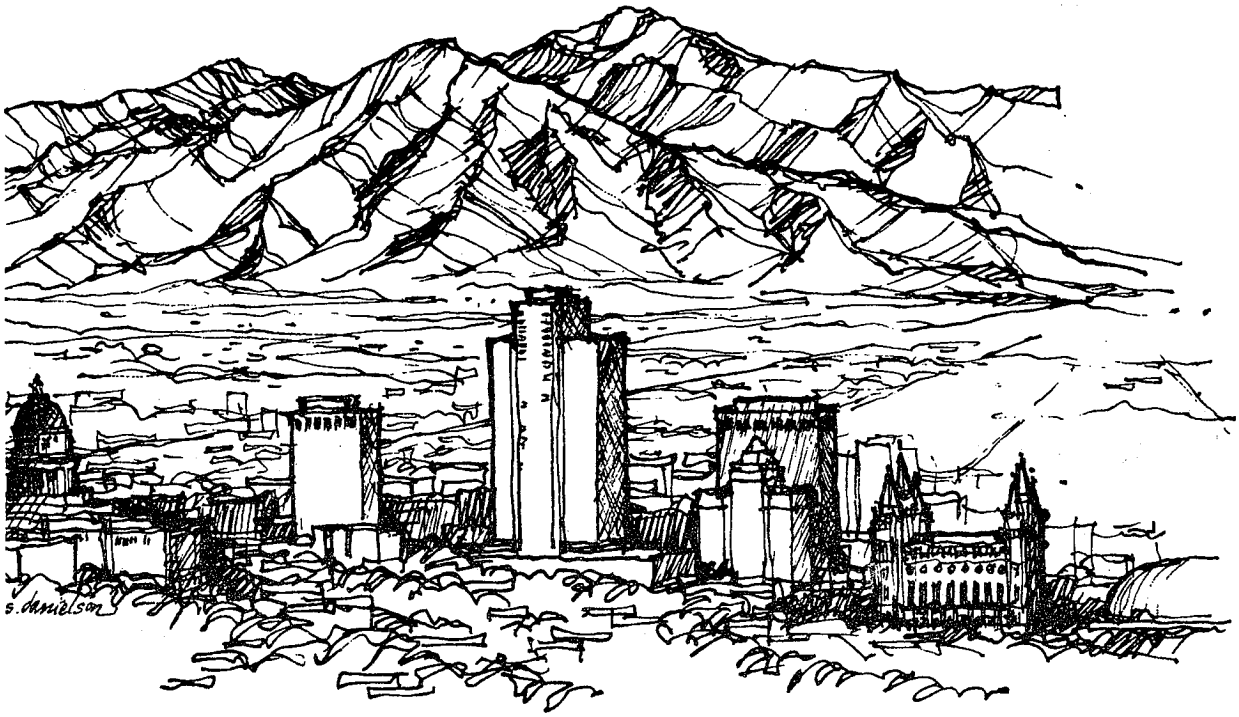


Wasatch Canyons Transportation Study

RECOMMENDATIONS FOR SHORT-RANGE TRANSPORTATION IMPROVEMENTS

Wasatch Front Regional Council

NOVEMBER 1976

PROPERTY
of
Wasatch Front Regional Council

WASATCH CANYONS TRANSPORTATION STUDY

RECOMMENDATIONS FOR SHORT-RANGE TRANSPORTATION IMPROVEMENTS

Prepared for the

WASATCH FRONT REGIONAL COUNCIL

AND

SALT LAKE COUNTY

Prepared by

PBQ&D, INC.
Santa Ana, California
under contract to VTN Consolidated, Inc.

November, 1976

CONTENTS

	Page
FOREWORD	1
INTRODUCTION	2
SUMMARY OF RECOMMENDATIONS	3
BACKGROUND: THE CANYONS OF THE WASATCH FRONT	5
Canyon Topography and Geographic Characteristics	5
Population Characteristics	8
Land Use Patterns	9
Recreation in Wasatch Canyons	10
TRANSPORTATION IN THE COTTONWOOD CANYONS: EXISTING CONDITIONS	14
Existing Canyon Traffic	14
Patterns of Travel to the Cottonwood Canyons	20
Public Transportation Service	24
Transportation Problems in the Cottonwood Canyons	25
GUIDELINES FOR SHORT-RANGE TRANSPORTATION PLANNING	29
Time Frame	29
Canyon Development, Land Use, and Activity Patterns	29
Short-Range Transportation Plan: Program Components	31
THE SALT LAKE/CANYONS TRANSIT CENTER	33
Design Criteria	33
Prototype Development and Phasing	34
Implementation	41
CANYON TRANSIT SERVICE DEMANDS	44
Transit Market Description and Ridership Estimates	44
Salt Lake Airport to Cottonwood Canyons Service	46
Downtown to Cottonwood Canyons Service	47
Salt Lake/Canyons Transit Center to Cottonwood Canyons Service	49
University Area to Cottonwood Canyons Service	50
Shuttle Services between Alta and Snowbird	51
Subscription and Summer Services	51
PROPOSED CANYON TRANSIT SERVICES	52
Service characteristics and Transit Routes	52
Operating Cost and Revenue Projections	70
Potential Problems and Related Improvements	70
ANNOTATED BIBLIOGRAPHY	73

FIGURES

		Page
Figure 1	Wasatch Canyons Study Area	6
Figure 2	Cottonwood Canyon Study Area	7
Figure 3	Utah Ski Industry Growth 1962-1963 through 1975-1976	12
Figure 4	Average Daily Traffic Volumes Big and Little Cottonwood Canyons, 1973 & 1975	16
Figure 5	Daily Traffic Volumes — Little Cottonwood Canyon	17
Figure 6	Hourly Directional Volumes Big and Little Cottonwood Canyons	22
Figure 7	Salt Lake/Canyons Transit Center Ground Level Plan, Phase I	35
Figure 8	Salt Lake/Canyons Transit Center Conceptual Sketch, Phase I	36
Figure 9	Salt Lake/Canyons Transit Center Ground Level Plan, Phase II	38
Figure 10	Salt Lake/Canyons Transit Center Conceptual Sketch, Phase II	39
Figure 11	Salt Lake/Canyons Transit Center Ground Level Plan, Phase III	41
Figure 12	Salt Lake/Canyons Transit Center Conceptual Plan, Phase III	42
Figure 13	Route Map, Airport to Little Cottonwood Canyon	53
Figure 14	Available Seats by Time of Day Salt Lake International Airport	54
Figure 15	Route Map, Downtown to Little Cottonwood Canyon Express	57
Figure 16	Route Map, Downtown to Little Cottonwood Canyon via University	58
Figure 17	Route Map, Downtown to Big Cottonwood Canyon via University	59
Figure 18	Route Map, Salt Lake Canyons Transit Center to Little Cottonwood Canyon	62
Figure 19	Route Map, Salt Lake Canyons Transit Center to Big Cottonwood Canyon	63

TABLES

		Page
Table 1	Average Daily Traffic Volumes	15
Table 2	Hourly Traffic Volumes Big Cottonwood Canyon Road	18
Table 3	Hourly Traffic Volumes Little Cottonwood Canyon Road	19
Table 4	Hourly Directional Volumes	21
Table 5	Traffic Accidents and Accident Rates	28
Table 6	Service Schedule Airport to Little Cottonwood Canyon	55
Table 7	Service Schedule Downtown to Little Cottonwood Canyon	60
Table 8	Service Schedule Downtown to Big Cottonwood Canyon	61
Table 9	Service Schedule Salt Lake/Canyons Transit Center to Little Cottonwood Canyon	65
Table 10	Service Schedule Salt Lake/Canyons Transit Center to Big Cottonwood Canyon	66
Table 11	Service Schedule University to Little Cottonwood Canyon	67
Table 12	Service Schedule University to Big Cottonwood Canyon	68
Table 13	Service Schedule Alta to Snowbird Shuttle	69
Table 14	Operating Costs and Revenue Estimates Wasatch Canyons Transit Service	71

FOREWORD

The Wasatch Canyons Transportation Study is a cooperative effort between the Wasatch Front Regional Council and the County of Salt Lake. The Study is funded in part by the Urban Mass Transportation Administration, U. S. Department of Transportation, with local matching funds and Study coordination provided by Salt Lake County. Cooperating agencies include the Salt Lake County Planning Commission, the Salt Lake County 208 Project, the U. S. Forest Service, the Utah State Department of Transportation, the Town of Alta, and numerous other local, regional, and statewide agencies and organizations. The Study is being coordinated by Salt Lake County as part of the continuing planning process for the Canyons of the Wasatch Front. Project consultant is PBQ&D, Inc., Santa Ana, California, under contract to VTN Consolidated, Inc.

* * * * *

INTRODUCTION

This report is one of a series of Working Papers and Technical Reports for the Wasatch Canyons Transportation Study. As a portion of the overall Salt Lake County effort designed to develop guidelines and plans for the Canyons of the Wasatch Front, this Transportation Study is being conducted simultaneously with other programs investigating land use, future growth, and water quality in the Canyons.

The Wasatch Canyons Transportation Study has been structured in three phases:

- Immediate Action Plan
- Short-Range Improvement Program
- Long-Range Development Concept

This report represents the summary document for the Short-Range Program. The Immediate Action Plan, stressing transportation improvement strategies for 1974-1975 and 1975-1976, has been completed and the recommendations have been implemented to the extent possible. The Short-Range Program is designed to build systematically on the recommendations for immediate action in order to develop a staged plan for transportation improvements in the Canyons, based on expected patterns of growth, land use, recreational participation, and Canyon development.

The Short-Range Improvement Program is a medium-range transportation program, designed to guide transit and traffic improvement measures over the period from 1976-1977 to 1980-1981. As such, major transit-related improvements are recommended to commence with the 1976-1977 ski season and to be in full-scale implementation by fall, 1977. During the remaining years of the program scope, improvements should be made based on operating experience gained the first two years. Such improvements can include service increases, route adjustments, and other operational changes. However, most of the public transportation and related traffic improvement recommendations contained in this report should be implemented over the next two-year period.

* * * * *

SUMMARY OF RECOMMENDATIONS

The Wasatch Canyons Short-Range Transportation Program is aimed at improving the transportation systems in the Wasatch Canyons over a five-year period from 1976-1977 through 1980-1981, primarily in Big and Little Cottonwood Canyons. As a near-term plan, improvements include minor roadway modifications, initiation of public transit to and within the Cottonwood Canyons by the Utah Transit Authority, and development of a modal transfer facility in Salt Lake Valley to serve as a terminal for remote parking and bus access to the Canyons.

The primary short-range recommendation, to be implemented beginning with the 1976-1977 ski season, is the introduction of UTA service in the Canyon area. This service is now possible with the acquisition by UTA of the operating franchise formerly held by the privately-owned Salt Lake Transportation Company, allowing operations between Salt Lake City and the Cottonwood Canyons. The recommendations provided in this report propose six basic classes of transit service to be furnished by UTA, as follows:

(1) Salt Lake Airport to Little Cottonwood Canyon
(2) Downtown to Cottonwood Canyons
(3) Salt Lake/Canyons Transit Center to Cottonwood Canyons
(4) University area to Cottonwood Canyons
(5) Shuttle services between the Town of Alta and Snowbird Resort
(6) Subscription and summer services

The first five services are designed to operate at full scale during the ski season. The final service (No. 6) is to operate during the non-skiing seasons with both scheduled and subscription services. The bus service during the primary 150-day winter period of full scheduling has the following attributes:

- Seasonal operating miles:	567,000
- Seasonal operating cost:	$905,000
- Estimated season patronage:	495,000
- Average number of passengers per bus per one-way trip:	12.1
- Estimated seasonal revenue (based on proposed fares):	$319,000
- Operating deficit:	$586,000
- Subsidy	65%

Fares are recommended to be between $.25 and $1.50, depending upon type of service. However, fare recommendations are provided only as an illustration of the revenue potential; the UTA will set the actual fare structure as a policy decision. Due to the limited nature of proposed off-season services, costs and revenues are not included in the above figures.

The second major recommendation in the Short-Range Plan is the development of a transfer facility in Salt Lake Valley, which has been termed the "Salt Lake/Canyons Transit Center (SL/CTC)." The development scheme is shown in three phases in this report; Phase I should be developed in 1977 and should be in operation for the 1977-1978 ski season, while Phase II should be completed before the end of the five-year period of this Plan. Phase III is strictly an optional development which is really not part of the Plan, but instead relies wholly on private capital and thus is shown for illustrative purposes only.

The recommendations presented in this report are based on a reasonable compromise between a high level of service and an acceptable level of cost. The program is reliant upon strong, well-directed marketing efforts on the part of UTA and the ski area operators. The required operational subsidy for Canyon transit services is estimated to be well under the UTA system-wide average, although the operational costs are high. Should program reductions be necessary due to budget limitations, it is recommended that the weekend service remain substantially as proposed and that savings be gained through modest reductions in weekday service.

* * * * *

BACKGROUND: THE CANYONS OF THE WASATCH FRONT

Canyon Topography and Geographic Characteristics

The study area for the Wasatch Canyons Transportation Project includes the seven canyons in the Salt Lake County portion of the Wasatch Front Range. Of these seven canyons, five have significant use and/or visitation: Emigration Canyon, Parleys Canyon, Mill Creek Canyon, Big Cottonwood Canyon and Little Cottonwood Canyon. Previous Working Papers published as part of the Wasatch Canyons Transportation Study have established that, based on current traffic conditions and projected land use, only the Cottonwood Canyons experience conditions extreme enough to warrant major transportation system improvements. Thus, this report is focused primarily on Big and Little Cottonwood Canyons.

The study area for the Wasatch Canyons Transportation Study is illustrated in Figure 1. This figure provides estimates of the annual average daily traffic (AADT) for the five canyons having significant use. The heaviest volumes occur in Parleys Canyon which is the location of Interstate 80. Most of the traffic in Parleys Canyon is through traffic, while the traffic in the other four canyons is generated primarily by canyon residences or recreation attractions.

Big Cottonwood Canyon and Little Cottonwood Canyon contain major ski areas and, therefore, experience severe transportation demands during peak winter periods. Emigration Canyon primarily serves residential traffic and Mill Creek Canyon serves mostly summer recreation activities and summer cabins. Although the annual average daily traffic in Emigration Canyon is the highest of these four canyons, it is spread relatively evenly over the year without severe seasonal peaks. Since the volumes in Emigration Canyon are oriented to the residences located in the Canyon, they diminish rather rapidly with distance from the Canyon mouth. This is not the case in either Big or Little Cottonwood Canyons since the primary traffic generators are the ski areas located near the point of deepest penetration of each Canyon access road, causing the majority of traffic to traverse the entire length of the road. In addition, the traffic on these roads exhibits extreme peaking conditions on weekends during the winter when road conditions due to weather are normally the poorest. These winter-related problems which exist in the Cottonwood Canyons, together with recent increases in summer use, have served to focus this study on the development of transportation system improvements for the Cottonwood Canyons.

Big and Little Cottonwood Canyons are a part of the steep western slope of the Wasatch Mountain, formed by uplifting along the still-active Wasatch Fault. The Canyons of the Wasatch Range are generally steep, cut by streams and, more recently, formed and etched by glaciation. The Cottonwood Canyons are the most southerly of the major Wasatch Canyons within the County of Salt Lake. Figure 2 illustrates the location and geographical and topographical features of the Cottonwood Canyon area in the Wasatch National Forest.

