements were recommended for portions of those routes which required additional capacity to satisfy anticipated 1965 travel demands. In other instances recommended improvements involved construction over new alignments to complete important links in the recommended network. Overall, a total of 161.69 miles of improvements are recommended, including over 142 miles of multi-lane facilities and 19.50 miles of two-lane routes, as shown in Table 57 and Figure 50.

Of the total multi-lane mileage, 40.66 are freeways and expressways, including the new North-South and East-West Freeways, Memorial Parkway, and Rideout Road. Urban divided routes comprise 37.57 miles of the multi-lane system, and urban undivided account for an additional 40.66 miles. The remaining 23.10 miles of multi-lane improvements are rural divided facilities.

TABLE 57

MILEAGE OF RECOMMENDED IMPROVEMENTS
By Facility Design

FACILITY DESIGN	MILEAGE
Multi-Lane	
Freeways and Expressways[1]	40.66
Urban Divided	37.57
Rural Divided	23.10
Urban Undivided	40.66
Subtotal	142.19
Two Lane	
Rural (no parking)	9.32
Urban (with parking)	10.18
Subtotal	19.50
TOTAL	161.69

[1]Includes programmed Memorial Parkway and Rideout Road projects.

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Names:

Cost Estimates
Design Criteria
Mileage of Recommended Improvements
Recommended Improvements - Chapter 9

Places:

Huntsville, AL

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table

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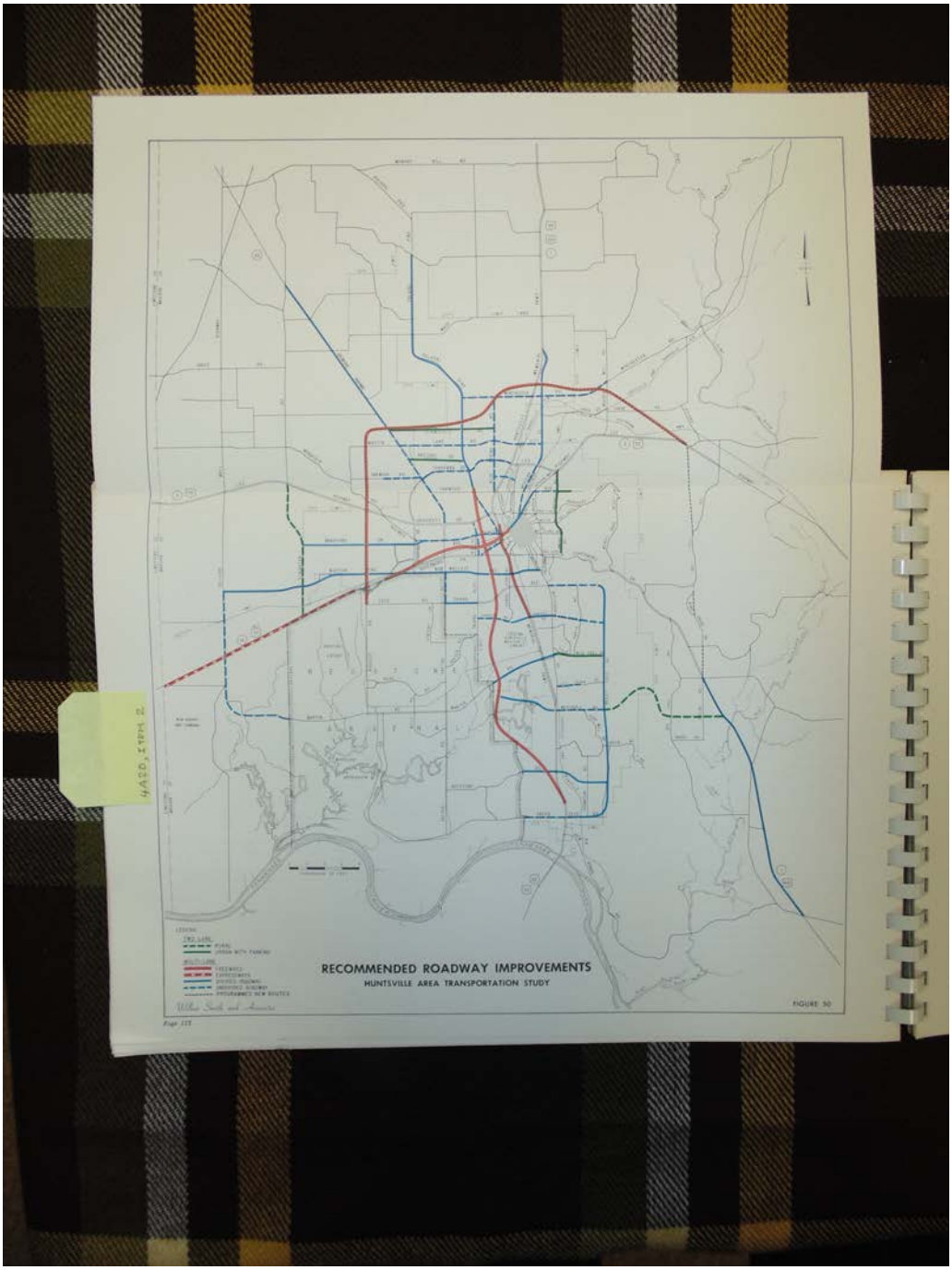

Names:
Recommended Improvements
Roadway

Places:
Huntsville, AL area

Types:
map

Dates:
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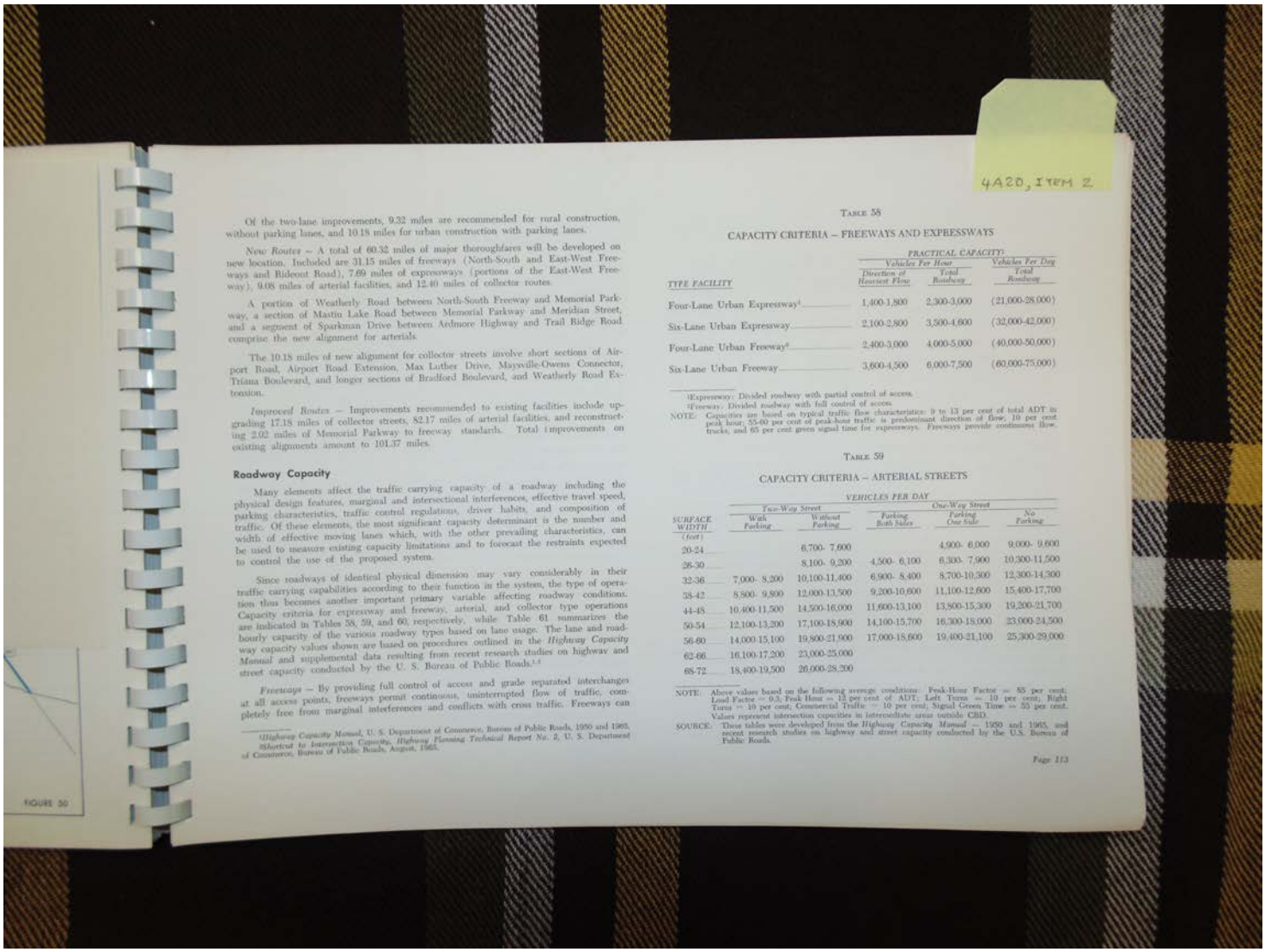

Of the two-lane improvements, 9.32 miles are recommended for rural construction, without parking lanes, and 10.18 miles for urban construction with parking lanes.

New Routes – A total of 60.32 miles of major thoroughfares will be developed on new location. Included are 31.15 miles of freeways (North-South and East-West Freeways and Rideout Road), 7.69 miles of expressways (portions of the East-West Freeway), 9.08 miles of arterial facilities, and 12.40 miles of collector routes.

A portion of Weatherly Road between North-South Freeway and Memorial Parkway, a section of Mastin Lake Road between Memorial Parkway and Meridian Street, and a segment of Sparkman Drive between Ardmore Highway and Trail Ridge Road comprise the new alignment for arterials.

The 10.18 miles of new alignment for collector streets involve short sections of Airport Road, Airport Road Extension, Max Luther Drive, Maysville-Owens Connector, Triana Boulevard, and longer sections of Bradford Boulevard, and Weatherly Road Extension.

Improved Routes – Improvements recommended to existing facilities include upgrading 17.18 miles of collector streets, 82.17 miles of arterial facilities, and reconstructing 2.02 miles of Memorial Parkway to freeway standards. Total improvements on existing alignments amount to 101.37 miles.

Roadway Capacity

Many elements affect the traffic carrying capacity of a roadway including the physical design features, marginal and intersectional interferences, effective travel speed, parking characteristics, traffic control regulations, driver habits, and composition of traffic. Of these elements, the most significant capacity determinant is the number and width of effective moving lanes which, with the other prevailing characteristics, can be used to measure existing capacity limitations and to forecast the restraints expected to control the use of the proposed system.

Since roadways of identical physical dimension may vary considerably in their traffic carrying capabilities according to their function in the system, the type of operation thus becomes another important primary variable affecting roadway conditions. Capacity criteria for expressway and freeway, arterial, and collector type operations are indicated in Tables 58, 59, and 60, respectively, while Table 61 summarizes the hourly capacity of the various roadway types based on lane usage. The lane and roadway capacity values shown are based on procedures outlined in the *Highway Capacity Manual* and supplemental data resulting from recent research studies on highway and street capacity conducted by the U. S. Bureau of Public Roads.[1-2]

Freeways – By providing full control of access and grade separated interchanges at all access points, freeways permit continuous, uninterrupted flow of traffic, completely free from marginal interferences and conflicts with cross traffic. Freeways can

[1]*Highway Capacity Manual*, U. S. Department of Commerce, Bureau of Public Roads, 1950 and 1965.
[2]*Shortcut to Intersection Capacity, Highway Planning Technical Report No. 2*, U. S. Department of Commerce, Bureau of Public Roads, August, 1965.

TABLE 58

CAPACITY CRITERIA – FREEWAYS AND EXPRESSWAYS

TYPE FACILITY	PRACTICAL CAPACITY: Vehicles Per Hour, Direction of Heaviest Flow	PRACTICAL CAPACITY: Vehicles Per Hour, Total Roadway	PRACTICAL CAPACITY: Vehicles Per Day, Total Roadway
Four-Lane Urban Expressway[1]	1,400-1,800	2,300-3,000	(21,000-28,000)
Six-Lane Urban Expressway	2,100-2,800	3,500-4,600	(32,000-42,000)
Four-Lane Urban Freeway[2]	2,400-3,000	4,000-5,000	(40,000-50,000)
Six-Lane Urban Freeway	3,600-4,500	6,000-7,500	(60,000-75,000)

[1]Expressway: Divided roadway with partial control of access.
[2]Freeway: Divided roadway with full control of access.
NOTE: Capacities are based on typical traffic flow characteristics: 9 to 13 per cent of total ADT in peak hour; 55-60 per cent of peak-hour traffic in predominant direction of flow; 10 per cent trucks; and 65 per cent green signal time for expressways. Freeways provide continuous flow.

TABLE 59

CAPACITY CRITERIA – ARTERIAL STREETS

SURFACE WIDTH (feet)	VEHICLES PER DAY: Two-Way Street, With Parking	Two-Way Street, Without Parking	One-Way Street, Parking Both Sides	One-Way Street, Parking One Side	One-Way Street, No Parking
20-24		6,700- 7,600		4,900- 6,000	9,000- 9,600
26-30		8,100- 9,200	4,500- 6,100	6,300- 7,900	10,300-11,500
32-36	7,000- 8,200	10,100-11,400	6,900- 8,400	8,700-10,300	12,300-14,300
38-42	8,800- 9,800	12,000-13,500	9,200-10,600	11,100-12,600	15,400-17,700
44-48	10,400-11,500	14,500-16,000	11,600-13,100	13,800-15,300	19,200-21,700
50-54	12,100-13,200	17,100-18,900	14,100-15,700	16,300-18,000	23,000-24,500
56-60	14,000-15,100	19,800-21,900	17,000-18,600	19,400-21,100	25,300-29,000
62-66	16,100-17,200	23,000-25,000			
68-72	18,400-19,500	26,000-28,200			

NOTE: Above values based on the following average conditions: Peak-Hour Factor = 55 per cent; Load Factor = 0.5; Peak Hour = 12 per cent of ADT; Left Turns = 10 per cent; Right Turns = 10 per cent; Commercial Traffic = 10 per cent; Signal Green Time = 55 per cent. Values represent intersection capacities in intermediate areas outside CBD.
SOURCE: These tables were developed from the *Highway Capacity Manual* – 1950 and 1965, and recent research studies on highway and street capacity conducted by the U.S. Bureau of Public Roads.

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FIGURE 50

Names:
Roadway Capacity

Places:
Huntsville, AL

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booklet table

Dates:
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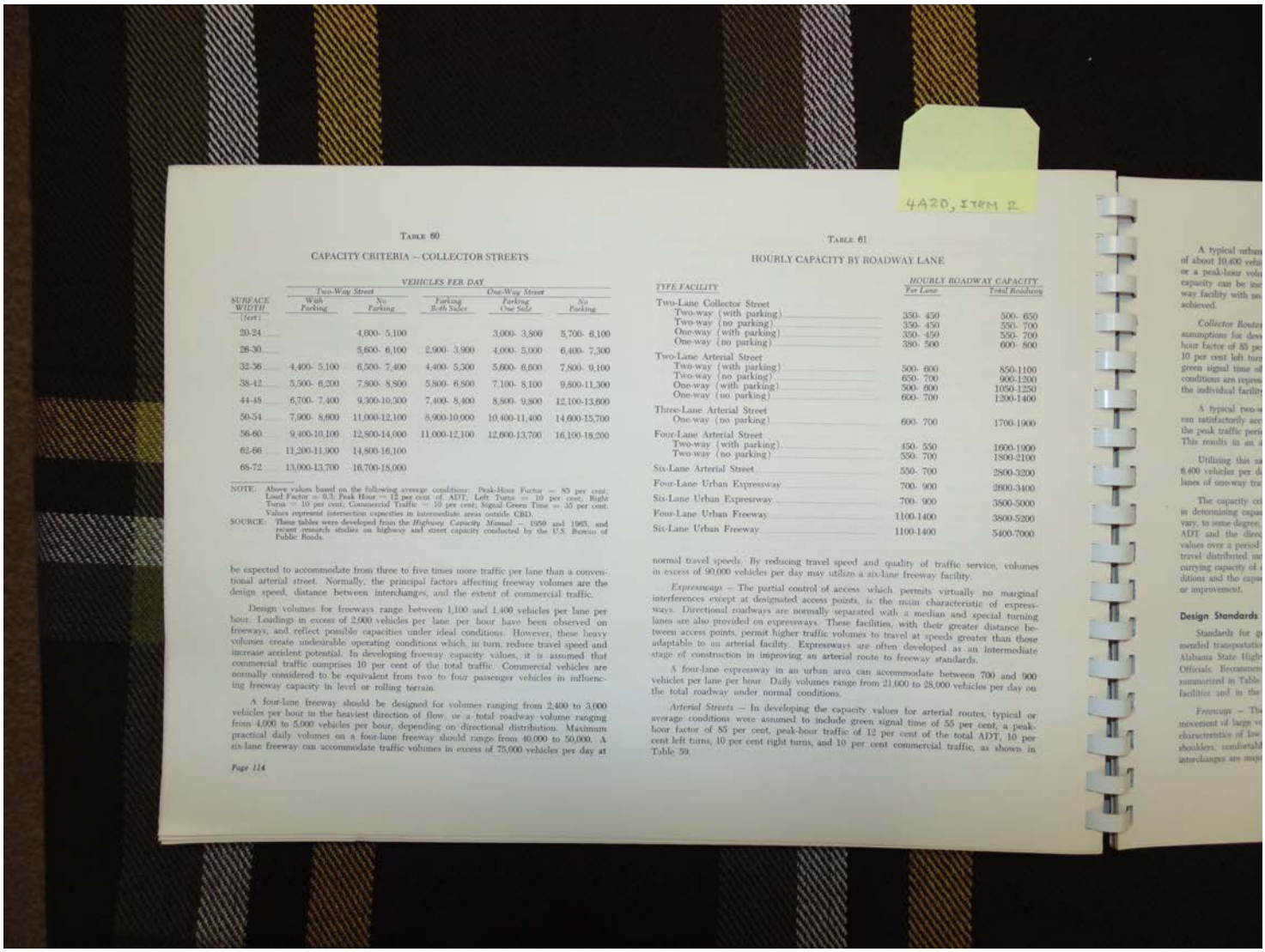

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TABLE 60

CAPACITY CRITERIA – COLLECTOR STREETS

SURFACE WIDTH (feet)	VEHICLES PER DAY: Two-Way Street, With Parking	Two-Way Street, No Parking	One-Way Street, Parking Both Sides	One-Way Street, Parking One Side	One-Way Street, No Parking
20-24		4,600- 5,100		3,000- 3,800	5,700- 6,100
26-30		5,600- 6,100	2,900- 3,900	4,000- 5,000	6,400- 7,300
32-36	4,400- 5,100	6,500- 7,400	4,400- 5,300	5,600- 6,600	7,800- 9,100
38-42	5,500- 6,200	7,800- 8,800	5,800- 6,800	7,100- 8,100	9,800-11,300
44-48	6,700- 7,400	9,300-10,300	7,400- 8,400	8,800- 9,800	12,100-13,600
50-54	7,900- 8,600	11,000-12,100	8,900-10,000	10,400-11,400	14,600-15,700
56-60	9,400-10,100	12,800-14,000	11,000-12,100	12,600-13,700	16,100-18,200
62-66	11,200-11,900	14,800-16,100			
68-72	13,000-13,700	16,700-18,000			

NOTE: Above values based on the following average conditions: Peak-Hour Factor = 85 per cent; Load Factor = 0.3; Peak Hour = 12 per cent of ADT; Left Turns = 10 per cent; Right Turns = 10 per cent; Commercial Traffic = 10 per cent; Signal Green Time = 55 per cent. Values represent intersection capacities in intermediate areas outside CBD.

SOURCE: These tables were developed from the *Highway Capacity Manual* – 1950 and 1965, and recent research studies on highway and street capacity conducted by the U.S. Bureau of Public Roads.

be expected to accommodate from three to five times more traffic per lane than a conventional arterial street. Normally, the principal factors affecting freeway volumes are the design speed, distance between interchanges, and the extent of commercial traffic.

Design volumes for freeways range between 1,100 and 1,400 vehicles per lane per hour. Loadings in excess of 2,000 vehicles per lane per hour have been observed on freeways, and reflect possible capacities under ideal conditions. However, these heavy volumes create undesirable operating conditions which, in turn, reduce travel speed and increase accident potential. In developing freeway capacity values, it is assumed that commercial traffic comprises 10 per cent of the total traffic. Commercial vehicles are normally considered to be equivalent from two to four passenger vehicles in influencing freeway capacity in level or rolling terrain.

A four-lane freeway should be designed for volumes ranging from 2,400 to 3,000 vehicles per hour in the heaviest direction of flow, or a total roadway volume ranging from 4,000 to 5,000 vehicles per hour, depending on directional distribution. Maximum practical daily volumes on a four-lane freeway should range from 40,000 to 50,000. A six-lane freeway can accommodate traffic volumes in excess of 75,000 vehicles per day at

TABLE 61

HOURLY CAPACITY BY ROADWAY LANE

TYPE FACILITY	HOURLY ROADWAY CAPACITY: Per Lane	Total Roadway
Two-Lane Collector Street		
Two-way (with parking)	350- 450	500- 650
Two-way (no parking)	350- 450	550- 700
One-way (with parking)	350- 450	550- 700
One-way (no parking)	380- 500	600- 800
Two-Lane Arterial Street		
Two-way (with parking)	500- 600	850-1100
Two-way (no parking)	650- 700	900-1200
One-way (with parking)	500- 600	1050-1250
One-way (no parking)	600- 700	1200-1400
Three-Lane Arterial Street		
One-way (no parking)	600- 700	1700-1900
Four-Lane Arterial Street		
Two-way (with parking)	450- 550	1600-1900
Two-way (no parking)	550- 700	1800-2100
Six-Lane Arterial Street	550- 700	2800-3200
Four-Lane Urban Expressway	700- 900	2600-3400
Six-Lane Urban Expressway	700- 900	3800-5000
Four-Lane Urban Freeway	1100-1400	3800-5200
Six-Lane Urban Freeway	1100-1400	5400-7000

normal travel speeds. By reducing travel speed and quality of traffic service, volumes in excess of 90,000 vehicles per day may utilize a six-lane freeway facility.

Expressways – The partial control of access which permits virtually no marginal interferences except at designated access points, is the main characteristic of expressways. Directional roadways are normally separated with a median and special turning lanes are also provided on expressways. These facilities, with their greater distance between access points, permit higher traffic volumes to travel at speeds greater than those adaptable to an arterial facility. Expressways are often developed as an intermediate stage of construction in improving an arterial route to freeway standards.

A four-lane expressway in an urban area can accommodate between 700 and 900 vehicles per lane per hour. Daily volumes range from 21,000 to 28,000 vehicles per day on the total roadway under normal conditions.

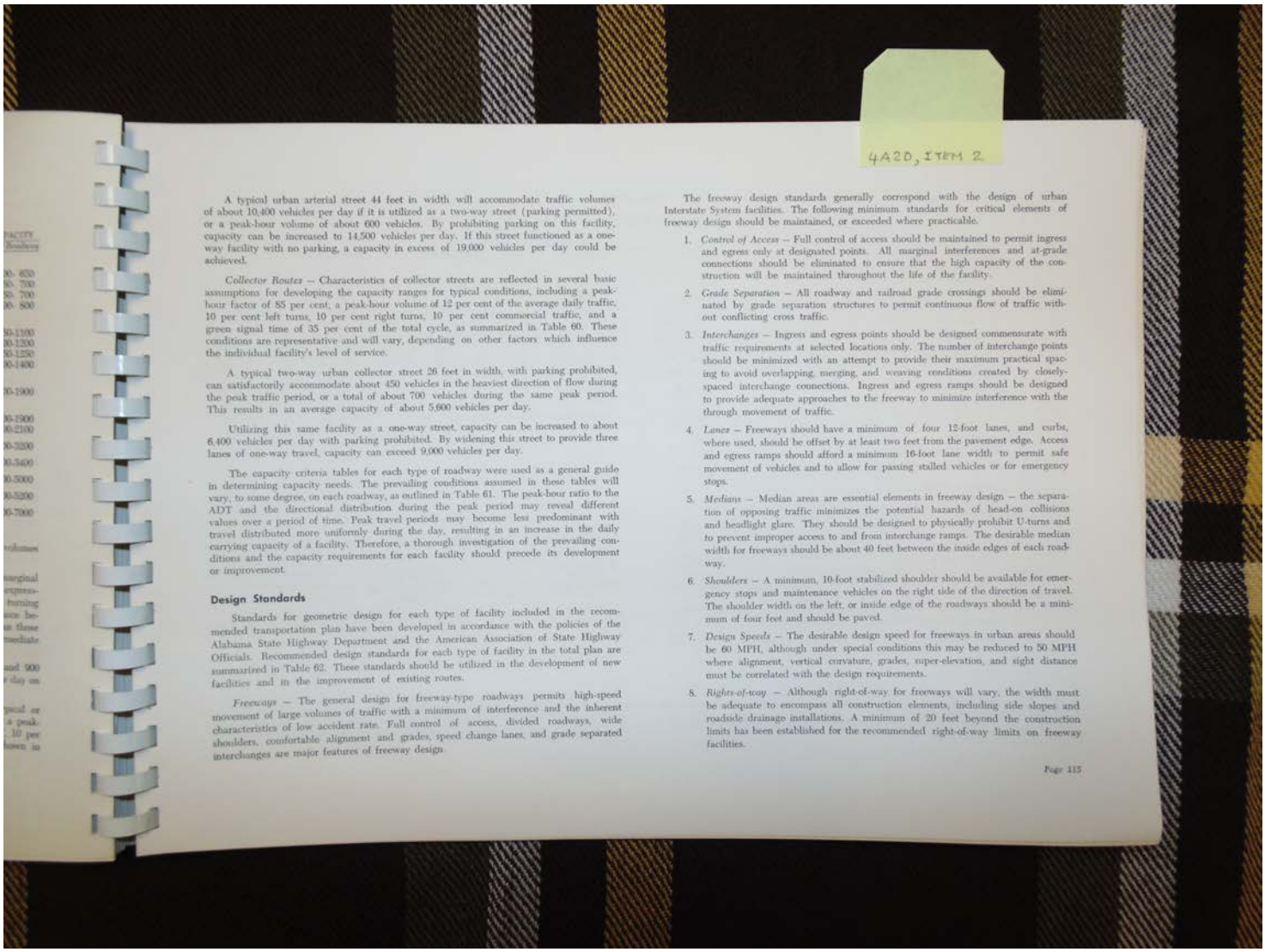
Arterial Streets – In developing the capacity values for arterial routes, typical or average conditions were assumed to include green signal time of 55 per cent, a peak-hour factor of 85 per cent, peak-hour traffic of 12 per cent of the total ADT, 10 per cent left turns, 10 per cent right turns, and 10 per cent commercial traffic, as shown in Table 59.

Names:
Roadway Capacity

Places:
Huntsville, AL

Types:
booklet table

Dates:
1966



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A typical urban arterial street 44 feet in width will accommodate traffic volumes of about 10,400 vehicles per day if it is utilized as a two-way street (parking permitted), or a peak-hour volume of about 600 vehicles. By prohibiting parking on this facility, capacity can be increased to 14,500 vehicles per day. If this street functioned as a one-way facility with no parking, a capacity in excess of 19,000 vehicles per day could be achieved.

Collector Routes — Characteristics of collector streets are reflected in several basic assumptions for developing the capacity ranges for typical conditions, including a peak-hour factor of 85 per cent, a peak-hour volume of 12 per cent of the average daily traffic, 10 per cent left turns, 10 per cent right turns, 10 per cent commercial traffic, and a green signal time of 35 per cent of the total cycle, as summarized in Table 60. These conditions are representative and will vary, depending on other factors which influence the individual facility's level of service.

A typical two-way urban collector street 26 feet in width, with parking prohibited, can satisfactorily accommodate about 450 vehicles in the heaviest direction of flow during the peak traffic period, or a total of about 700 vehicles during the same peak period. This results in an average capacity of about 5,600 vehicles per day.

Utilizing this same facility as a one-way street, capacity can be increased to about 6,400 vehicles per day with parking prohibited. By widening this street to provide three lanes of one-way travel, capacity can exceed 9,000 vehicles per day.

The capacity criteria tables for each type of roadway were used as a general guide in determining capacity needs. The prevailing conditions assumed in these tables will vary, to some degree, on each roadway, as outlined in Table 61. The peak-hour ratio to the ADT and the directional distribution during the peak period may reveal different values over a period of time. Peak travel periods may become less predominant with travel distributed more uniformly during the day, resulting in an increase in the daily carrying capacity of a facility. Therefore, a thorough investigation of the prevailing conditions and the capacity requirements for each facility should precede its development or improvement.

Design Standards

Standards for geometric design for each type of facility included in the recommended transportation plan have been developed in accordance with the policies of the Alabama State Highway Department and the American Association of State Highway Officials. Recommended design standards for each type of facility in the total plan are summarized in Table 62. These standards should be utilized in the development of new facilities and in the improvement of existing routes.

Freeways — The general design for freeway-type roadways permits high-speed movement of large volumes of traffic with a minimum of interference and the inherent characteristics of low accident rate. Full control of access, divided roadways, wide shoulders, comfortable alignment and grades, speed change lanes, and grade separated interchanges are major features of freeway design.

The freeway design standards generally correspond with the design of urban Interstate System facilities. The following minimum standards for critical elements of freeway design should be maintained, or exceeded where practicable.

1. *Control of Access* — Full control of access should be maintained to permit ingress and egress only at designated points. All marginal interferences and at-grade connections should be eliminated to ensure that the high capacity of the construction will be maintained throughout the life of the facility.
2. *Grade Separation* — All roadway and railroad grade crossings should be eliminated by grade separation structures to permit continuous flow of traffic without conflicting cross traffic.
3. *Interchanges* — Ingress and egress points should be designed commensurate with traffic requirements at selected locations only. The number of interchange points should be minimized with an attempt to provide their maximum practical spacing to avoid overlapping, merging, and weaving conditions created by closely-spaced interchange connections. Ingress and egress ramps should be designed to provide adequate approaches to the freeway to minimize interference with the through movement of traffic.
4. *Lanes* — Freeways should have a minimum of four 12-foot lanes, and curbs, where used, should be offset by at least two feet from the pavement edge. Access and egress ramps should afford a minimum 16-foot lane width to permit safe movement of vehicles and to allow for passing stalled vehicles or for emergency stops.
5. *Medians* — Median areas are essential elements in freeway design — the separation of opposing traffic minimizes the potential hazards of head-on collisions and headlight glare. They should be designed to physically prohibit U-turns and to prevent improper access to and from interchange ramps. The desirable median width for freeways should be about 40 feet between the inside edges of each roadway.
6. *Shoulders* — A minimum, 10-foot stabilized shoulder should be available for emergency stops and maintenance vehicles on the right side of the direction of travel. The shoulder width on the left, or inside edge of the roadways should be a minimum of four feet and should be paved.
7. *Design Speeds* — The desirable design speed for freeways in urban areas should be 60 MPH, although under special conditions this may be reduced to 50 MPH where alignment, vertical curvature, grades, super-elevation, and sight distance must be correlated with the design requirements.
8. *Rights-of-way* — Although right-of-way for freeways will vary, the width must be adequate to encompass all construction elements, including side slopes and roadside drainage installations. A minimum of 20 feet beyond the construction limits has been established for the recommended right-of-way limits on freeway facilities.

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Names:
Design Standards

Places:
Huntsville, AL

Types:
booklet

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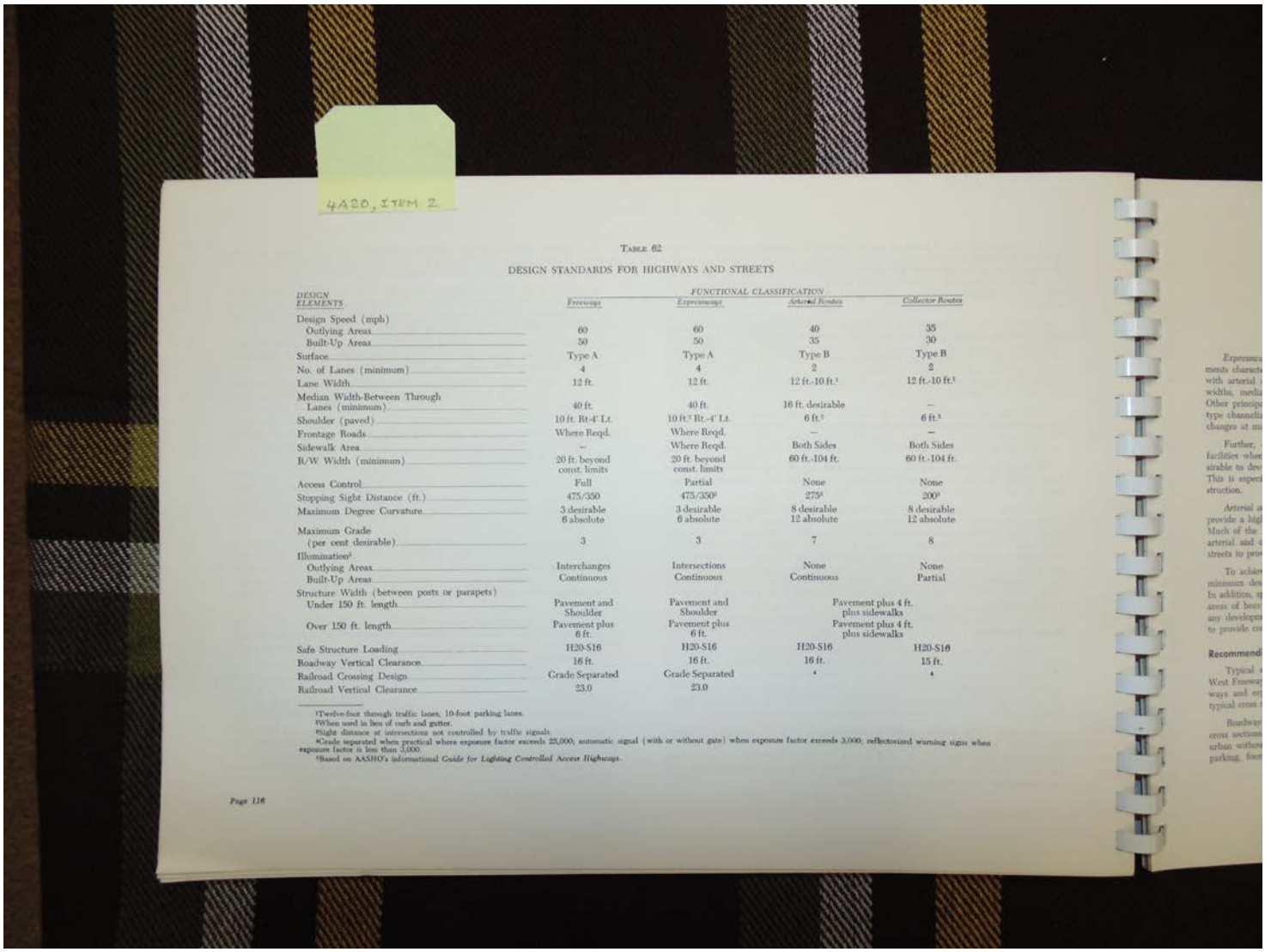

TABLE 62

DESIGN STANDARDS FOR HIGHWAYS AND STREETS

DESIGN ELEMENTS	FUNCTIONAL CLASSIFICATION			
	Freeways	Expressways	Arterial Routes	Collector Routes
Design Speed (mph)				
Outlying Areas	60	60	40	35
Built-Up Areas	50	50	35	30
Surface	Type A	Type A	Type B	Type B
No. of Lanes (minimum)	4	4	2	2
Lane Width	12 ft.	12 ft.	12 ft.-10 ft.[1]	12 ft.-10 ft.[1]
Median Width-Between Through Lanes (minimum)	40 ft.	40 ft.	16 ft. desirable	–
Shoulder (paved)	10 ft. Rt.-4' Lt.	10 ft.[2] Rt.-4' Lt.	6 ft.[3]	6 ft.[3]
Frontage Roads	Where Reqd.	Where Reqd.	–	–
Sidewalk Area	–	Where Reqd.	Both Sides	Both Sides
R/W Width (minimum)	20 ft. beyond const. limits	20 ft. beyond const. limits	60 ft.-104 ft.	60 ft.-104 ft.
Access Control	Full	Partial	None	None
Stopping Sight Distance (ft.)	475/350	475/350[5]	275[5]	200[5]
Maximum Degree Curvature	3 desirable 6 absolute	3 desirable 6 absolute	8 desirable 12 absolute	8 desirable 12 absolute
Maximum Grade (per cent desirable)	3	3	7	8
Illumination[4]				
Outlying Areas	Interchanges	Intersections	None	None
Built-Up Areas	Continuous	Continuous	Continuous	Partial
Structure Width (between posts or parapets)				
Under 150 ft. length	Pavement and Shoulder	Pavement and Shoulder	Pavement plus 4 ft. plus sidewalks	
Over 150 ft. length	Pavement plus 6 ft.	Pavement plus 6 ft.	Pavement plus 4 ft. plus sidewalks	
Safe Structure Loading	H20-S16	H20-S16	H20-S16	H20-S16
Roadway Vertical Clearance	16 ft.	16 ft.	16 ft.	15 ft.
Railroad Crossing Design	Grade Separated	Grade Separated	[6]	[6]
Railroad Vertical Clearance	23.0	23.0		

[1]Twelve-foot through traffic lanes, 10-foot parking lanes.
[2]When used in lieu of curb and gutter.
[3]Sight distance at intersections not controlled by traffic signals.
[4]Grade separated when practical where exposure factor exceeds 25,000; automatic signal (with or without gate) when exposure factor exceeds 3,000; reflectorized warning signs when exposure factor is less than 3,000.
[5]Based on AASHO's informational *Guide for Lighting Controlled Access Highways*.

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Names:
Design Standardsfor
Highways & Streets

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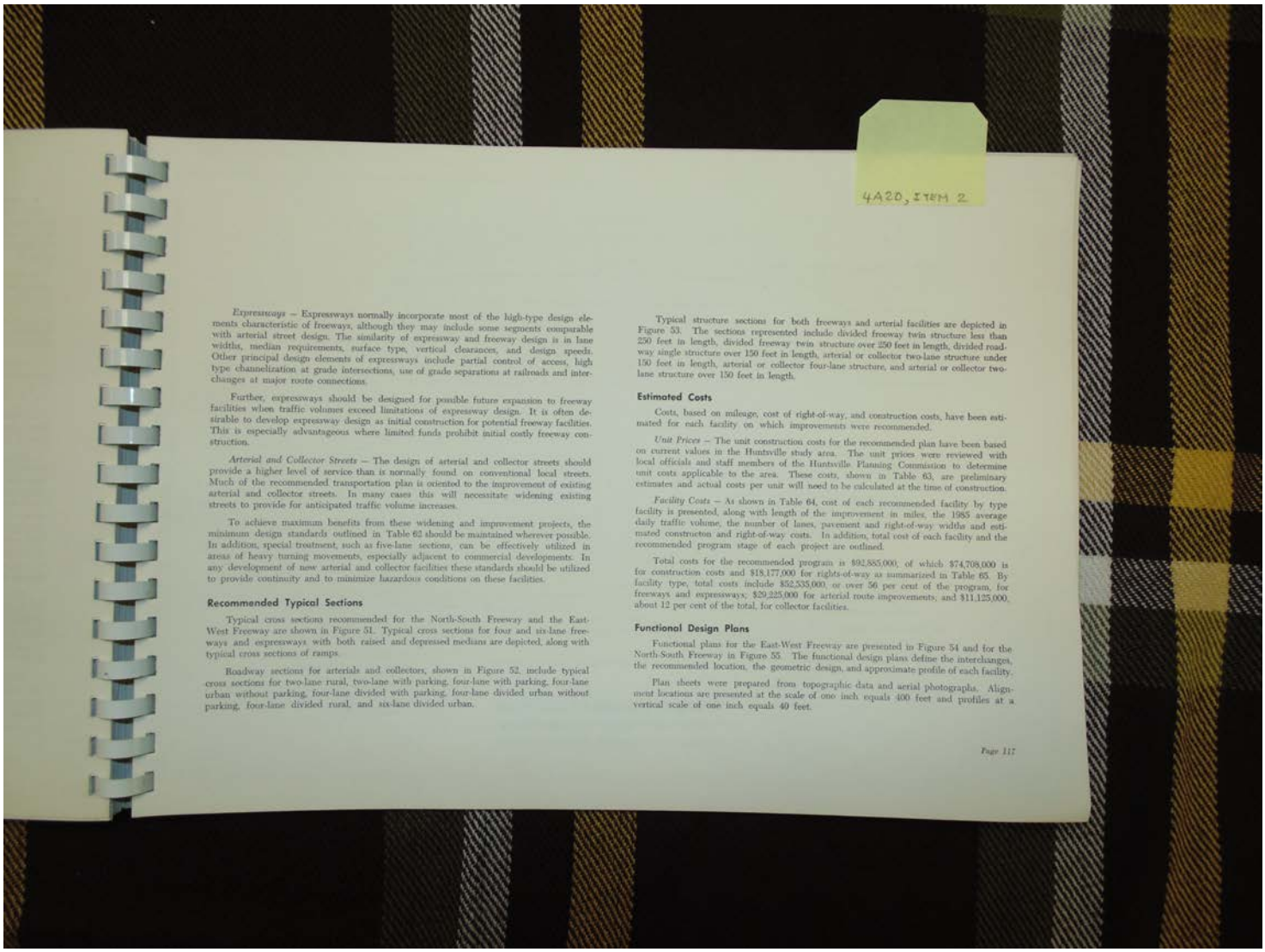


Expressways — Expressways normally incorporate most of the high-type design elements characteristic of freeways, although they may include some segments comparable with arterial street design. The similarity of expressway and freeway design is in lane widths, median requirements, surface type, vertical clearances, and design speeds. Other principal design elements of expressways include partial control of access, high type channelization at grade intersections, use of grade separations at railroads and interchanges at major route connections.

Further, expressways should be designed for possible future expansion to freeway facilities when traffic volumes exceed limitations of expressway design. It is often desirable to develop expressway design as initial construction for potential freeway facilities. This is especially advantageous where limited funds prohibit initial costly freeway construction.

Arterial and Collector Streets — The design of arterial and collector streets should provide a higher level of service than is normally found on conventional local streets. Much of the recommended transportation plan is oriented to the improvement of existing arterial and collector streets. In many cases this will necessitate widening existing streets to provide for anticipated traffic volume increases.

To achieve maximum benefits from these widening and improvement projects, the minimum design standards outlined in Table 62 should be maintained wherever possible. In addition, special treatment, such as five-lane sections, can be effectively utilized in areas of heavy turning movements, especially adjacent to commercial developments. In any development of new arterial and collector facilities these standards should be utilized to provide continuity and to minimize hazardous conditions on these facilities.

Recommended Typical Sections

Typical cross sections recommended for the North-South Freeway and the East-West Freeway are shown in Figure 51. Typical cross sections for four and six-lane freeways and expressways with both raised and depressed medians are depicted, along with typical cross sections of ramps.

Roadway sections for arterials and collectors, shown in Figure 52, include typical cross sections for two-lane rural, two-lane with parking, four-lane with parking, four-lane urban without parking, four-lane divided with parking, four-lane divided urban without parking, four-lane divided rural, and six-lane divided urban.

Typical structure sections for both freeways and arterial facilities are depicted in Figure 53. The sections represented include divided freeway twin structure less than 250 feet in length, divided freeway twin structure over 250 feet in length, divided roadway single structure over 150 feet in length, arterial or collector two-lane structure under 150 feet in length, arterial or collector four-lane structure, and arterial or collector two-lane structure over 150 feet in length.

Estimated Costs

Costs, based on mileage, cost of right-of-way, and construction costs, have been estimated for each facility on which improvements were recommended.

Unit Prices — The unit construction costs for the recommended plan have been based on current values in the Huntsville study area. The unit prices were reviewed with local officials and staff members of the Huntsville Planning Commission to determine unit costs applicable to the area. These costs, shown in Table 63, are preliminary estimates and actual costs per unit will need to be calculated at the time of construction.

Facility Costs — As shown in Table 64, cost of each recommended facility by type facility is presented, along with length of the improvement in miles, the 1985 average daily traffic volume, the number of lanes, pavement and right-of-way widths and estimated construction and right-of-way costs. In addition, total cost of each facility and the recommended program stage of each project are outlined.

Total costs for the recommended program is $92,885,000, of which $74,708,000 is for construction costs and $18,177,000 for rights-of-way as summarized in Table 65. By facility type, total costs include $52,535,000, or over 56 per cent of the program, for freeways and expressways; $29,225,000 for arterial route improvements; and $11,125,000, about 12 per cent of the total, for collector facilities.

Functional Design Plans

Functional plans for the East-West Freeway are presented in Figure 54 and for the North-South Freeway in Figure 55. The functional design plans define the interchanges, the recommended location, the geometric design, and approximate profile of each facility.

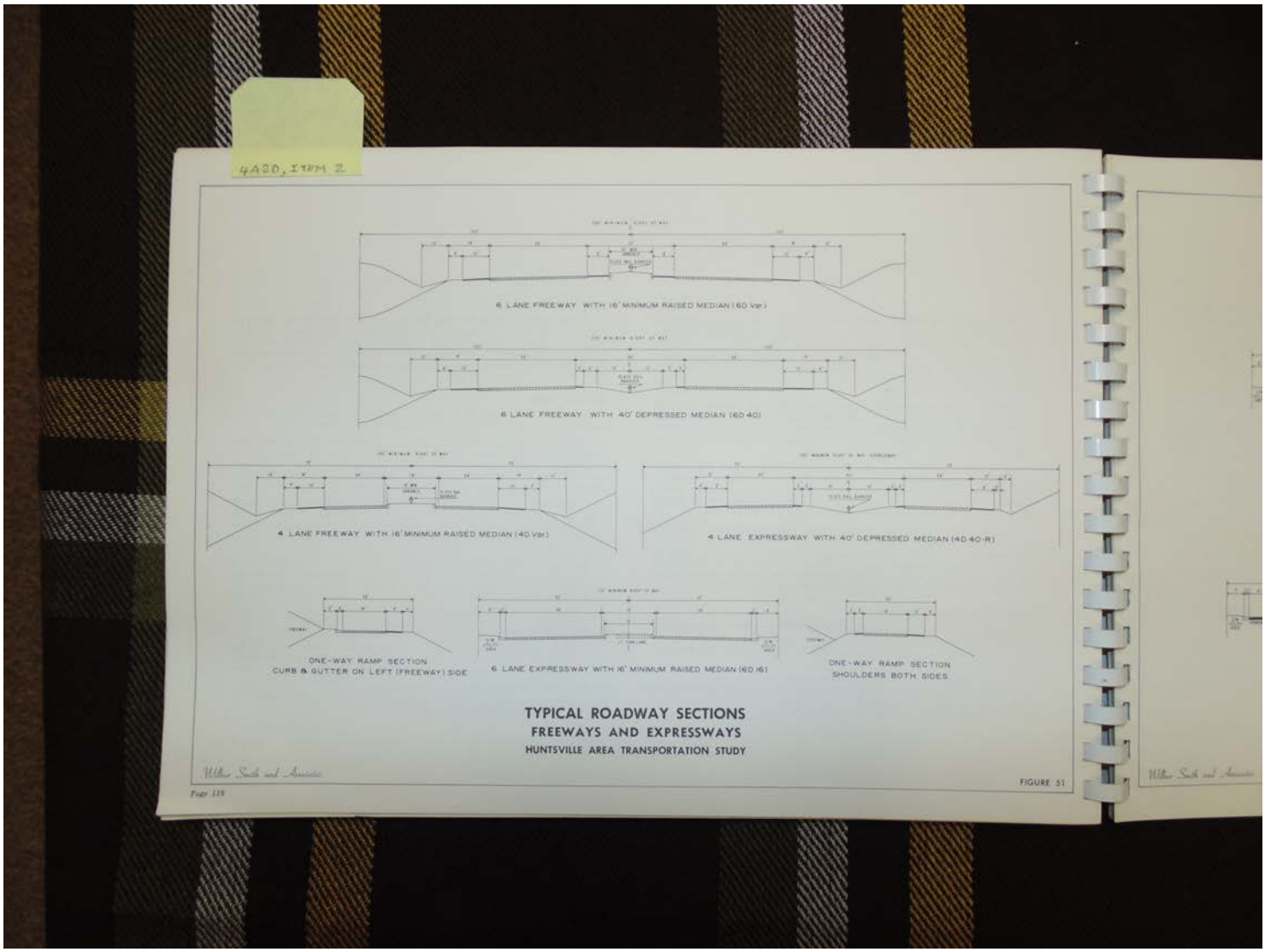
Plan sheets were prepared from topographic data and aerial photographs. Alignment locations are presented at the scale of one inch equals 400 feet and profiles at a vertical scale of one inch equals 40 feet.

Names:
Estimated Costs
Functional Design Plans
Recommended Typical Sections

Places:
Huntsville, AL

Types:
booklet

Dates:
1966

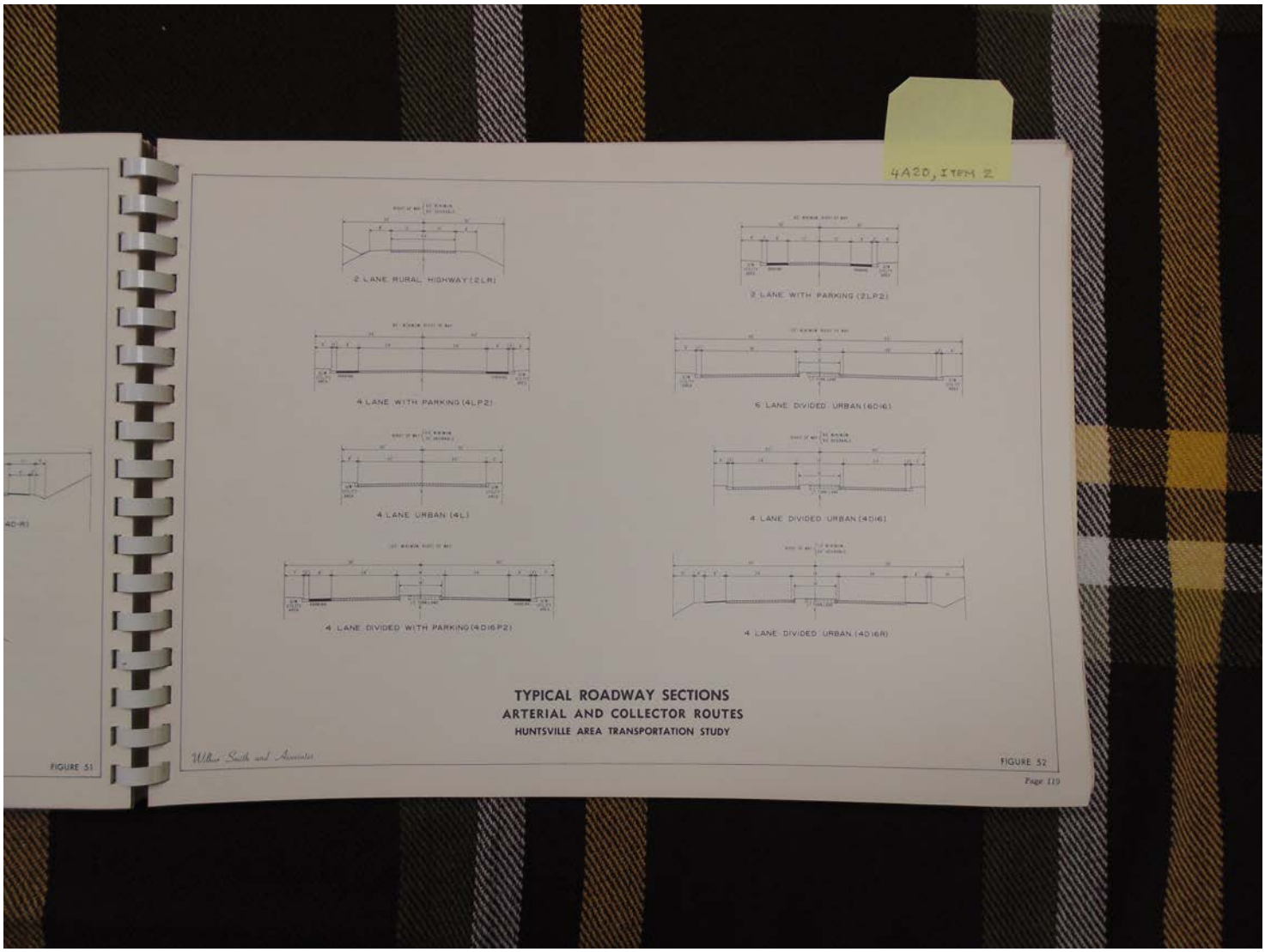


Names:
Typical Roadway Sections

Places:
Huntsville, AL

Types:
illustration

Dates:
1966

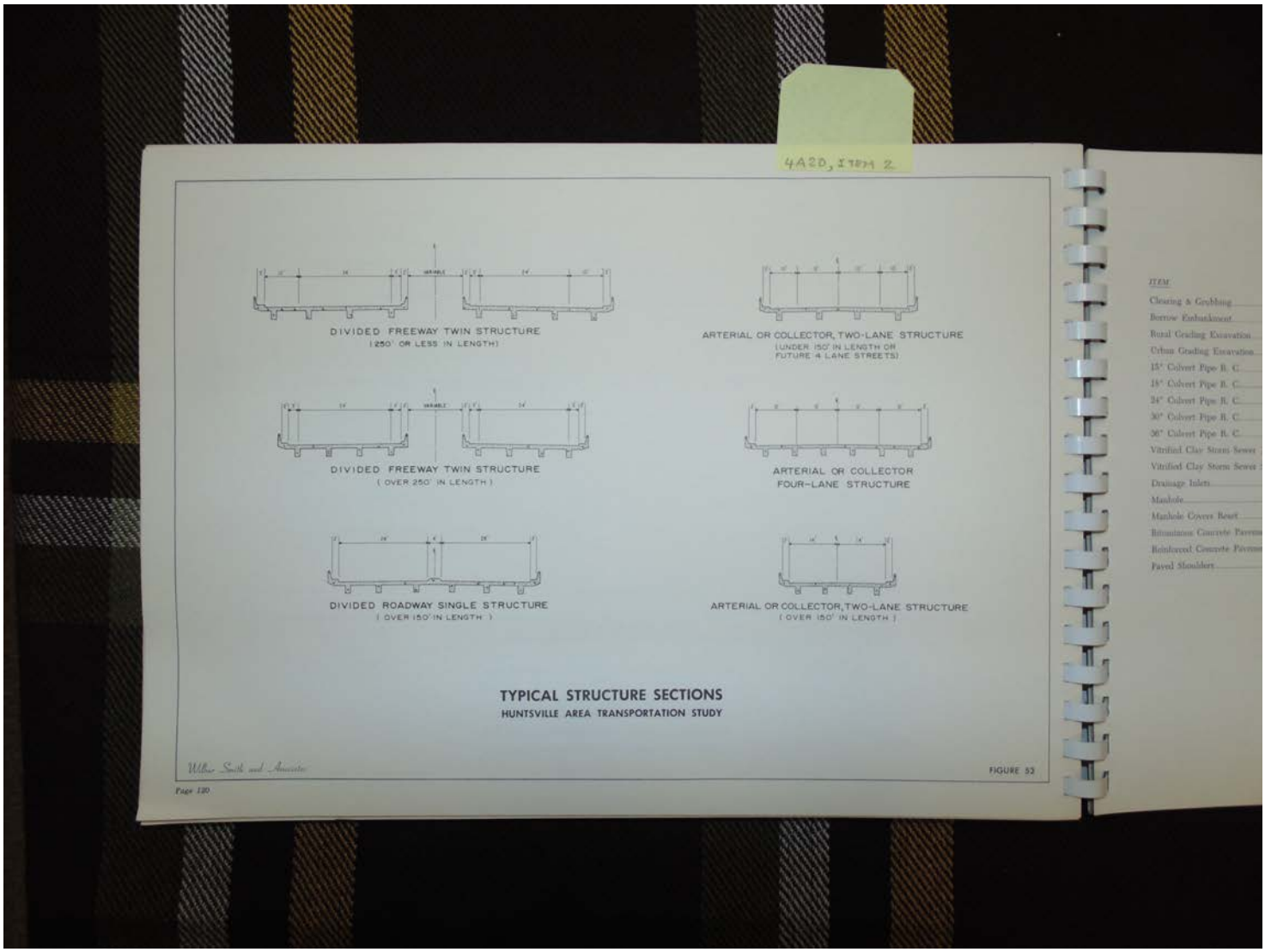


Names:
Typical Roadway Sections

Places:
Huntsville, AL

Types:
illustration

Dates:
1966

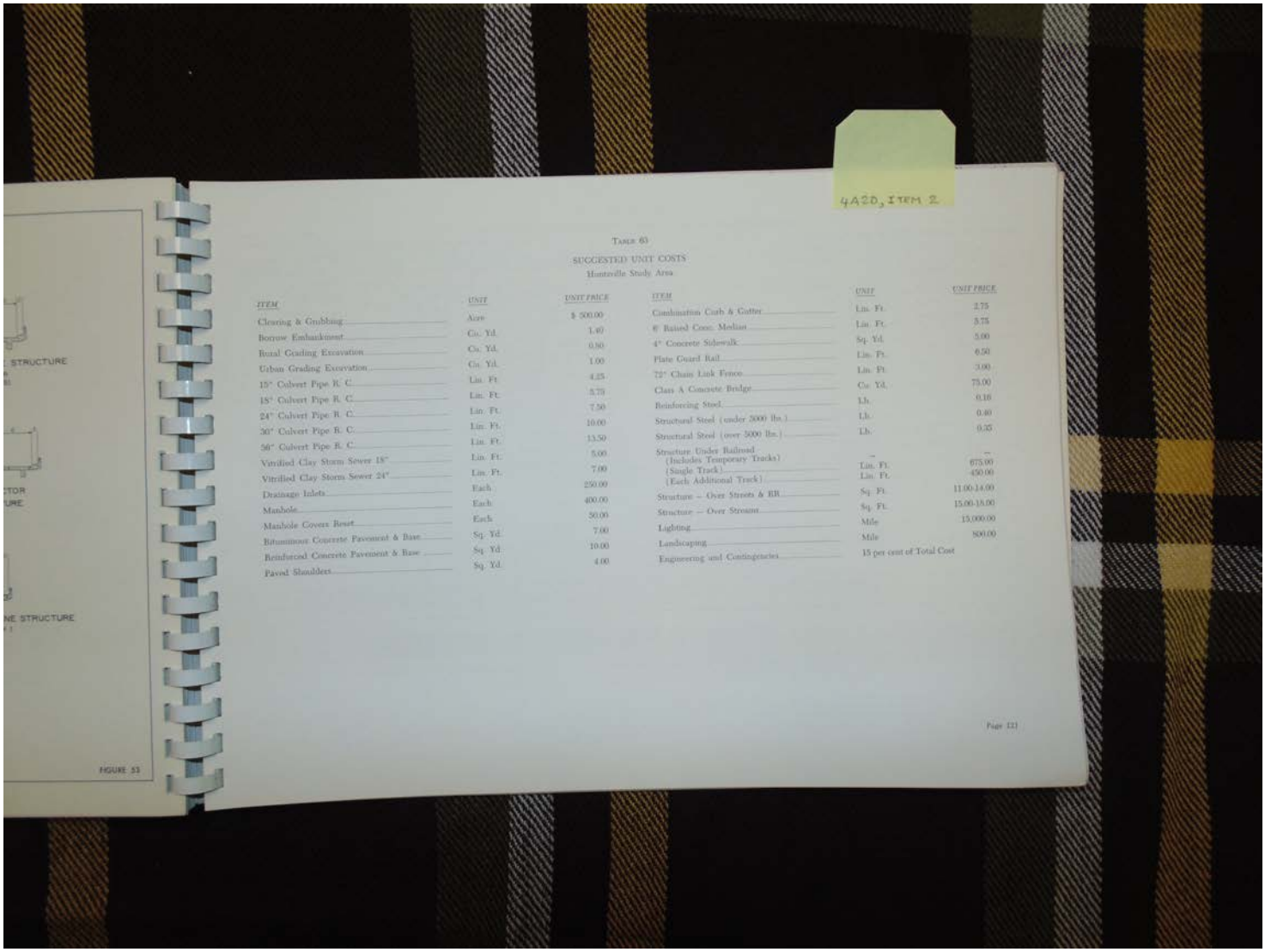


Names:
Typical Structure Sections

Places:
Huntsville, AL

Types:
illustration

Dates:
1966

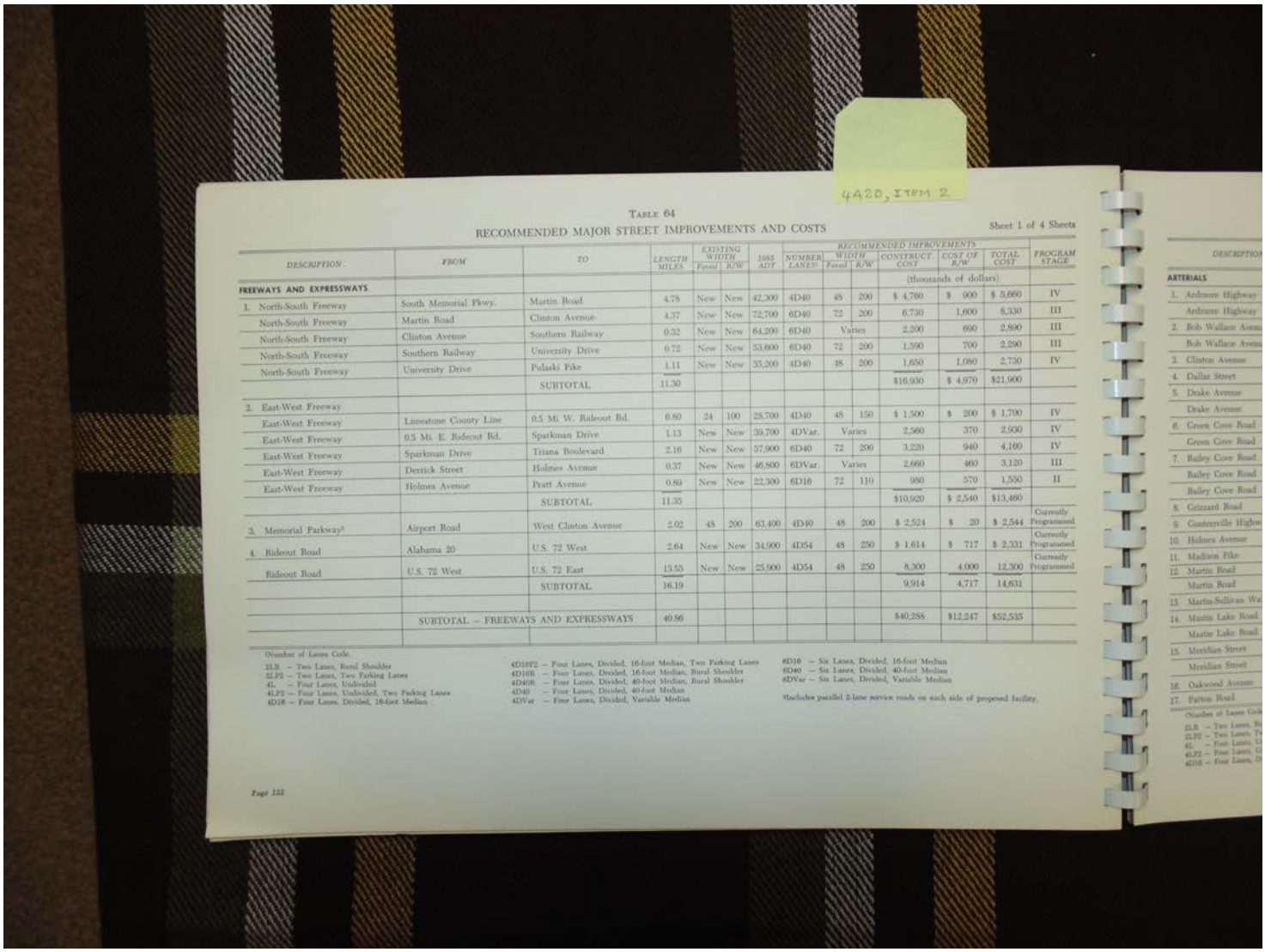


Names:
Suggested Unit Costs

Places:
Huntsville, AL area

Types:
table

Dates:
1966



4A20, ITEM 2

TABLE 64

RECOMMENDED MAJOR STREET IMPROVEMENTS AND COSTS

Sheet 1 of 4 Sheets

DESCRIPTION	FROM	TO	LENGTH MILES	EXISTING WIDTH Paved	EXISTING WIDTH R/W	1985 ADT	RECOMMENDED IMPROVEMENTS NUMBER LANES[1]	RECOMMENDED IMPROVEMENTS WIDTH Paved	RECOMMENDED IMPROVEMENTS WIDTH R/W	CONSTRUCT. COST	COST OF R/W	TOTAL COST	PROGRAM STAGE
										(thousands of dollars)			
FREEWAYS AND EXPRESSWAYS													
1. North-South Freeway	South Memorial Pkwy.	Martin Road	4.78	New	New	42,300	4D40	48	200	$ 4,760	$ 900	$ 5,660	IV
North-South Freeway	Martin Road	Clinton Avenue	4.37	New	New	72,700	6D40	72	200	6,730	1,600	8,330	III
North-South Freeway	Clinton Avenue	Southern Railway	0.32	New	New	84,200	6D40	Varies		2,200	690	2,890	III
North-South Freeway	Southern Railway	University Drive	0.72	New	New	53,600	6D40	72	200	1,590	700	2,290	III
North-South Freeway	University Drive	Pulaski Pike	1.11	New	New	35,200	4D40	48	200	1,650	1,080	2,730	IV
		SUBTOTAL	11.30							$16,930	$ 4,970	$21,900	
2. East-West Freeway													
East-West Freeway	Limestone County Line	0.5 Mi W. Rideout Rd.	6.80	24	100	28,700	4D40	48	150	$ 1,500	$ 200	$ 1,700	IV
East-West Freeway	0.5 Mi. E. Rideout Rd.	Sparkman Drive	1.13	New	New	39,700	4DVar.	Varies		2,560	370	2,930	IV
East-West Freeway	Sparkman Drive	Triana Boulevard	2.16	New	New	57,900	6D40	72	200	3,220	940	4,160	IV
East-West Freeway	Derrick Street	Holmes Avenue	0.37	New	New	46,500	6DVar.	Varies		2,660	460	3,120	III
East-West Freeway	Holmes Avenue	Pratt Avenue	0.89	New	New	22,300	6D16	72	110	980	570	1,550	II
		SUBTOTAL	11.35							$10,920	$ 2,540	$13,460	
3. Memorial Parkway[2]	Airport Road	West Clinton Avenue	2.02	48	200	63,400	4D40	48	200	$ 2,524	$ 20	$ 2,544	Currently Programmed
4. Rideout Road	Alabama 20	U.S. 72 West	2.64	New	New	34,900	4D54	48	250	$ 1,614	$ 717	$ 2,331	Currently Programmed
Rideout Road	U.S. 72 West	U.S. 72 East	13.53	New	New	25,900	4D54	48	250	8,300	4,000	12,300	Currently Programmed
		SUBTOTAL	16.19							9,914	4,717	14,631	
		SUBTOTAL — FREEWAYS AND EXPRESSWAYS	40.86							$40,288	$12,247	$52,535	