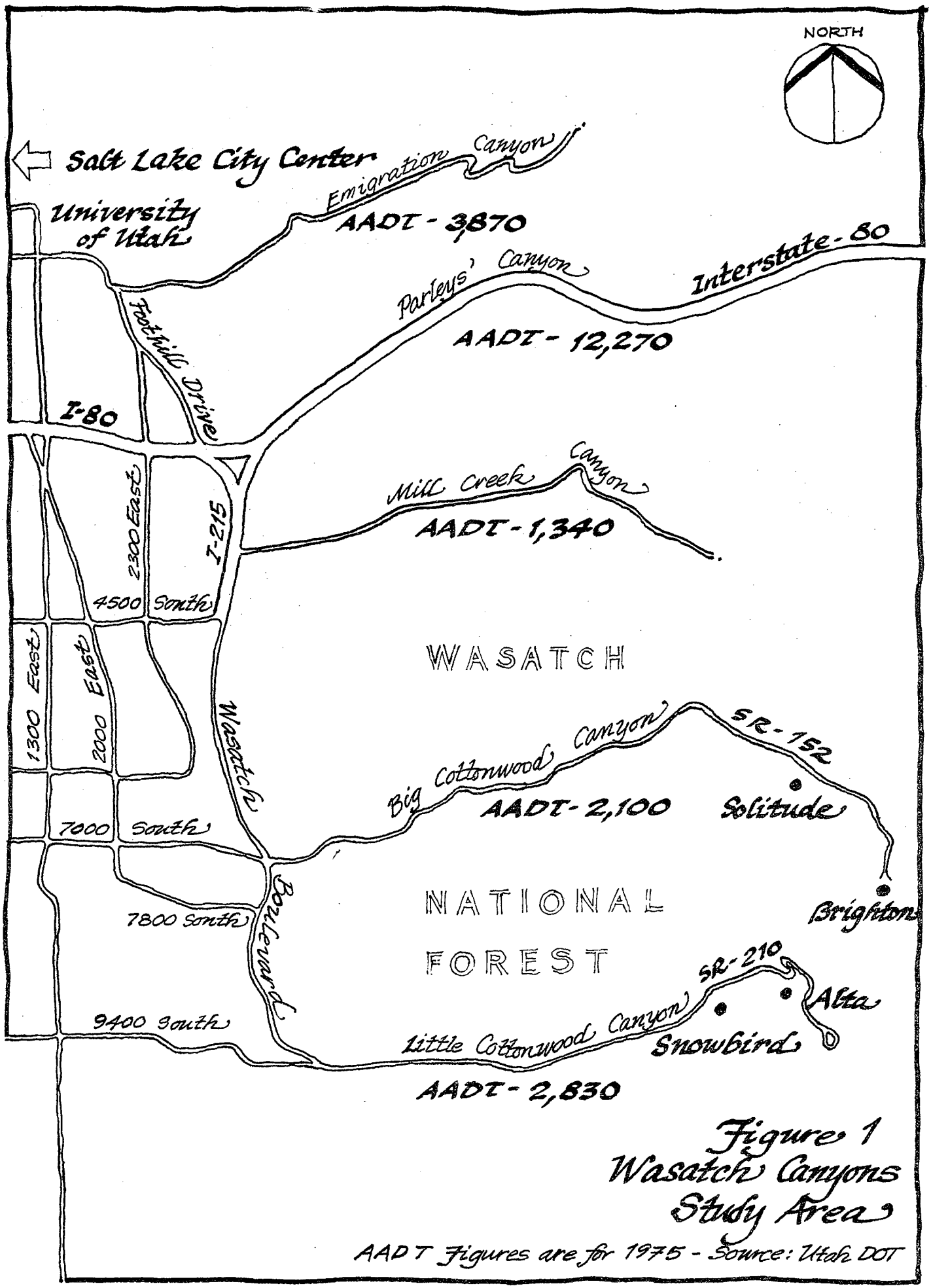


Figure 1
Wasatch Canyons
Study Area

AADT Figures are for 1975 - Source: Utah DOT

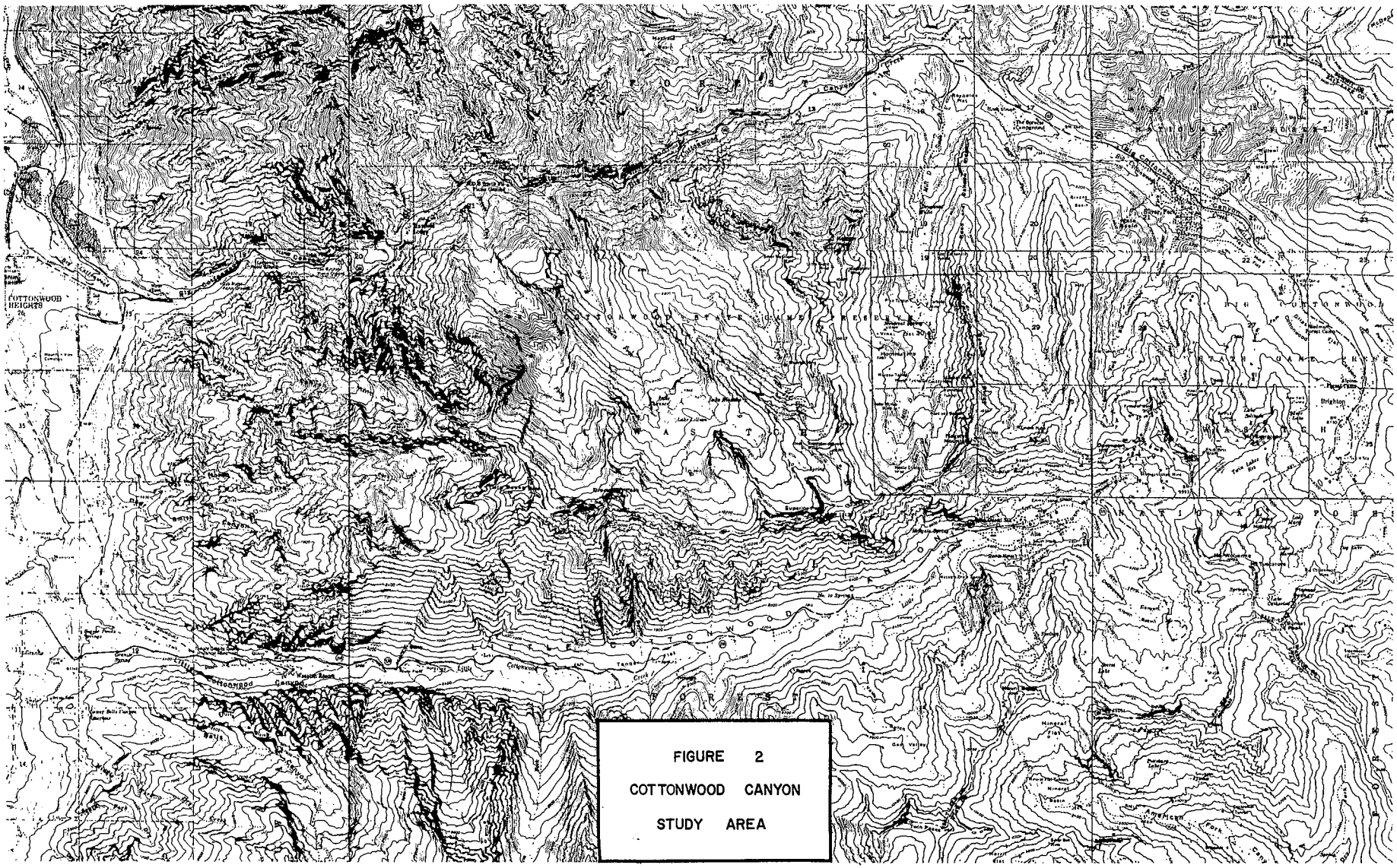


FIGURE 2

COTTONWOOD CANYON

STUDY AREA

Big Cottonwood Canyon is a major canyon of extensive length with a large number of lesser canyons branching off of it. Near its mouth, it is narrow with steep sides towering over 4,000 feet above the canyon floor. Farther into the canyon, the canyon floor widens out and the slopes on both sides become more gentle. The floor of the Canyon has an elevation of about 5,000 feet at the canyon mouth and rises to an elevation of nearly 9,000 feet at the terminus of the canyon access road. The mountain peaks which form the canyon walls tower to well over 10,000 feet.

Little Cottonwood Canyon differs from Big Cottonwood Canyon in that it is more linear in nature with a wider floor and generally steeper sides. The floor of Little Cottonwood Canyon rises from an elevation of about 5,400 feet at the mouth to approximately 9,600 feet at the Albion Basin. Mountain peaks on either side rise to heights in excess of 11,000 feet. The north wall of the canyon is generally steeper than the south wall, which contains a greater number of minor canyons branching off of the main canyon.

Population Characteristics

In 1975 the population of Salt Lake County was approximately 520,000 persons, with 35 percent of the population located in central Salt Lake City and an additional 54 percent of the population located within the "fringes" of the city. Population forecasts provided by the Salt Lake County 208 Study project a 22 percent increase in population by 1985, occurring mainly in the southeast and southwest portions of Salt Lake Valley. An additional increase of 25 percent is projected by 1995. Although major increases are forecast near the areas at the mouths of Big and Little Cottonwood Canyons, no significant increase in population is anticipated within the Canyons. Currently there are 71 permanent residents in Big Cottonwood Canyon and 229 permanent residents in Little Cottonwood Canyon. There are a number of summer cabins, especially in Big Cottonwood Canyon, but they are not occupied on a full-time basis.

There appear to be two major factors which will influence future residential growth in the Canyons:

1. The suitability of land for residential development and associated environmental factors such as water quality; and
2. The small amount of privately owned land and the relatively high price of that land, which tend to reduce the suitability for residential development.

There currently are shortages of housing for employees of the ski resorts, especially temporary employees, but there are no present plans to alleviate this problem. Snowbird Corporation has indicated, however, that additional employee housing will be furnished at such time as new lodging facilities are developed in order to provide basic services during periods of road-closure and to respond to emergency conditions. During the peak season there are approximately 140 employees in the Big Cottonwood Canyon and 830 employees in Little Cottonwood Canyon. Projections for employment increases, in a study by Williams and Mocine, forecast

a five percent increase for Big Cottonwood Canyon and a seven percent increase for Little Cottonwood Canyon. It is unlikely that these projections include the possibility of reopening the Solitude ski area in Big Cottonwood Canyon or any major expansions of ski facilities in Little Cottonwood Canyon. If these occurred, there could be a much larger growth in the number of employees.

In summary, while the greater Salt Lake area is experiencing strong growth in population and the trend is expected to continue through the next 20 years, the Canyons of the Wasatch Front can expect some small growth in permanent population or residential housing. The net effect will very likely be an increased demand for Canyon recreational amenities (both winter and summer) on the part of a growing base population, with commensurate pressures for the expansion of such recreational facilities against the constraint of limited land suitability, high land cost and probable negative environmental consequences.

Land Use Patterns

Commercial recreation in Little Cottonwood Canyon began in the 1930's with the development of Alta as a ski resort. In 1937, the second chair lift in the Western United States was constructed at Alta. During the 30-year period subsequent to initial development, commercial facilities were developed in the following sequence:

Snowpine Lodge	1937
Rustler Lodge	1938
Alta Lodge	1941
Peruvian Lodge	1948
Goldminer's Daughter	1962

In addition, the U. S. Forest Service has built two cabins, the Alta Ski Lift Company has constructed three additional lifts, and the University of Utah now operates a high altitude research facility. Today, Alta has six modern chair lifts, ranging in length from 3,600 feet to 5,200 feet, with verticals from 730 feet to 1250 feet.

Other developments have occurred near the Town of Alta at Hellgate, in Grizzley Gulch, and in Albion Basin. In these areas, some 18 private cabins have been built, along with lodges at Hellgate and Blackjack and a small commercial day facility in Albion Basin.

In December of 1971, recreational use in the Canyon increased sharply with the opening of the Snowbird Resort. To date, the development of this resort has included several condominium/hotel facilities, an extensive commercial complex, a 120-passenger aerial tramway and three chair lifts.

The first commercial ski facilities in Big Cottonwood Canyon were developed at Brighton in 1936. Development continued over the years and there are presently four double chair lifts operating at Brighton. Limited facilities exist at this resort for lodging and, hence, the Big Cottonwood Canyon has evolved to its present state as an almost exclusively day-skiing facility. A second ski area, Solitude, in Big Cottonwood Canyon operated through 1973, but has been closed in recent years pending renovation and new ownership.

The primary focus of activity in Little Cottonwood Canyon centers on its two major ski areas and resorts at Alta and Snowbird. In contrast, the numerous picnic areas and private cabins located in Big Cottonwood Canyon generate as much summertime activity as do the ski resorts in the winter. The two ski areas in Little Cottonwood Canyon are large in scale with each having lift capacities in excess of 5,000 skiers per hour. Both resorts are served by extensive lodging facilities, with capacities of 1,140 and 600 beds at Snowbird and Alta, respectively. These areas are nationally and even internationally known and attract skiers from all over the United States and many foreign countries. The two ski areas in Big Cottonwood Canyon, Brighton and Solitude, are somewhat smaller in scale, attracting primarily local and generally less proficient skiers. Lift capacity at Brighton is 3,650 skiers per hour. Solitude is undergoing a reconstruction program and its opening date is tentatively scheduled for the 1977-1978 season.

Ski area utilization differs between Big and Little Cottonwood Canyons, in terms of both intensity and type of use. During peak periods, the Little Cottonwood Canyon resorts have a combined skiing population of over 10,000 skiers. Snowbird estimates that about 80 percent of its skiing population consists of "day skiers," which includes both local Utah residents and those non-local visitors who do not stay overnight at any of the Snowbird lodging facilities. Big Cottonwood Canyon (Brighton) has peak period skier population in excess of 2,000, consisting almost entirely of day skiers. Lodging capacity at Brighton totals only 110 beds which, even during peak periods, are only some 60 percent utilized.

Recreation in Wasatch Canyons

Summer Recreation

National Forest campgrounds are located in both Big and Little Cottonwood Canyons. In 1974, there were 64,500 reported visitor days in the six areas open for camping. The Forest Service reports that campground use is increasing at an approximate rate of five percent per year. Using this five percent growth rate would give an anticipated 86,500 visitor days per year by 1980 and 110,500 visitor days by 1985. Although the campgrounds on the average are not utilized to capacity, the Forest Service reports that available capacity is exceeded at peak periods during the summer season, particularly on weekends. As the campgrounds become more crowded and the quality of the camping experience is diminished, the growth rate may decline unless existing facilities are expanded or new facilities developed.

The Forest Service also estimates that 95 percent of the use of the National Forest facilities is by local residents, almost exclusively from Salt Lake and Davis Counties. This produces a rate of approximately 100 visitor days per 1000 population. There is no information readily available on Canyon area camping facilities other than for those administered by the U. S. Forest Service.

The Canyon reservoirs do not currently provide for boating or other water recreation (except fishing). Many local boaters now travel north to Weber County to Pine View Reservoir. Tentative proposals for a high-level dam

in Parleys Canyon include boating and water recreation facilities. Currently, however, there are no confirmed plans for expansion of summer recreational facilities. Since many areas are experiencing demands exceeding their capacities on weekends and some evenings, and since the population for the Salt Lake area is projected to increase by more than 50 percent by 1995, it is likely that the Forest Service and/or others may develop additional summer recreational facilities in the future. In any case, it seems certain that demand for recreational facilities in the Canyons and utilization of these facilities will increase over the next two decades.

Winter Recreation

The primary winter recreation activity which impacts transportation planning in the Wasatch Canyons is downhill skiing. Although data on recreational participation, particularly those data relating to patterns of travel and skier origins, have been incomplete over the years, the Utah State University Institute for the Study of Outdoor Recreation and Tourism has conducted several studies of the ski industry in Utah. The Institute has studied a number of trends and has developed projections for growth in skiing over the next decade. These projections are statewide, however, rather than for individual ski areas.

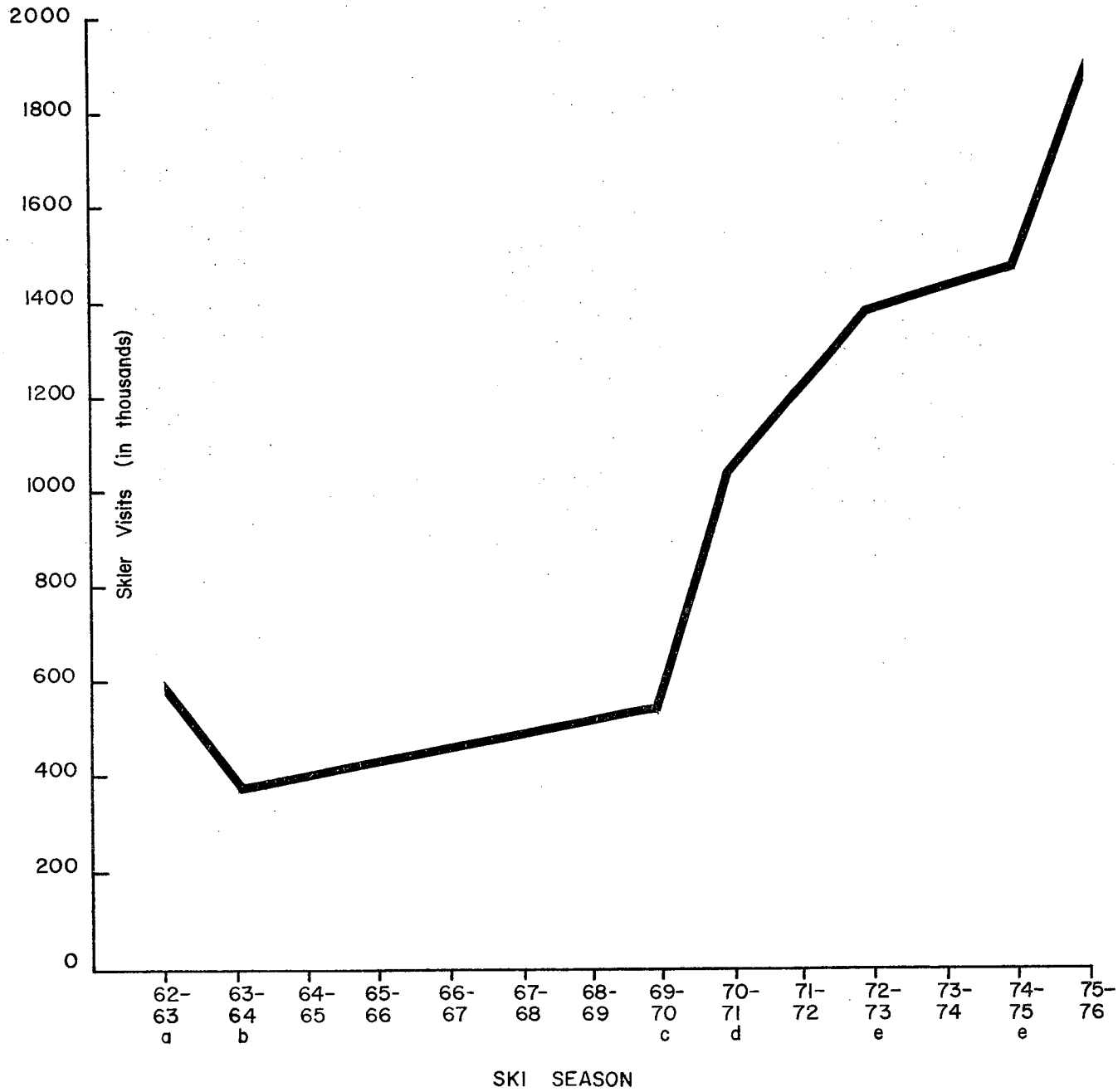
Data from the Institute for the Study of Outdoor Recreation and Tourism and the Utah Ski Association show the following number of skier days during the 1972-1973, 1974-1975, and 1975-1976 ski seasons:

Utah Ski Areas	Number of Skier Days			Percentage Change
	1972-1973	1974-1975	1975-1976	'72-'73 to '75-'76
"Nonresident" Ski Areas (Alta, Brian Head, Park City, Snowbird)	828,000	899,000	1,250,000	+51%
"Resident" Ski Areas (Brighton, Nordic Valley, Park West, Powder Mountain, Snow Basin, Sundance)	485,000	433,000	515,000	+ 6%
"Rural" Ski Areas (Beaver Mountain, Blue Mountain, Mt. Holly, Snowland)	57,000	70,000	85,000	+49%
TOTAL STATEWIDE	1,370,000	1,402,000	1,850,000	+35%

FIGURE 3

UTAH SKI INDUSTRY GROWTH

1962-1963 THROUGH 1975-1976



SOURCES:

a) Jensen, 1964.
b) Herrington, 1967.
c) Utah State Foundation, 1970
d) Brigham Young University Center for Business and Economic Research, 1971.
e) Utah State University Institute for the Study of Outdoor Recreation and Tourism, Source was estimates made by the ski areas

As shown in Figure 3, the Utah ski industry has grown from some 600,000 skier-visits in 1962-1963 to more than 1.85 million skier-visits in 1975-1976. This is an increase of 1,250,000 skier-visits per year, or 210 percent, representing an average annual increase over the 14 seasons of some 15 percent. The number of skier-days in 1975-1976 increased dramatically over the preceding several seasons, perhaps due to the generally poor skiing conditions elsewhere during the season. Excluding this past season, the rate of growth seemed to slow somewhat during the period between 1972 and 1975. Since participation in skiing is so dependent upon factors such as snow conditions, promotional activities, the national economy and conditions elsewhere, it is difficult to establish trends and develop future projections for skier participation. The Utah State Institute for the Study of Outdoor Recreation and Tourism, however, forecasts a five-year increase in skier visits ranging from about 55 percent to over 200 percent, depending on the particular method of projection and based upon historical use data for the six-year period from 1968-1969 to 1973-1974.

There are a number of factors which could affect the actual five-year growth in skier-visits to the Wasatch Canyons ski areas. One is the anticipated reopening of Solitude in Big Cottonwood Canyon, tentatively scheduled for 1977-1978. This would produce a significantly higher increase in skier visits in the Big Cottonwood Canyon area. It is anticipated that Solitude will attract the same basic type of skier who is presently utilizing Brighton.

Another influencing factor would be any significant expansion of existing ski areas. There are tentative plans for increased uphill capacity at Albion Basin at Alta, but no formal plans have been confirmed. There are also tentative plans for major expansion at Snowbird. Plans call for a new, large conference facility, 300 to 400 additional hotel rooms, and five new chair lifts, which would double the present lift capacity to over 10,000 persons per hour. If these developments are completed during the next five years, the growth rate will be significantly increased. Snowbird is anticipating an increase of 80 percent in skier-days and an annual average increase of approximately 13 percent per year for the next five years.

Another factor which could influence the growth rate would be an increase in the utilization of the ski areas during off-peak times. According to information provided by the ski areas, most are currently operating below capacity at all but peak use periods. Snowbird currently has a combined uphill lift capacity of 5,400 persons per hour; it is estimated that at peak periods some 5,000 skiers are on the mountain, compared to about 1,700 skiers during average periods. At Alta, lift capacity is 5,025 skiers per hour; lift ticket sales average about 2,000 per day with over 5,500 per day during peak periods. Brighton has an uphill capacity of 3,650 per hour, and is approximately 40 percent utilized during weekdays and 90 percent utilized on weekends.

Increased utilization at off-peak times would enable an increase in efficiency and would not place nearly the burden on transportation facilities as would an increase in uphill capacity.

TRANSPORTATION IN THE COTTONWOOD CANYONS: EXISTING CONDITIONS

This chapter presents an overview of the current transportation situation in the Cottonwood Canyons. Although the State Department of Transportation (DOT) keeps much data on traffic operation, highway maintenance, accidents, and other relative statistics, there is an absence of the type of data which is most useful for planning purposes--specifically, information on the origins and destination of Canyon visitors and related data pertaining to patterns of travel. The only real information on travel patterns--other than certain marketing-related data held by the ski resorts--is found in the Recreation Area Parking Study conducted by the Utah DOT in December, 1973. The data presented in this report reflect that deficiency.

Existing Canyon Traffic

Traffic volumes have increased dramatically in both of the Cottonwood Canyons in recent years, as shown by the annual average daily traffic (AADT) volumes provided in Table 1 and illustrated in Figure 4. Permanent State Highway Department counting stations on both of the Canyon roads provide almost continuous records of hourly traffic. The average daily traffic volumes recorded by month for 1973, 1975 and 1976, presentted in Table 1, indicate the strong seasonal variation in traffic flow in the Canyons. Monthly ADT volumes in 1975 for Big Cottonwood Canyon ranged from a low of 1,418 in April to a high of 3,564 in July. The lowest monthly ADT volume for Little Cottonwood Canyon was 950 recorded in May, and the highest monthly ADT volume was 4,302 recorded in February. These high and low monthly ADT's illustrate the seasonal differences in use of the two Canyons; Big Cottonwood Canyon receives its highest use during the summer months and Little Cottonwood Canyon experiences greatest use during the winter ski season.

Even more dramatic than the seasonal variation in traffic volumes is the variation by the day of the week and hour of the day. This is illustrated by Figure 5, which shows daily traffic volumes during the 1973-1974 ski season for Little Cottonwood Canyon, and by Tables 2 and 3, which give the hourly volumes recorded during a typical week of the 1974-1975 season for both Big and Little Cottonwood Canyons. The magnitude of the variation in daily traffic volumes is illustrated by the fact that while the annual average daily traffic volume in Little Cottonwood Canyon for 1975 was 2,830 vehicles, there were 29 days during the winter of 1975 in which the volume was over 5,000; and the peak daily volume (recorded January 1, 1975) was 7,986. To illustrate the increasing trend, in the winter of 1974 there were only about eight days with volumes over 5,000 and the peak day (February 2, 1974) volume was 6,515.

Examination of the highest 30 hourly volumes recorded at each of the permanent counting stations in the Cottonwood Canyons reveals some interesting differences. The highest peak hour recorded in Big Cottonwood Canyon in 1973 was 883 and the 30th highest volume (often used as a basis for highway design) was 596. In Little Cottonwood Canyon, the highest peak hour was 1,292 and the 30th highest hourly volume was

TABLE 1

AVERAGE DAILY TRAFFIC VOLUMES

Year	Big Cottonwood Canyon Road (U-152)	Little Cottonwood Canyon Road (U-210)
1967	1544	746
1968	1589	862
1069	1633	1105
1970	2211	1160
1971	2097	1393
1972	2236	2233
1973	2213	2565
1974	2270	2530
1975	2100	2830

Month	1973	1975	1976	1973	1975	1976
January	2065	2262	1905	3533	4073	4776
February	2257	1986	1895	3698	4302	4919
March	1850	1604	1672	3523	3570	4714
April	1240	1418	1451	2778	3243	4084
May	1755	1694	2045	1430	950	1610
June	2671	2298	2855	1796	1871	2174
July	3448	3564	3391	2130	2673	3184
August	3124	3120		2278	2631	
September	2217	2414		2071	2336	
October	1960	1835		1972	2001	
November	1748	1332		2731	2266	
December	2221	1722		2836	4235	

Source: Utah State Department of Transportation, Planning Statistics Section

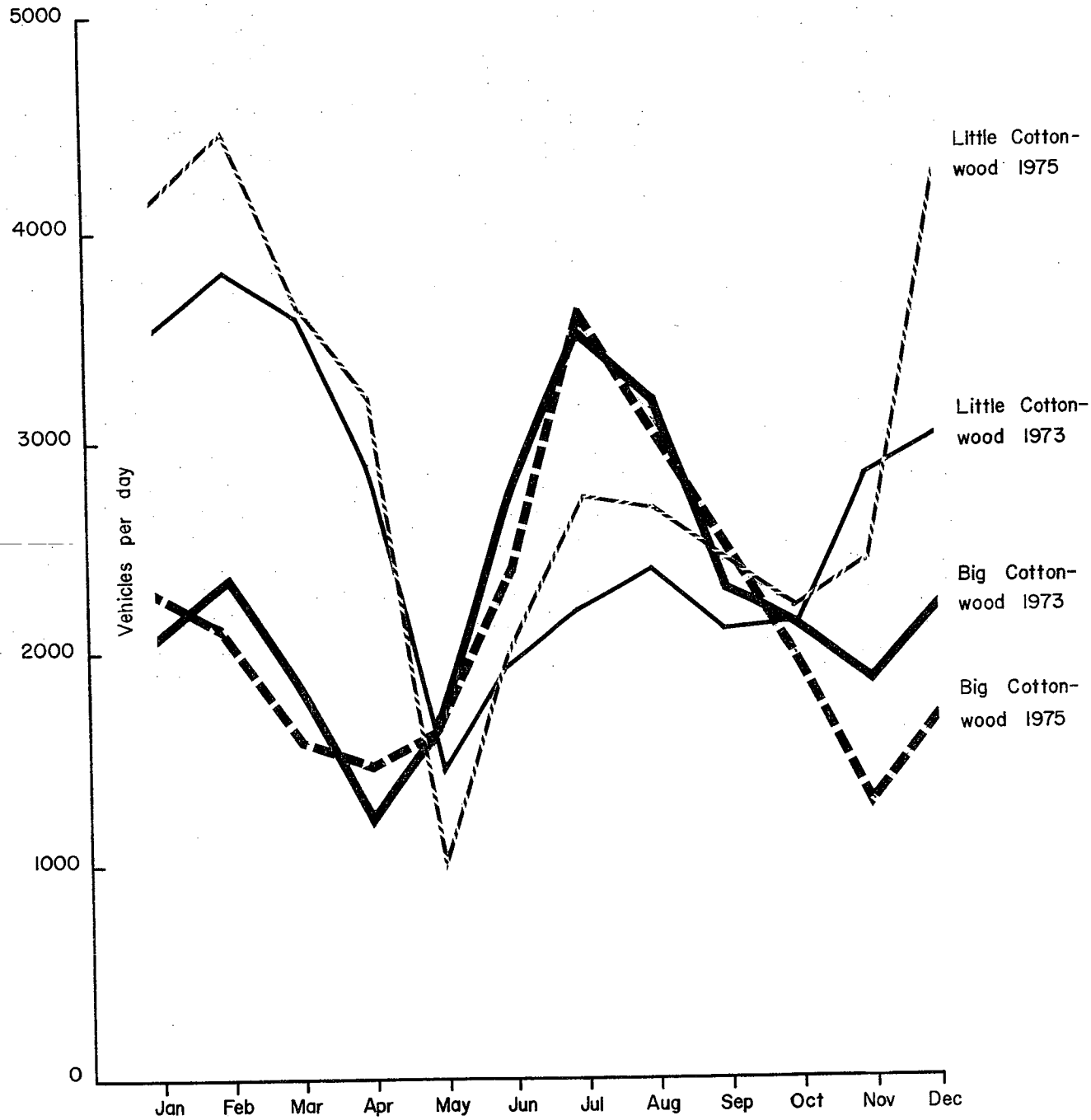


FIGURE 4

AVERAGE DAILY TRAFFIC VOLUMES

BIG & LITTLE COTTONWOOD CANYONS

1973 & 1975

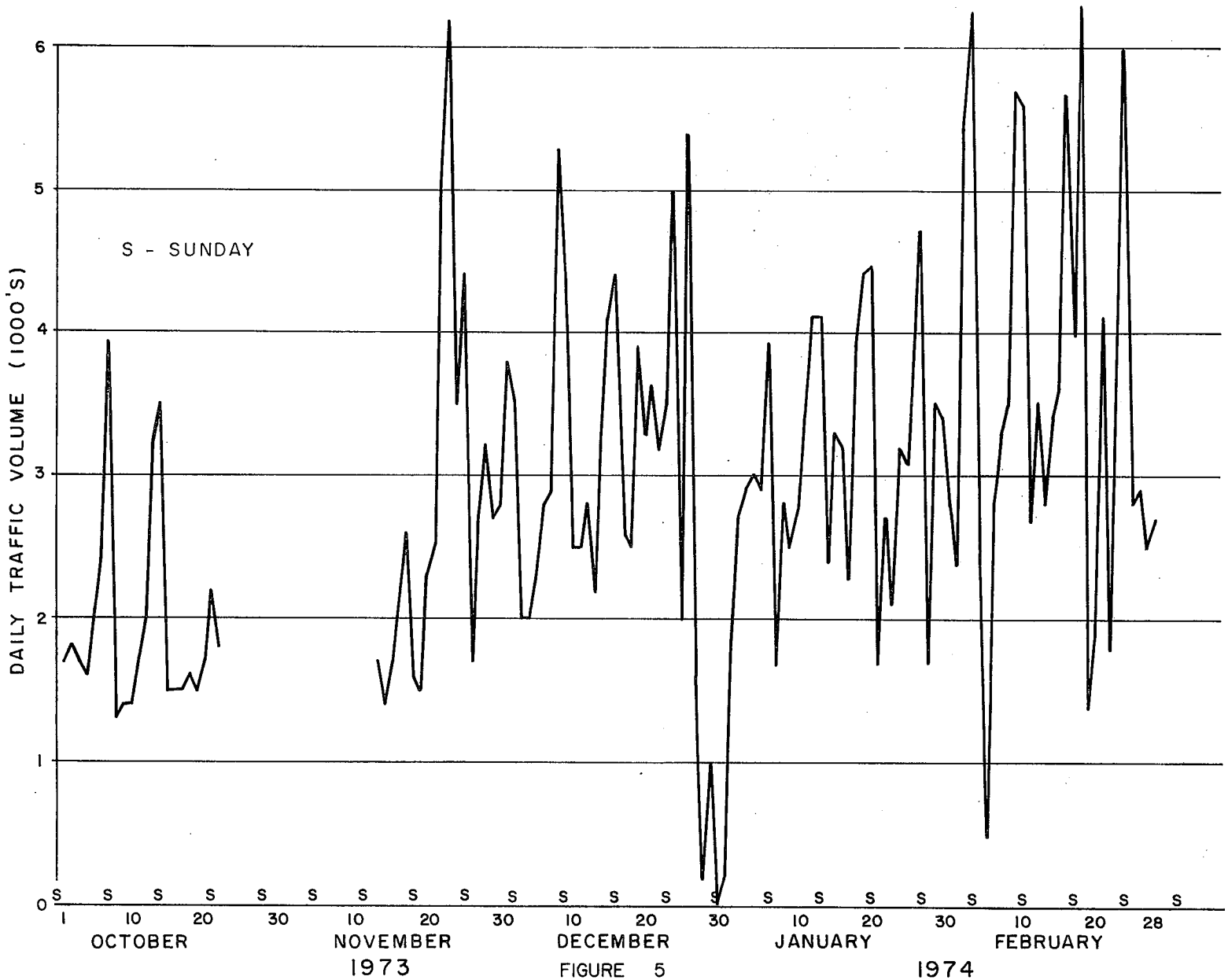


FIGURE 5

DAILY TRAFFIC VOLUMES – LITTLE COTTONWOOD CANYON

TABLE 2

HOURLY TRAFFIC VOLUMES
BIG COTTONWOOD CANYON ROAD

Typical Winter Week
January 19-25, 1976

Hour	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
12-1 AM	25	4	14	3	9	10	25
1-2	12	1	3	5	4	7	18
2-3	5	2	5	2	2	4	11
3-4	2		1	5			3
4-5	1						1
5-6	2		2			1	4
6-7	4	4	2	3	3	5	6
7-8	27	16	18	19	24	24	44
8-9	180	48	46	40	48	57	197
9-10	364	144	94	92	98	109	407
10-11	274	81	90	68	89	76	293
11-12	304	73	84	66	88	64	283
12-1 PM	374	160	127	141	222	184	371
1-2	447	145	133	132	173	222	392
2-3	386	119	94	101	93	77	351
3-4	472	124	116	103	106	98	411
4-5	657	177	183	173	211	203	544
5-6	491	165	97	139	228	253	553
6-7	120	36	39	50	38	50	156
7-8	40	18	41	37	19	57	107
8-9	41	18	36	36	17	27	73
9-10	25	19	43	18	20	39	57
10-11	18	16	22	13	19	42	62
11-12	14	21	16	11	13	57	74
TOTAL	4285	1391	1306	1257	1524	1666	4443

Source: Utah State Department of Transportation, Planning Statistics Section

TABLE 3

HOURLY TRAFFIC VOLUMES
LITTLE COTTONWOOD CANYON ROAD

Typical Winter Week
January 19-25, 1975

Hour	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
12-1 AM	54	10	27	8	13	8	37
1-2	29	6	4	7	7	10	7
2-3	5	8	2	4	2	3	4
3-4	6	3	1	1	2	3	2
4-5	4	1	2	4	2	7	11
5-6	11	10	10	16	16	20	21
6-7	32	34	44	51	89	105	106
7-8	153	125	133	154	195	230	572
8-9	740	286	300	351	435	370	863
9-10	911	270	355	344	359	316	608
10-11	547	212	261	215	277	240	433
11-12	470	187	296	287	309	280	490
12-1 PM	478	255	357	304	275	266	416
1-2	430	188	188	177	223	241	426
2-3	528	220	247	224	300	322	572
3-4	825	370	518	606	593	456	1095
4-5	1238	412	534	445	430	285	889
5-6	480	139	151	128	177	141	199
6-7	170	69	74	109	78	103	125
7-8	74	60	64	59	60	87	107
8-9	49	50	61	71	56	88	119
9-10	52	51	57	67	60	90	93
10-11	40	40	52	53	49	68	80
11-12	34	39	31	38	32	52	63
TOTAL	7360	3045	3769	3723	4039	3791	7338

Source: Utah State Department of Transportation, Planning Statistics Section

724. Of the 30 highest hours in Big Cottonwood Canyon, 12 were on Sundays and nine were on Wednesdays, with 29 occurring in the afternoon, mostly in the hour from 4 to 5 p.m., and 13 of the highest 30 hourly volumes occurred in July. In Little Cottonwood Canyon, 12 of the highest 30 hourly volumes in 1973 occurred on Saturdays, and eight were on Mondays, 25 occurring in the afternoon mostly during the hour from 5 to 6 p.m. The heavy concentration of use during the winter ski season in Little Cottonwood Canyon is illustrated by the fact that 19 of the 30 highest peak hours occurred during the months of January and February. The higher traffic volumes and concentration of daily and hourly peaks during the winter months in Little Cottonwood Canyon illustrate the need to focus planned transportation improvements on the requirements of Little Cottonwood Canyon.

Problems presented by the magnitude of the peak hourly volumes occurring during the ski season are accentuated by the heavy directional nature of these volumes. This is illustrated by the hourly directional volumes given in Table 4, and illustrated in Figure 6, which were recorded during the Recreation Area Parking Study conducted by the State Department of Transportation in 1973. It can be seen from these directional volumes that during peak hours as much as 80 to 90 percent of the traffic may be flowing in one direction: in-bound (up-Canyon) during the morning peak hours and out-bound (down-Canyon) during the afternoon peak hours. This unusually heavy directionality in the traffic flow reduces the total volume which the road might otherwise accommodate given a more even directional split and, therefore, compounds the congestion problem.

Patterns of Travel to the Cottonwood Canyons

Generally, in determining patterns of travel, factors of interest include mode, time and direction of travel, and purpose of trip. In the case of the Cottonwood Canyons, the travel patterns are somewhat simplified as there is little variation in mode or direction. Data from the Utah Winter Sports Ski Industry Study indicate that over 98 percent of Utah residents travel to ski areas by car, and over 86 percent of non-resident skiers used a car (either private or rental) for ski area access from their Utah location. Since Snowbird reports that over 90 percent of their lodgers utilize a mode other than private automobile to reach the lodge, it can be assumed that ski area lodgers represent the major users of other modes for ski area access. The ski area lodgers generally stay an average of about six days, and presumably do not travel the Canyon roads on a daily basis. This means that in excess of 95 percent of the people using the Canyon roads on a given day would be traveling by car.

Direction is not a significant variable in Canyon travel except as it relates to time. Conventional vehicular travel is limited by the road network to merely up-Canyon and down-Canyon. Through travel is possible only by conventional road vehicles in Big Cottonwood Canyon during the summertime when the unimproved road to Park City is open. As might be expected, this constitutes a very small percentage of total Canyon travel. Directional movement of vehicles is thus largely limited to up the Canyon and back down the Canyon, with upward movements predominating in the morning hours and down-Canyon flow predominating in the afternoon.

TABLE 4

HOURLY DIRECTIONAL VOLUMES

Hour	Wednesday 2/14/73 Inbound	Wednesday 2/14/73 Outbound	Saturday 2/17/73 Inbound	Saturday 2/17/73 Outbound
BIG COTTONWOOD CANYON				
8-9 am	49	9	367	12
9-10	122	15	686	60
10-11	71	17	209	92
11-12	50	11	152	56
12-1 pm	109	24	187	183
1-2	59	49	193	206
2-3	37	72	120	173
3-4	26	100	130	263
4-5	26	111	125	381
Total *	549	408	2,169	1,426
LITTLE COTTONWOOD CANYON				
8-9 am	183	17	521	28
9-10	338	35	636	89
10-11	321	34	388	82
11-12	165	34	240	70
12-1 pm	214	38	284	103
1-2	189	87	211	173
2-3	59	146	90	219
3-4	50	202	135	373
4-5	53	503	142	632
Total *	1,461	1,096	2,647	1,769

*Total volumes for 9-hour period (8:00 a.m. -5:00 p.m.). This period generally includes 70-75 percent of the daily traffic volumes in the Canyons during the winter season.

Source: Recreation Area Parking Study, Phase 1, Data Collection, Utah State Department of Highways, December 1973.

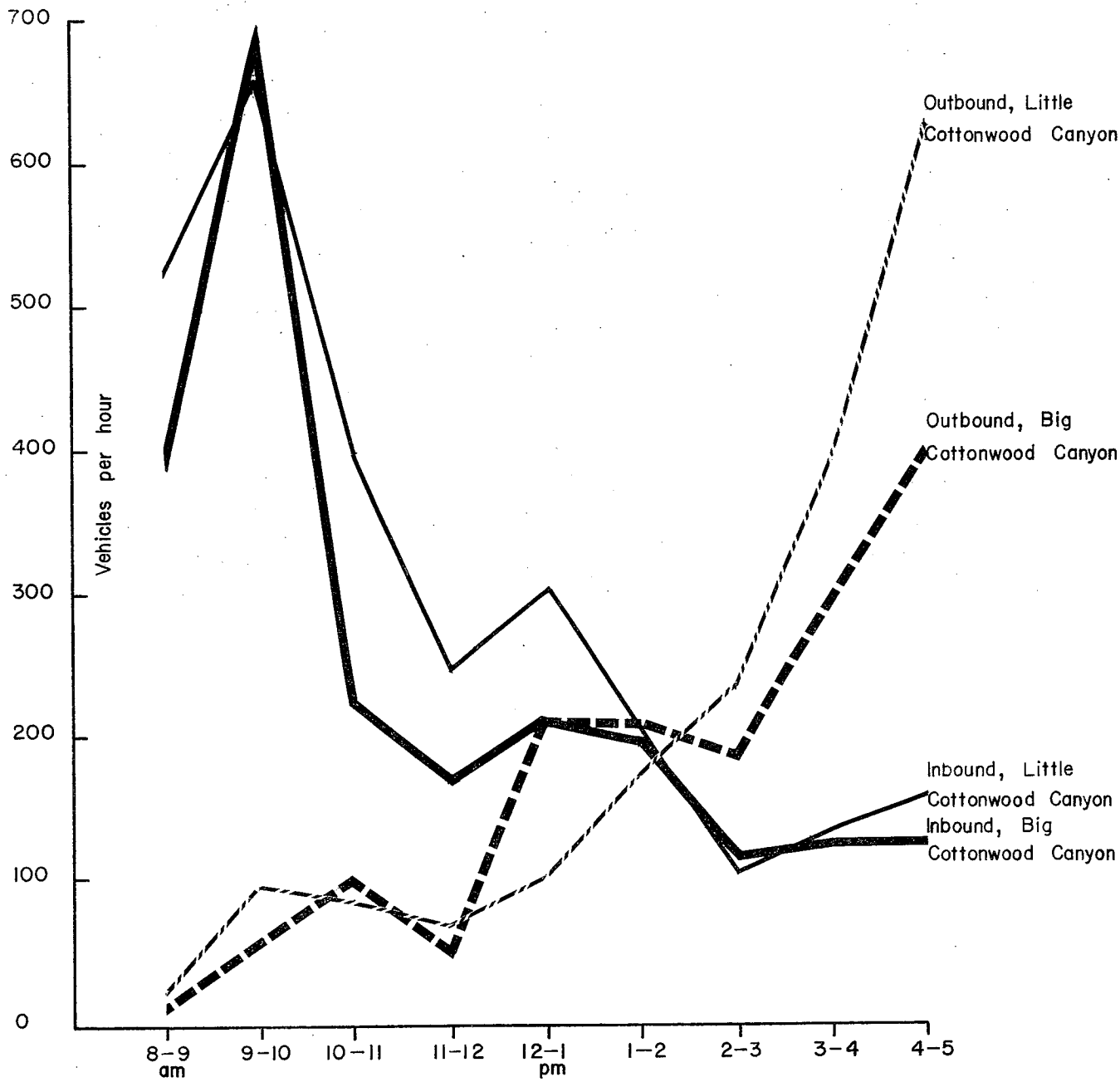


FIGURE 6

HOURLY DIRECTIONAL VOLUMES

BIG & LITTLE COTTONWOOD CANYONS

Saturday, February 17, 1973

Responses to the postcard survey of persons entering the Cottonwood Canyons, conducted by the Utah State Department of Transportation in February, 1973, illustrate the dominance of the ski areas as destinations. Over 90 percent of respondents in Big Cottonwood Canyon were destined for Brighton (57.6 percent) or Solitude (32.7 percent), and 97.2 percent of respondents in Little Cottonwood Canyon were destined for Alta (54.4 percent) or Snowbird (42.8 percent). This postcard survey was conducted in conjunction with a Canyon study coordinated by the Wasatch Front Regional Council.

Because of the dominance of the automobile as a travel mode, traffic volumes on the Canyon roads provide an accurate representation of the time variations over the course of a day for Canyon travel. Average daily traffic (ADT) volumes exhibit a strong seasonal variation, with volumes in Little Cottonwood Canyon showing much greater variation from month-to-month than the volumes in Big Cottonwood Canyon. Traffic volumes in Little Cottonwood Canyon during peak winter months are nearly twice as high as monthly ADT volumes during the summer; however, in Big Cottonwood Canyon the highest monthly ADT volumes occur during the summer months. More pronounced than the seasonal variation is the variation by day of the week and hour of the day. Weekend volumes are generally much higher than weekday volumes with a more pronounced difference in the winter months. The hourly pattern is very pronounced during the winter months, reflecting the ski lift operating hours. Traffic volumes are extremely heavy from 9 to 11 a.m. and 4 to 6 p.m., during weekends in particular. The heaviest morning volumes generally occur on Saturdays, with the heaviest afternoon volumes usually occurring on Sunday afternoons.

Directional traffic counts taken in February, 1973, by the State Department of Transportation, indicate that over 90 percent of the morning peak hour traffic is in the in-bound (up-Canyon) direction. Unfortunately, the counts were terminated at 5 p.m. during the middle of the afternoon peak, so the exact split during the afternoon peak is not determinable. However, the trend indicates that afternoon peak hour traffic would have shown a directional split close to 90 percent out-bound (down-Canyon). In the case of the Cottonwood Canyons during the winter months, determining trip purpose is really a matter of identifying Canyon travelers. Responses to the February postcard survey confirm that the predominant trip purpose of Canyon travelers (69.2 percent in Big Cottonwood Canyon and 76.0 percent in Little Cottonwood Canyon) is skiing. During the winter months, over 90 percent of the travel on Canyon roads is by skiers and Canyon employees. For travel pattern purposes, skiers are best divided into three types:

1. Utah Residents--almost all resident skiers are day skiers who travel to and from the ski area on the day they ski, and 98 percent of these use automobiles as their access mode;
2. Non-Resident Day Skiers--these are non-residents of Utah who generally stay in Salt Lake Valley and travel to the ski areas each day they ski. Most of these skiers use private automobiles or rental cars as their access mode, but a significant number staying in the downtown area used bus transportation

when it was provided in past years by the Salt Lake Transportation Company to Snowbird and Alta;

3. Ski Area Lodgers--these are primarily non-resident skiers who stay in the lodges at the resorts and do not travel up and down the Canyons on a daily basis. These skiers historically have used taxis, limos, buses or helicopters to reach the ski areas, as well as private and rental automobiles.

Employees in the Canyons constitute a significant portion of the travel volumes, particularly in Little Cottonwood Canyon. "Work" was the stated trip purpose of 6.3 percent of survey respondents in Big Cottonwood Canyon, according to the Recreation Area Parking Study. During the winter season, there are some 1,125 people employed at Snowbird and Alta. Of these, 425 live in the Canyon, and about 700 commute on a daily basis. Employees living in the Canyon make only occasional trips up and down the Canyon, but those commuting made a round trip every day, generally coincident with or slightly before (a.m.) or after (p.m.) the peak travel times.

Public Transportation Service

Only limited transit service has been available in recent years in the Cottonwood Canyons. The Salt Lake Transportation Company was franchised through Spring, 1976, to operate regularly scheduled service in both of the Cottonwood Canyons, and Lewis Brothers' Stages is franchised to serve between the Cottonwood Canyons and Park City. Due to a Public Services Commission ruling permitting the operator to cancel trips not attracting at least six riders, scheduled service to Big Cottonwood Canyon has been practically non-existent. During the 1974-1975 ski season, the Salt Lake Transportation Company operated four regularly scheduled round-trips per day between the Salt Lake International Airport and the Snowbird and Alta ski areas in Little Cottonwood Canyon. These runs also served the downtown bus terminal and other in-route locations. Lewis Brothers' Stages operated two regularly scheduled round-trips per day between Park City and Alta/Snowbird during the 1974-1975 ski season. No scheduled transit service has been available during summer months to the Cottonwood Canyons.

Transit fares (one-way) during winter 1974-1975 were as follows:

- Airport to Alta/Snowbird	$5.00
- Downtown Salt Lake City to Alta/Snowbird	1.75
- University of Utah to Alta/Snowbird	1.25
- Park City to Alta/Snowbird	4.00

During the early part of the 1974-1975 season, the Salt Lake Transportation Company also provided shuttle service between Alta and Snowbird, operating on a 20- to 30-minute headway. When a competing service was

initiated by the Sandy, Alta, West Jordan Taxicab Company, this shuttle service was abandoned by Salt Lake Transportation Company.

The Salt Lake Transportation Company reports that patronage during 1974-1975 on the Airport/Downtown to Alta/Snowbird service was 500-800 passengers per week. About 20 percent of the ski area transit trips are to and from the airport; about 60 percent are to or from downtown, and about 20 percent are to or from intermediate points such as the University of Utah. During the 1973-1974 season when the Alta/Snowbird shuttle was operated the entire season, a total of 18,100 passengers (about 150 passengers per day) were carried on the shuttle service.

In 1976, the Utah Transit Authority (UTA), acting upon recommendations from the Immediate Action Program phase of the Wasatch Canyons Transportation Study, purchased certain franchise rights from the Salt Lake Transportation company allowing the provision of UTA services to the Cottonwood Canyons. This service began late in the 1975-1976 ski season, under an arrangement using existing Salt Lake Transportation Company equipment and operators. While this arrangement was not wholly satisfactory, the purchase of the Canyon operating rights by UTA has set the stage for a full schedule of UTA services to the Canyons to be initiated with the beginning of the 1976-1977 ski season.

Transportation Problems in the Cottonwood Canyons

Current transportation problems in Big and Little Cottonwood Canyons can be summarized as follows:

- The number of vehicles using the Canyon roads (especially Little Cottonwood) often exceeds the design capacity of the roadways.
- Winter parking demand frequently exceeds parking capacity in the Canyons.
- Weather conditions and avalanches create road safety problems and road closures.

While these problems exist to some degree in both Canyons, they are more severe in Little Cottonwood Canyon because of higher winter usage, more pronounced peaking of traffic volumes and a much greater threat of avalanches. Volumes in Little Cottonwood Canyon have been growing at an increased rate in recent years subsequent to the opening of the Snowbird Resort.

The traffic volume problem stems not so much from the total vehicular traffic on these canyon roads, but from the fact that a disproportionate amount of the traffic is concentrated on winter weekends and during morning and evening peak hours. Daily traffic volumes in Big Cottonwood Canyon are similar for summer and winter days. However, the volumes during the winter present a greater problem because of road conditions and the sharper peaking resulting from the desire of skiers to coordinate their travel with ski lift operating hours. In Little Cottonwood Canyon, traffic volumes during winter weekends are much greater than those experienced on summer weekends and in recent years have become considerably heavier than those experienced during the winter in Big Cottonwood Canyon.

The roads in both Canyons are relatively narrow, winding, two-lane roads, traversing rather steep grades over most of their lengths. Both Canyon roads have a paved width of approximately 22 feet and neither has any three-lane sections or designated turnouts to facilitate passing. These factors severely restrict the capacity of the Canyon roads to safely and efficiently handle peak traffic volumes.