[1]Number of Lanes Code.
2LB — Two Lanes, Rural Shoulder
2LP2 — Two Lanes, Two Parking Lanes
4L — Four Lanes, Undivided
4LP2 — Four Lanes, Undivided, Two Parking Lanes
4D16 — Four Lanes, Divided, 16-foot Median
4D16P2 — Four Lanes, Divided, 16-foot Median, Two Parking Lanes
4D16R — Four Lanes, Divided, 16-foot Median, Rural Shoulder
4D40R — Four Lanes, Divided, 40-foot Median, Rural Shoulder
4D40 — Four Lanes, Divided, 40-foot Median
4DVar — Four Lanes, Divided, Variable Median
6D16 — Six Lanes, Divided, 16-foot Median
6D40 — Six Lanes, Divided, 40-foot Median
6DVar — Six Lanes, Divided, Variable Median

[2]Includes parallel 2-lane service roads on each side of proposed facility.

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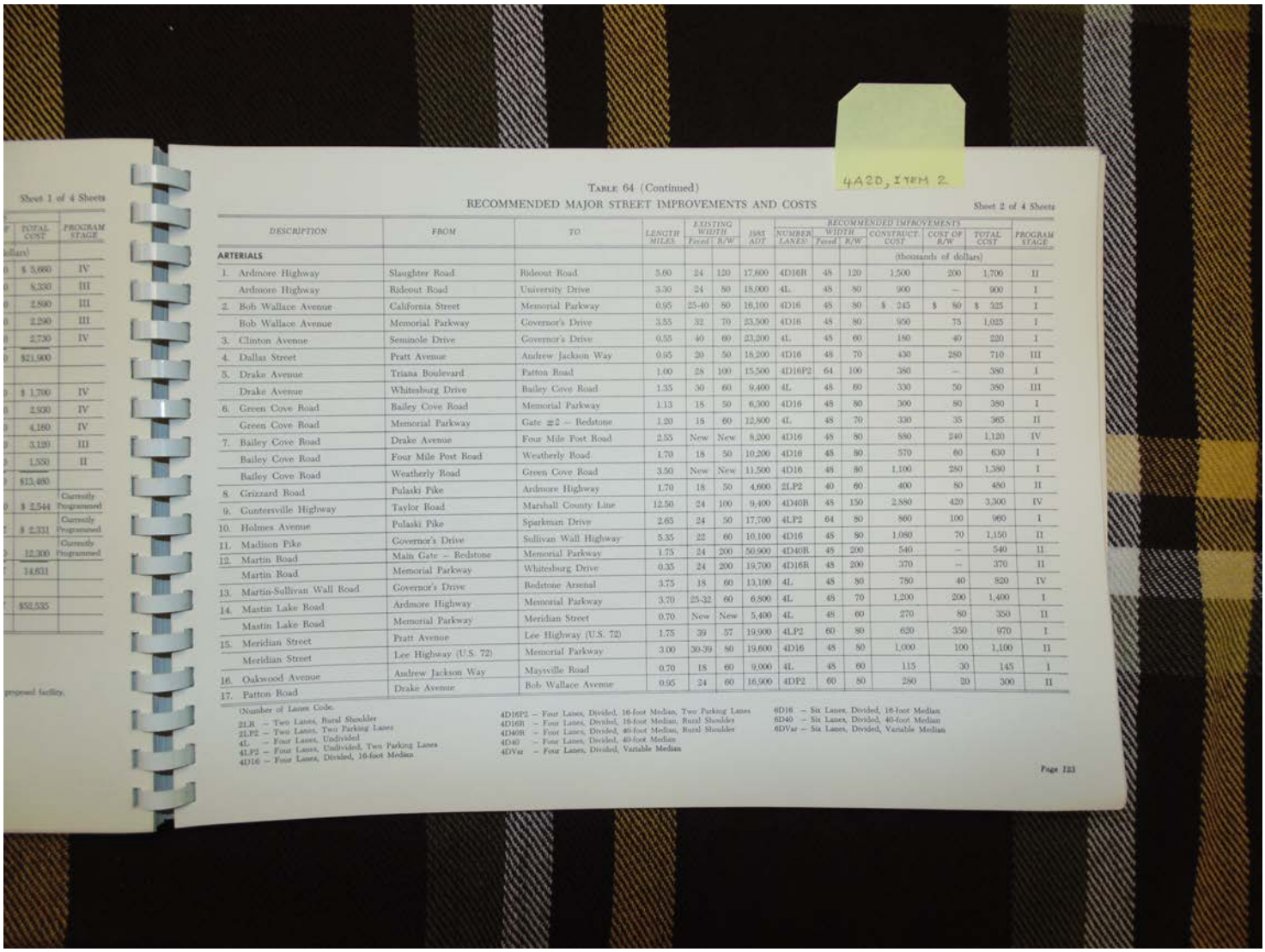
Names:
Recommended Major Street
Improvements

Places:
Huntsville, AL

Types:
table

Dates:
1966



Sheet 1 of 4 Sheets

TOTAL COST	PROGRAM STAGE
(dollars)	
$ 5,660	IV
8,350	III
2,880	III
2,290	III
2,730	IV
$21,900	
$ 1,700	IV
2,930	IV
4,160	IV
3,120	III
1,550	II
$13,480	
$ 2,544	Currently Programmed
$ 2,331	Currently Programmed
12,300	Currently Programmed
14,831	
$52,535	

proposed facility.

4A20, ITEM 2

TABLE 64 (Continued)
RECOMMENDED MAJOR STREET IMPROVEMENTS AND COSTS

Sheet 2 of 4 Sheets

DESCRIPTION	FROM	TO	LENGTH MILES	EXISTING WIDTH Paved	EXISTING WIDTH R/W	1985 ADT	RECOMMENDED IMPROVEMENTS NUMBER LANES	WIDTH Paved	WIDTH R/W	CONSTRUCT. COST	COST OF R/W	TOTAL COST	PROGRAM STAGE
ARTERIALS										(thousands of dollars)			
1. Ardmore Highway	Slaughter Road	Rideout Road	5.60	24	120	17,600	4D16R	48	120	1,500	200	1,700	II
Ardmore Highway	Rideout Road	University Drive	3.30	24	80	18,000	4L	48	80	900	–	900	I
2. Bob Wallace Avenue	California Street	Memorial Parkway	0.95	25-40	80	16,100	4D16	48	80	$ 245	$ 80	$ 325	I
Bob Wallace Avenue	Memorial Parkway	Governor's Drive	3.55	32	70	23,500	4D16	48	80	950	75	1,025	I
3. Clinton Avenue	Seminole Drive	Governor's Drive	0.55	40	60	23,200	4L	48	60	180	40	220	I
4. Dallas Street	Pratt Avenue	Andrew Jackson Way	0.95	20	50	18,200	4D16	48	70	430	280	710	III
5. Drake Avenue	Triana Boulevard	Patton Road	1.00	28	100	15,500	4D16P2	64	100	380	–	380	I
Drake Avenue	Whitesburg Drive	Bailey Cove Road	1.35	30	60	9,400	4L	48	60	330	50	380	III
6. Green Cove Road	Bailey Cove Road	Memorial Parkway	1.13	18	50	6,300	4D16	48	80	300	80	380	I
Green Cove Road	Memorial Parkway	Gate #2 – Redstone	1.20	18	60	12,800	4L	48	70	330	35	365	II
7. Bailey Cove Road	Drake Avenue	Four Mile Post Road	2.55	New	New	8,200	4D16	48	80	880	240	1,120	IV
Bailey Cove Road	Four Mile Post Road	Weatherly Road	1.70	18	50	10,200	4D16	48	80	570	60	630	I
Bailey Cove Road	Weatherly Road	Green Cove Road	3.50	New	New	11,500	4D16	48	80	1,100	280	1,380	I
8. Grizzard Road	Pulaski Pike	Ardmore Highway	1.70	18	50	4,600	2LP2	40	60	400	80	480	II
9. Guntersville Highway	Taylor Road	Marshall County Line	12.50	24	100	9,400	4D40R	48	150	2,880	420	3,300	IV
10. Holmes Avenue	Pulaski Pike	Sparkman Drive	2.65	24	50	17,700	4LP2	64	80	860	100	960	I
11. Madison Pike	Governor's Drive	Sullivan Wall Highway	5.35	22	60	10,100	4D16	48	80	1,080	70	1,150	II
12. Martin Road	Main Gate – Redstone	Memorial Parkway	1.75	24	200	50,900	4D40R	48	200	540	–	540	II
Martin Road	Memorial Parkway	Whitesburg Drive	0.35	24	200	19,700	4D16R	48	200	370	–	370	II
13. Martin-Sullivan Wall Road	Governor's Drive	Redstone Arsenal	3.75	18	60	13,100	4L	48	80	780	40	820	IV
14. Mastin Lake Road	Ardmore Highway	Memorial Parkway	3.70	25-32	60	6,800	4L	48	70	1,200	200	1,400	I
Mastin Lake Road	Memorial Parkway	Meridian Street	0.70	New	New	5,400	4L	48	60	270	80	350	II
15. Meridian Street	Pratt Avenue	Lee Highway (U.S. 72)	1.75	39	57	19,900	4LP2	60	80	620	350	970	I
Meridian Street	Lee Highway (U.S. 72)	Memorial Parkway	3.00	30-39	80	19,600	4D16	48	80	1,000	100	1,100	II
16. Oakwood Avenue	Andrew Jackson Way	Maysville Road	0.70	18	60	9,000	4L	48	60	115	30	145	I
17. Patton Road	Drake Avenue	Bob Wallace Avenue	0.95	24	60	16,900	4DP2	60	80	280	20	300	II

(Number of Lanes Code.
2LR – Two Lanes, Rural Shoulder
2LP2 – Two Lanes, Two Parking Lanes
4L – Four Lanes, Undivided
4LP2 – Four Lanes, Undivided, Two Parking Lanes
4D16 – Four Lanes, Divided, 16-foot Median
4D16P2 – Four Lanes, Divided, 16-foot Median, Two Parking Lanes
4D16R – Four Lanes, Divided, 16-foot Median, Rural Shoulder
4D40R – Four Lanes, Divided, 40-foot Median, Rural Shoulder
4D40 – Four Lanes, Divided, 40-foot Median
4DVar – Four Lanes, Divided, Variable Median
6D16 – Six Lanes, Divided, 16-foot Median
6D40 – Six Lanes, Divided, 40-foot Median
6DVar – Six Lanes, Divided, Variable Median

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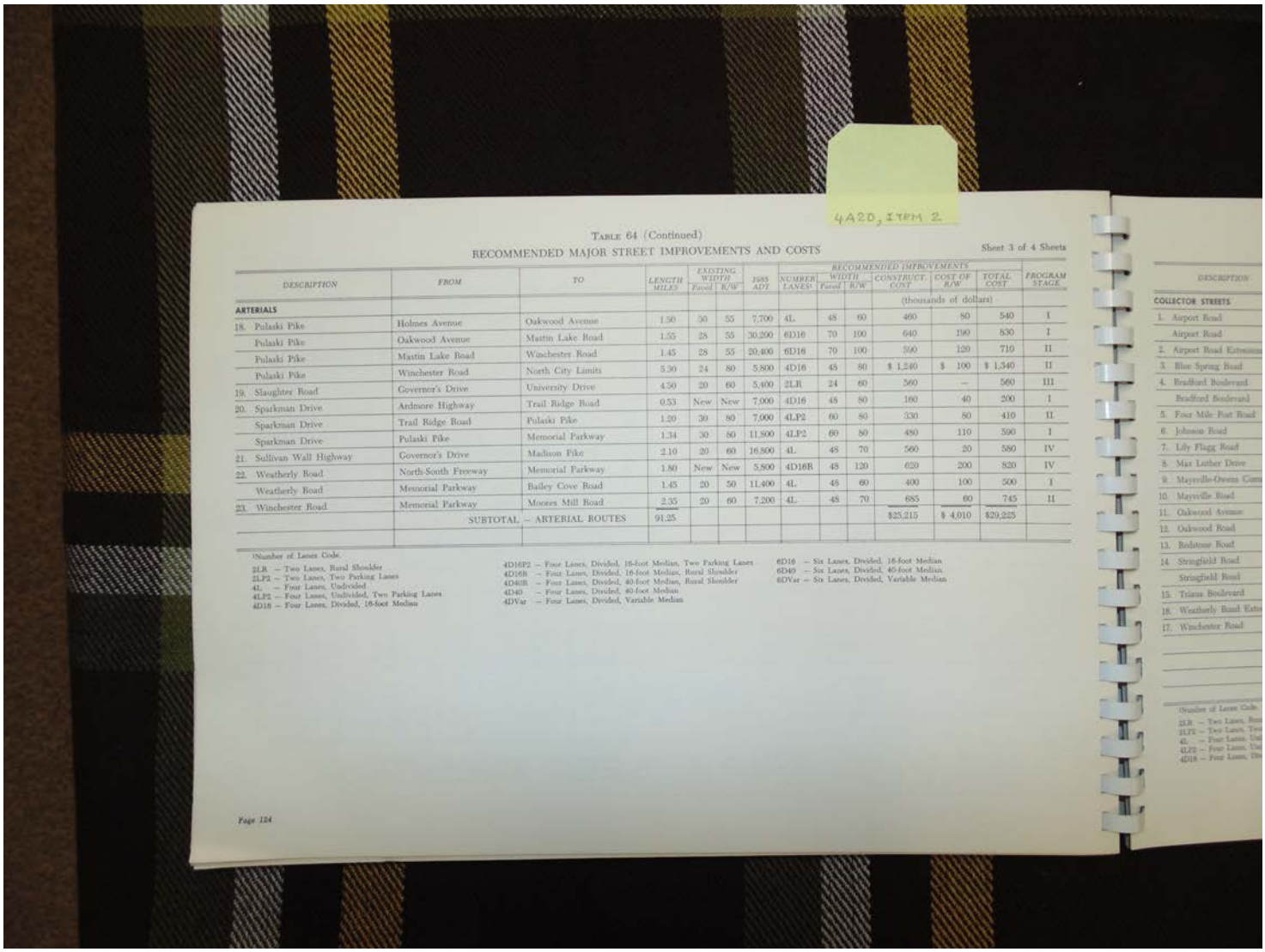
Names:
Recommended Major Street
Improvements

Places:
Huntsville, AL

Types:
table

Dates:
1966



4A20, ITEM 2

TABLE 64 (Continued)
RECOMMENDED MAJOR STREET IMPROVEMENTS AND COSTS
Sheet 3 of 4 Sheets

DESCRIPTION	FROM	TO	LENGTH MILES	EXISTING WIDTH Paved	EXISTING WIDTH R/W	1985 ADT	RECOMMENDED IMPROVEMENTS NUMBER LANES[1]	RECOMMENDED IMPROVEMENTS WIDTH Paved	RECOMMENDED IMPROVEMENTS WIDTH R/W	CONSTRUCT. COST	COST OF R/W	TOTAL COST	PROGRAM STAGE
										(thousands of dollars)			
ARTERIALS													
18. Pulaski Pike	Holmes Avenue	Oakwood Avenue	1.50	30	55	7,700	4L	48	60	460	80	540	I
Pulaski Pike	Oakwood Avenue	Mastin Lake Road	1.55	28	55	30,200	6D16	70	100	640	190	830	I
Pulaski Pike	Mastin Lake Road	Winchester Road	1.45	28	55	20,400	6D16	70	100	590	120	710	II
Pulaski Pike	Winchester Road	North City Limits	5.30	24	80	5,800	4D16	48	80	$ 1,240	$ 100	$ 1,340	II
19. Slaughter Road	Governor's Drive	University Drive	4.50	20	60	5,400	2LR	24	60	360	–	360	III
20. Sparkman Drive	Ardmore Highway	Trail Ridge Road	0.53	New	New	7,000	4D16	48	80	160	40	200	I
Sparkman Drive	Trail Ridge Road	Pulaski Pike	1.20	30	80	7,000	4LP2	60	80	330	80	410	II
Sparkman Drive	Pulaski Pike	Memorial Parkway	1.34	30	80	11,800	4LP2	60	80	480	110	590	I
21. Sullivan Wall Highway	Governor's Drive	Madison Pike	2.10	20	60	16,800	4L	48	70	560	20	580	IV
22. Weatherly Road	North-South Freeway	Memorial Parkway	1.80	New	New	5,800	4D16R	48	120	620	200	820	IV
Weatherly Road	Memorial Parkway	Bailey Cove Road	1.45	20	50	11,400	4L	48	60	400	100	500	I
23. Winchester Road	Memorial Parkway	Moores Mill Road	2.35	20	60	7,200	4L	48	70	685	60	745	II
	SUBTOTAL – ARTERIAL ROUTES		91.25							$25,215	$ 4,010	$29,225	

[1]Number of Lanes Code.
2LR – Two Lanes, Rural Shoulder
2LP2 – Two Lanes, Two Parking Lanes
4L – Four Lanes, Undivided
4LP2 – Four Lanes, Undivided, Two Parking Lanes
4D16 – Four Lanes, Divided, 16-foot Median
4D16P2 – Four Lanes, Divided, 16-foot Median, Two Parking Lanes
4D16R – Four Lanes, Divided, 16-foot Median, Rural Shoulder
4D40R – Four Lanes, Divided, 40-foot Median, Rural Shoulder
4D40 – Four Lanes, Divided, 40-foot Median
4DVar – Four Lanes, Divided, Variable Median
6D16 – Six Lanes, Divided, 16-foot Median
6D40 – Six Lanes, Divided, 40-foot Median
6DVar – Six Lanes, Divided, Variable Median

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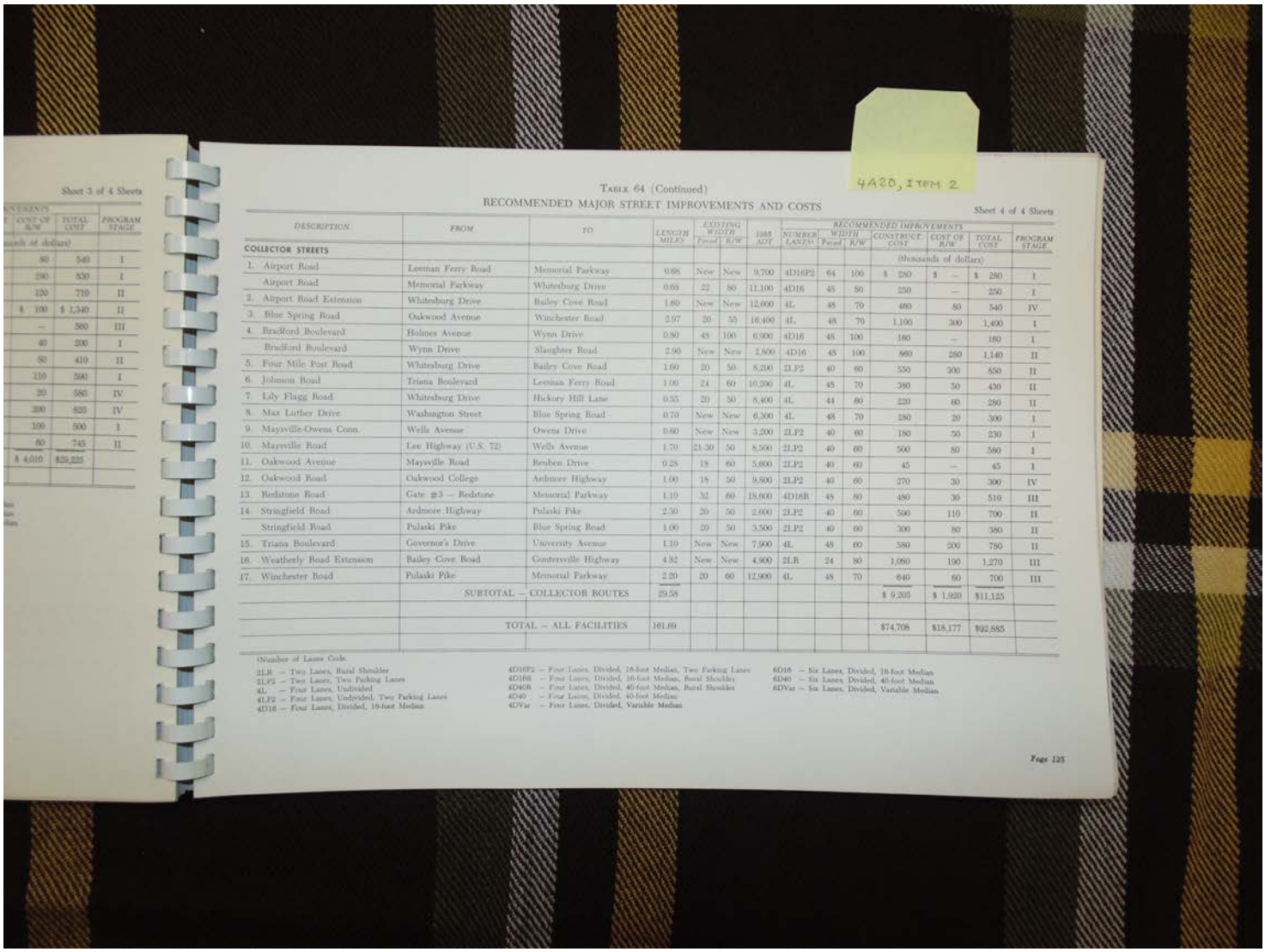
DESCRIPTION
COLLECTOR STREETS
1. Airport Road
Airport Road
2. Airport Road Extension
3. Blue Spring Road
4. Bradford Boulevard
Bradford Boulevard
5. Four Mile Post Road
6. Johnson Road
7. Lily Flagg Road
8. Max Luther Drive
9. Maysville-Owens Cross
10. Maysville Road
11. Oakwood Avenue
12. Oakwood Road
13. Redstone Road
14. Stringfield Road
Stringfield Road
15. Triana Boulevard
16. Weatherly Road Extension
17. Winchester Road

Names:
Recommended Major Street
Improvements

Places:
Huntsville, AL

Types:
table

Dates:
1966



Sheet 3 of 4 Sheets

COST OF R/W	TOTAL COST	PROGRAM STAGE
(thousands of dollars)		
80	540	I
190	850	I
120	710	II
$ 100	$ 1,340	II
–	360	III
40	200	I
80	410	II
110	590	I
20	580	IV
200	820	IV
100	500	I
60	745	II
$ 4,010	$29,225	

4A20, ITEM 2

TABLE 64 (Continued)
RECOMMENDED MAJOR STREET IMPROVEMENTS AND COSTS

Sheet 4 of 4 Sheets

DESCRIPTION	FROM	TO	LENGTH MILES	EXISTING WIDTH Paved	EXISTING WIDTH R/W	1985 ADT	RECOMMENDED IMPROVEMENTS NUMBER LANES[1]	RECOMMENDED IMPROVEMENTS WIDTH Paved	RECOMMENDED IMPROVEMENTS WIDTH R/W	CONSTRUCT COST	COST OF R/W	TOTAL COST	PROGRAM STAGE
COLLECTOR STREETS										(thousands of dollars)			
1. Airport Road	Leeman Ferry Road	Memorial Parkway	0.65	New	New	9,700	4D16P2	64	100	$ 280	$ –	$ 280	I
Airport Road	Memorial Parkway	Whitesburg Drive	0.65	22	80	11,100	4D16	48	80	250	–	250	I
2. Airport Road Extension	Whitesburg Drive	Bailey Cove Road	1.60	New	New	12,900	4L	48	70	480	80	540	IV
3. Blue Spring Road	Oakwood Avenue	Winchester Road	2.97	20	55	16,400	4L	48	70	1,100	300	1,400	I
4. Bradford Boulevard	Holmes Avenue	Wynn Drive	0.80	48	100	6,900	4D16	48	100	160	–	160	I
Bradford Boulevard	Wynn Drive	Slaughter Road	2.90	New	New	2,800	4D16	48	100	860	280	1,140	II
5. Four Mile Post Road	Whitesburg Drive	Bailey Cove Road	1.60	20	50	8,200	2LP2	40	60	350	300	650	II
6. Johnson Road	Triana Boulevard	Leeman Ferry Road	1.00	24	60	10,200	4L	48	70	380	50	430	II
7. Lily Flagg Road	Whitesburg Drive	Hickory Hill Lane	0.55	20	50	8,400	4L	44	60	220	60	280	II
8. Max Luther Drive	Washington Street	Blue Spring Road	0.70	New	New	6,300	4L	48	70	280	20	300	I
9. Maysville-Owens Conn.	Wells Avenue	Owens Drive	0.60	New	New	3,200	2LP2	40	60	180	50	230	I
10. Maysville Road	Lee Highway (U.S. 72)	Wells Avenue	1.70	21-30	50	8,500	2LP2	40	60	500	80	580	I
11. Oakwood Avenue	Maysville Road	Reuben Drive	0.25	18	60	5,800	2LP2	40	60	45	–	45	I
12. Oakwood Road	Oakwood College	Ardmore Highway	1.00	18	50	9,800	2LP2	40	60	270	30	300	IV
13. Redstone Road	Gate #3 – Redstone	Memorial Parkway	1.10	32	60	18,000	4D16R	48	80	480	30	510	III
14. Stringfield Road	Ardmore Highway	Pulaski Pike	2.30	20	50	2,600	2LP2	40	60	590	110	700	II
Stringfield Road	Pulaski Pike	Blue Spring Road	1.00	20	50	3,500	2LP2	40	60	300	80	380	II
15. Triana Boulevard	Governor's Drive	University Avenue	1.10	New	New	7,900	4L	48	60	580	200	780	II
16. Weatherly Road Extension	Bailey Cove Road	Gooterville Highway	4.82	New	New	4,900	2LR	24	80	1,080	190	1,270	III
17. Winchester Road	Pulaski Pike	Memorial Parkway	2.20	20	60	12,900	4L	48	70	640	60	700	III
	SUBTOTAL – COLLECTOR ROUTES		29.58							$ 9,205	$ 1,920	$11,125	
	TOTAL – ALL FACILITIES		161.69							$74,708	$18,177	$92,885	

[1]Number of Lanes Code.
2LR – Two Lanes, Rural Shoulder
2LP2 – Two Lanes, Two Parking Lanes
4L – Four Lanes, Undivided
4LP2 – Four Lanes, Undivided, Two Parking Lanes
4D16 – Four Lanes, Divided, 16-foot Median
4D16P2 – Four Lanes, Divided, 16-foot Median, Two Parking Lanes
4D16R – Four Lanes, Divided, 16-foot Median, Rural Shoulder
4D40R – Four Lanes, Divided, 40-foot Median, Rural Shoulder
4D40 – Four Lanes, Divided, 40-foot Median
4DVar – Four Lanes, Divided, Variable Median
6D16 – Six Lanes, Divided, 16-foot Median
6D40 – Six Lanes, Divided, 40-foot Median
6DVar – Six Lanes, Divided, Variable Median