In traffic engineering terms, the capacity of a highway is defined as the maximum volume of traffic which it can be expected to carry at a given level of service over a given period of time such as one hour or one day. The Utah State Department of Transportation, in the Recreation Area Parking Study (December 1973), estimated the theoretical capacity of Big and Little Cottonwood Canyon roads at 497 and 336 vehicles per hour per direction, respectively. These estimates of theoretical capacity are presumably based on a level of service which the Department of Transportation feels represents acceptable conditions for recreation-oriented highways in mountainous terrain. Based on these estimates of hourly one-direction capacity, traffic counts during the past several ski seasons have indicated that the capacity of Little Cottonwood Canyon Road was substantially exceeded from two to four hours per day on virtually all weekends and holidays and many weekdays during the ski season.

The practical capacity of the Canyon roads may be somewhat higher than the Utah DOT figures indicate if a level of service more accurately reflecting the realities of traffic flow in the Canyons were used to calculate hourly roadway capacity. In any event, it is clear that the Cottonwood Canyon roads--especially Little Cottonwood Canyon--carry excessive traffic volumes which in turn create significant congestion, delay and hazardous driving conditions.

In addition to the problems which the excessive peak-hour traffic volumes create for highway users, they also may have serious negative impacts on the environment of the Canyons. The vehicles using the Canyon roads produce air, noise and even water pollution. The polluting is magnified by congestion which intensifies noise and increases the rate of pollutants emitted into the air per vehicle-mile of travel. The correlations between vehicular volume and environmental impact are presently being researched as part of the 208 Study.

The parking problem in the Canyons is also intensified during the ski season. Most skiers are in the Canyons for extended periods during the day and leave their vehicles parked for at least several hours. This high demand for parking during the ski season, and the restrictive use of available facilities imposed by snow conditions, result in significant parking problems during winter weekends. Parking facilities in Little Cottonwood Canyon include: 25 spaces at Albion Basin; 1240 spaces at Snowbird, and 1200 spaces at Alta. During the winter not all of this parking has been available, and occasionally there are as few as 650 useable parking spaces. Since the average occupancy per vehicle is approximately 2.5 to 2.7 persons, the Canyon parking facilities, on the "best" days, have accommodated some 6,100 to 6,600 persons.

The insufficiency of parking capacity, particularly in Little Cottonwood Canyon, results in use of inappropriate or inadequate locations for parking,

often infringing on the use of roads and driveways for traffic circulation. This is especially true near the mouth of the Canyon where vehicles are parked beside the road for carpooling and to facilitate hitch-hiking.

The provision of adequate parking capacity in the Canyon presents significant problems. Surface parking facilities consume large amounts of space, and parking structures are an expensive means to resolve problems that occur only 40 to 50 days per year. Both types of facilities pose negative aesthetic impacts to the Canyon environment, and increased parking facilities represent increased runoff problems and potential for stream pollution. Also, increased parking facilities could encourage increased use of a highway whose capacity is already frequently exceeded.

Weather conditions and avalanches constitute both a safety problem and a convenience problem. Snow and icy conditions frequently make travel on the Canyon roads quite hazardous. This is accentuated by the presence of vehicles which are not equipped with snow tires or chains, although this situation may be alleviated by strict enforcement of the ordinance prohibiting use of Canyon roads during the winter season by ill-equipped or "nonwinterized" vehicles.

While avalanches are perceived to be a major hazard to road use, particularly in Little Cottonwood Canyon, they have in fact proven to be more of an inconvenience problem than a safety hazard. This is because avalanches are effectively controlled by the Forest Service through intentional initiation at predetermined times. However, even controlled initiation of avalanches often results in extensive road closures. Although efforts are made to minimize the impact of these closures, they represent a significant inconvenience to Canyon visitors.

The safety hazard posed by winter weather conditions on the steep, winding, narrow Canyon roads is evidenced by the Utah State Department of Highways accident statistics presented in Table 5. The accident rates reported for both Cottonwood Canyon roads are substantially higher than the overall rates for Federal Aid Secondary Highways in Utah. In addition to causing property damage, injuries and death, accidents often create major traffic blockages, resulting in long delays to road users. Vehicles immobilized by ice or snow also can cause major traffic tie-ups. These tie-ups are often extensive enough to result in visitors missing airplane connections.

* * * * *

TABLE 5

TRAFFIC ACCIDENTS AND ACCIDENT RATES

Location	Length (miles)	Year	Number of Accidents: Injury	Fatal	Property Damage	Total	Accident Rate*
Big Cottonwood Canyon Road (State Route 152) Wasatch Forest Boundary to Brighton, including Brighton Loop	14.2	1972	20	1	49	70	9.26
		1973	14	1	40	55	6.77
		1974	38	1	45	84	10.42
Little Cottonwood Canyon Road (State Route 210) Wasatch Forest Boundary to Alta	8.5	1972	26	0	47	73	17.70
		1973	16	2	39	57	8.22
		1974	23	0	39	62	8.40

Accident rates for all Federal Aid Secondary Highways in Utah for these years were:

1972	6.08
1973	5.99
1974	44.58

* Number of accidents per million vehicle miles.

Source: Utah Traffic Accidents and Accident Rates 1972, 1973, 1974. Utah State Department of Highways.

GUIDELINES FOR SHORT-RANGE TRANSPORTATION PLANNING

Time Frame

The Immediate Action Plan for transportation in the Wasatch Canyons, submitted in November, 1975, recommended transportation improvements for the 1975-1976 season. These recommendations, including interim measures to improve public transit to Big and Little Cottonwood Canyons, have been in the process of implementation since winter, 1976. The Short-Range Improvement Program is assumed to cover a five-year period, beginning with the 1976-1977 season and concluding with the 1980-1981 season. Thus, the recommendations for transportation improvements included in this Short-Range Program will be staged over a five-year period to facilitate incremental implementation.

This five-year time frame is considered to be an appropriate period for various transportation schemes to be developed, primarily based on low capital-intensive approaches. During the early part of this period, it is expected that long-range plans for the growth and development of the Canyons will be formulated, reviewed and adopted by private groups, governmental agencies and the public in Salt Lake County. Long-range transportation system development, which may or may not involve extensive capital-intensive system construction, will depend essentially on the course which is determined for future Canyon development. The Short-Range Program will be designed to lead into the longer-range concept; even if little or no growth is allowed, there are substantial improvements which could be made to help alleviate some of the transportation-related problems that presently occur in the Canyons. The recommendations which are developed in the Short-Range Program will be aimed at the access requirements associated with assumed levels of Canyon activity during this five-year planning period.

Canyon Development, Land use and Activity Patterns

Certain assumptions are necessary in order for the Short-Range Improvement Program and resulting recommendations to most accurately reflect expected land use and activity patterns and general planning constraints in the Wasatch Canyons over the five-year planning period. These planning guidelines fall into the following categories:

- Canyon Priorities for Transportation Planning
- Public Transit Operation and Management
- Development in the Canyons
- Transportation System Investment
- Public Agency Roles

Preliminary assumptions and policy guidelines discussed in this report are those which will have some effect on the development of the five-year transportation plan. These guidelines, according to the above categories, are as follows:

Canyon Priorities for Transportation Planning. As described earlier in this report, Emigration, Parley's, Mill Creek, and Big and Little Cottonwood Canyons have significant traffic volumes. However, only Little Cottonwood Canyon and, to some extent, Big Cottonwood Canyon have experienced problems related to access and circulation. While the other Canyons may, in the future, experience growth or land use changes which create significant transportation-related problems, it is assumed that no such changes will occur in the five-year time frame of the Short-Range Improvement Program. Thus, the priority for Canyon transportation planning will be with Big and Little Cottonwood Canyons for the five-year program.

Public Transit Operation and Management. It is assumed that the Utah Transit Authority (UTA) will have ultimate responsibility for planning and implementing public transit systems in Big and Little Cottonwood Canyons. With the recent purchase of Canyon franchise rights by UTA from the existing private operator, it will be appropriate to presume that all transit improvements are to be the responsibility of the Utah Transit Authority and that no private franchise holder will be involved.

Private Development in the Canyons. Through discussion with various agencies, including the Salt Lake County Planning Departments, the U.S. Forest Service, the County "208" Study, and others, it has been determined that little significant development will occur in Big or Little Cottonwood Canyons during the five-year time frame for the Short-Range Improvement Program. This includes major new developments as well as significant additions to or changes in existing developments. This assumption covers both development of recreational facilities and residential/commercial facilities. Although Snowbird and Alta have planned additional ski area and commercial development--some quite extensive--no such plans have been approved to date by the relevant agencies. With the exception of one additional chair lift--roughly paralleling the lower portion of the Snowbird aerial tramway--which should be in operation by the 1976-1977 ski season, no further improvements other than minor changes/additions have been scheduled at either Alta or Snowbird.

It should be noted, however, that Snowbird is presently preparing plans for the development of a large conference facility, 300 to 400 additional hotel rooms and five new chair lifts. Improvements to the transportation systems which are recommended as part of the Wasatch Canyons Transportation Study will include the ability to respond to such development in Little Cottonwood Canyon. In addition, planning will take into account the probable reopening of Solitude which will place the use of Big Cottonwood Canyon at a level considerably greater than the present level.

It is important to note that significant changes in the transportation system serving Little Cottonwood Canyon could provide an impetus for increased development of the Canyon. Representatives of the ski areas have indicated that increases in access

capacity could spur resort expansion if such plans could be made compatible with acceptable levels of use. That is, there may be a definite distinction in the holding capacity of the Canyons when expressed in terms of human use as opposed to vehicular use. While such correlations are still unproven, it is clear that future development could well be a function of improved access.

Transportation System Investment. Planning guidelines in this category serve to constrain transportation system design in order for such design to be compatible with the assumptions for five-year development and land use in the Canyons. Since no significant growth or alterations to existing land uses are anticipated during the planning period for the Short-Range Improvement Program, it is realistically expected that a capital-intensive, fixed-guideway access system will be a longer-range system candidate for the Cottonwood Canyons. The objective of the Short-Range Program will be to anticipate the probable future consideration of high-technology systems for access-circulation in the Cottonwood Canyons; thus, all planning for bus systems, staging area development, and modal interchange facilities will be accomplished with the provision for future accommodation of at-grade or aerial transit system development. (The objective of the Long-Range Development Plan for transportation in the Canyons will be to conceptualize various alternative systems which can, as conditions dictate, replace reliance on buses and private vehicles for access with fixed-facility transit systems or other high-technology modes.)

Public Agency Roles. A major consideration in short-range transportation planning for the Canyons is the role various public agencies will assume, especially with respect to the design, implementation, and operation of systems and facilities recommended as part of the Short-Range Improvement Program. As stated earlier, it will be assumed that UTA will have ultimate responsibility for transit operations in the Cottonwood Canyons. It is likely that other responsibilities, including the development of staging areas and/or modal transfer facilities, will be coordinated by the Wasatch Front Regional Council as part of requirements for development of the regional transit improvement program and transportation systems management plans. Additionally, it is possible that some recommendations may include the assumed participation of private interests in cooperation with public agencies. Again, it is assumed that the Wasatch Front Regional Council will be in a coordinating role for development of modal transfer facilities, with regional planning input provided by Salt Lake County and cooperation by the State or local municipalities where either state-owned or city-owned land may be involved. Coordination of private development interests, where such roles are defined, will be assumed to be the responsibility of the County.

Short-Range Transportation Plan: Program Components

The following sections of this report describe the program components which are recommended as part of the Short-Range Transportation Plan.

Although the Plan is a five-year plan, it is recommended that most of the improvements be undertaken during the first two years, and that during the final three years of the program necessary changes and "fine-tuning" be conducted based on the operating experience gained during the initial program years.

Major components of the program include scheduled UTA transit service to Big and Little Cottonwood Canyons from Salt Lake Valley; the development of a modal transfer/remote parking facility; and minor but necessary roadway and other physical improvements to facilitate the influx of buses up the Canyon roads.

The overall bus service package is dependent upon the recommendation for the development of the modal transfer facility where Canyon-bound users could park their automobiles and board UTA buses destined for Big and Little Cottonwood Canyons. The concepts underlying the proposal for this facility are presented in the following chapter of this report, together with preliminary sketches of the recommended configuration for the facility broken down into three development phases.

* * * * *

THE SALT LAKE/CANYONS TRANSIT CENTER

An integral part of the public transit service package for the Canyons of the Wasatch Front is the development of a specific facility in Salt Lake Valley where Canyon users can leave their automobiles and catch UTA Canyon-bound buses. It is envisioned that such a facility would serve as a Canyon transit depot only as its secondary function--during weekdays its primary function would be as a park-and-ride lot, part of the proposed UTA system of express bus and park-and-ride service from various areas of Salt Lake Valley to downtown. On winter weekends, however, its primary function would be as a readily identifiable center for ski area access, including such possible amenities as lift ticket sales, ski rentals, lockers and restroom facilities, convenience retail and food facilities. (Of course, it would still function in this capacity on weekdays, while also serving commuter park-and-ride trips.)

A set of design criteria and a possible phasing program has been developed for the proposed Salt Lake/Canyons Transit Center (SL/CTC). Phase I calls for the development of a "skeletal" facility for Canyon park-and-ride uses. Since no significant construction is required for Phase I, it should be able to be in operation by the start of the 1977-1978 ski season. Recommendations for possible sites in Salt Lake Valley were forwarded to the Wasatch Front Regional Council in a memorandum from PBQ&D, Inc., dated June 4, 1976. It is important to note that several of the proposed transit services are based on the existence of a transfer facility; thus, the development of the SL/CTC (or a like facility) should represent an important priority in Short-Range Transportation Planning for Canyon access.

Design Criteria

The Study has resulted in the identification of a set of design criteria for development of the Salt Lake/Canyons Transit Center. In addition, prototypical site layouts and sketches of each of the three phases have been included to demonstrate both the proposed staging plan and the associated uses and costs tied to each phase of development. The basic requirements of the transfer facility are as follows:

- Location at an intersection of arterial streets or arterial street and freeway in order to provide proper access for both bus and auto traffic
- Location north of Big Cottonwood Canyon to minimize "back tracking" of riders from Salt Lake City
- Provision of loading capacity that can expand to 1200 people per hour, with headways at peak periods of under five minutes
- Provision for UTA ticketing, information and support offices
- Provision for UTA service covering local residential areas to stop at the SL/CTC, to encourage local residents to use public transit for home-to-Canyon trips

- Provision for recreational services, ticketing, information, and support offices. The ski operators will provide personnel to handle lift ticket sales and ski area information; the Forest Service could establish an office for fire and camping permits, trail maps, etc.

- Provision for locker and restroom facilities for skiers and hikers

- Provision for long-term parking for at least 1200 cars, possibly in conjunction with school or shopping center parking

- Provision for appropriate commercial/retail facilities such as ski/sports shop, restaurant, bank, drug store, etc.

Prototype Development and Phasing

Phase I: Salt Lake/Canyons Transit Center

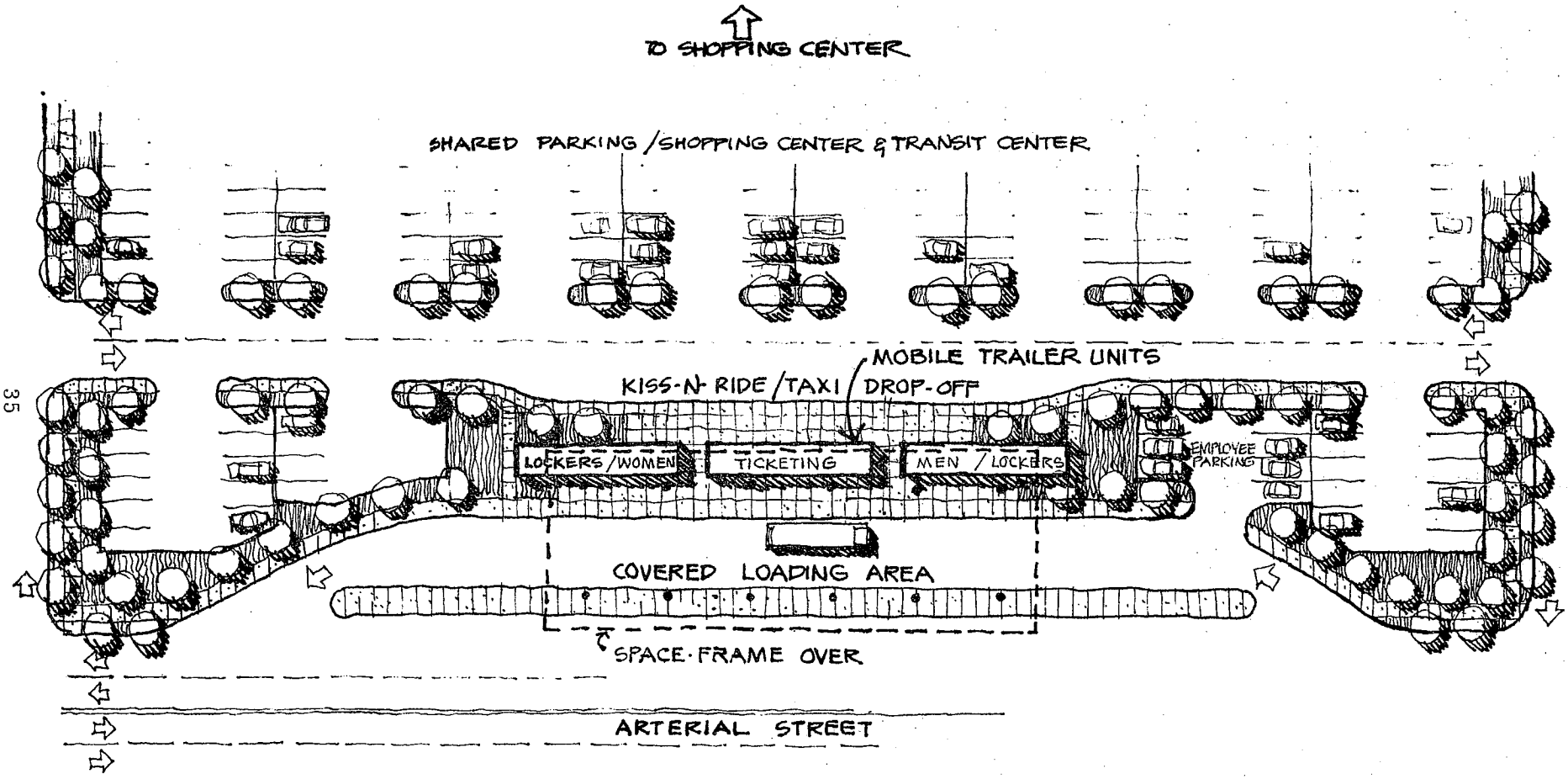
Figures 7 and 8 show a facility that could be in operation by the 1977-1978 ski season. It provides bus circulation and loading areas adequate to expand to the heaviest demands of a long-term facility. A simple right-hand turn-out provides safe and easy maneuvers for the buses with all curb loading under the cover of a space frame.