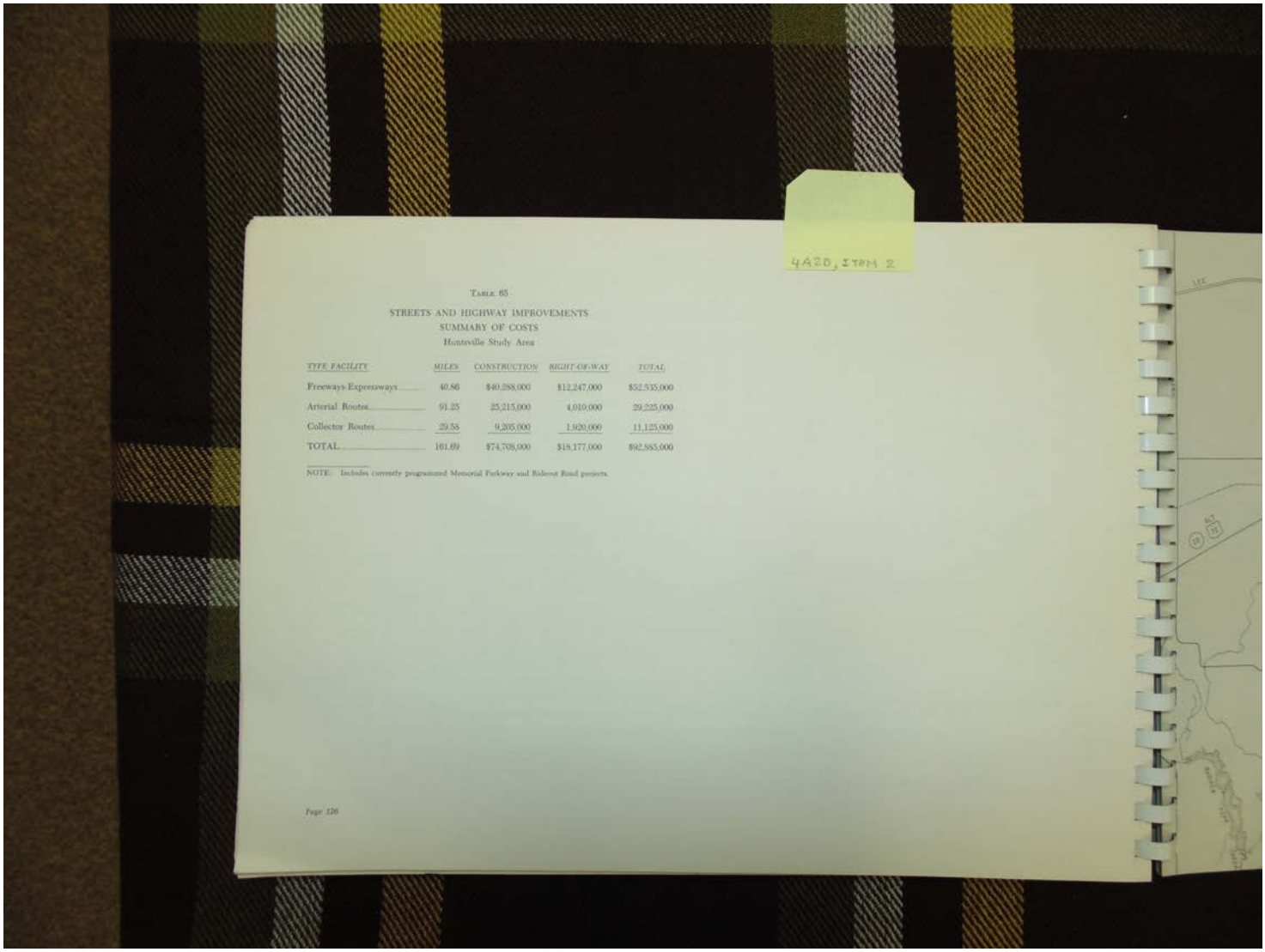
Page 125

Names:
Recommended Major Street
Improvements

Places:
Huntsville, AL

Types:
table

Dates:
1966

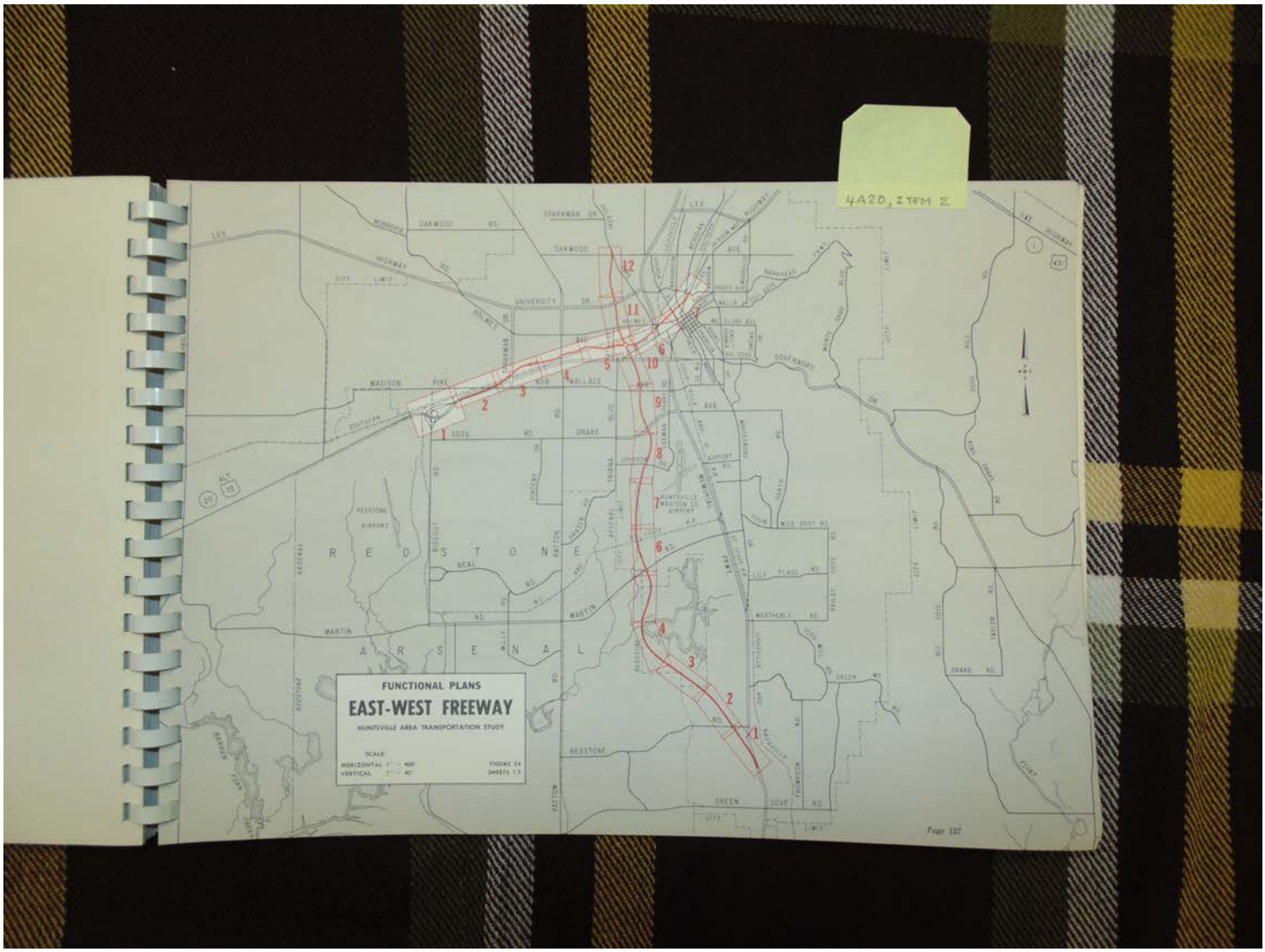


Names:
Streets & Highway Improvements - Costs

Places:
Huntsville, AL area

Types:
table

Dates:
1966

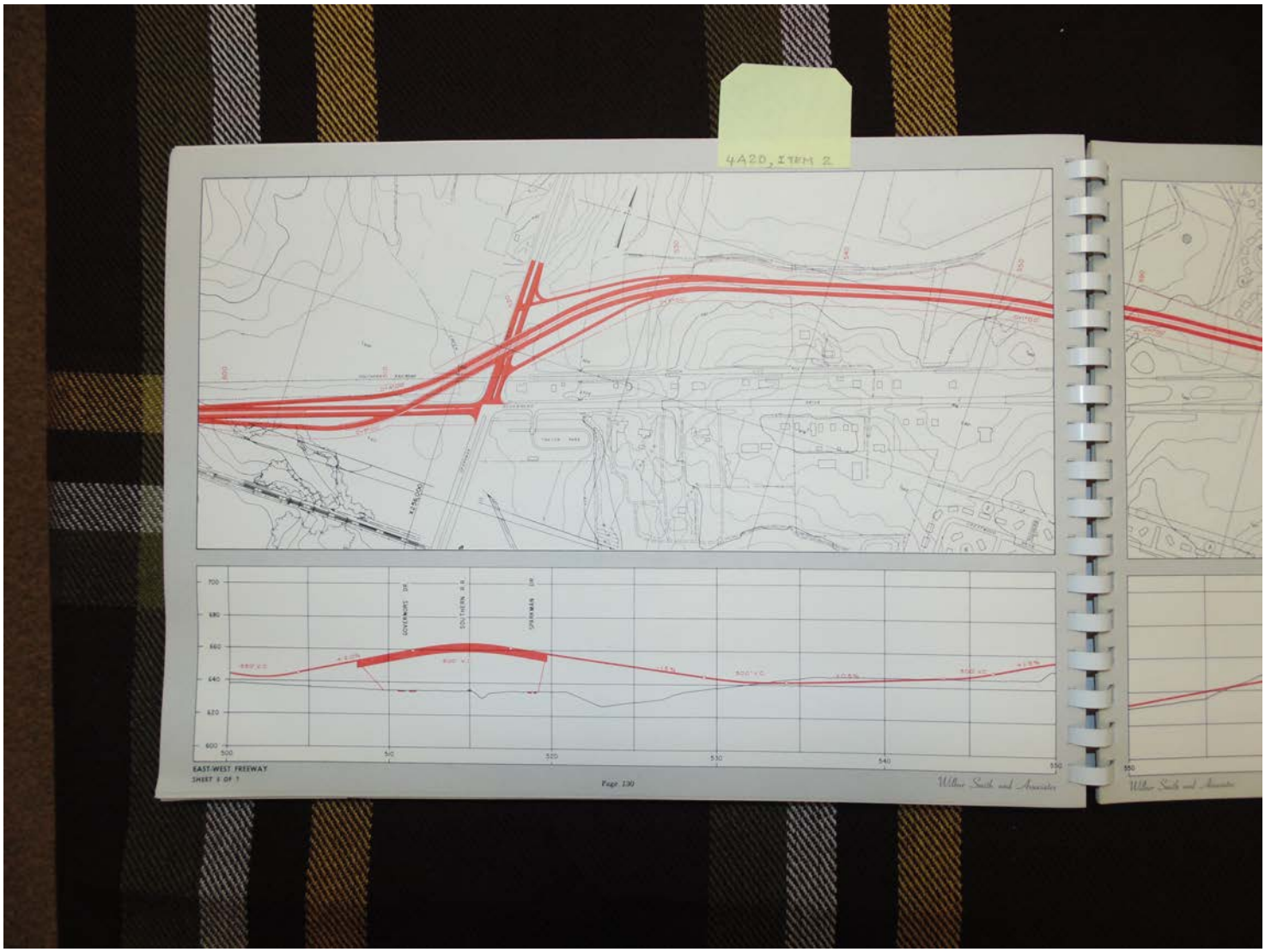


Names:
East - West Freeway
Plan

Places:
Huntsville, AL

Types:
map

Dates:
1966

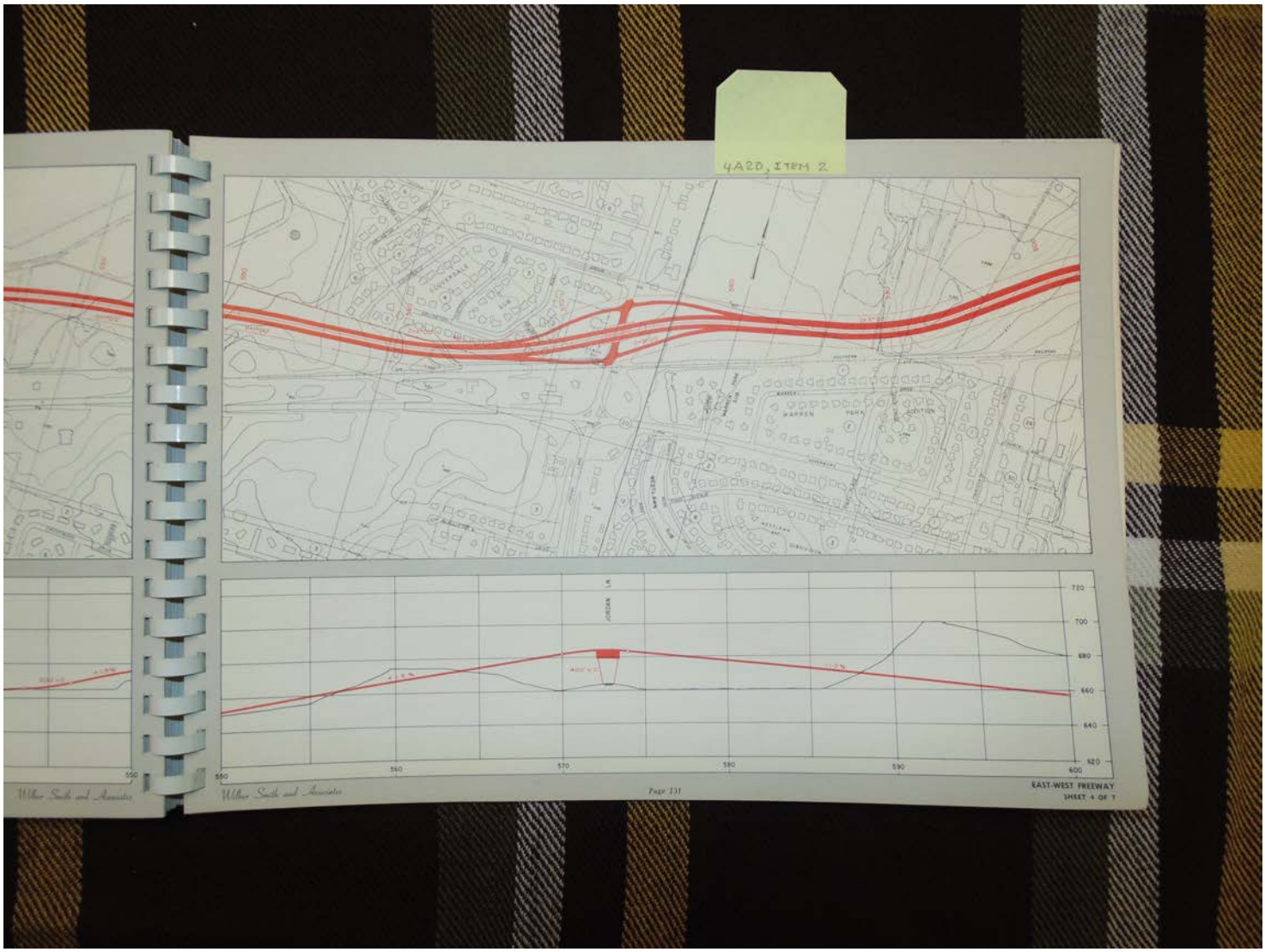


Names:
East - West Freeway
Plan

Places:
Huntsville, AL

Types:
map

Dates:
1966



Names:
East - West Freeway
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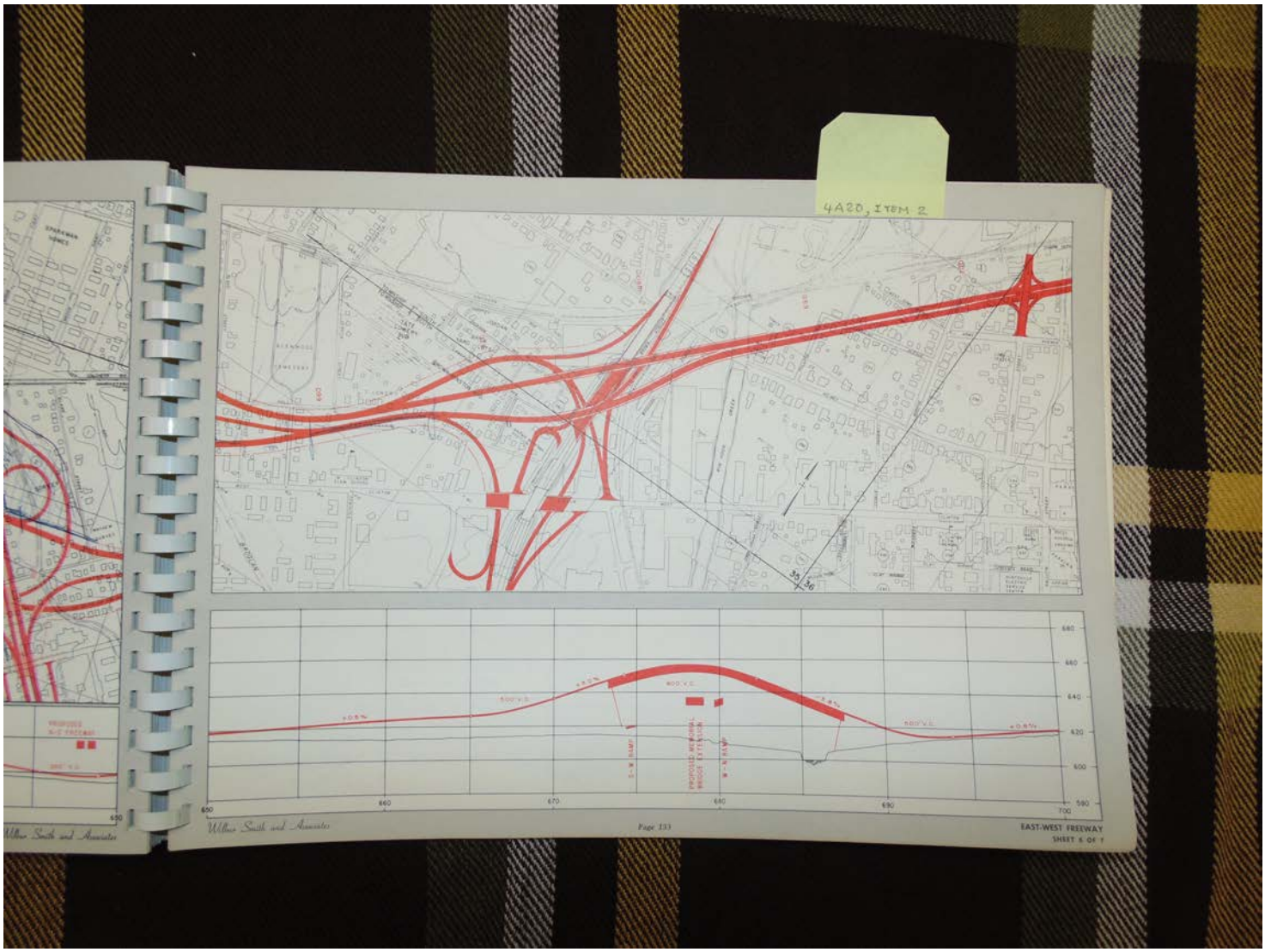

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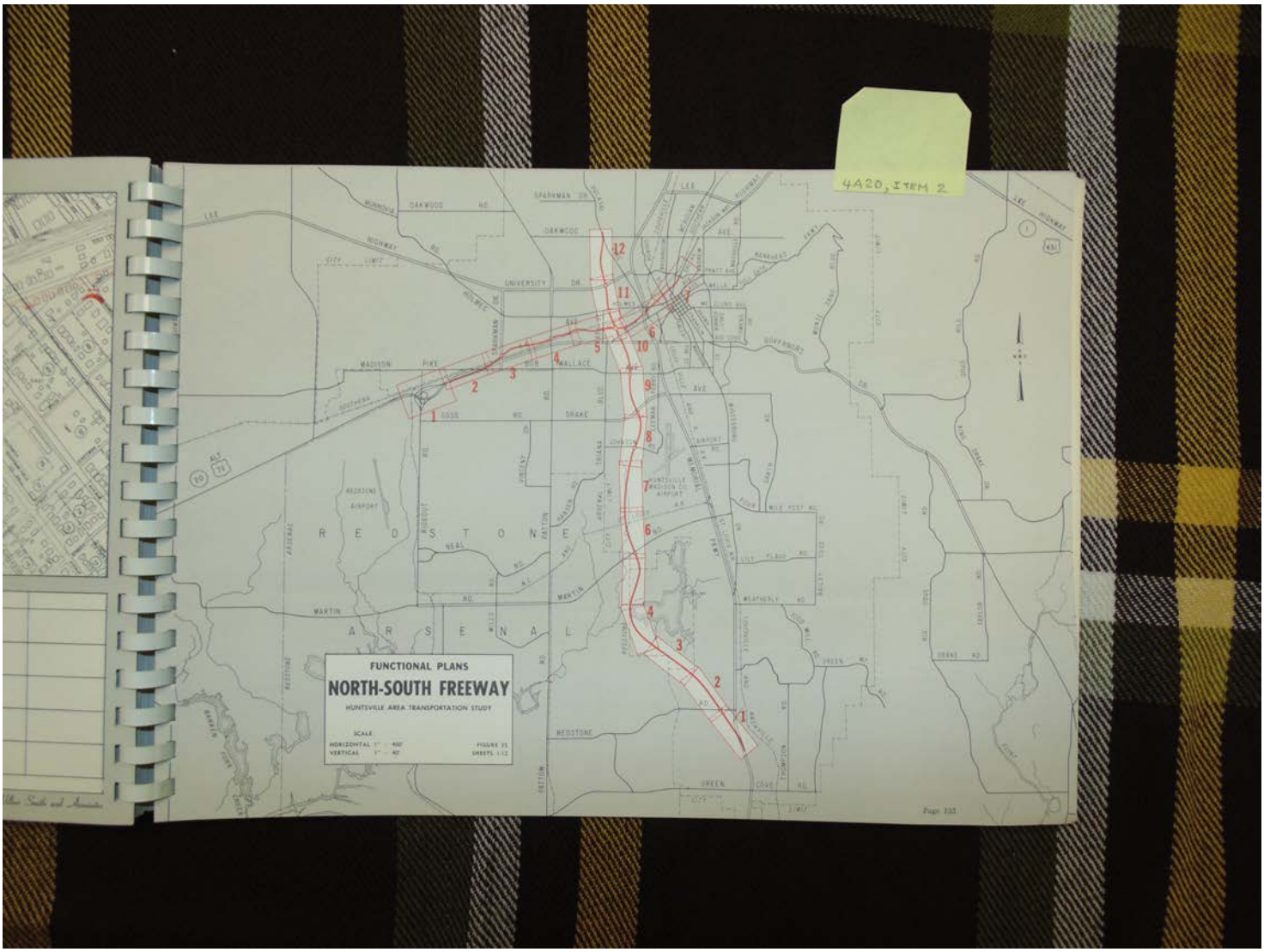

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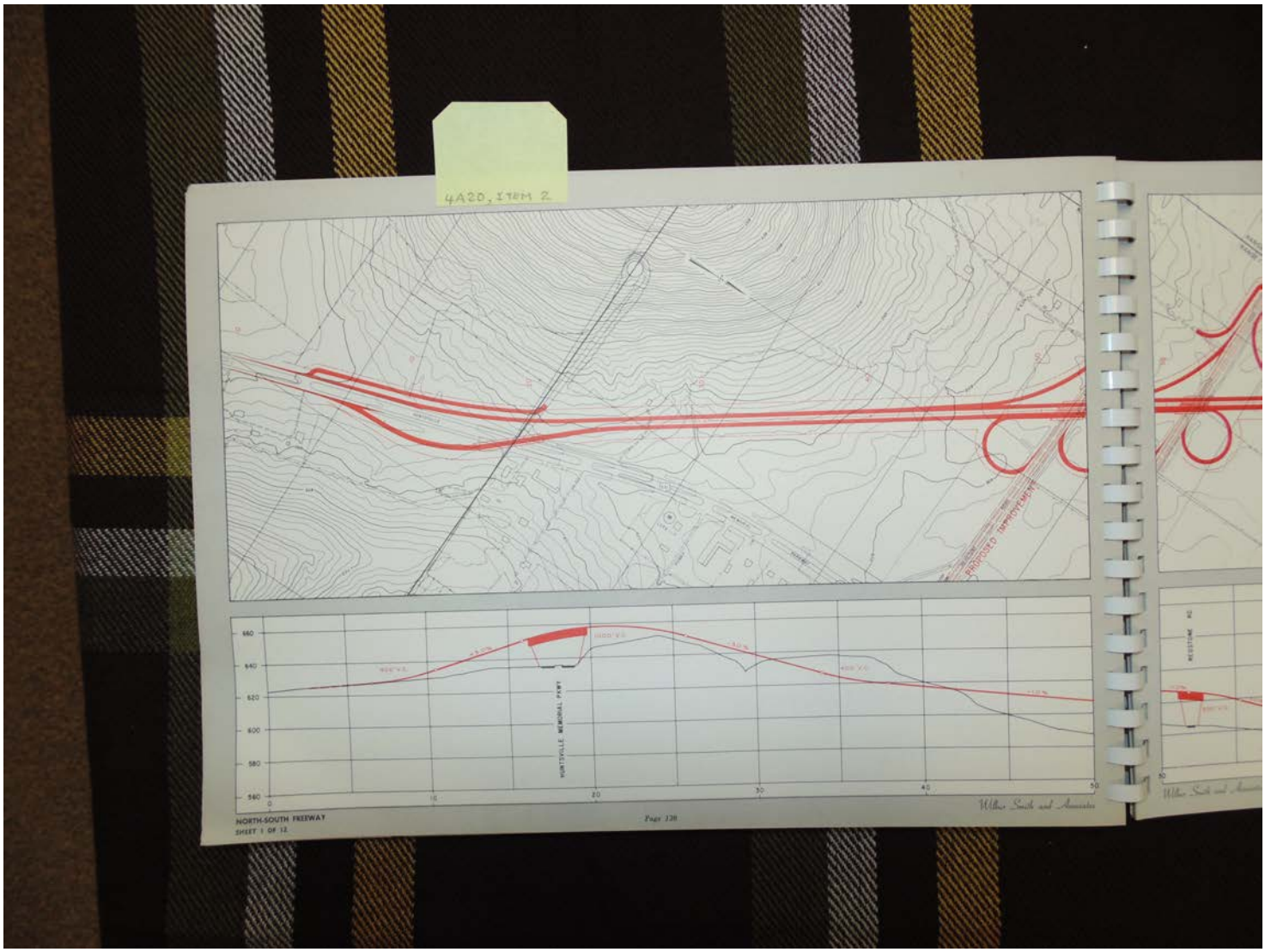

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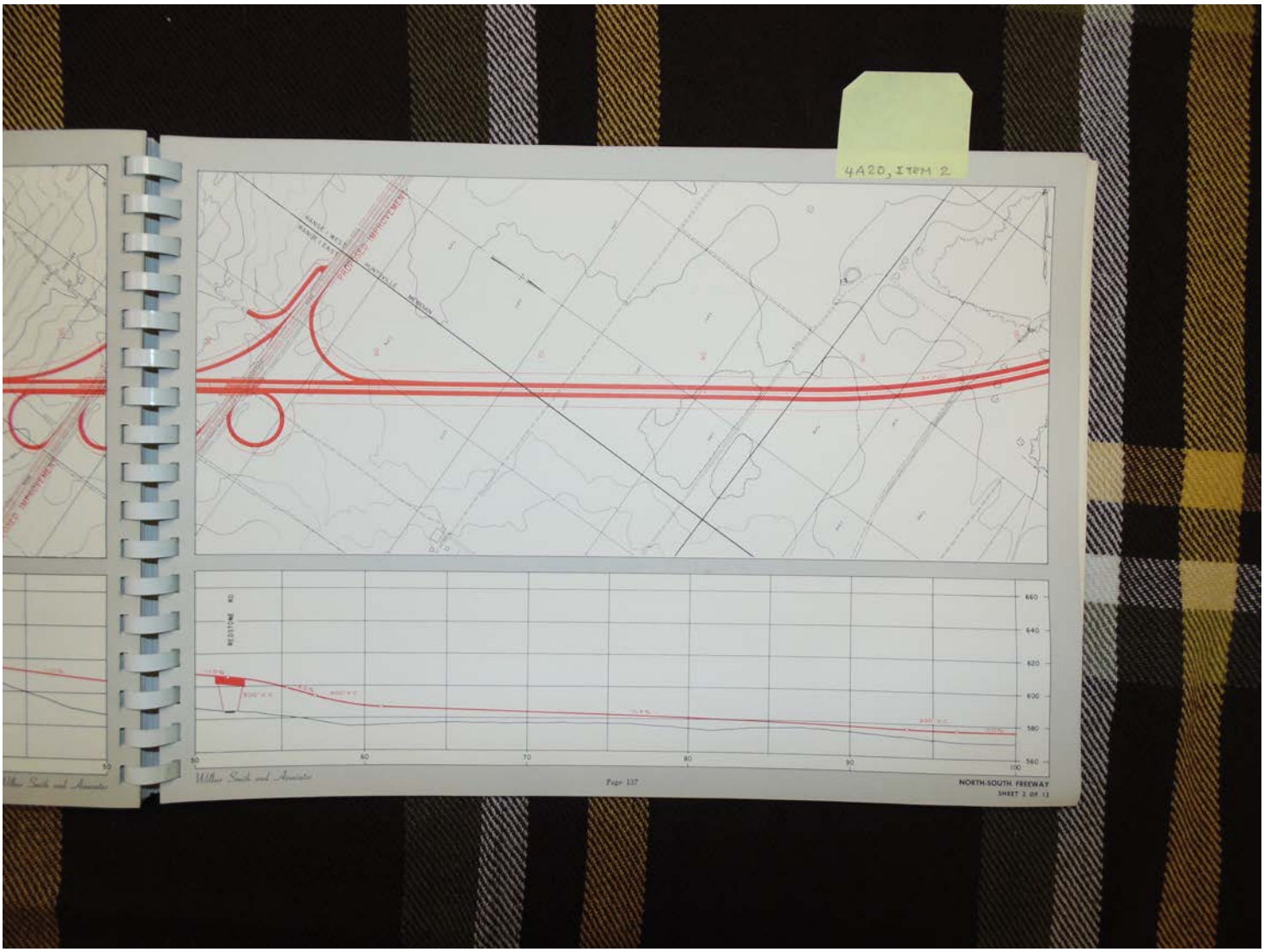