The "space frame" proposed is a theme structure as well as an amenity. It is a graceful and unique structure which will provide a readily identifiable symbol for this new Canyon area bus service. The space frame is easy and fast to assemble so it conforms to the time requirement for a short-term operation ready for next ski season. The space frame and bus circulation and loading area can remain the same throughout the life of the project (the space frame expands two bays in Phase III) so that the pattern of use does not have to be modified.

The ticketing, restroom, and locker facilities are provided by three mobile trailer units. These are available on short notice and provide a perfect solution for a start-up program that does not require heavy initial capital expenditure. Strong graphics developed for the three units and/or some wood finish detailing could give these temporary units a pleasing and substantial appearance.

Passenger drop-off by private auto or taxi would be on the "in-board" side of the facility with a drop-off lane developed from a secondary road in the parking lot.

The site itself could be at a shopping center, with the transit facility located adjacent to an arterial street. Thus, the parking lies between the shopping and transit facilities, and so utilizes the fringe parking of the retail development. A school or library site could be used, but the future commercial, office, retail potential of the SL/CTC favors a shopping center location. Also, a shopping center would be a more frequent destination for local transit riders and so provides a more useful location for UTA service.



SL/CTC : SALT LAKE/CANYONS TRANSIT CENTER : PBQ&D, Inc.
GROUND LEVEL PLAN/ PHASE I
ENGINEERS, NO SCALE
sd.

Figure 7

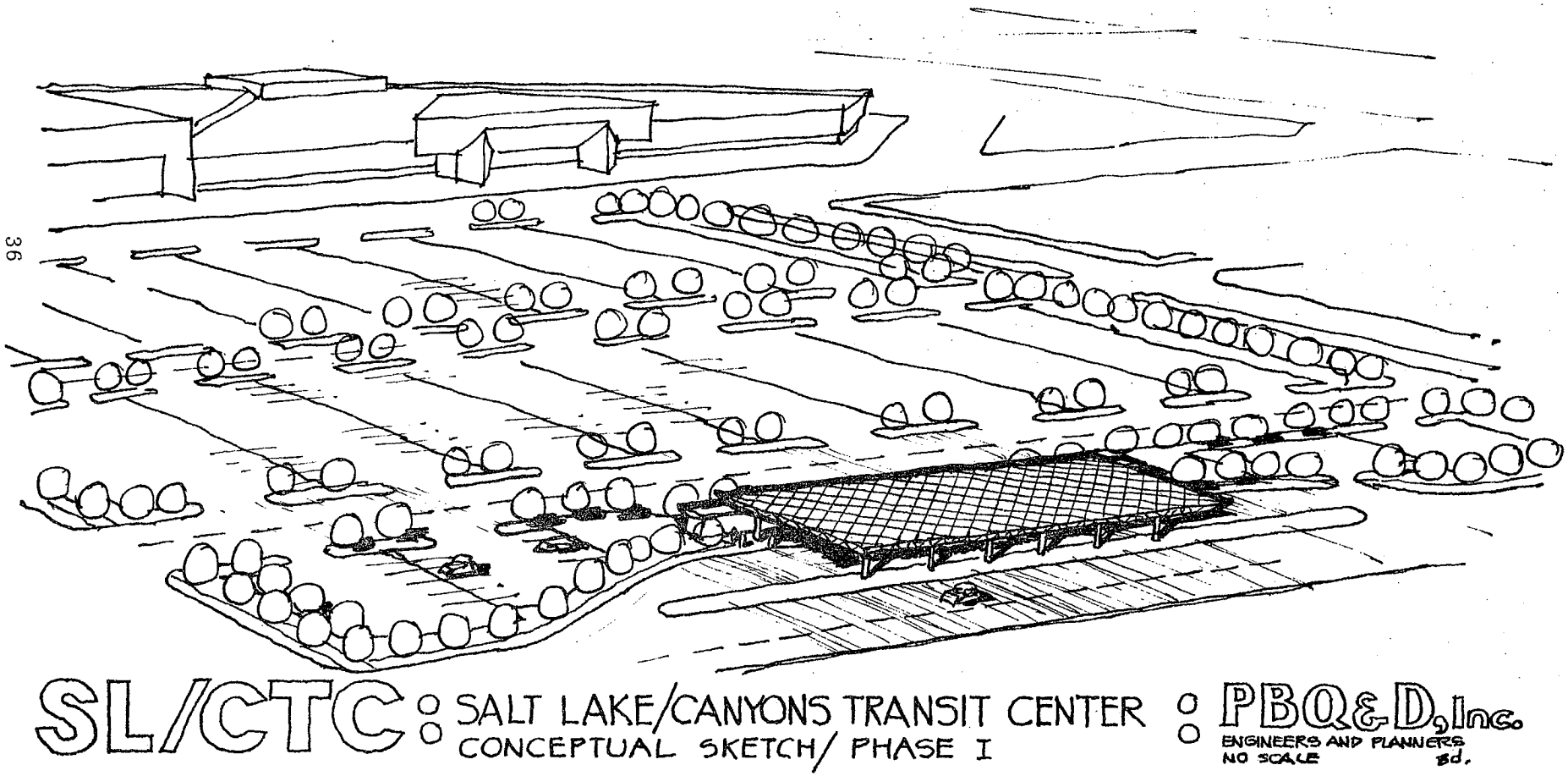

SL/CTC: SALT LAKE/CANYONS TRANSIT CENTER
CONCEPTUAL SKETCH/ PHASE I
PBQ&D, Inc.
ENGINEERS AND PLANNERS
NO SCALE
Bd.

Figure 8

The estimated cost for Phase I is $156,000, including contingencies and professional fees. Cost of land is not included. The breakout is as follows:

Mobile Trailers (3)	$43,000	
Special Finishes/Detailing	10,000	
Space Frame Cover	49,000	($18,000 if one lane only)
Landscaping	10,000	
Paving	18,000	
SUBTOTAL	$130,000	($99,000)
Contingenices	13,000	(9,900)
Professional Fees	13,000	(9,900)
TOTAL COST	$156,000	($118,800) (excluding land)

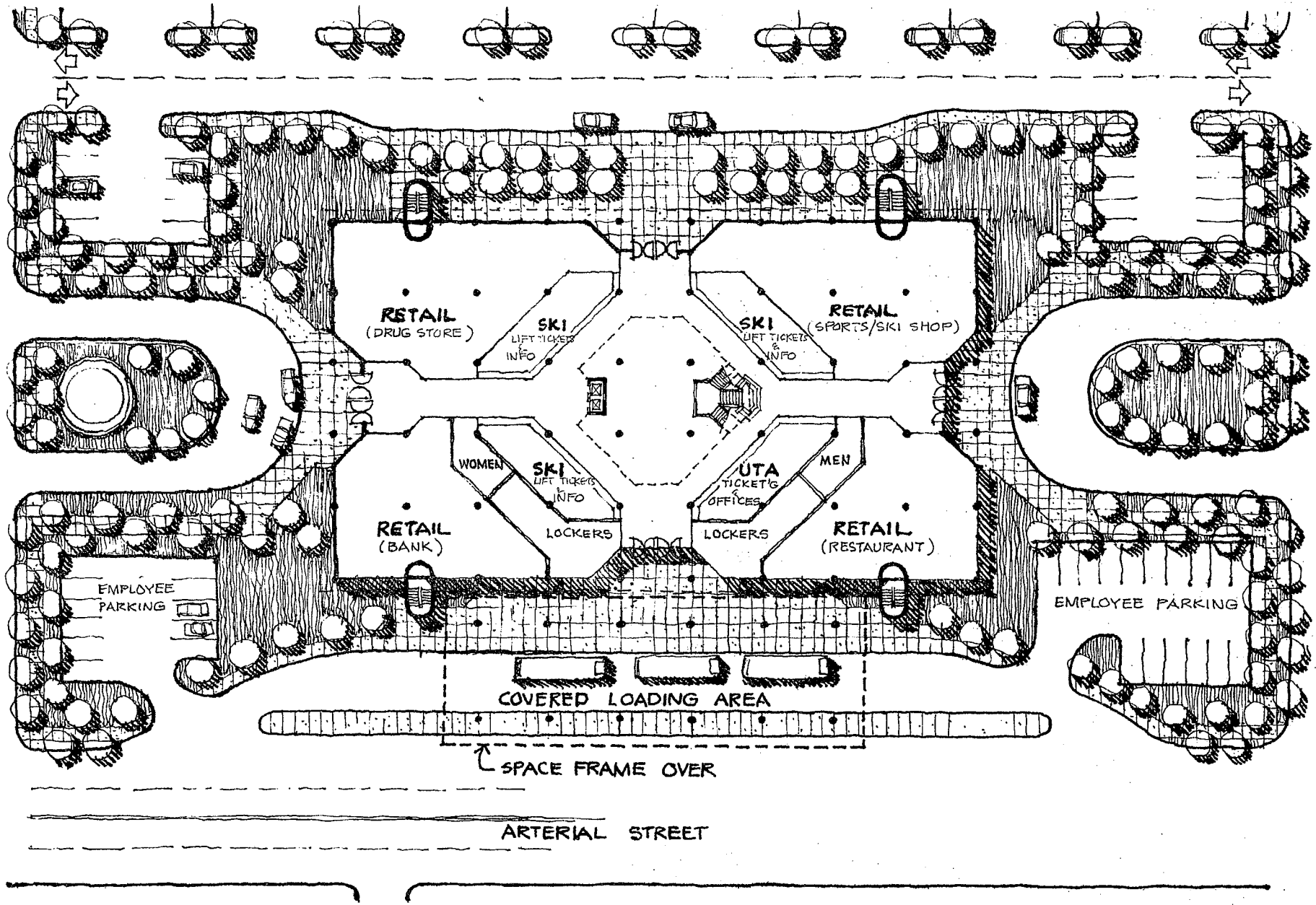
Phase II: Salt Lake/Canyon Transit Center

Figures 9 and 10 illustrate the next phase of development which envisions a two-story facility that would be erected "in-board" of the space frame. This would allow construction to proceed without shutting down the temporary facilities. Drop-off areas would operate from two new drive-up loops planned for the ends of the new SL/CTC. These loops would be constructed before the Center was started so that access to the Phase I facility would not be blocked.

With a permanent facility, each ski area could have its own sales and information counter and small office. The increasing ridership generated would also make the SL/CTC a perfect location for a sports and ski shop, restaurants, and other uses such as a bank, drugstore, etc. The second floor could be offices and/or other retail uses, depending on the market.

The estimated cost for Phase II is $2,950,000, including contingencies and professional fees. Cost of land is not included. The breakout is as follows:

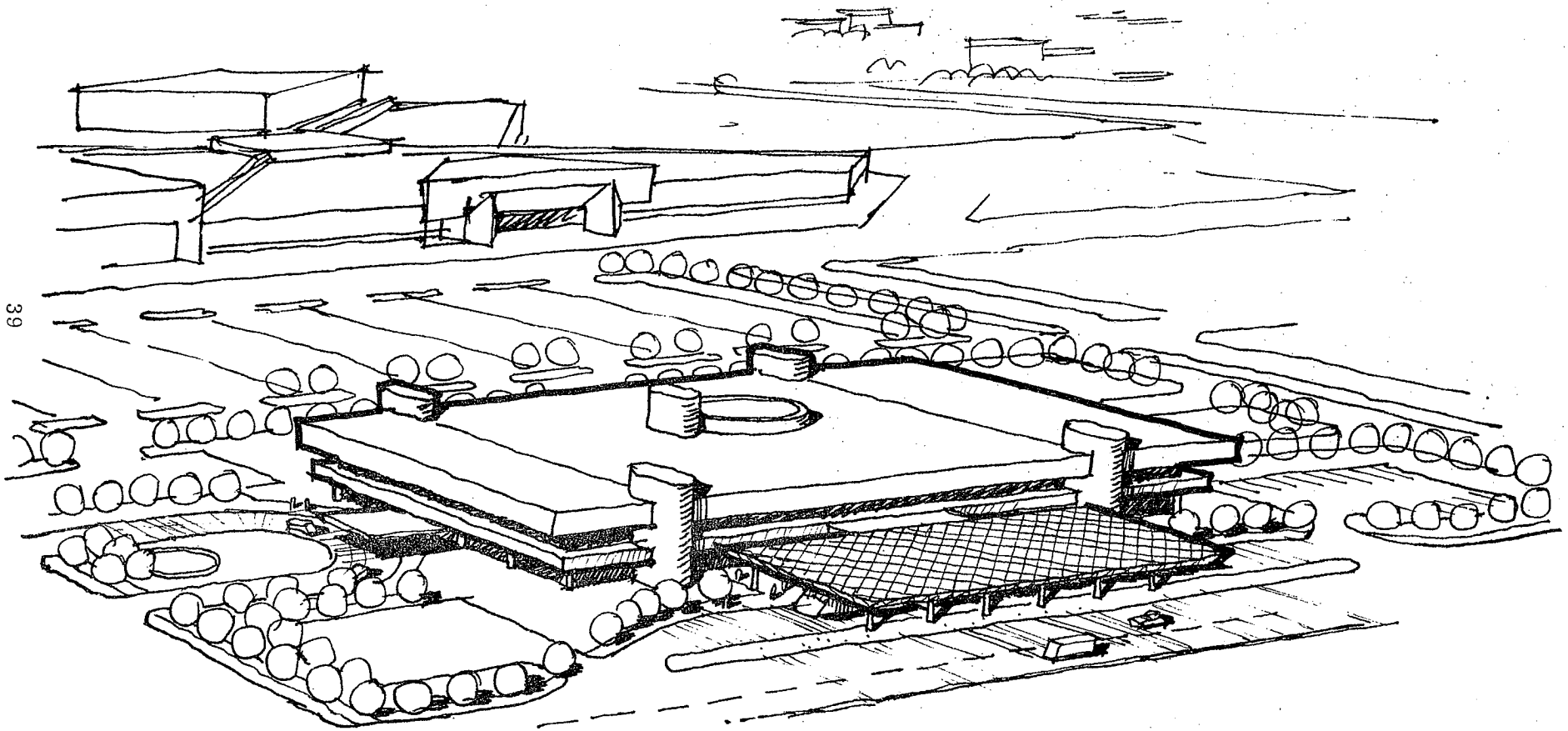
Transit Center 81,000 sq. ft. @$30/sq. ft.	$2,430,000	
Landscaping	40,000	
Paving	30,000	
SUBTOTAL	$2,500,000	
Contingencies	250,000	
Professional Fees	200,000	
TOTAL COST	$2,950,000	(excluding land)



SL/CTC: SALT LAKE/CANYONS TRANSIT CENTER
GROUND LEVEL PLAN/ PHASE II

PBQ&D, Inc.
ENGINEERS AND PLANNERS
NO SCALE sd.

Figure 9



SL/CTC : SALT LAKE/CANYONS TRANSIT CENTER : PBQ&D, Inc.
CONCEPTUAL SKETCH/ PHASE II
ENGINEERS AND PLANNERS
NO SCALE ed.

Figure 10

Phase III: Salt Lake/Canyons Transit Center

Phase III of the Canyons Transit Center is strictly an optional development, based upon presumed major participation by private developers. Phase II includes all of the basic functions and activities that are recommended to be part of the Salt Lake Valley transfer facility, and the Center will become an integral part of the transit service package, both for the Canyons service as well as basic commuter park-and-ride services. Phase III, however, goes one step further, should the market demand be present for the included uses and should private capital, to the extent necessary, be infused into the financial package for the SL/CTC.

Figures 11 and 12 indicate a third phase based on a highly used local and Canyons transit service where the SL/CTC would be well established and an essential part of the transportation network of the region. In this case, and with the probable expansion and success of the shopping center, the SL/CTC could expand into a business complex as well, with the addition of an office tower and a hotel. The commercial and retail facilities at the base and in the adjacent shopping center make this location very desirable for office space. With the inclusion of a hotel, an exciting location for corporate offices can be created, where clients and visiting employees can be met, housed and entertained--with summer recreation and skiing readily accessible by transit.