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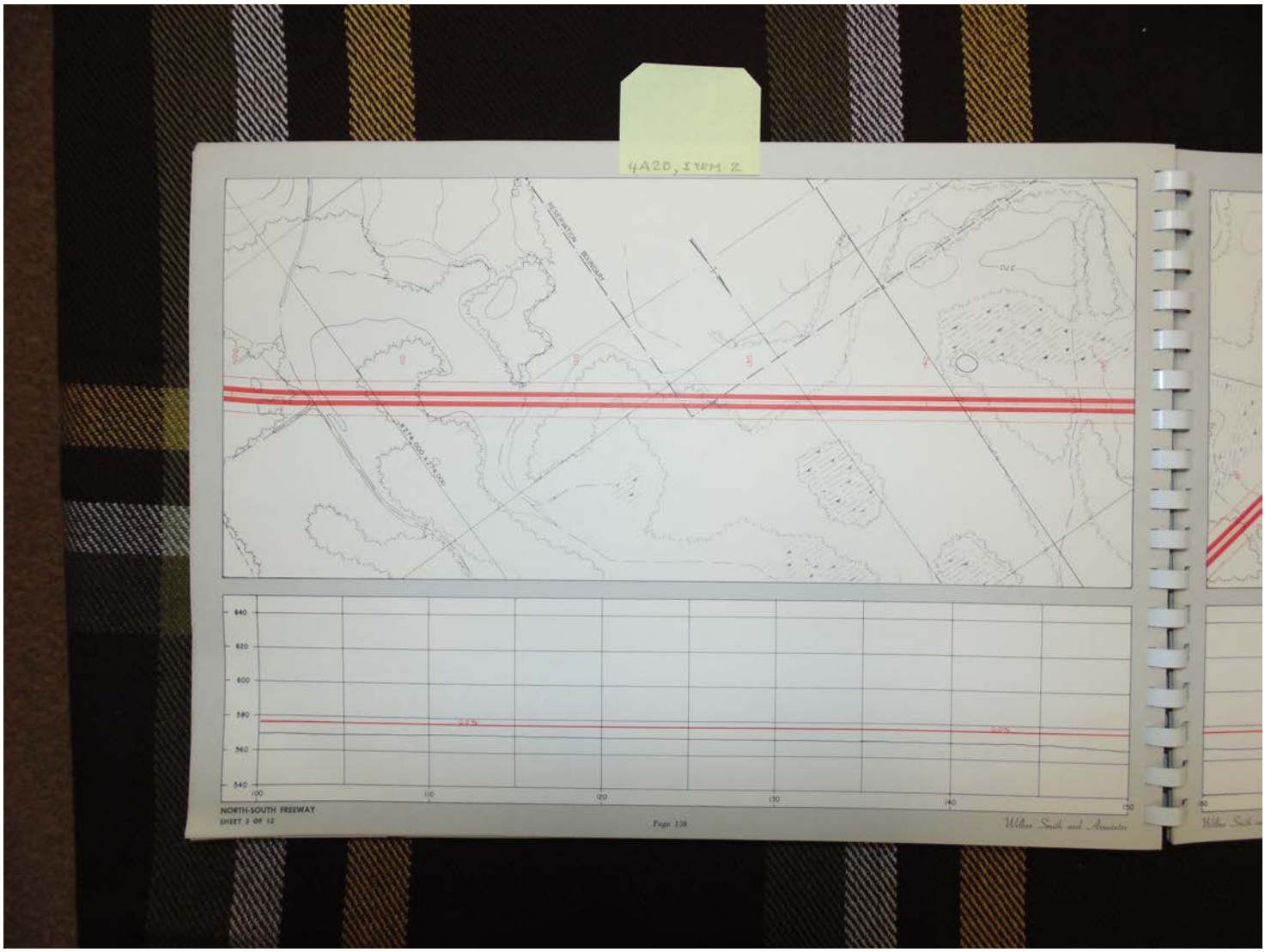

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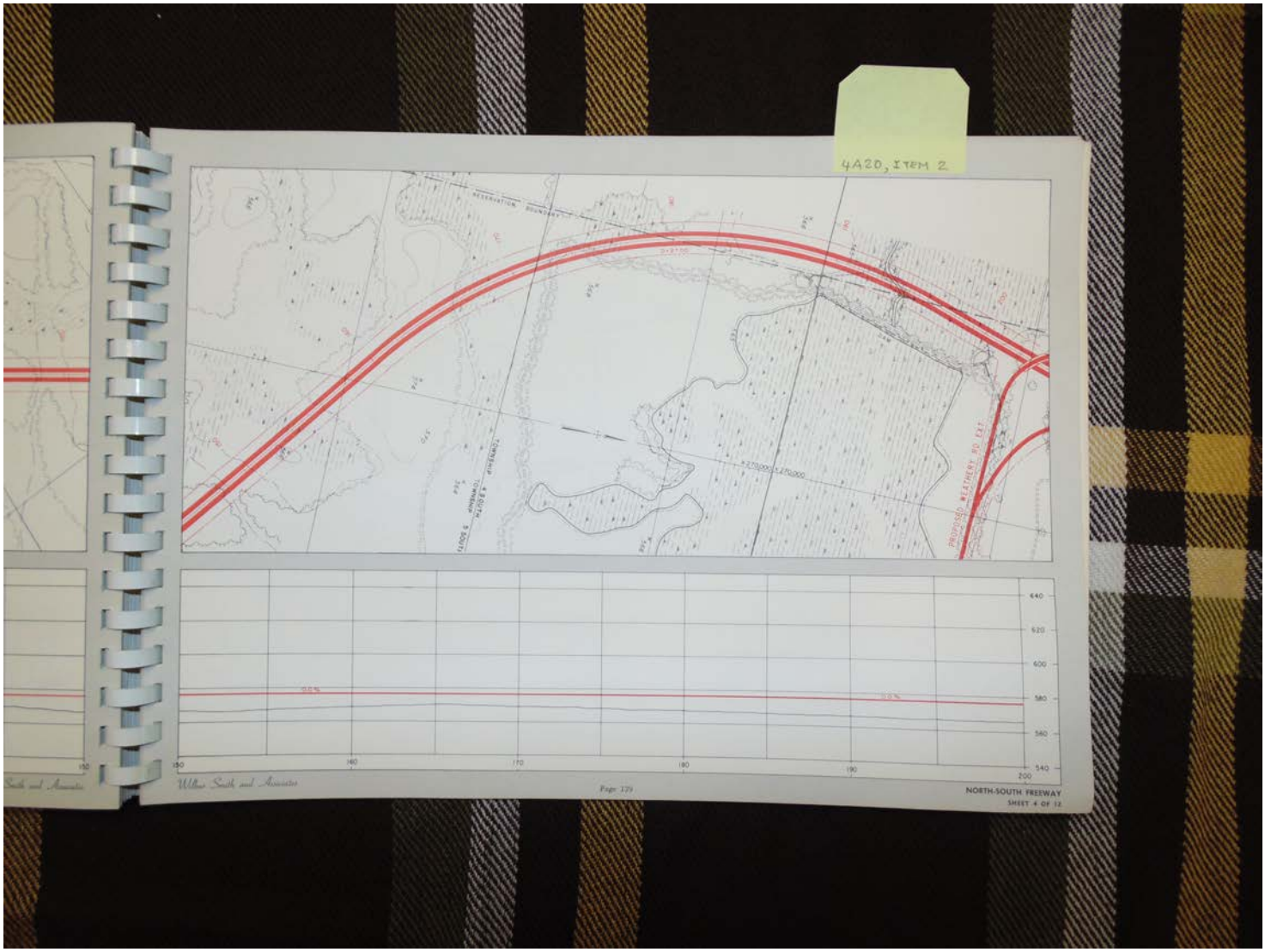

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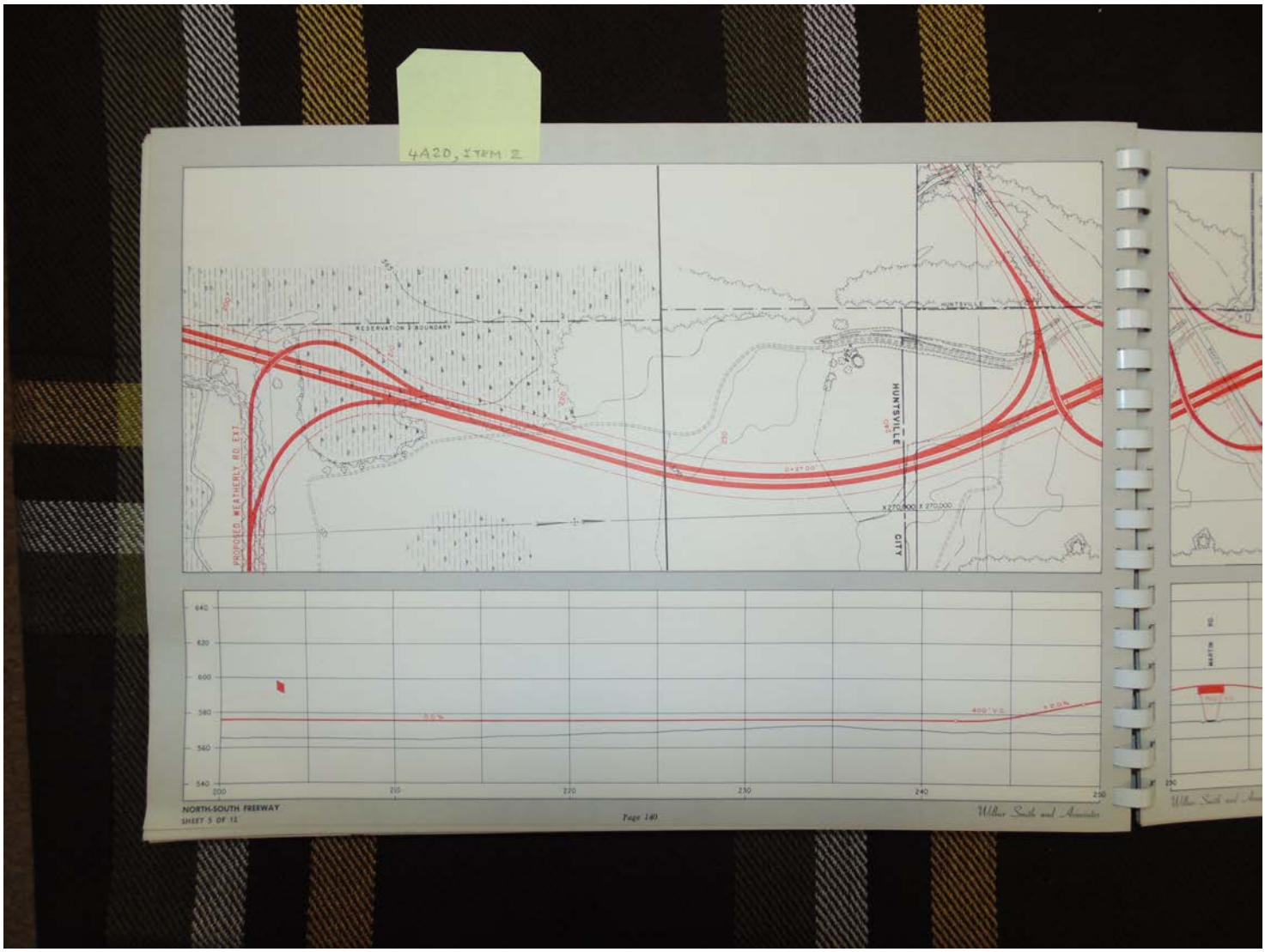

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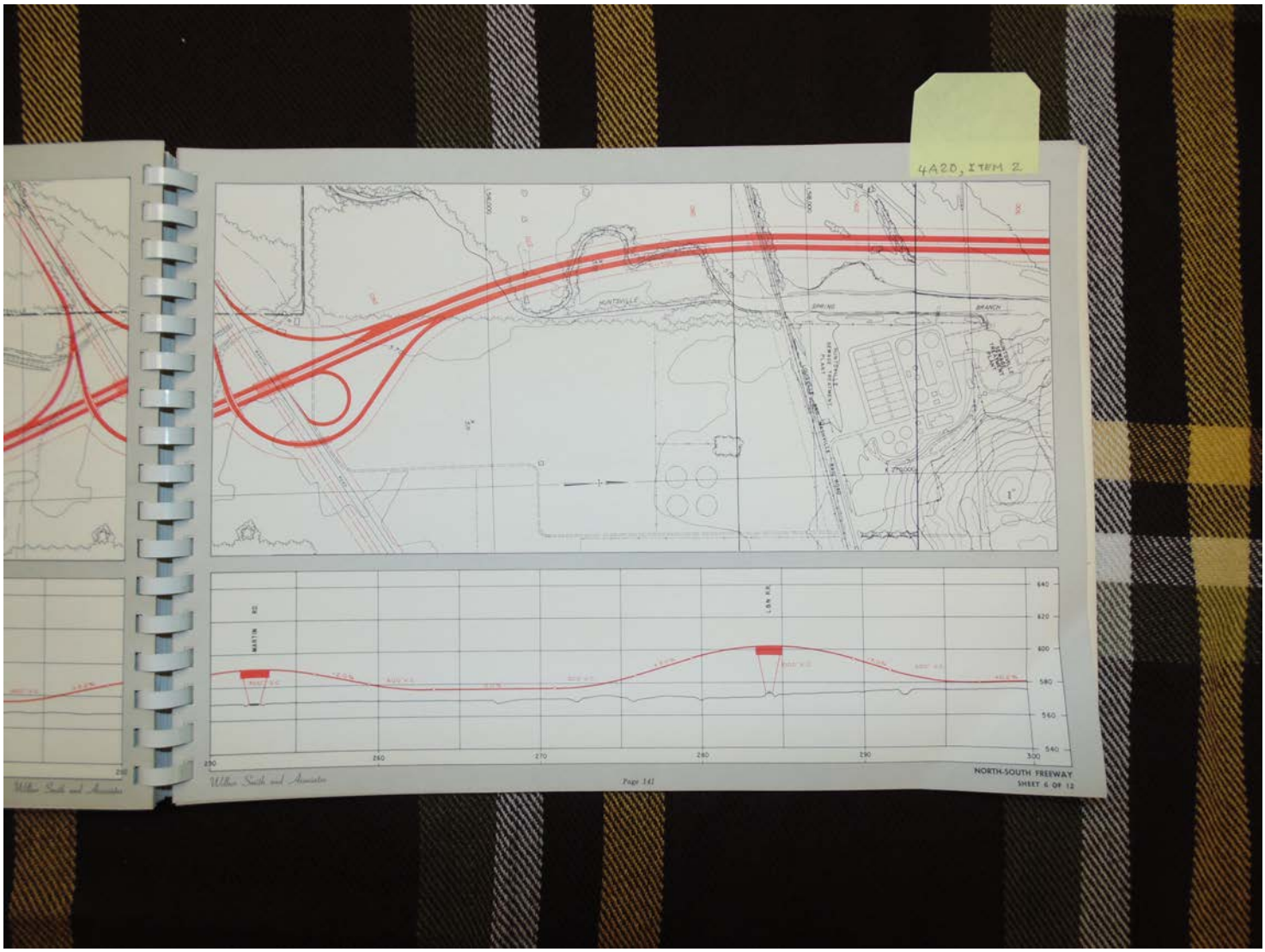

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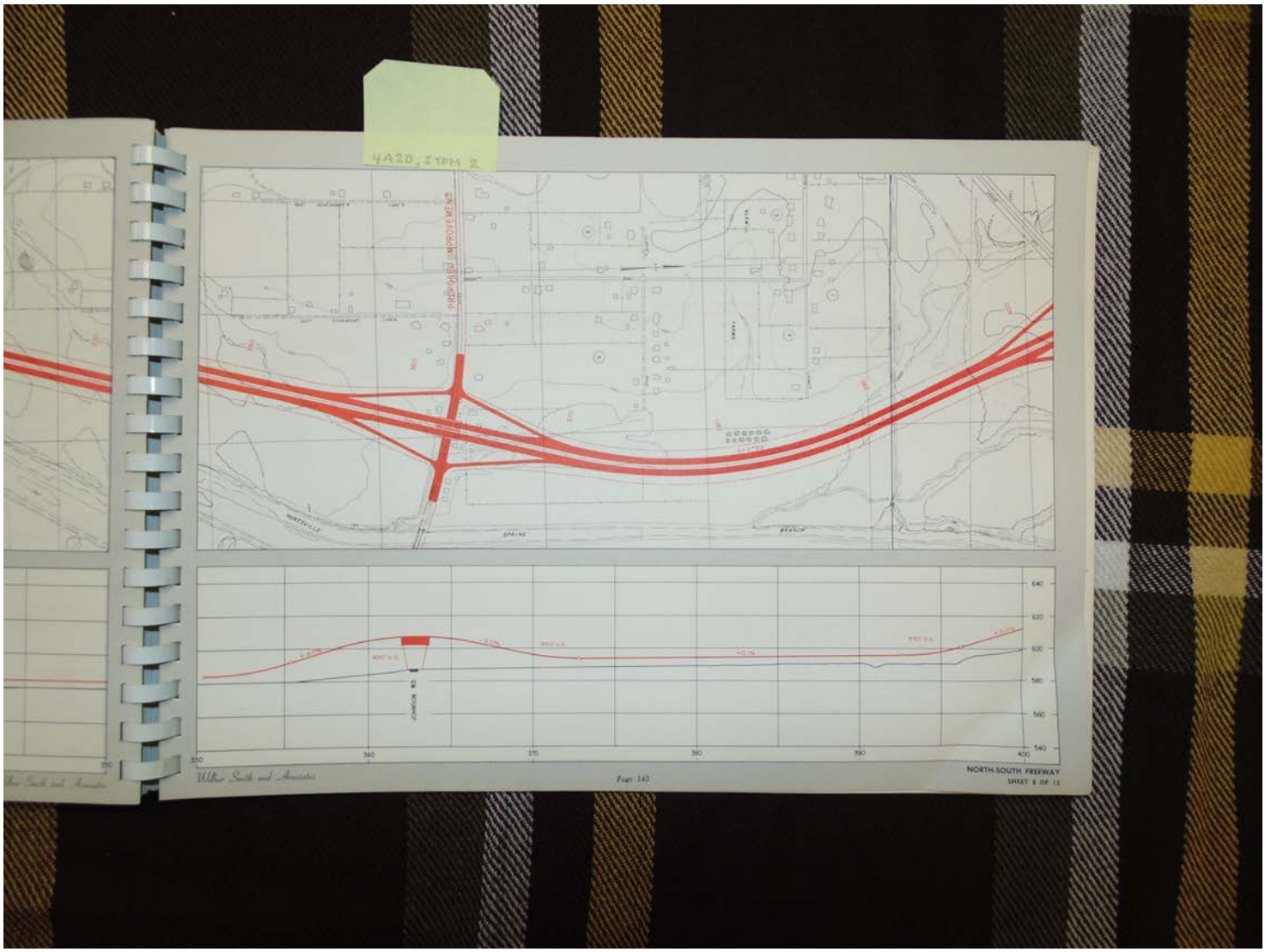

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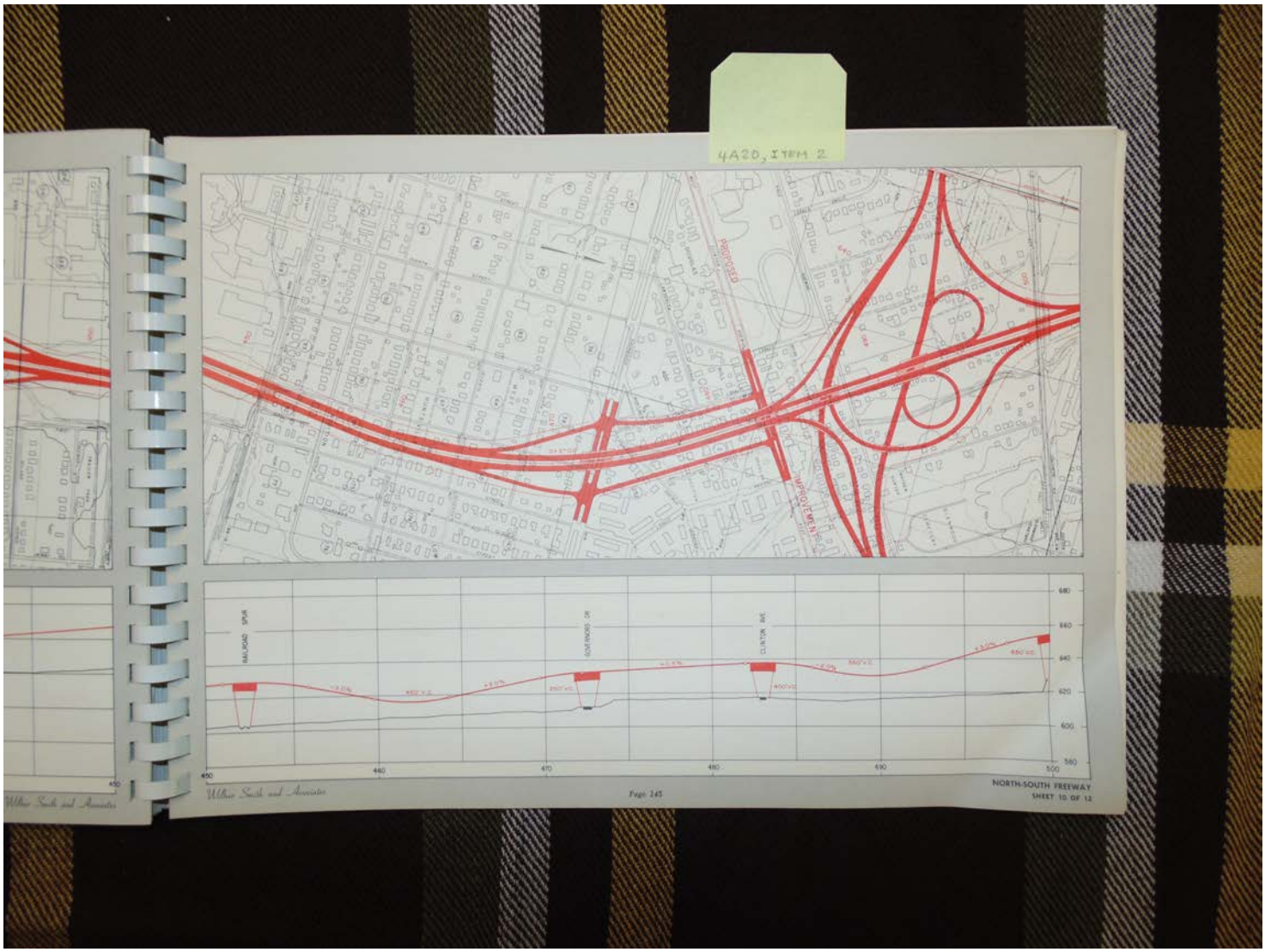

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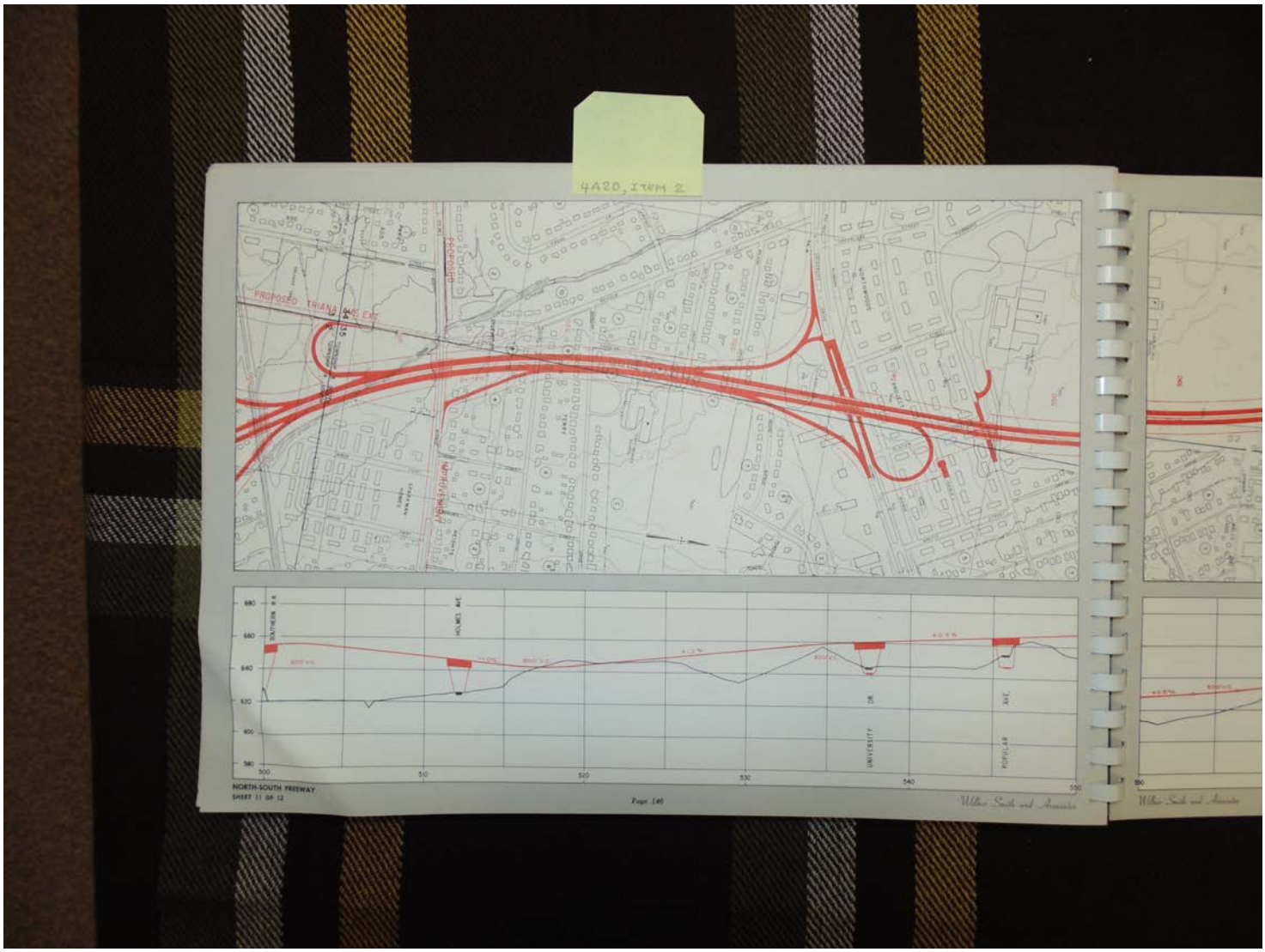

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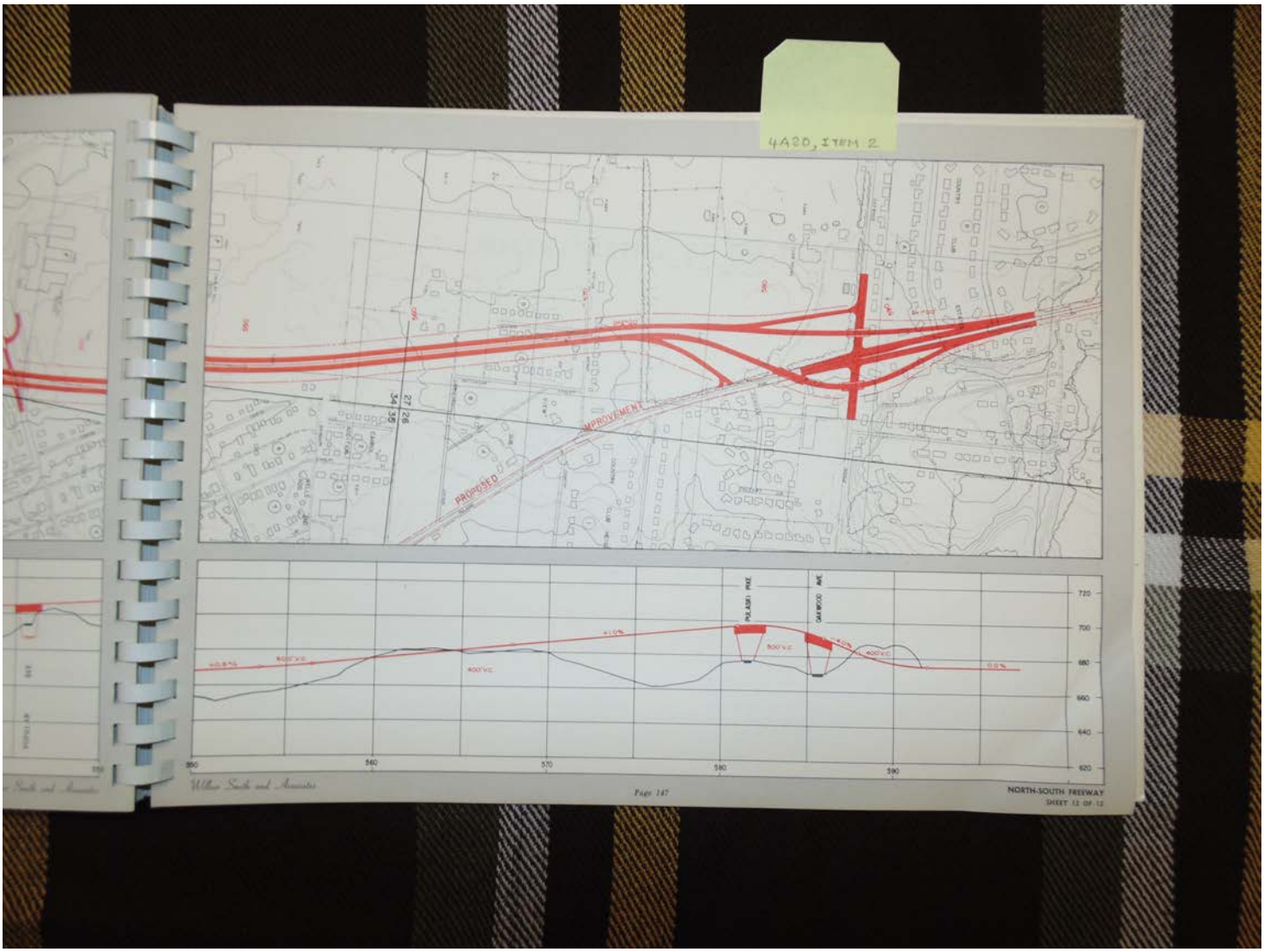

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Freeway Plan

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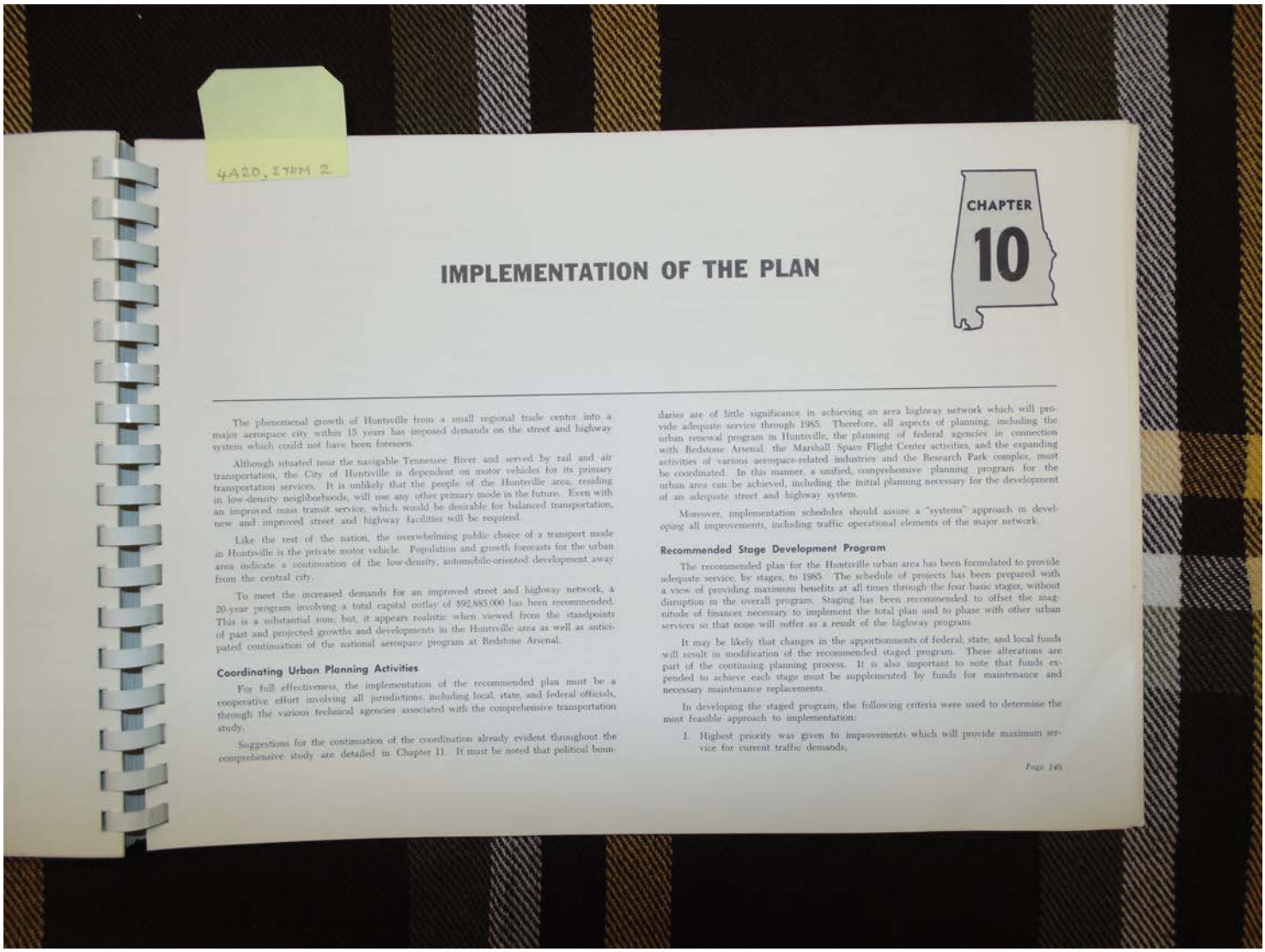

Names:

Implementation of Transportation Plan
- Chapter 10
Stage Development Program
Urban Planning

Places:

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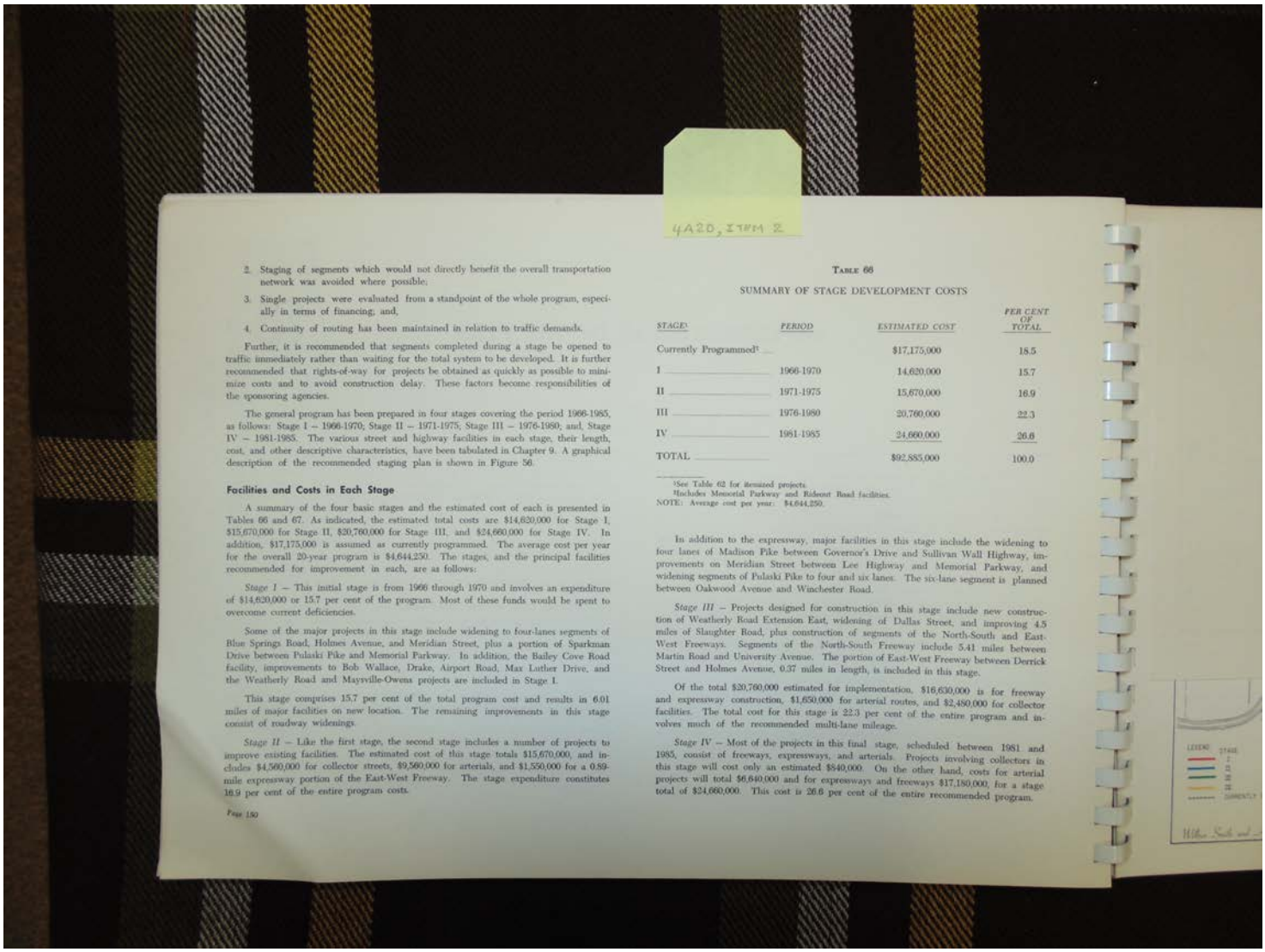

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2. Staging of segments which would not directly benefit the overall transportation network was avoided where possible;
3. Single projects were evaluated from a standpoint of the whole program, especially in terms of financing; and,
4. Continuity of routing has been maintained in relation to traffic demands.

Further, it is recommended that segments completed during a stage be opened to traffic immediately rather than waiting for the total system to be developed. It is further recommended that rights-of-way for projects be obtained as quickly as possible to minimize costs and to avoid construction delay. These factors become responsibilities of the sponsoring agencies.

The general program has been prepared in four stages covering the period 1966-1985, as follows: Stage I — 1966-1970; Stage II — 1971-1975; Stage III — 1976-1980; and, Stage IV — 1981-1985. The various street and highway facilities in each stage, their length, cost, and other descriptive characteristics, have been tabulated in Chapter 9. A graphical description of the recommended staging plan is shown in Figure 56.

Facilities and Costs in Each Stage

A summary of the four basic stages and the estimated cost of each is presented in Tables 66 and 67. As indicated, the estimated total costs are $14,620,000 for Stage I, $15,670,000 for Stage II, $20,760,000 for Stage III, and $24,660,000 for Stage IV. In addition, $17,175,000 is assumed as currently programmed. The average cost per year for the overall 20-year program is $4,644,250. The stages, and the principal facilities recommended for improvement in each, are as follows:

Stage I — This initial stage is from 1966 through 1970 and involves an expenditure of $14,620,000 or 15.7 per cent of the program. Most of these funds would be spent to overcome current deficiencies.

Some of the major projects in this stage include widening to four-lanes segments of Blue Springs Road, Holmes Avenue, and Meridian Street, plus a portion of Sparkman Drive between Pulaski Pike and Memorial Parkway. In addition, the Bailey Cove Road facility, improvements to Bob Wallace, Drake, Airport Road, Max Luther Drive, and the Weatherly Road and Maysville-Owens projects are included in Stage I.

This stage comprises 15.7 per cent of the total program cost and results in 6.01 miles of major facilities on new location. The remaining improvements in this stage consist of roadway widenings.

Stage II — Like the first stage, the second stage includes a number of projects to improve existing facilities. The estimated cost of this stage totals $15,670,000, and includes $4,560,000 for collector streets, $9,560,000 for arterials, and $1,550,000 for a 0.59-mile expressway portion of the East-West Freeway. The stage expenditure constitutes 16.9 per cent of the entire program costs.

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TABLE 66

SUMMARY OF STAGE DEVELOPMENT COSTS

STAGE[1]	PERIOD	ESTIMATED COST	PER CENT OF TOTAL
Currently Programmed[2]		$17,175,000	18.5
I	1966-1970	14,620,000	15.7
II	1971-1975	15,670,000	16.9
III	1976-1980	20,760,000	22.3
IV	1981-1985	24,660,000	26.6
TOTAL		$92,885,000	100.0

[1]See Table 62 for itemized projects.
[2]Includes Memorial Parkway and Rideout Road facilities.
NOTE: Average cost per year: $4,644,250.

In addition to the expressway, major facilities in this stage include the widening to four lanes of Madison Pike between Governor's Drive and Sullivan Wall Highway, improvements on Meridian Street between Lee Highway and Memorial Parkway, and widening segments of Pulaski Pike to four and six lanes. The six-lane segment is planned between Oakwood Avenue and Winchester Road.

Stage III — Projects designed for construction in this stage include new construction of Weatherly Road Extension East, widening of Dallas Street, and improving 4.5 miles of Slaughter Road, plus construction of segments of the North-South and East-West Freeways. Segments of the North-South Freeway include 5.41 miles between Martin Road and University Avenue. The portion of East-West Freeway between Derrick Street and Holmes Avenue, 0.37 miles in length, is included in this stage.

Of the total $20,760,000 estimated for implementation, $16,630,000 is for freeway and expressway construction, $1,650,000 for arterial routes, and $2,480,000 for collector facilities. The total cost for this stage is 22.3 per cent of the entire program and involves much of the recommended multi-lane mileage.

Stage IV — Most of the projects in this final stage, scheduled between 1981 and 1985, consist of freeways, expressways, and arterials. Projects involving collectors in this stage will cost only an estimated $840,000. On the other hand, costs for arterial projects will total $6,640,000 and for expressways and freeways $17,180,000, for a stage total of $24,660,000. This cost is 26.6 per cent of the entire recommended program.

Names:
Facilities & Costs

Places:
Huntsville, AL

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Dates:
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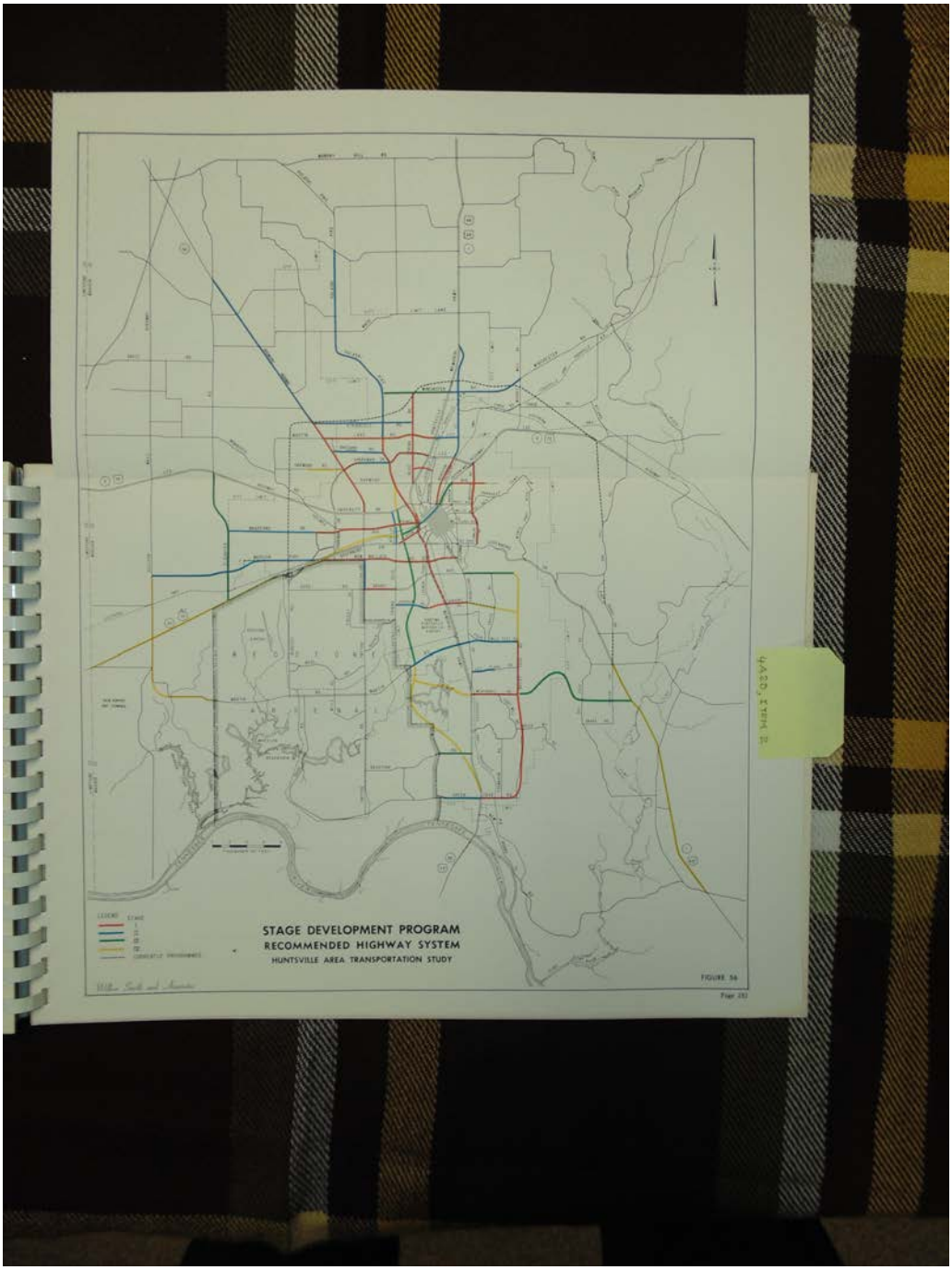

Names:
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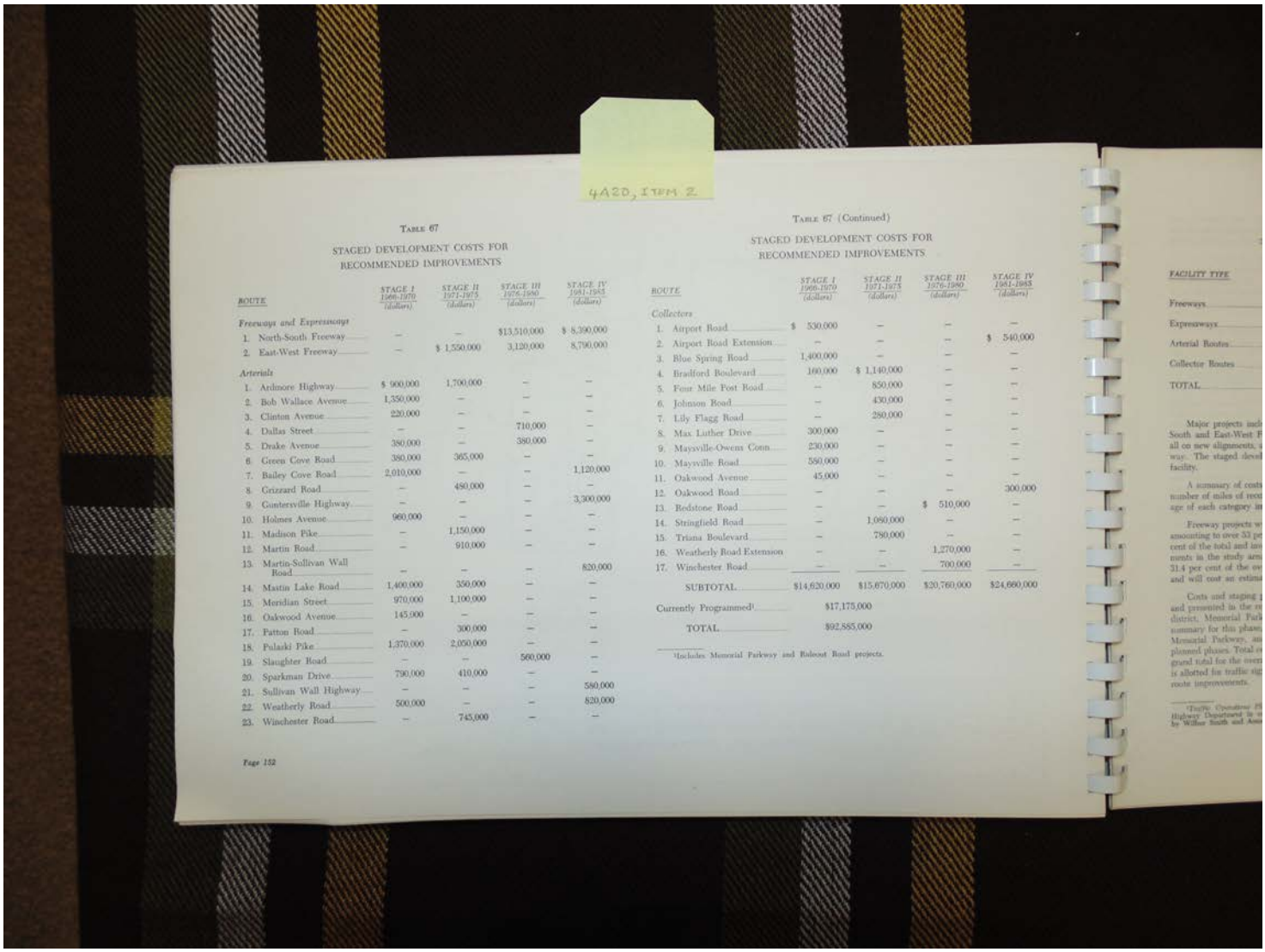

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TABLE 67

STAGED DEVELOPMENT COSTS FOR RECOMMENDED IMPROVEMENTS

ROUTE	STAGE I 1969-1970 (dollars)	STAGE II 1971-1975 (dollars)	STAGE III 1976-1980 (dollars)	STAGE IV 1981-1985 (dollars)
Freeways and Expressways				
1. North-South Freeway	–	–	$13,510,000	$ 8,390,000
2. East-West Freeway	–	$ 1,550,000	3,120,000	8,790,000
Arterials				
1. Ardmore Highway	$ 900,000	1,700,000	–	–
2. Bob Wallace Avenue	1,350,000	–	–	–
3. Clinton Avenue	220,000	–	–	–
4. Dallas Street	–	–	710,000	–
5. Drake Avenue	380,000	–	380,000	–
6. Green Cove Road	380,000	365,000	–	–
7. Bailey Cove Road	2,010,000	–	–	1,120,000
8. Grizzard Road	–	480,000	–	–
9. Gontersville Highway	–	–	–	3,300,000
10. Holmes Avenue	960,000	–	–	–
11. Madison Pike	–	1,150,000	–	–
12. Martin Road	–	910,000	–	–
13. Martin-Sullivan Wall Road	–	–	–	820,000
14. Martin Lake Road	1,400,000	350,000	–	–
15. Meridian Street	970,000	1,100,000	–	–
16. Oakwood Avenue	145,000	–	–	–
17. Patton Road	–	300,000	–	–
18. Pulaski Pike	1,370,000	2,050,000	–	–
19. Slaughter Road	–	–	560,000	–
20. Sparkman Drive	790,000	410,000	–	–
21. Sullivan Wall Highway	–	–	–	580,000
22. Weatherly Road	500,000	–	–	820,000
23. Winchester Road	–	745,000	–	–

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TABLE 67 (Continued)

STAGED DEVELOPMENT COSTS FOR RECOMMENDED IMPROVEMENTS

ROUTE	STAGE I 1969-1970 (dollars)	STAGE II 1971-1975 (dollars)	STAGE III 1976-1980 (dollars)	STAGE IV 1981-1985 (dollars)
Collectors				
1. Airport Road	$ 530,000	–	–	–
2. Airport Road Extension	–	–	–	$ 540,000
3. Blue Spring Road	1,400,000	–	–	–
4. Bradford Boulevard	160,000	$ 1,140,000	–	–
5. Four Mile Post Road	–	850,000	–	–
6. Johnson Road	–	430,000	–	–
7. Lily Flagg Road	–	280,000	–	–
8. Max Luther Drive	300,000	–	–	–
9. Maysville-Owens Conn.	230,000	–	–	–
10. Maysville Road	580,000	–	–	–
11. Oakwood Avenue	45,000	–	–	–
12. Oakwood Road	–	–	–	300,000
13. Redstone Road	–	–	$ 510,000	–
14. Stringfield Road	–	1,080,000	–	–
15. Triana Boulevard	–	780,000	–	–
16. Weatherly Road Extension	–	–	1,270,000	–
17. Winchester Road	–	–	700,000	–
SUBTOTAL	$14,620,000	$15,670,000	$20,760,000	$24,660,000
Currently Programmed[1]	$17,175,000			
TOTAL	$92,885,000			

[1]Includes Memorial Parkway and Bideout Road projects.

FACILITY TYPE

Freeways
Expressways
Arterial Routes
Collector Routes
TOTAL

Major projects incl... South and East-West F... all on new alignments, ... way. The staged devel... facility.

A summary of costs ... number of miles of rec... age of each category in...

Freeway projects w... amounting to over 53 pe... cent of the total and inv... ments in the study are... 31.4 per cent of the ov... and will cost an estima...

Costs and staging ... and presented in the re... district. Memorial Park... summary for this phase... Memorial Parkway, an... planned phases. Total e... grand total for the over... is allotted for traffic sig... roads improvements.

[1]Traffic Operations Pl... Highway Department in c... by Wilbur Smith and Asso...

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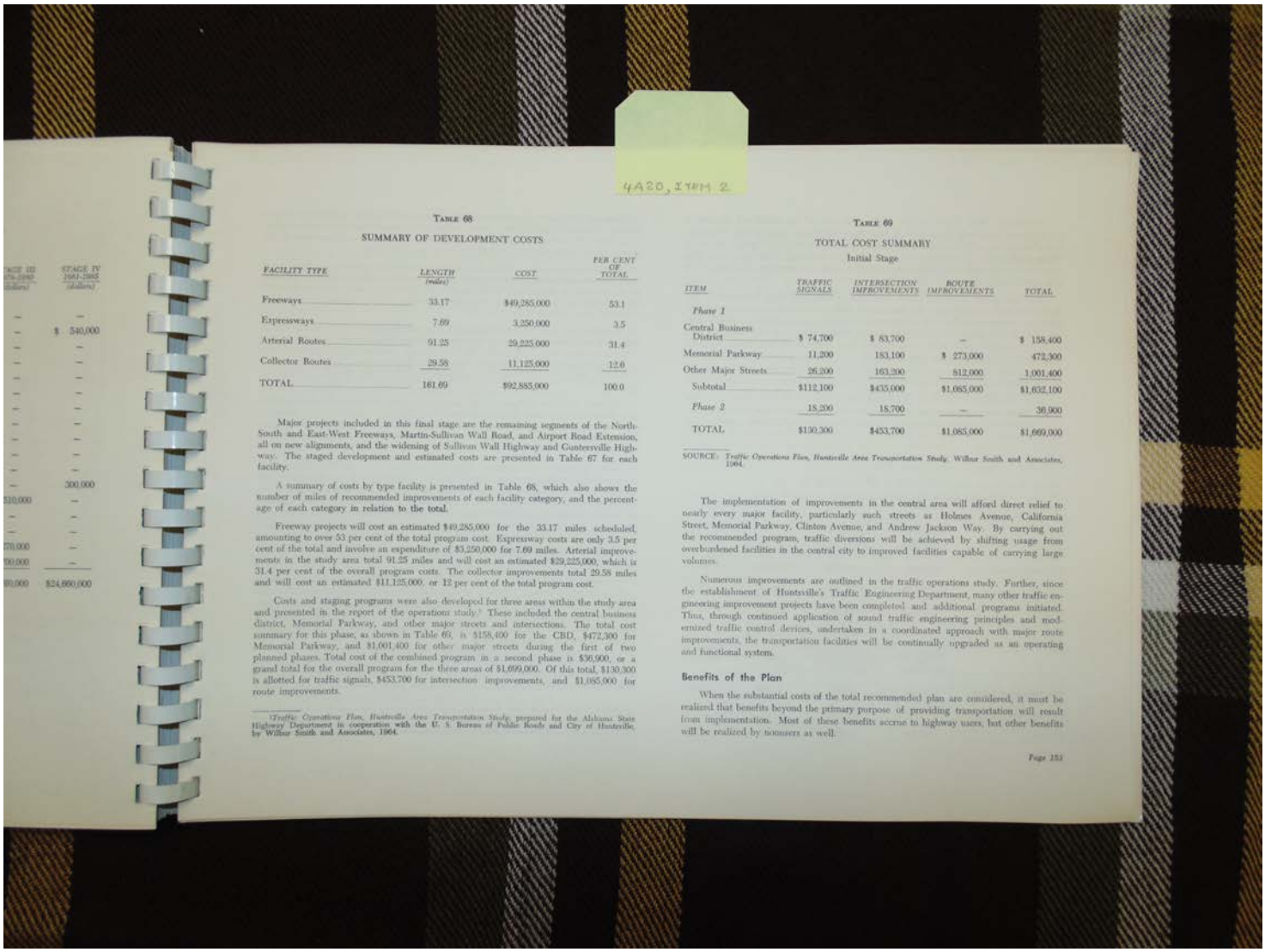

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TABLE 68

SUMMARY OF DEVELOPMENT COSTS

FACILITY TYPE	LENGTH (miles)	COST	PER CENT OF TOTAL
Freeways	33.17	$49,285,000	53.1
Expressways	7.69	3,250,000	3.5
Arterial Routes	91.25	29,225,000	31.4
Collector Routes	29.58	11,125,000	12.0
TOTAL	161.69	$92,885,000	100.0

Major projects included in this final stage are the remaining segments of the North-South and East-West Freeways, Martin-Sullivan Wall Road, and Airport Road Extension, all on new alignments, and the widening of Sullivan Wall Highway and Guntersville Highway. The staged development and estimated costs are presented in Table 67 for each facility.

A summary of costs by type facility is presented in Table 68, which also shows the number of miles of recommended improvements of each facility category, and the percentage of each category in relation to the total.

Freeway projects will cost an estimated $49,285,000 for the 33.17 miles scheduled, amounting to over 53 per cent of the total program cost. Expressway costs are only 3.5 per cent of the total and involve an expenditure of $3,250,000 for 7.69 miles. Arterial improvements in the study area total 91.25 miles and will cost an estimated $29,225,000, which is 31.4 per cent of the overall program costs. The collector improvements total 29.58 miles and will cost an estimated $11,125,000, or 12 per cent of the total program cost.

Costs and staging programs were also developed for three areas within the study area and presented in the report of the operations study.[1] These included the central business district, Memorial Parkway, and other major streets and intersections. The total cost summary for this phase, as shown in Table 69, is $158,400 for the CBD, $472,300 for Memorial Parkway, and $1,001,400 for other major streets during the first of two planned phases. Total cost of the combined program in a second phase is $36,900, or a grand total for the overall program for the three areas of $1,699,000. Of this total, $130,300 is allotted for traffic signals, $453,700 for intersection improvements, and $1,085,000 for route improvements.

[1] *Traffic Operations Plan, Huntsville Area Transportation Study*, prepared for the Alabama State Highway Department in cooperation with the U. S. Bureau of Public Roads and City of Huntsville, by Wilbur Smith and Associates, 1964.

TABLE 69

TOTAL COST SUMMARY

Initial Stage

ITEM	TRAFFIC SIGNALS	INTERSECTION IMPROVEMENTS	ROUTE IMPROVEMENTS	TOTAL
Phase 1				
Central Business District	$ 74,700	$ 83,700	–	$ 158,400
Memorial Parkway	11,200	183,100	$ 273,000	472,300
Other Major Streets	26,200	163,200	812,000	1,001,400
Subtotal	$112,100	$435,000	$1,085,000	$1,632,100
Phase 2	18,200	18,700	–	36,900
TOTAL	$130,300	$453,700	$1,085,000	$1,669,000

SOURCE: *Traffic Operations Plan, Huntsville Area Transportation Study*, Wilbur Smith and Associates, 1964.

The implementation of improvements in the central area will afford direct relief to nearly every major facility, particularly such streets as Holmes Avenue, California Street, Memorial Parkway, Clinton Avenue, and Andrew Jackson Way. By carrying out the recommended program, traffic diversions will be achieved by shifting usage from overburdened facilities in the central city to improved facilities capable of carrying large volumes.

Numerous improvements are outlined in the traffic operations study. Further, since the establishment of Huntsville's Traffic Engineering Department, many other traffic engineering improvement projects have been completed and additional programs initiated. Thus, through continued application of sound traffic engineering principles and modernized traffic control devices, undertaken in a coordinated approach with major route improvements, the transportation facilities will be continually upgraded as an operating and functional system.

Benefits of the Plan

When the substantial costs of the total recommended plan are considered, it must be realized that benefits beyond the primary purpose of providing transportation will result from implementation. Most of these benefits accrue to highway users, but other benefits will be realized by nonusers as well.

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Cost Summary Plan Benefits

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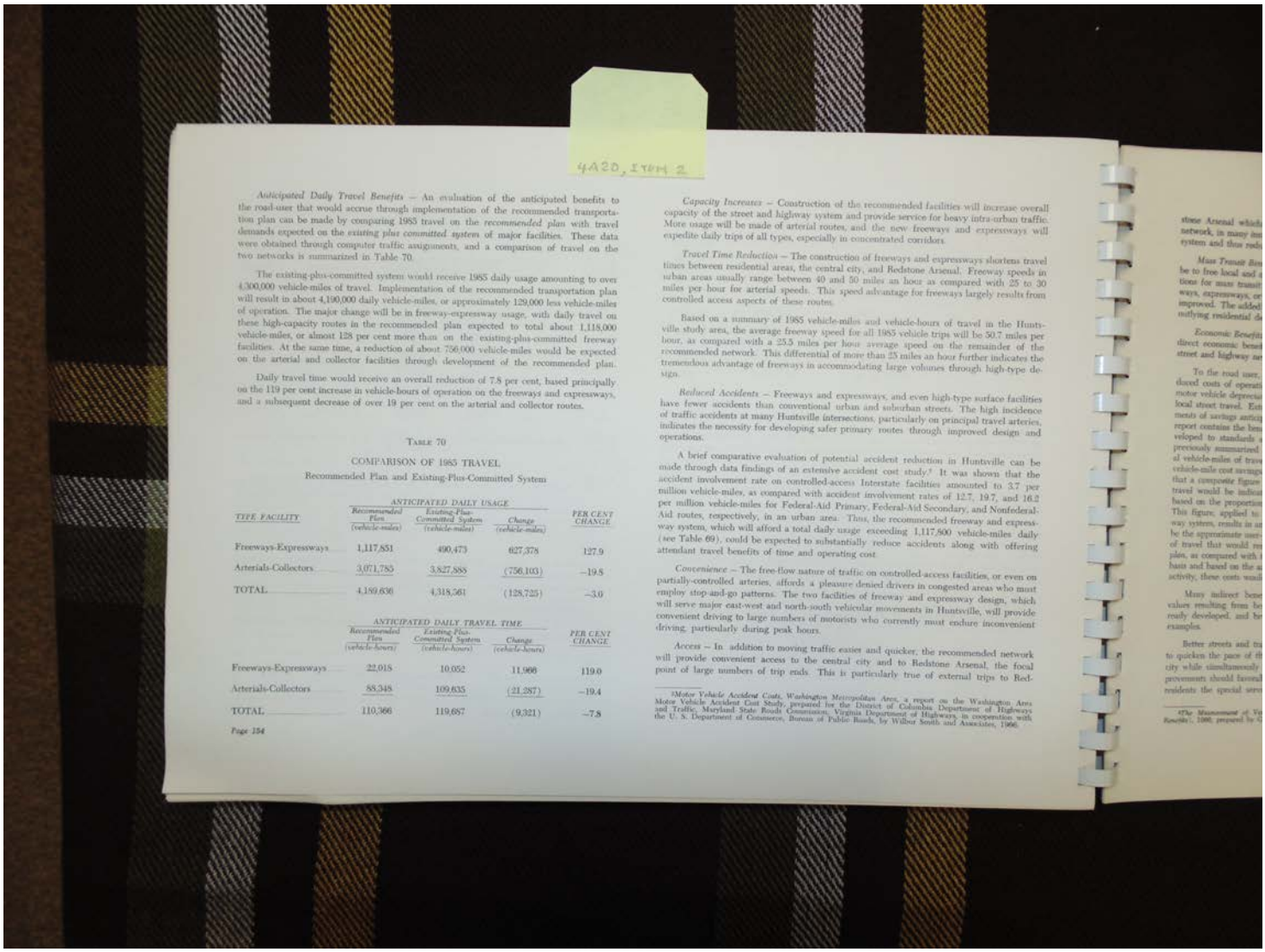

Anticipated Daily Travel Benefits — An evaluation of the anticipated benefits to the road-user that would accrue through implementation of the recommended transportation plan can be made by comparing 1985 travel on the *recommended plan* with travel demands expected on the *existing plus committed system* of major facilities. These data were obtained through computer traffic assignments, and a comparison of travel on the two networks is summarized in Table 70.