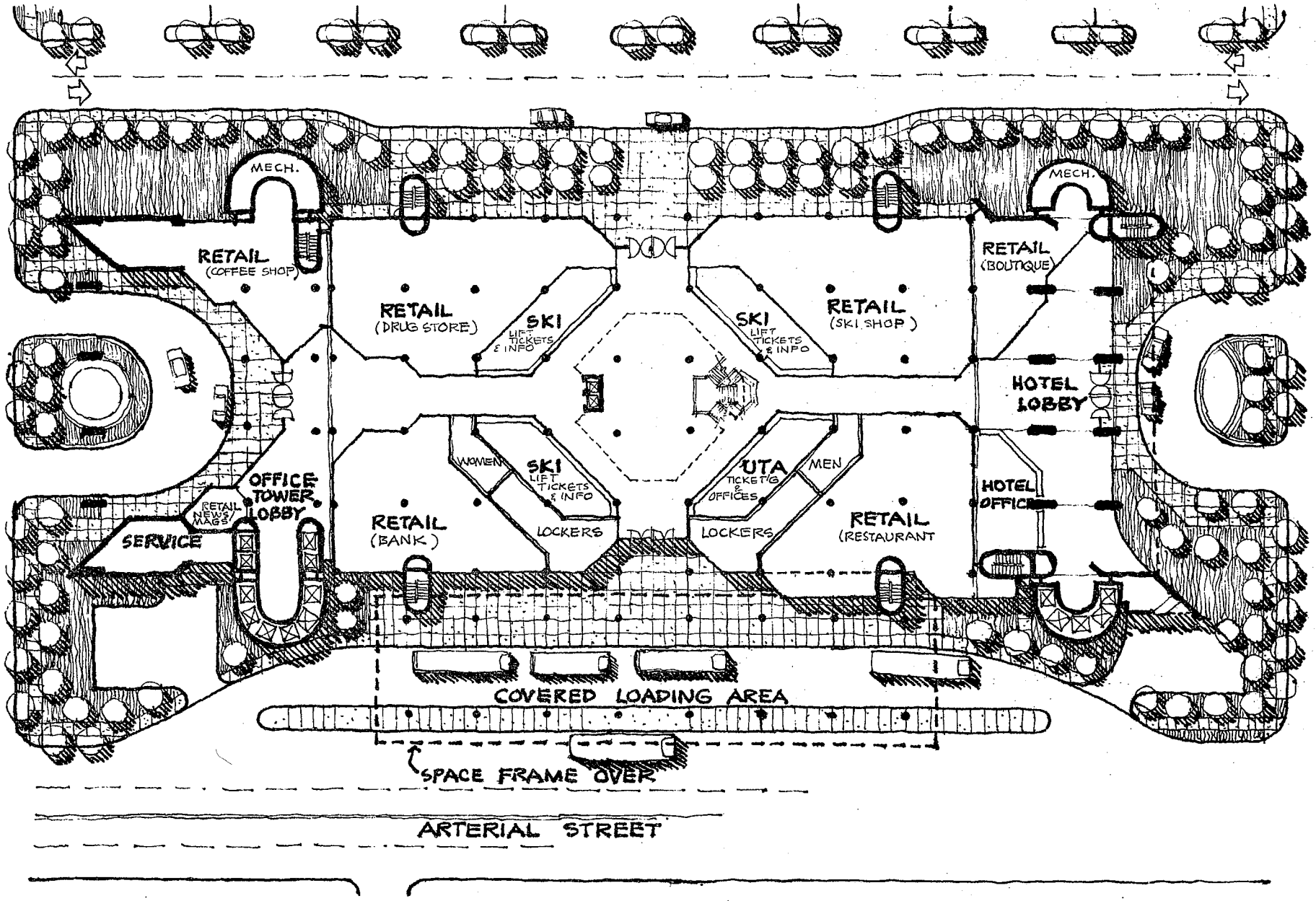
With the in-board drop-off area developed for Phase II, Phase III can be constructed with no interruption in operations of the SL/CTC.

The estimated cost for Phase III is $26,460,000, including contingencies and professional fees. Cost of land is not included. The breakout is as follows:

Office Tower 22 floors=412,000 sq. ft. @$45/sq. ft.	$18,540,000
Hotel 15 floors=168,000 sq. ft. @$30/sq. ft.	5,040,000
Space Frame (2 bay addition)	18,000
Landscaping	20,000
Paving	12,000
SUBTOTAL	$23,630,000
Contingencies	$1,180,000
Professional Fees	1,650,000
TOTAL COST	$26,460,000 (excluding land)

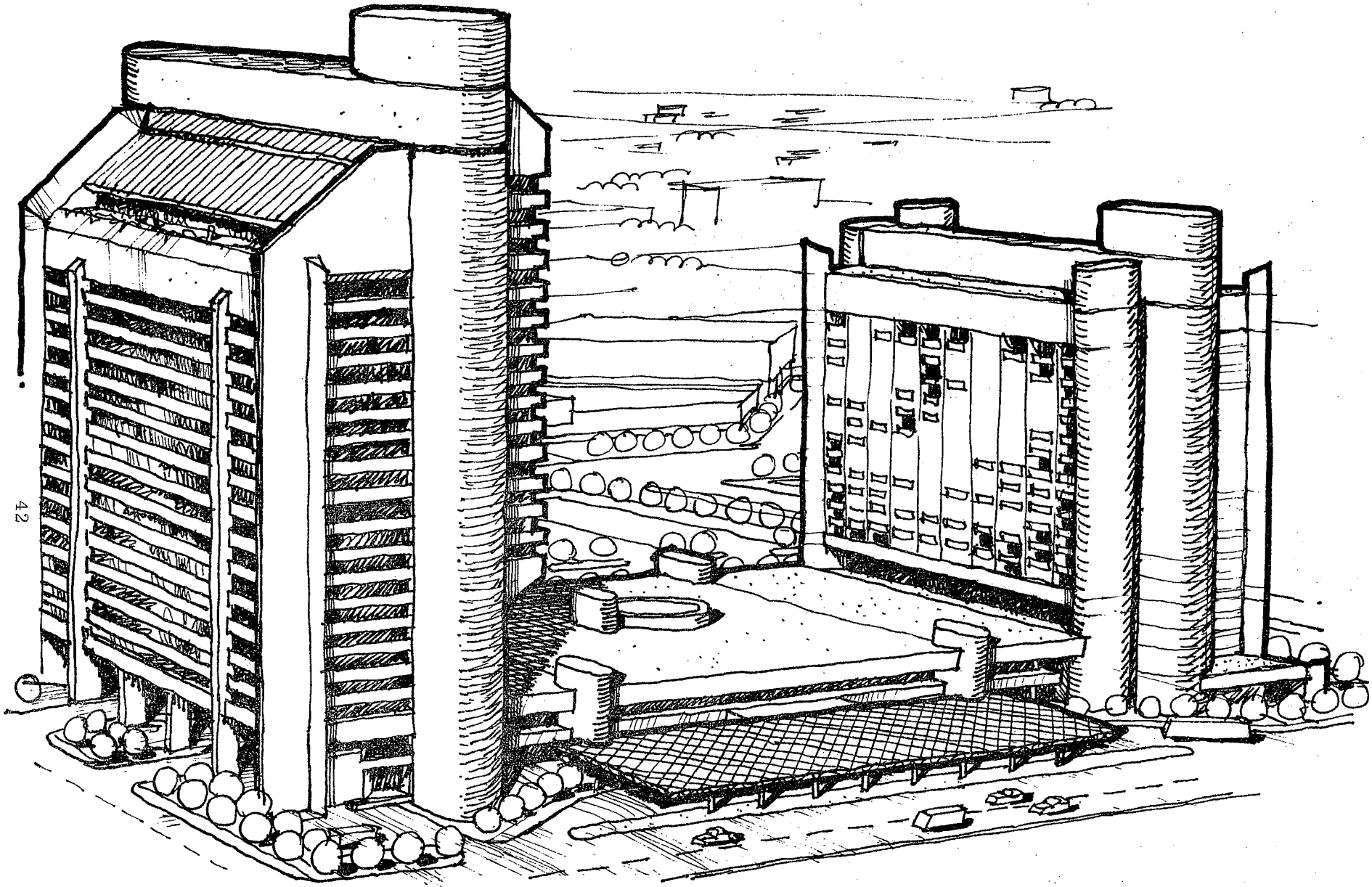
Implementation

The implementation options open to the Wasatch Front Regional Council and the Utah Transit Authority in creating the Salt Lake/Canyons Transit Center are considerable. First, there are multiple sites in the urban area which meet the criteria for the transit center. By negotiating between



SL/CTC : SALT LAKE/CANYONS TRANSIT CENTER : PBQ&D, Inc.
GROUND LEVEL PLAN/ PHASE III
ENGINEERS AND PLANNERS
NO SCALE SD.

Figure 11



SL/CTC : SALT LAKE/CANYONS TRANSIT CENTER : PBQ&D, Inc.
CONCEPTUAL SKETCH/ PHASE III
ENGINEERS AND PLANNERS
NO SCALE sd.

Figure 12

various owners and/or developers, the UTA can optimize its land cost and capital expenditures. Second, the Canyons transit service and local urban service can create a volume of users who are potential patrons wherever they disembark or board. Therefore, the SL/CTC has a market value that can be negotiated as it will generate patronage for surrounding commercial and retail facilities. Third, the UTA will need to lease its facilities, and will attract ski operators who will wish to lease space for their lift sales. Fourth, the UTA can seek bonds and perhaps federal funding to provide the front-end money for a facility in return for a favorable lease. Finally, through bonds and possible UMTA funding, UTA could build its own facility and lease out concession space.

Thus, there is considerable strength in UTA's bargaining position. With such a position, a favorable implementation plan should be able to be developed. Implementation plans can range from direct build, to lease-back, to a straight leasing arrangement. The choice will depend on which strategy gives the UTA the best terms in the right time frame, and which most closely complies with requirements for federal participation.

However realized, the concept itself will allow for the immediate and long-term growth potential that meets the needs of the Wasatch Region and will provide an outstanding transit facility which can contribute to the orderly growth of the local community. Its role in the provision of successful Canyon transit service can be dramatic, and thus it is recommended that planning for implementation of Phase I be undertaken immediately with the identification and acquisition of a suitable site, in keeping with earlier recommendations for potential sites in Salt Lake Valley.

* * * * *

CANYON TRANSIT SERVICE DEMANDS

Demands for Canyon transit service cannot be estimated in the traditional manner. Specialized recreation-oriented transit, supplied by urban area public transit operators, is just now beginning to be planned and initiated in several areas around the country; the UTA/Wasatch Canyons service is a pioneering effort on a relatively large scale and no real foundation for estimation based on previous experience is readily applicable. Various combinations of service, schedules, routing, fares, and marketing and incentive programs can be expected to have varying impacts on the demand for service between Salt Lake Valley and Big and Little Cottonwood Canyons. Estimates of demand are therefore based on the volumes of existing recreational travel in the Canyons, parking utilization, ridership figures from the previous private Canyon transit service, and knowledge of current utilization of existing UTA services in other areas within Utah Transit Authority jurisdiction.

Transit Market Description and Ridership Estimates

Existing patterns of Canyon travel, parking, traffic volumes, and utilization of recreational facilities in Big and Little Cottonwood Canyons were summarized earlier in this report. Recent data show a significant increase in the average utilization of the Canyon roads, and reports from the resort and ski lift operators bear out the conclusion that the 1975-1976 ski season was a "banner year" for the Wasatch resorts. Although partially attributable to poor ski conditions in California and Colorado, the trend has been toward greatly increased skier visitation to Utah, especially to Little Cottonwood Canyon ski areas.

While Big Cottonwood Canyon has not shown increases in road use, Little Cottonwood Canyon Road absorbed a large increase in use during the January-April period in 1976--average daily traffic for the four-month period increased 37 percent between 1973 and 1976 and almost 23 percent between 1975 and 1976. Although 1976 may well prove to be an odd year due to generally poor skiing conditions everywhere in the country with the exception of Utah, the dramatic increase in road use (and in skier-days at Alta and Snowbird) underscores the role which mass transportation could play in alleviating problems related to congestion and safety--especially regarding up-Canyon parking.

Ridership figures for the former Salt Lake Transportation Company Canyon transit service may provide an indication of existing public transit demand, but data from private operators are not always reliable. In addition, major differences in proposed fare structures and service levels may also render the historic data inappropriate to gauge patronage for proposed UTA services. However, data for the 1974-1975 ski season indicate that the Salt Lake Transportation Company's Little Cottonwood Canyon routes from the Airport, Downtown, and the University area generated a composite average of some 500-800 passengers per week. In terms of origin, these passengers followed this approximate distribution:

- 60% to/from Downtown
- 20% to/from the Airport
- 20% to/from Intermediate Points (e.g., University of Utah)

The shuttle service between Alta and Snowbird carried an average of 150 passengers per day during the course of the season.

The potential market for public transit services to the Cottonwood Canyons includes several different groups, distinguished by origin, arrival mode, and seasonality of Canyon use. These groups might be classified in the following way:

Winter Users

- Resort area workers/ employees
- Local Skiers (greater Salt Lake City area)
- Non-local skiers staying at resort areas and arriving in the region via private vehicle
- Non-local skiers staying at resort areas and arriving in the region via common carrier (airplane, bus, train, etc.)
- Non-local skiers staying downtown and arriving in the region via private vehicle
- Non-local skiers staying downtown and arriving in the region via common carrier.

Summer Users

- Sightseers/picknickers/hikers
- Attendees at summer events/institutes/conferences
- Resort area workers/ employees

Each of these groups of Canyon users is unique in terms of transit requirements and service criteria. Thus, six separate classes of Canyon transit service which differ substantially in terms of targeted ridership, routing and sheduling, and fare structure are recommended. These six basic Canyon transit services are described and illustrated in this report, together with recommendations for service levels and estimates of patronage. The major classes of scheduled transit service are proposed to be in effect during the ski season; however, a more limited schedule should remain in effect during the summer to Little Cottonwood Canyon, coordinated with activities such as the arts/music institute and other events which attract significant numbers of Canyon travelers.

The basic Canyon transit services proposed are as follows:

(1) Salt Lake Airport to Cottonwood Canyons
(2) Downtown to Cottonwood Canyons
(3) Salt Lake/Canyons Transit Center to Cottonwood Canyons
(4) University Area to Cottonwood Canyons
(5) Shuttle Services between Alta and Snowbird
(6) Specialized Subscription Services

(It should be pointed out that UTA has already initiated Airport to Downtown services; clearly, this service will carry some Canyon-bound tourists. This service has not been specifically considered as part of the package of Canyon-oriented transit services, although it is important to recognize that during the ski season UTA will need to use buses equipped with ski racks to transport those arriving skiers destined for downtown rather than the ski areas.)

Salt Lake Airport to Cottonwood Canyons Service

This service is based on the transit service requirements of non-local Canyon users, primarily those who are staying at any of the accommodations in Little Cottonwood Canyon. According to 1974-1975 data from the Institute for the Study of Outdoor Recreation and Tourism (Utah State University), approximately 52 percent of the non-resident skiers who come to Utah and travel to "non-resident ski areas" (Alta, Snowbird, Park City and Brian Head) arrive and depart by plane. While data cannot be isolated for Little Cottonwood Canyon, approximately nine percent of all non-local skiers during the 1974-1975 season utilized bus transit to reach Alta, Snowbird, Park City and Brian Head.

During the 1974-1975 ski season, Institute data indicate that there were a total of 899,000 skier-visits to Alta, Snowbird, Park City and Brian Head. Of these visits, about 542,000 or 60 percent, were made by non-resident skiers. Little Cottonwood Canyon resorts reported a combined total of 554,000 skier-visits for 1974-1975, and, using the non-resident percentage of 60 percent, it is assumed that Alta and Snowbird had about 326,000 skier visits from non-residents in 1974-1975.

During the 1975-1976 season, Little Cottonwood Canyon had some 743,000 skier-visits, approximately 483,000 of which were attributable to non-residents. Using an average non-resident length-of-stay of six nights, this translates to a total of approximately 80,000 non-local skiers using Little Cottonwood Canyon resorts in 1975-1976. Since some 50 percent to 55 percent of non-resident skiers arrive by air in Salt Lake City, it is estimated that about 40,000 skiers using Little Cottonwood Canyon arrive via airplane and stay either on-site at the ski resorts, in downtown hotels/ motels, or with friends/relatives.

Utah State data indicate that slightly less than half of the non-resident skiers stay on-site (at the ski areas) during their ski vacation. There is no correlation provided between the mode of non-resident access to Salt Lake City and the place stayed while on vacation. A recent survey at Snowbird by Hughes Air West, however, indicated that over 80 percent of those staying at lodges in Snowbird arrived by air. This implies that the skiers staying on-site in Little Cottonwood Canyon are probably more inclined to use the air mode than those staying downtown or with friends/ relatives. Thus, of the 40,000 non-resident skiers arriving by airplane and skiing Alta/Snowbird, probably some 25,000 to 30,000 skiers can be considered to be the potential market for Airport to Little Cottonwood Canyon transit services.