The existing-plus-committed system would receive 1985 daily usage amounting to over 4,300,000 vehicle-miles of travel. Implementation of the recommended transportation plan will result in about 4,190,000 daily vehicle-miles, or approximately 129,000 less vehicle-miles of operation. The major change will be in freeway-expressway usage, with daily travel on these high-capacity routes in the recommended plan expected to total about 1,118,000 vehicle-miles, or almost 128 per cent more than on the existing-plus-committed freeway facilities. At the same time, a reduction of about 756,000 vehicle-miles would be expected on the arterial and collector facilities through development of the recommended plan.

Daily travel time would receive an overall reduction of 7.8 per cent, based principally on the 119 per cent increase in vehicle-hours of operation on the freeways and expressways, and a subsequent decrease of over 19 per cent on the arterial and collector routes.

TABLE 70

COMPARISON OF 1985 TRAVEL
Recommended Plan and Existing-Plus-Committed System

TYPE FACILITY	ANTICIPATED DAILY USAGE: Recommended Plan (vehicle-miles)	Existing-Plus-Committed System (vehicle-miles)	Change (vehicle-miles)	PER CENT CHANGE
Freeways-Expressways	1,117,851	490,473	627,378	127.9
Arterials-Collectors	3,071,785	3,827,888	(756,103)	−19.8
TOTAL	4,189,636	4,318,561	(128,725)	−3.0

	ANTICIPATED DAILY TRAVEL TIME: Recommended Plan (vehicle-hours)	Existing-Plus-Committed System (vehicle-hours)	Change (vehicle-hours)	PER CENT CHANGE
Freeways-Expressways	22,018	10,052	11,966	119.0
Arterials-Collectors	88,348	109,635	(21,287)	−19.4
TOTAL	110,366	119,687	(9,321)	−7.8

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Capacity Increases — Construction of the recommended facilities will increase overall capacity of the street and highway system and provide service for heavy intra-urban traffic. More usage will be made of arterial routes, and the new freeways and expressways will expedite daily trips of all types, especially in concentrated corridors.

Travel Time Reduction — The construction of freeways and expressways shortens travel times between residential areas, the central city, and Redstone Arsenal. Freeway speeds in urban areas usually range between 40 and 50 miles an hour as compared with 25 to 30 miles per hour for arterial speeds. This speed advantage for freeways largely results from controlled access aspects of these routes.

Based on a summary of 1985 vehicle-miles and vehicle-hours of travel in the Huntsville study area, the average freeway speed for all 1985 vehicle trips will be 50.7 miles per hour, as compared with a 25.5 miles per hour average speed on the remainder of the recommended network. This differential of more than 25 miles an hour further indicates the tremendous advantage of freeways in accommodating large volumes through high-type design.

Reduced Accidents — Freeways and expressways, and even high-type surface facilities have fewer accidents than conventional urban and suburban streets. The high incidence of traffic accidents at many Huntsville intersections, particularly on principal travel arteries, indicates the necessity for developing safer primary routes through improved design and operations.

A brief comparative evaluation of potential accident reduction in Huntsville can be made through data findings of an extensive accident cost study.[3] It was shown that the accident involvement rate on controlled-access Interstate facilities amounted to 3.7 per million vehicle-miles, as compared with accident involvement rates of 12.7, 19.7, and 16.2 per million vehicle-miles for Federal-Aid Primary, Federal-Aid Secondary, and Nonfederal-Aid routes, respectively, in an urban area. Thus, the recommended freeway and expressway system, which will afford a total daily usage exceeding 1,117,800 vehicle-miles daily (see Table 69), could be expected to substantially reduce accidents along with offering attendant travel benefits of time and operating cost.

Convenience — The free-flow nature of traffic on controlled-access facilities, or even on partially-controlled arteries, affords a pleasure denied drivers in congested areas who must employ stop-and-go patterns. The two facilities of freeway and expressway design, which will serve major east-west and north-south vehicular movements in Huntsville, will provide convenient driving to large numbers of motorists who currently must endure inconvenient driving, particularly during peak hours.

Access — In addition to moving traffic easier and quicker, the recommended network will provide convenient access to the central city and to Redstone Arsenal, the focal point of large numbers of trip ends. This is particularly true of external trips to Red-

[3]*Motor Vehicle Accident Costs, Washington Metropolitan Area*, a report on the Washington Area Motor Vehicle Accident Cost Study, prepared for the District of Columbia Department of Highways and Traffic, Maryland State Roads Commission, Virginia Department of Highways, in cooperation with the U. S. Department of Commerce, Bureau of Public Roads, by Wilbur Smith and Associates, 1966.

Names:
Plan Benefits

Places:
Huntsville, AL

Types:
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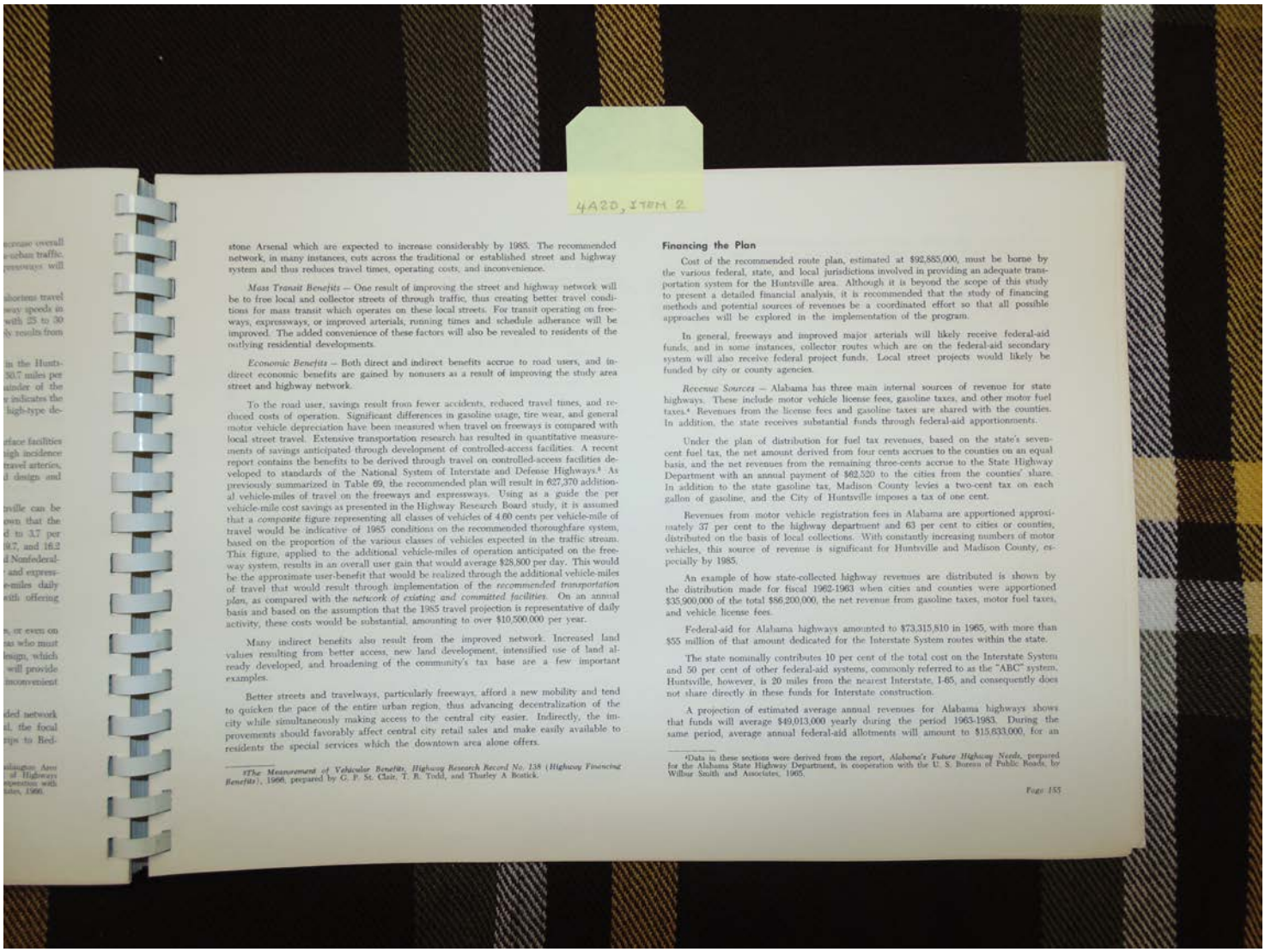

stone Arsenal which are expected to increase considerably by 1985. The recommended network, in many instances, cuts across the traditional or established street and highway system and thus reduces travel times, operating costs, and inconvenience.

Mass Transit Benefits — One result of improving the street and highway network will be to free local and collector streets of through traffic, thus creating better travel conditions for mass transit which operates on these local streets. For transit operating on freeways, expressways, or improved arterials, running times and schedule adherance will be improved. The added convenience of these factors will also be revealed to residents of the outlying residential developments.

Economic Benefits — Both direct and indirect benefits accrue to road users, and indirect economic benefits are gained by nonusers as a result of improving the study area street and highway network.

To the road user, savings result from fewer accidents, reduced travel times, and reduced costs of operation. Significant differences in gasoline usage, tire wear, and general motor vehicle depreciation have been measured when travel on freeways is compared with local street travel. Extensive transportation research has resulted in quantitative measurements of savings anticipated through development of controlled-access facilities. A recent report contains the benefits to be derived through travel on controlled-access facilities developed to standards of the National System of Interstate and Defense Highways.[3] As previously summarized in Table 69, the recommended plan will result in 627,370 additional vehicle-miles of travel on the freeways and expressways. Using as a guide the per vehicle-mile cost savings as presented in the Highway Research Board study, it is assumed that a *composite* figure representing all classes of vehicles of 4.60 cents per vehicle-mile of travel would be indicative of 1985 conditions on the recommended thoroughfare system, based on the proportion of the various classes of vehicles expected in the traffic stream. This figure, applied to the additional vehicle-miles of operation anticipated on the freeway system, results in an overall user gain that would average $28,800 per day. This would be the approximate user-benefit that would be realized through the additional vehicle-miles of travel that would result through implementation of the *recommended transportation plan*, as compared with the *network of existing and committed facilities*. On an annual basis and based on the assumption that the 1985 travel projection is representative of daily activity, these costs would be substantial, amounting to over $10,500,000 per year.

Many indirect benefits also result from the improved network. Increased land values resulting from better access, new land development, intensified use of land already developed, and broadening of the community's tax base are a few important examples.

Better streets and travelways, particularly freeways, afford a new mobility and tend to quicken the pace of the entire urban region, thus advancing decentralization of the city while simultaneously making access to the central city easier. Indirectly, the improvements should favorably affect central city retail sales and make easily available to residents the special services which the downtown area alone offers.

[3]*The Measurement of Vehicular Benefits, Highway Research Record No. 138* (*Highway Financing Benefits*), 1966, prepared by C. F. St. Clair, T. R. Todd, and Thurley A. Bostick.

Financing the Plan

Cost of the recommended route plan, estimated at $92,885,000, must be borne by the various federal, state, and local jurisdictions involved in providing an adequate transportation system for the Huntsville area. Although it is beyond the scope of this study to present a detailed financial analysis, it is recommended that the study of financing methods and potential sources of revenues be a coordinated effort so that all possible approaches will be explored in the implementation of the program.

In general, freeways and improved major arterials will likely receive federal-aid funds, and in some instances, collector routes which are on the federal-aid secondary system will also receive federal project funds. Local street projects would likely be funded by city or county agencies.

Revenue Sources — Alabama has three main internal sources of revenue for state highways. These include motor vehicle license fees, gasoline taxes, and other motor fuel taxes.[4] Revenues from the license fees and gasoline taxes are shared with the counties. In addition, the state receives substantial funds through federal-aid apportionments.

Under the plan of distribution for fuel tax revenues, based on the state's seven-cent fuel tax, the net amount derived from four cents accrues to the counties on an equal basis, and the net revenues from the remaining three-cents accrue to the State Highway Department with an annual payment of $62,520 to the cities from the counties' share. In addition to the state gasoline tax, Madison County levies a two-cent tax on each gallon of gasoline, and the City of Huntsville imposes a tax of one cent.

Revenues from motor vehicle registration fees in Alabama are apportioned approximately 37 per cent to the highway department and 63 per cent to cities or counties, distributed on the basis of local collections. With constantly increasing numbers of motor vehicles, this source of revenue is significant for Huntsville and Madison County, especially by 1985.

An example of how state-collected highway revenues are distributed is shown by the distribution made for fiscal 1962-1963 when cities and counties were apportioned $35,900,000 of the total $86,200,000, the net revenue from gasoline taxes, motor fuel taxes, and vehicle license fees.

Federal-aid for Alabama highways amounted to $73,315,810 in 1965, with more than $55 million of that amount dedicated for the Interstate System routes within the state.

The state nominally contributes 10 per cent of the total cost on the Interstate System and 50 per cent of other federal-aid systems, commonly referred to as the "ABC" system. Huntsville, however, is 20 miles from the nearest Interstate, I-65, and consequently does not share directly in these funds for Interstate construction.

A projection of estimated average annual revenues for Alabama highways shows that funds will average $49,013,000 yearly during the period 1963-1983. During the same period, average annual federal-aid allotments will amount to $15,633,000, for an

[4]Data in these sections were derived from the report, *Alabama's Future Highway Needs*, prepared for the Alabama State Highway Department, in cooperation with the U. S. Bureau of Public Roads, by Wilbur Smith and Associates, 1965.

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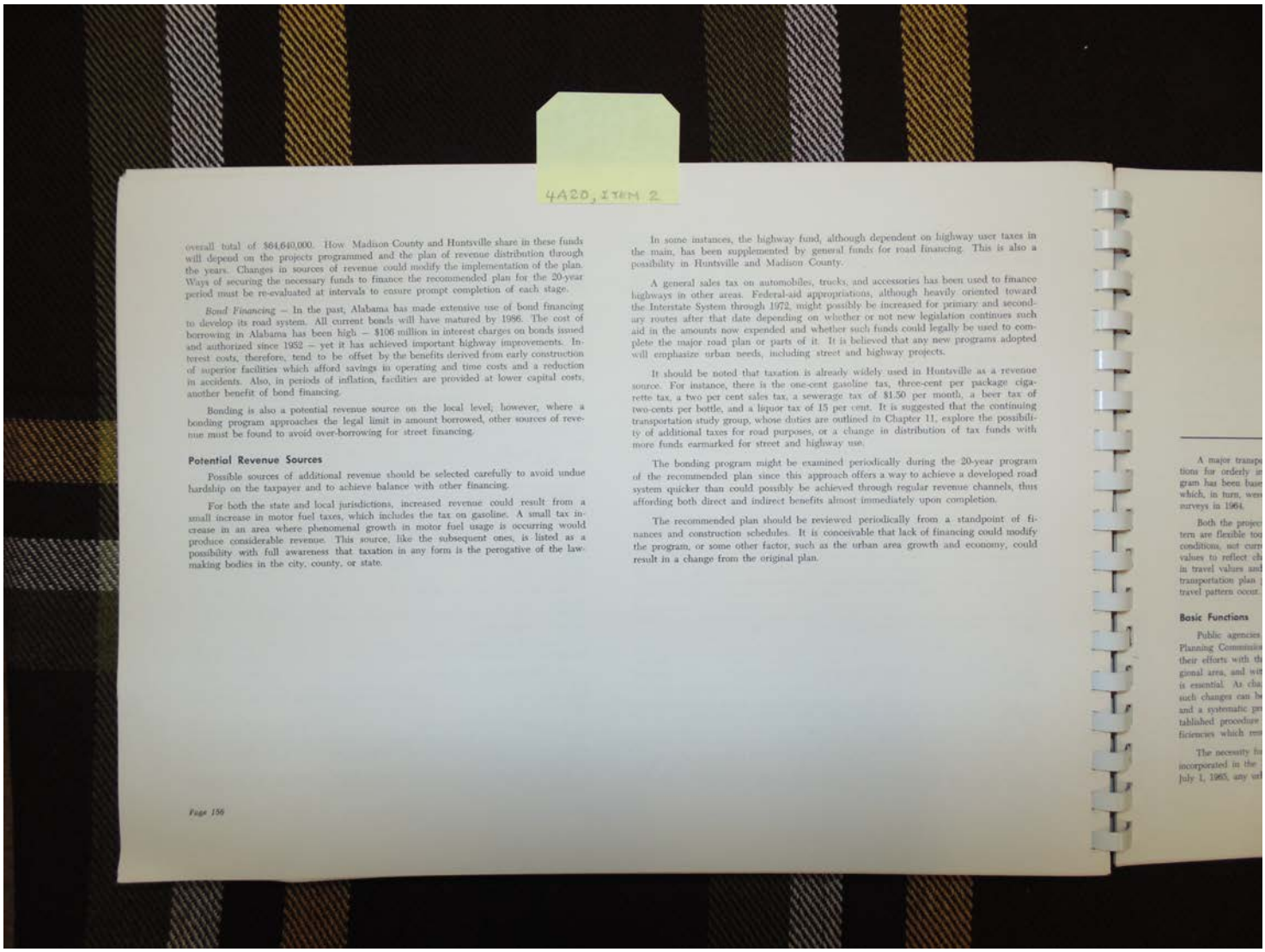

overall total of $64,640,000. How Madison County and Huntsville share in these funds will depend on the projects programmed and the plan of revenue distribution through the years. Changes in sources of revenue could modify the implementation of the plan. Ways of securing the necessary funds to finance the recommended plan for the 20-year period must be re-evaluated at intervals to ensure prompt completion of each stage.

Bond Financing – In the past, Alabama has made extensive use of bond financing to develop its road system. All current bonds will have matured by 1986. The cost of borrowing in Alabama has been high – $106 million in interest charges on bonds issued and authorized since 1952 – yet it has achieved important highway improvements. Interest costs, therefore, tend to be offset by the benefits derived from early construction of superior facilities which afford savings in operating and time costs and a reduction in accidents. Also, in periods of inflation, facilities are provided at lower capital costs, another benefit of bond financing.

Bonding is also a potential revenue source on the local level; however, where a bonding program approaches the legal limit in amount borrowed, other sources of revenue must be found to avoid over-borrowing for street financing.

Potential Revenue Sources

Possible sources of additional revenue should be selected carefully to avoid undue hardship on the taxpayer and to achieve balance with other financing.

For both the state and local jurisdictions, increased revenue could result from a small increase in motor fuel taxes, which includes the tax on gasoline. A small tax increase in an area where phenomenal growth in motor fuel usage is occurring would produce considerable revenue. This source, like the subsequent ones, is listed as a possibility with full awareness that taxation in any form is the perogative of the law-making bodies in the city, county, or state.

In some instances, the highway fund, although dependent on highway user taxes in the main, has been supplemented by general funds for road financing. This is also a possibility in Huntsville and Madison County.

A general sales tax on automobiles, trucks, and accessories has been used to finance highways in other areas. Federal-aid appropriations, although heavily oriented toward the Interstate System through 1972, might possibly be increased for primary and secondary routes after that date depending on whether or not new legislation continues such aid in the amounts now expended and whether such funds could legally be used to complete the major road plan or parts of it. It is believed that any new programs adopted will emphasize urban needs, including street and highway projects.

It should be noted that taxation is already widely used in Huntsville as a revenue source. For instance, there is the one-cent gasoline tax, three-cent per package cigarette tax, a two per cent sales tax, a sewerage tax of $1.50 per month, a beer tax of two-cents per bottle, and a liquor tax of 15 per cent. It is suggested that the continuing transportation study group, whose duties are outlined in Chapter 11, explore the possibility of additional taxes for road purposes, or a change in distribution of tax funds with more funds earmarked for street and highway use.

The bonding program might be examined periodically during the 20-year program of the recommended plan since this approach offers a way to achieve a developed road system quicker than could possibly be achieved through regular revenue channels, thus affording both direct and indirect benefits almost immediately upon completion.

The recommended plan should be reviewed periodically from a standpoint of finances and construction schedules. It is conceivable that lack of financing could modify the program, or some other factor, such as the urban area growth and economy, could result in a change from the original plan.

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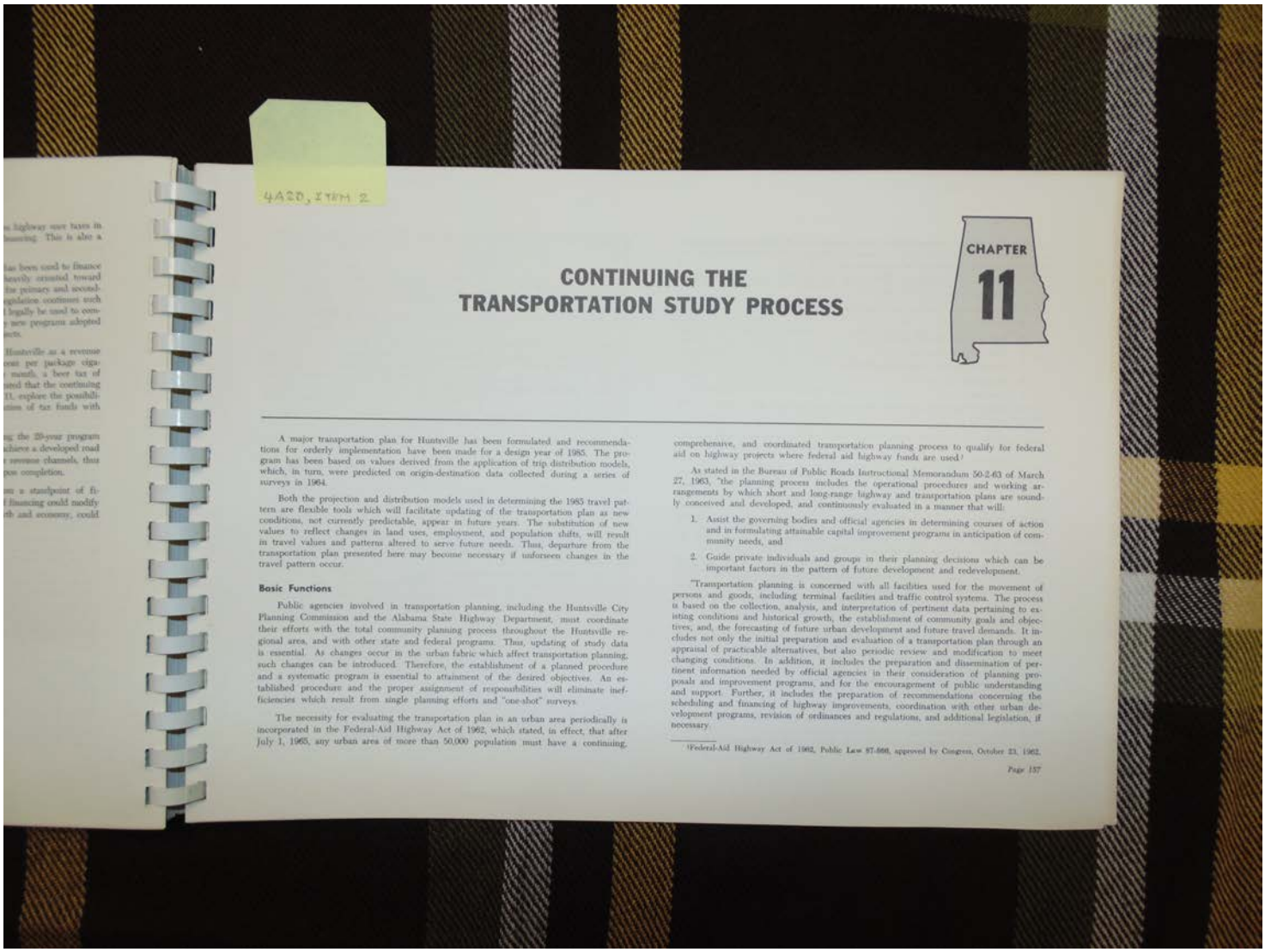

4A20, ITEM 2

CHAPTER 11

CONTINUING THE TRANSPORTATION STUDY PROCESS

A major transportation plan for Huntsville has been formulated and recommendations for orderly implementation have been made for a design year of 1985. The program has been based on values derived from the application of trip distribution models, which, in turn, were predicted on origin-destination data collected during a series of surveys in 1964.

Both the projection and distribution models used in determining the 1985 travel pattern are flexible tools which will facilitate updating of the transportation plan as new conditions, not currently predictable, appear in future years. The substitution of new values to reflect changes in land uses, employment, and population shifts, will result in travel values and patterns altered to serve future needs. Thus, departure from the transportation plan presented here may become necessary if unforseen changes in the travel pattern occur.

Basic Functions

Public agencies involved in transportation planning, including the Huntsville City Planning Commission and the Alabama State Highway Department, must coordinate their efforts with the total community planning process throughout the Huntsville regional area, and with other state and federal programs. Thus, updating of study data is essential. As changes occur in the urban fabric which affect transportation planning, such changes can be introduced. Therefore, the establishment of a planned procedure and a systematic program is essential to attainment of the desired objectives. An established procedure and the proper assignment of responsibilities will eliminate inefficiencies which result from single planning efforts and "one-shot" surveys.

The necessity for evaluating the transportation plan in an urban area periodically is incorporated in the Federal-Aid Highway Act of 1962, which stated, in effect, that after July 1, 1965, any urban area of more than 50,000 population must have a continuing, comprehensive, and coordinated transportation planning process to qualify for federal aid on highway projects where federal aid highway funds are used.[1]

As stated in the Bureau of Public Roads Instructional Memorandum 50-2-63 of March 27, 1963, "the planning process includes the operational procedures and working arrangements by which short and long-range highway and transportation plans are soundly conceived and developed, and continuously evaluated in a manner that will:

1. Assist the governing bodies and official agencies in determining courses of action and in formulating attainable capital improvement programs in anticipation of community needs, and
2. Guide private individuals and groups in their planning decisions which can be important factors in the pattern of future development and redevelopment.

"Transportation planning is concerned with all facilities used for the movement of persons and goods, including terminal facilities and traffic control systems. The process is based on the collection, analysis, and interpretation of pertinent data pertaining to existing conditions and historical growth, the establishment of community goals and objectives, and, the forecasting of future urban development and future travel demands. It includes not only the initial preparation and evaluation of a transportation plan through an appraisal of practicable alternatives, but also periodic review and modification to meet changing conditions. In addition, it includes the preparation and dissemination of pertinent information needed by official agencies in their consideration of planning proposals and improvement programs, and for the encouragement of public understanding and support. Further, it includes the preparation of recommendations concerning the scheduling and financing of highway improvements, coordination with other urban development programs, revision of ordinances and regulations, and additional legislation, if necessary.

[1]Federal-Aid Highway Act of 1962, Public Law 87-866, approved by Congress, October 23, 1962.

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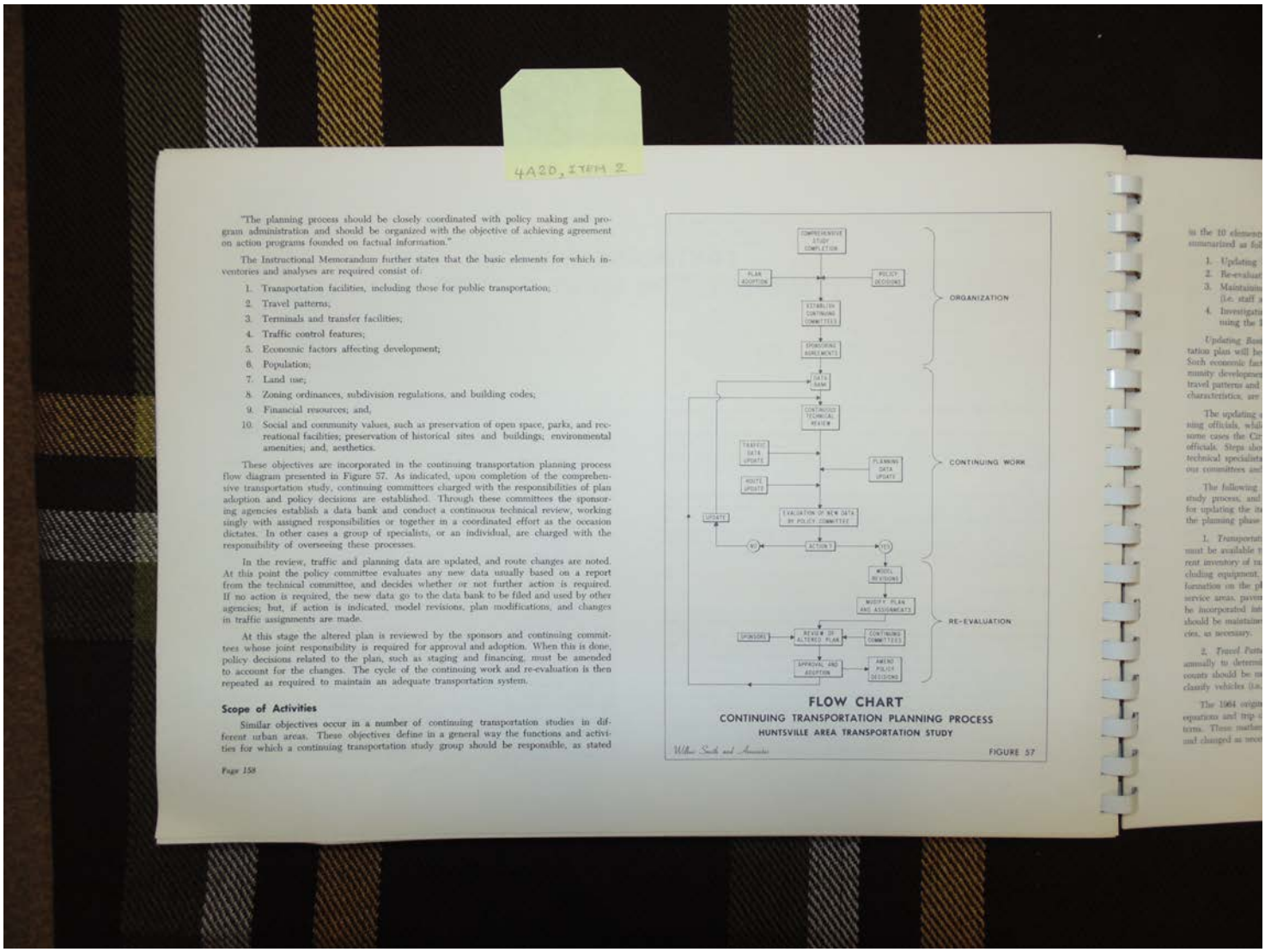

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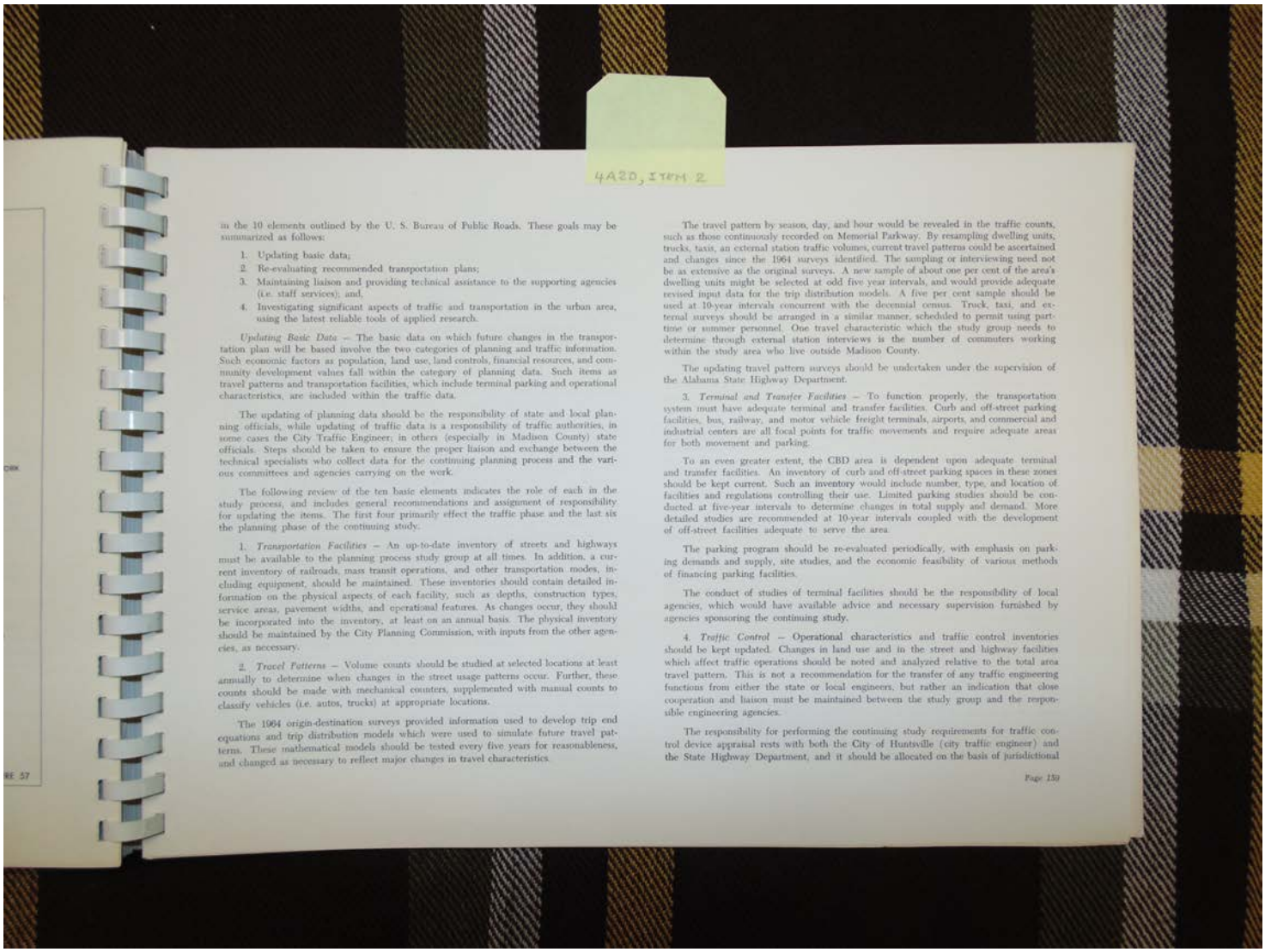

in the 10 elements outlined by the U. S. Bureau of Public Roads. These goals may be summarized as follows:

1. Updating basic data;
2. Re-evaluating recommended transportation plans;
3. Maintaining liaison and providing technical assistance to the supporting agencies (i.e. staff services); and,
4. Investigating significant aspects of traffic and transportation in the urban area, using the latest reliable tools of applied research.

Updating Basic Data — The basic data on which future changes in the transportation plan will be based involve the two categories of planning and traffic information. Such economic factors as population, land use, land controls, financial resources, and community development values fall within the category of planning data. Such items as travel patterns and transportation facilities, which include terminal parking and operational characteristics, are included within the traffic data.

The updating of planning data should be the responsibility of state and local planning officials, while updating of traffic data is a responsibility of traffic authorities, in some cases the City Traffic Engineer; in others (especially in Madison County) state officials. Steps should be taken to ensure the proper liaison and exchange between the technical specialists who collect data for the continuing planning process and the various committees and agencies carrying on the work.

The following review of the ten basic elements indicates the role of each in the study process, and includes general recommendations and assignment of responsibility for updating the items. The first four primarily effect the traffic phase and the last six the planning phase of the continuing study.

1. *Transportation Facilities* — An up-to-date inventory of streets and highways must be available to the planning process study group at all times. In addition, a current inventory of railroads, mass transit operations, and other transportation modes, including equipment, should be maintained. These inventories should contain detailed information on the physical aspects of each facility, such as depths, construction types, service areas, pavement widths, and operational features. As changes occur, they should be incorporated into the inventory, at least on an annual basis. The physical inventory should be maintained by the City Planning Commission, with inputs from the other agencies, as necessary.

2. *Travel Patterns* — Volume counts should be studied at selected locations at least annually to determine when changes in the street usage patterns occur. Further, these counts should be made with mechanical counters, supplemented with manual counts to classify vehicles (i.e. autos, trucks) at appropriate locations.

The 1964 origin-destination surveys provided information used to develop trip end equations and trip distribution models which were used to simulate future travel patterns. These mathematical models should be tested every five years for reasonableness, and changed as necessary to reflect major changes in travel characteristics.

The travel pattern by season, day, and hour would be revealed in the traffic counts, such as those continuously recorded on Memorial Parkway. By resampling dwelling units, trucks, taxis, an external station traffic volumes, current travel patterns could be ascertained and changes since the 1964 surveys identified. The sampling or interviewing need not be as extensive as the original surveys. A new sample of about one per cent of the area's dwelling units might be selected at odd five year intervals, and would provide adequate revised input data for the trip distribution models. A five per cent sample should be used at 10-year intervals concurrent with the decennial census. Truck, taxi, and external surveys should be arranged in a similar manner, scheduled to permit using part-time or summer personnel. One travel characteristic which the study group needs to determine through external station interviews is the number of commuters working within the study area who live outside Madison County.

The updating travel pattern surveys should be undertaken under the supervision of the Alabama State Highway Department.

3. *Terminal and Transfer Facilities* — To function properly, the transportation system must have adequate terminal and transfer facilities. Curb and off-street parking facilities, bus, railway, and motor vehicle freight terminals, airports, and commercial and industrial centers are all focal points for traffic movements and require adequate areas for both movement and parking.

To an even greater extent, the CBD area is dependent upon adequate terminal and transfer facilities. An inventory of curb and off-street parking spaces in these zones should be kept current. Such an inventory would include number, type, and location of facilities and regulations controlling their use. Limited parking studies should be conducted at five-year intervals to determine changes in total supply and demand. More detailed studies are recommended at 10-year intervals coupled with the development of off-street facilities adequate to serve the area.

The parking program should be re-evaluated periodically, with emphasis on parking demands and supply, site studies, and the economic feasibility of various methods of financing parking facilities.

The conduct of studies of terminal facilities should be the responsibility of local agencies, which would have available advice and necessary supervision furnished by agencies sponsoring the continuing study.

4. *Traffic Control* — Operational characteristics and traffic control inventories should be kept updated. Changes in land use and in the street and highway facilities which affect traffic operations should be noted and analyzed relative to the total area travel pattern. This is not a recommendation for the transfer of any traffic engineering functions from either the state or local engineers, but rather an indication that close cooperation and liaison must be maintained between the study group and the responsible engineering agencies.

The responsibility for performing the continuing study requirements for traffic control device appraisal rests with both the City of Huntsville (city traffic engineer) and the State Highway Department, and it should be allocated on the basis of jurisdictional

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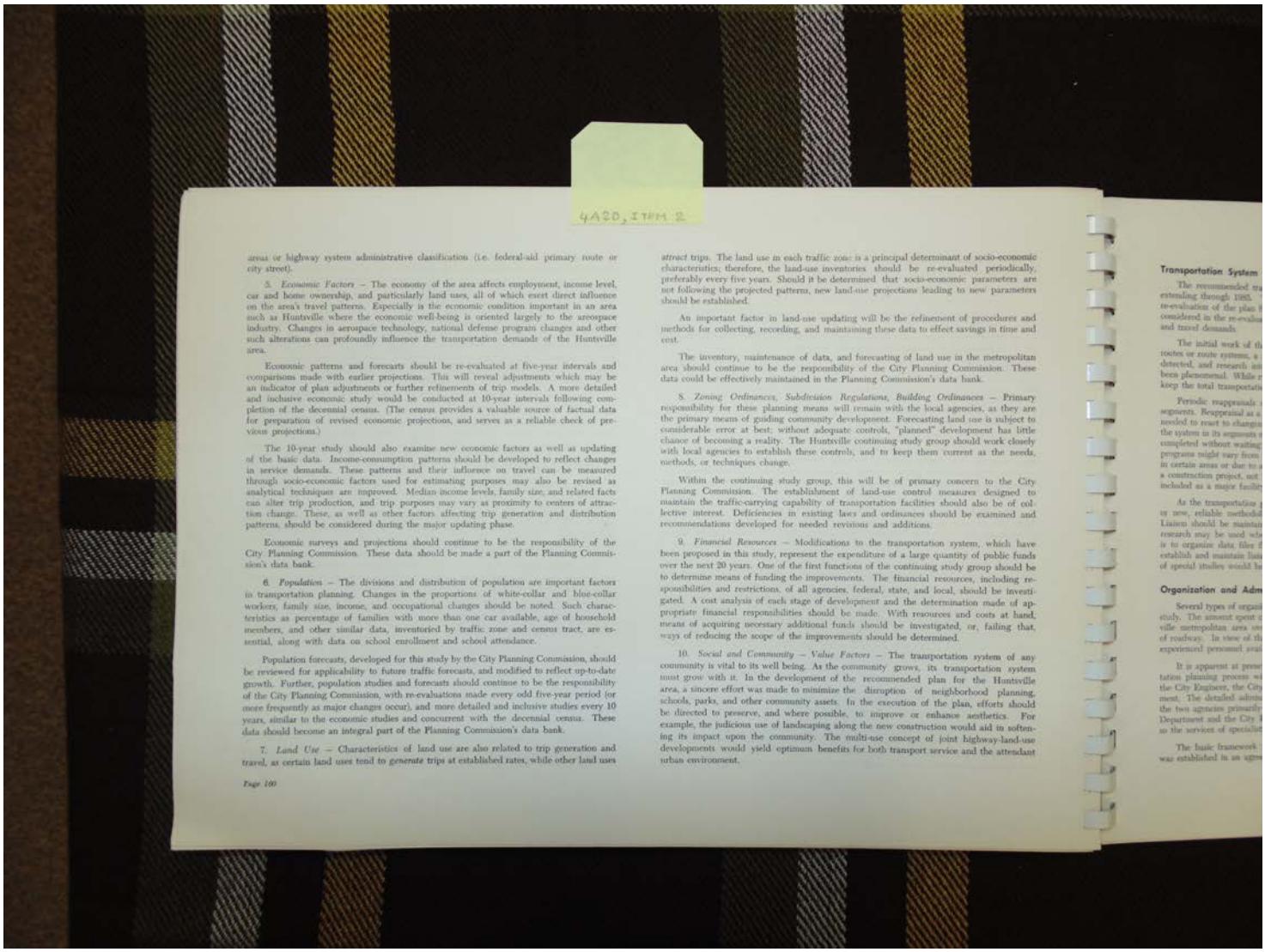

areas or highway system administrative classification (i.e. federal-aid primary route or city street).

5. *Economic Factors* — The economy of the area affects employment, income level, car and home ownership, and particularly land uses, all of which exert direct influence on the area's travel patterns. Especially is the economic condition important in an area such as Huntsville where the economic well-being is oriented largely to the aerospace industry. Changes in aerospace technology, national defense program changes and other such alterations can profoundly influence the transportation demands of the Huntsville area.

Economic patterns and forecasts should be re-evaluated at five-year intervals and comparisons made with earlier projections. This will reveal adjustments which may be an indicator of plan adjustments or further refinements of trip models. A more detailed and inclusive economic study would be conducted at 10-year intervals following completion of the decennial census. (The census provides a valuable source of factual data for preparation of revised economic projections, and serves as a reliable check of previous projections.)

The 10-year study should also examine new economic factors as well as updating of the basic data. Income-consumption patterns should be developed to reflect changes in service demands. These patterns and their influence on travel can be measured through socio-economic factors used for estimating purposes may also be revised as analytical techniques are improved. Median income levels, family size, and related facts can alter trip production, and trip purposes may vary as proximity to centers of attraction change. These, as well as other factors affecting trip generation and distribution patterns, should be considered during the major updating phase.

Economic surveys and projections should continue to be the responsibility of the City Planning Commission. These data should be made a part of the Planning Commission's data bank.

6. *Population* — The divisions and distribution of population are important factors in transportation planning. Changes in the proportions of white-collar and blue-collar workers, family size, income, and occupational changes should be noted. Such characteristics as percentage of families with more than one car available, age of household members, and other similar data, inventoried by traffic zone and census tract, are essential, along with data on school enrollment and school attendance.

Population forecasts, developed for this study by the City Planning Commission, should be reviewed for applicability to future traffic forecasts, and modified to reflect up-to-date growth. Further, population studies and forecasts should continue to be the responsibility of the City Planning Commission, with re-evaluations made every odd five-year period (or more frequently as major changes occur), and more detailed and inclusive studies every 10 years, similar to the economic studies and concurrent with the decennial census. These data should become an integral part of the Planning Commission's data bank.

7. *Land Use* — Characteristics of land use are also related to trip generation and travel, as certain land uses tend to *generate* trips at established rates, while other land uses *attract* trips. The land use in each traffic zone is a principal determinant of socio-economic characteristics; therefore, the land-use inventories should be re-evaluated periodically, preferably every five years. Should it be determined that socio-economic parameters are not following the projected patterns, new land-use projections leading to new parameters should be established.

An important factor in land-use updating will be the refinement of procedures and methods for collecting, recording, and maintaining these data to effect savings in time and cost.

The inventory, maintenance of data, and forecasting of land use in the metropolitan area should continue to be the responsibility of the City Planning Commission. These data could be effectively maintained in the Planning Commission's data bank.

8. *Zoning Ordinances, Subdivision Regulations, Building Ordinances* — Primary responsibility for these planning means will remain with the local agencies, as they are the primary means of guiding community development. Forecasting land use is subject to considerable error at best; without adequate controls, "planned" development has little chance of becoming a reality. The Huntsville continuing study group should work closely with local agencies to establish these controls, and to keep them current as the needs, methods, or techniques change.

Within the continuing study group, this will be of primary concern to the City Planning Commission. The establishment of land-use control measures designed to maintain the traffic-carrying capability of transportation facilities should also be of collective interest. Deficiencies in existing laws and ordinances should be examined and recommendations developed for needed revisions and additions.

9. *Financial Resources* — Modifications to the transportation system, which have been proposed in this study, represent the expenditure of a large quantity of public funds over the next 20 years. One of the first functions of the continuing study group should be to determine means of funding the improvements. The financial resources, including responsibilities and restrictions, of all agencies, federal, state, and local, should be investigated. A cost analysis of each stage of development and the determination made of appropriate financial responsibilities should be made. With resources and costs at hand, means of acquiring necessary additional funds should be investigated, or, failing that, ways of reducing the scope of the improvements should be determined.

10. *Social and Community Value Factors* — The transportation system of any community is vital to its well being. As the community grows, its transportation system must grow with it. In the development of the recommended plan for the Huntsville area, a sincere effort was made to minimize the disruption of neighborhood planning, schools, parks, and other community assets. In the execution of the plan, efforts should be directed to preserve, and where possible, to improve or enhance aesthetics. For example, the judicious use of landscaping along the new construction would aid in softening its impact upon the community. The multi-use concept of joint highway-land-use developments would yield optimum benefits for both transport service and the attendant urban environment.

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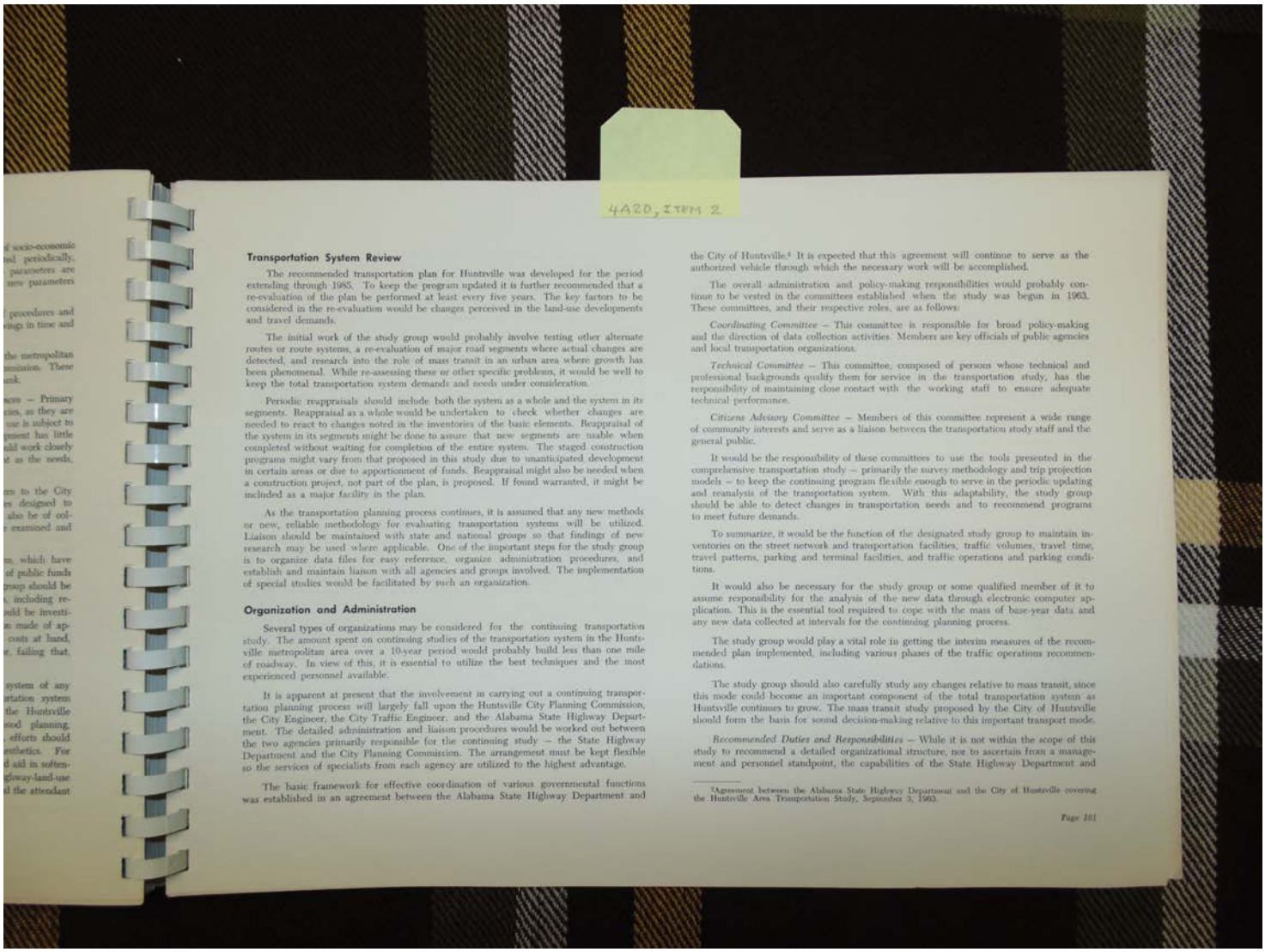

Transportation System Review

The recommended transportation plan for Huntsville was developed for the period extending through 1985. To keep the program updated it is further recommended that a re-evaluation of the plan be performed at least every five years. The key factors to be considered in the re-evaluation would be changes perceived in the land-use developments and travel demands.

The initial work of the study group would probably involve testing other alternate routes or route systems, a re-evaluation of major road segments where actual changes are detected, and research into the role of mass transit in an urban area where growth has been phenomenal. While re-assessing these or other specific problems, it would be well to keep the total transportation system demands and needs under consideration.

Periodic reappraisals should include both the system as a whole and the system in its segments. Reappraisal as a whole would be undertaken to check whether changes are needed to react to changes noted in the inventories of the basic elements. Reappraisal of the system in its segments might be done to assure that new segments are usable when completed without waiting for completion of the entire system. The staged construction programs might vary from that proposed in this study due to unanticipated development in certain areas or due to apportionment of funds. Reappraisal might also be needed when a construction project, not part of the plan, is proposed. If found warranted, it might be included as a major facility in the plan.

As the transportation planning process continues, it is assumed that any new methods or new, reliable methodology for evaluating transportation systems will be utilized. Liaison should be maintained with state and national groups so that findings of new research may be used where applicable. One of the important steps for the study group is to organize data files for easy reference, organize administration procedures, and establish and maintain liaison with all agencies and groups involved. The implementation of special studies would be facilitated by such an organization.

Organization and Administration

Several types of organizations may be considered for the continuing transportation study. The amount spent on continuing studies of the transportation system in the Huntsville metropolitan area over a 10-year period would probably build less than one mile of roadway. In view of this, it is essential to utilize the best techniques and the most experienced personnel available.

It is apparent at present that the involvement in carrying out a continuing transportation planning process will largely fall upon the Huntsville City Planning Commission, the City Engineer, the City Traffic Engineer, and the Alabama State Highway Department. The detailed administration and liaison procedures would be worked out between the two agencies primarily responsible for the continuing study — the State Highway Department and the City Planning Commission. The arrangement must be kept flexible so the services of specialists from each agency are utilized to the highest advantage.

The basic framework for effective coordination of various governmental functions was established in an agreement between the Alabama State Highway Department and the City of Huntsville.[1] It is expected that this agreement will continue to serve as the authorized vehicle through which the necessary work will be accomplished.

The overall administration and policy-making responsibilities would probably continue to be vested in the committees established when the study was begun in 1963. These committees, and their respective roles, are as follows:

Coordinating Committee — This committee is responsible for broad policy-making and the direction of data collection activities. Members are key officials of public agencies and local transportation organizations.

Technical Committee — This committee, composed of persons whose technical and professional backgrounds qualify them for service in the transportation study, has the responsibility of maintaining close contact with the working staff to ensure adequate technical performance.

Citizens Advisory Committee — Members of this committee represent a wide range of community interests and serve as a liaison between the transportation study staff and the general public.

It would be the responsibility of these committees to use the tools presented in the comprehensive transportation study — primarily the survey methodology and trip projection models — to keep the continuing program flexible enough to serve in the periodic updating and reanalysis of the transportation system. With this adaptability, the study group should be able to detect changes in transportation needs and to recommend programs to meet future demands.

To summarize, it would be the function of the designated study group to maintain inventories on the street network and transportation facilities, traffic volumes, travel time, travel patterns, parking and terminal facilities, and traffic operations and parking conditions.

It would also be necessary for the study group or some qualified member of it to assume responsibility for the analysis of the new data through electronic computer application. This is the essential tool required to cope with the mass of base-year data and any new data collected at intervals for the continuing planning process.

The study group would play a vital role in getting the interim measures of the recommended plan implemented, including various phases of the traffic operations recommendations.

The study group should also carefully study any changes relative to mass transit, since this mode could become an important component of the total transportation system as Huntsville continues to grow. The mass transit study proposed by the City of Huntsville should form the basis for sound decision-making relative to this important transport mode.

Recommended Duties and Responsibilities — While it is not within the scope of this study to recommend a detailed organizational structure, nor to ascertain from a management and personnel standpoint, the capabilities of the State Highway Department and

[1]Agreement between the Alabama State Highway Department and the City of Huntsville covering the Huntsville Area Transportation Study, September 3, 1963.

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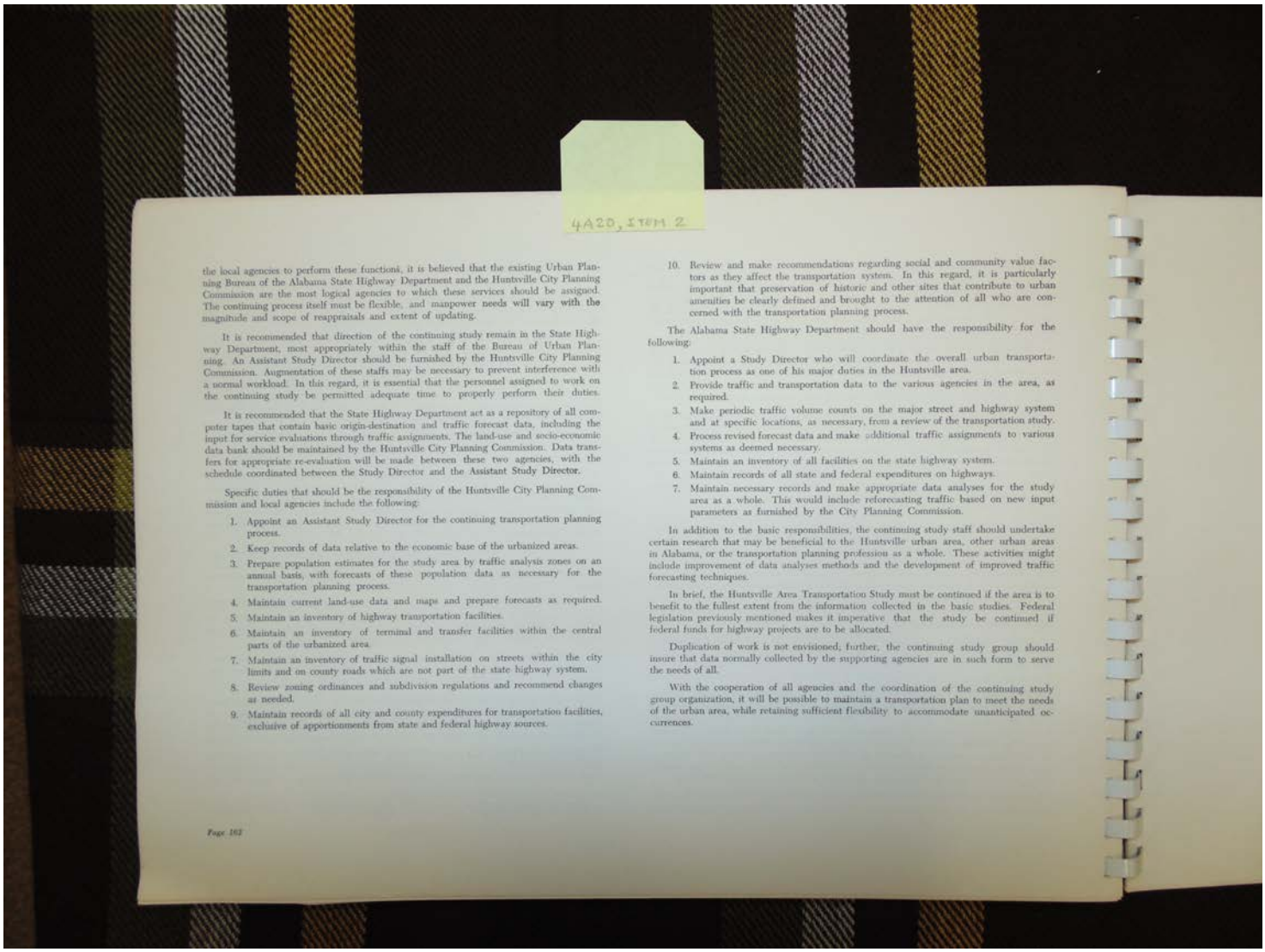

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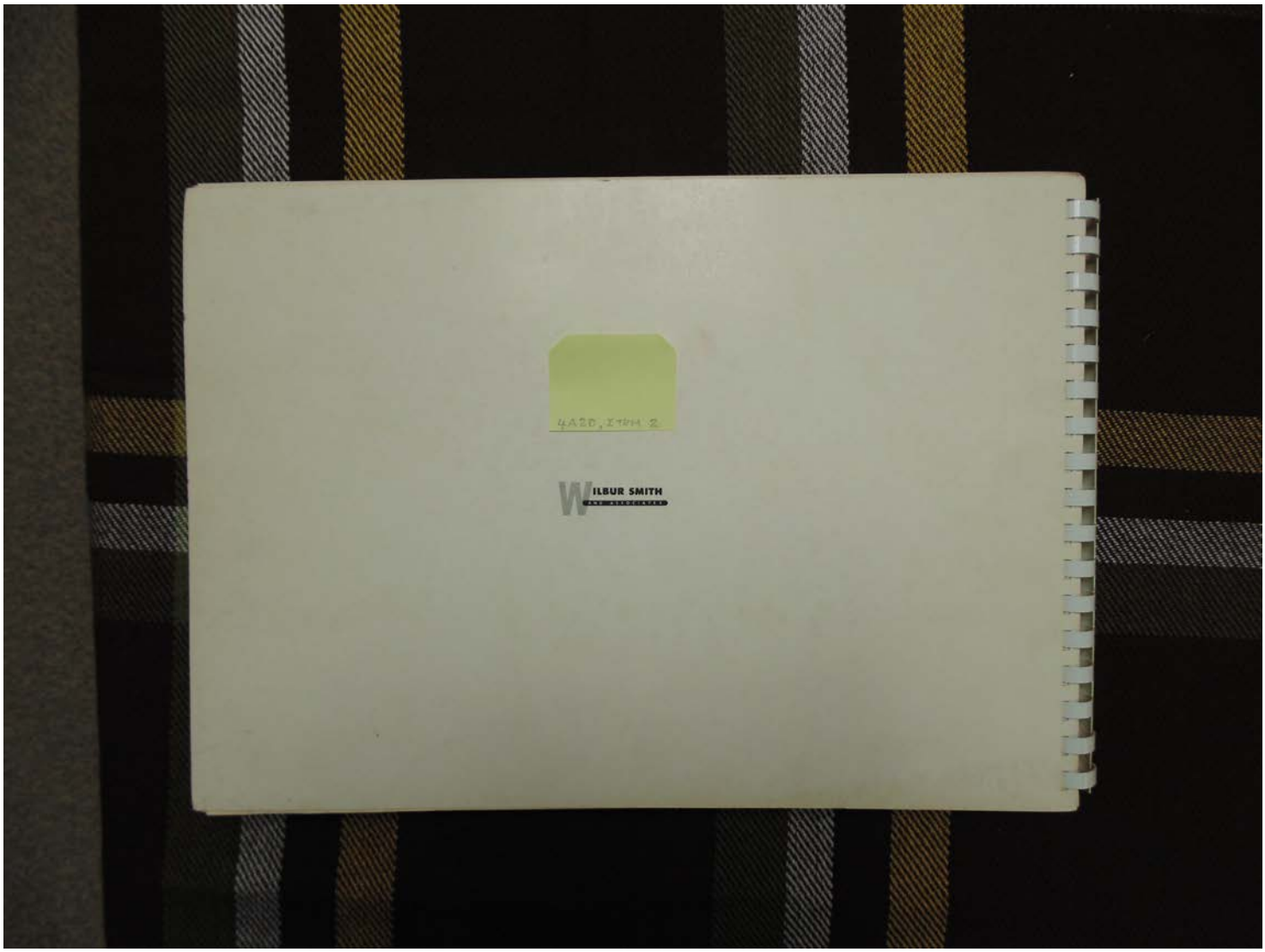

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Frances Cabaniss Roberts Collection

Preferred Citation: Frances Cabaniss Roberts Collection, Archives and Special Collections, M. Louis Salmon Library, University of Alabama in Huntsville, Huntsville, AL.

Collection Scope and Content: The Collection of 114 Linear ft. includes a total of 156 Archival Boxes. The Frances Cabaniss Roberts collection covers the historical records of the Cabaniss Roberts family. This collection contains extensive correspondence records of the Cabaniss Roberts family circa 1830 to 1930.

Archives/Special Collections Access Restrictions: None

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