Currently, according to the Hughes Air West survey, the usage of access modes to Snowbird for those non-resident skiers staying on-site is distributed in the following manner:

Bus	21.7%
Rental Car	13.7%
Limousine	9.7%
Taxi	35.4%
Private Car	18.2%
Other	1.3%

With frequent and low-cost Airport to Little Cottonwood Canyon public transportation service, it is expected that the percentage using buses could increase significantly over present levels, especially for those currently using taxis, limousines, and rental cars.

Downtown to Cottonwood Canyons Service

The primary market for downtown-oriented service is the non-resident skier who chooses to stay downtown, perhaps skiing several different areas during the vacation period. This service will include scheduled stops at three locations downtown, proximate to the major areas of hotel room concentrations. Of course, local residents could also utilize this service if convenient to their residential or employment location, as well as resort area employees. (It is expected, however, that service from the park-and-ride lot will cater to local skiers and resort employees.) Generally, most downtown-to-Canyon service will be express; however, during certain periods of the day, service from downtown to Big and Little Cottonwood Canyons is proposed to operate via the University area to serve the demands from this area. Travel time will be only slightly greater and route mileage almost identical via the university route.

The potential market for Downtown-Canyon transit services is larger than the Airport-Canyon service market--those who enter Salt Lake City by any mode (plane, car, bus) and stay downtown might well wish to use public transit to the Cottonwood Canyons if it is convenient and inexpensive, especially in inclement weather. Although Airport express service will exclude Big Cottonwood Canyon, since Brighton is not a destination resort, it is proposed that some downtown service be provided to Big Cottonwood Canyon.

During the 1975-1976 season, Little Cottonwood Canyon had an estimated 483,000 non-resident skier-visits, up from 345,000 in 1974-1975. Big Cottonwood Canyon, on the other hand, did not increase from 1974-1975 to 1975-1976, underscoring the "local skier" orientation of Brighton. There were an estimated 150,000 skier-visits to Brighton, mostly from local Salt Lake area residents. However, since the non-resident skier who stays downtown has the tendency to ski many of the Wasatch areas--including so-called "resident ski areas"--limited service is proposed between downtown and Brighton. When Solitude opens (tentatively set for 1977-1978), the service to Big Cottonwood Canyon will increase as necessary.

The potential transit market between downtown and Little Cottonwood Canyon is strengthened by the fact that non-resident skiers who stay downtown may need transportation each day of the vacation to the ski areas. While the "downtown skier" may choose to go to other areas in addition to Little Cottonwood Canyon (e.g., Park City), there still remains the need for more trips to and from Little Cottonwood Canyon per skier party than for those non-resident skiers arriving at the airport and destined for lodging at the resort areas.

In the preceding section describing demands for the Airport-Canyon service, it was estimated that about 80,000 non-resident skiers use Little Cottonwood Canyon during an average ski season. The Hughes Air West/Snowbird survey conducted last season indicated that a strong tendency appears to exist for those arriving in Salt Lake via the air mode to stay on-site at the resort areas; thus, it seems reasonable to assume that those staying downtown are more likely to have brought their own vehicles. (Informal observations have borne out the fact that many of the Californians--who comprise about one-third of all non-resident skiers in Utah--tend to drive to Utah, stay downtown, and use their cars to visit the various ski areas along the Wasatch Front. It is questionable whether this particular group can be as viable a market for public transit service as the remaining non-resident skier population.) The Snowbird survey provided the following breakdown of existing modal usage from downtown to Snowbird for a random sample of skiers (consisting, presumably, of an average mix of local and non-resident skiers staying on-site and off-site):

	All Skiers at Snowbird	Snowbird Lodge Guests Only
Bus	16.8%	21.7%
Rental Car	18.5%	13.7%
Limousine	7.1%	9.7%
Taxi	13.7%	35.4%
Private Car	42.1%	18.2%
Other	1.8%	1.3%

While the figures for "all skiers" showing transportation from Salt Lake City to Snowbird include some local skiers, it is still clear that more private vehicle transportation is available to those staying downtown. Of the approximate 80,000 non-resident skiers using Little Cottonwood Canyon, it was estimated that about 25,000-30,000 comprise the potential market for Airport-Canyon service. According to 1974-1975 data, slightly more than half of the non-resident skiers utilize off-site accommodations; of these, at least one-third stay with friends and relatives. It is a fair hypothesis that a goodly portion of the non-resident skiers who do have private cars available are those who stay with friends and relatives--these skiers have either their own and/or their friends'/relatives' cars available. Thus, perhaps 30,000 skiers who use Little Cottonwood Canyon stay in hotels/motels downtown. Assuming an average non-resident skier length-of-stay of six days, and further assuming that the average downtown

skier heads to Little Cottonwood Canyon three to four days during his/her vacation, it is estimated that the potential public transit market for Downtown to Little Cottonwood Canyon trips is about 90,000 to 120,000 skiers per season.

Service to Big Cottonwood Canyon from downtown has a much smaller potential market than Little Cottonwood Canyon service. Data from the Institute of Outdoor Recreation and Tourism indicate that, in 1974-1975, only 54,000 skier-visits were recorded by non-resident skiers at all of the Wasatch Front "resident" ski areas (Brighton, Nordic Valley, Park West, Powder Mountain, Snow Basin and Sundance). Thus, since no significant increases in visitation occurred at these "local" ski areas between 1974-1975 and 1975-1976, it is obvious that the number of non-resident skier-visits out of the total of 150,000 skier-visits recorded at Brighton in 1975-1976 is indeed small. However, since overnight accommodation capacity at Brighton is negligible, it is probable that almost all of these non-resident visits to Big Cottonwood Canyon originated from downtown--skiers either staying in hotels/motels or with friends/relatives. It is estimated that perhaps five percent to ten percent of the skier-visits to Brighton are non-resident skiers; this implies that some 20 percent of all non-resident skiers using the "resident" ski areas listed above choose Brighton. Translating these percentages to actual numbers of skiers, it is estimated that the potential transit market for Downtown-Big Cottonwood Canyon trips is somewhere between 8,000 and 14,000 skiers per season.

Salt Lake/Canyons Transit Center to Cottonwood Canyons Service

This class of service is the primary transit service for local skiers to Big and Little Cottonwood Canyons. As shown earlier in this report, it is recommended that a facility for park-and-ride services be developed; this class of service is dependent on such a facility or, at the very least, an existing parking lot which could be used in the interim. With the combination of easy access, lockers, lift ticket sales, and low bus fares, many local skiers could be attracted to use the park-and-ride lot and UTA buses for ski area access.

The potential market for this service is essentially all of the local skiers, but it is unrealistic to assume that many local skiers could be induced to use buses unless (1) they were cheap, (2) they were convenient and comfortable, and (3) the schedules served skier demands with little delay. Resort area employees may be a "built in" market for this service--especially on weekends when their employers would prefer to reserve as much of the available resort parking as possible for guests.

During the 1975-1976 ski season, it was estimated that more than half of the skier-visits to Little Cottonwood Canyon were non-resident skiers. Although this figure may be high due to poor conditions elsewhere, it is clear that more out-of-state skiers are "discovering" Utah. The local skier, however, still provides anywhere from 40 percent to 60 percent of the total skier-visits annually to Little Cottonwood Canyon, depending upon conditions, and over 90 percent to Big Cottonwood Canyon. Thus, it is estimated that the following number of seasonal skier-visits to the Cottonwood Canyons are attributable to local skiers:

Little Cottonwood Canyon:	260,000 local skier-visits
Big Cottonwood Canyon:	135,000 local skier-visits

Together with resort area employees, these local skiers provide the primary market for Canyon transit service from the Salt Lake/Canyons Transit Center (park-and-ride lot). While some of the local skiers will find the University area service (described in the following section) more convenient, it is expected that most will prefer the SL/CTC--especially once the amenities of lift ticket sales, ski rentals, food facilities, and other such services become part of the Center.

With close to 100 percent of all local skiers presently driving private cars to the Canyons, it is difficult to estimate the percentage who will use UTA services. It is estimated, however, that a good marketing campaign and an appropriate interim or Phase I facility may be able to attract 15 percent to 20 percent of the local ski trips to Little Cottonwood Canyon over the 1976-1977 season, and perhaps as high as 30 percent to 35 percent on weekends/holidays.

Furthermore, it is estimated that at least half of the work trips made by employees from Salt Lake Valley up the Canyon can be via public transit--especially if a subsidy is arranged or if fares are paid by the resorts in trade for increased resort area parking capacity. In Little Cottonwood Canyon there are about 700 employees who commute daily from Salt Lake City to the Town of Alta and to Snowbird. Assuming that 20 percent of the annual ski trips and 50 percent of the annual employees trips are made via transit from the Salt Lake/Canyons Transit Center, the market over the season for this service is about 100,000-110,000 round trips.

The problems of congestion, parking, avalanaches, and hazardous road conditions are considerably less severe in Big Cottonwood Canyon, and hence it may be more difficult to attract auto users to the transit mode. However, it is possible that on weekends a number of Brighton-bound skiers could be induced to use buses. Some 15 percent to 20 percent of the local weekend skiers destined for Big Cottonwood Canyon are projected to use the Transit Center service; since some 60,000-70,000 local skier-days are recorded at Brighton on Saturdays and Sundays, this implies that the market for this service would be approximately 9,000-13,000 round trips over the course of the ski season.

University Area to Cottonwood Canyons Service

This service will be limited in scope, designed to serve students and other local skiers residing in the vicinity of the University of Utah. No "hard" data exist which can provide insights as to potential market size. However, the Recreation Area Parking Study (Utah State Department of Highways, 1973) showed that a fair number of trips to the Cottonwood Canyons originated in the general University area--some 10 percent of all trips to both Big and Little Cottonwood Canyons. In addition, data provided by the Salt Lake Transportation Company indicated that about 20 percent of the partronage on routes to Alta/Snowbird originated at intermediate points between downtown and the ski areas--primarily the University

area. Thus, it is recommended that about half of the Downtown-Little Cottonwood Canyon service be via the University and all of the Downtown-Big Cottonwood Canyon service be via the University. With negligible operating cost increases and little time lost to downtown riders, UTA will be able to serve the demands that exist for ski area transit service from the University area. Estimates of seasonal ridership are around 10,000-12,000 skiers to Little Cottonwood Canyon and perhaps 3,000-4,000 to Big Cottonwood Canyon, based on historical data and expected ridership increases upon introduction of UTA service.

Shuttle Services between Alta and Snowbird

This service has the potential for excellent ridership based on observations and input from the ski area operators. While it is impossible to quantify the market size for this service, Salt Lake Transportation Company recorded some 18,000 passengers riding the shuttle during the 1973-1974 ski season. With increased interchangeability between Snowbird and Alta lift passes, it is likely that increased commutation between the areas will occur. Additionally, a low price and regular, short-headway service will do much to insure patronage. It is estimated that, on the average, 500-700 skiers per day would comprise the market for Little Cottonwood Canyon shuttle services. This means that the seasonal ridership for this service would be in the neighborhood of 100,000 trips (one-way) per season.

Subscription and Summer Services

Subscription services are non-scheduled transit services which would be available to schools, clubs, or other groups with recurring needs for service to the Canyons. On a demand basis, UTA could schedule subscription services, similar to charter services but on a regular basis, with standard service fares for class of service offered. While specific details cannot be provided on this type of service, it is nonetheless recommended for consideration by UTA. In addition, a minimum level of scheduled service should remain in effect to Little Cottonwood Canyon during summer months, to provide basic transportation to the Town of Alta and to allow visitors to attend summer activities in the Canyon without the necessity for using an automobile.

* * * * *

PROPOSED CANYON TRANSIT SERVICES

Service Characteristics and Transit Routes

This section of the report provides specifics for each of the above-described classes of transit service. Included are route maps, schedules, estimated partronage, fare structures, fleet requirements, and operating costs and revenues for each of the five scheduled services, excluding subscription and summer services. An overall average of $1.60 per bus-mile has been assumed for the calculation of operating costs.

Salt Lake Airport to Cottonwood Canyons

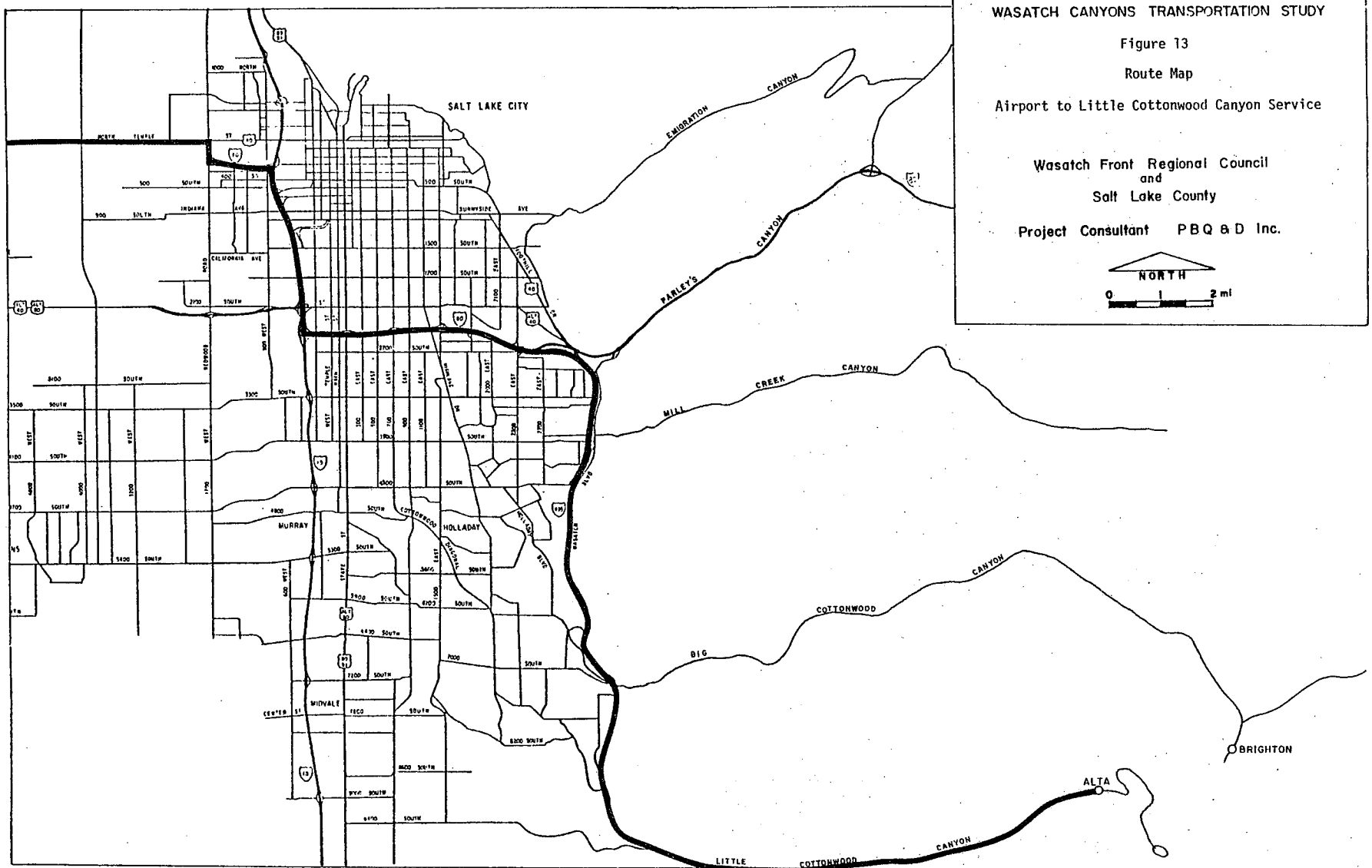
This service is illustrated in Figure 13. Scheduling and frequency have been based on the average arrival/departure pattern at Salt Lake International Airport. The number of scheduled airline seats arriving and departing over a typical day at the Airport is shown in Figure 14. This frequency distribution remains reasonably constant over the course of the year; the actual load factors (seat occupancy) vary by season and by day of the week. The airlines report that a load factor of about 60 percent is average during the ski season. According to the ski resort, Saturday is generally the heaviest day for guest arrivals at the ski lodges in Little Cottonwood Canyon. Based on these data, the proposed service for Airport-Little Cottonwood Canyon Service is given in Table 6. It is recommended that 18 round trips be scheduled on Saturdays and 11 round trips on the other days of the week during the ski season. With a round trip distance of 64 miles, this totals to a seasonal operating mileage of 115,000 miles, for a seasonal operating cost of $184,000 at $1.60 per bus-mile.

As developed in the market description for Airport-Little Cottonwood Canyon Services, it is estimated that some 30,000 skiers arrive by plane in Salt Lake City and proceed to accommodations in Little Cottonwood Canyon. Strong marketing and travel packaging, together with the proposed service schedule, could induce perhaps half of these travelers to use UTA services between the Airport and the Canyon. It is recommended that the one-way fare be $1.50, which is much lower than the average for both this type of service and the mileage involved. Annual operating revenue would be in the neighborhood of $50,000, for a net operating deficit for this service of about 73 percent.

Downtown to Cottonwood Canyons

This class of service has three basic routes:

(1) Downtown to Alta/Snowbird Express
(2) Downtown to Alta/Snowbird via University
(3) Downtown to Big Cottonwood Canyon via University



WASATCH CANYONS TRANSPORTATION STUDY

Figure 13

Route Map

Airport to Little Cottonwood Canyon Service

Wasatch Front Regional Council
and
Salt Lake County

Project Consultant PBQ & D Inc.

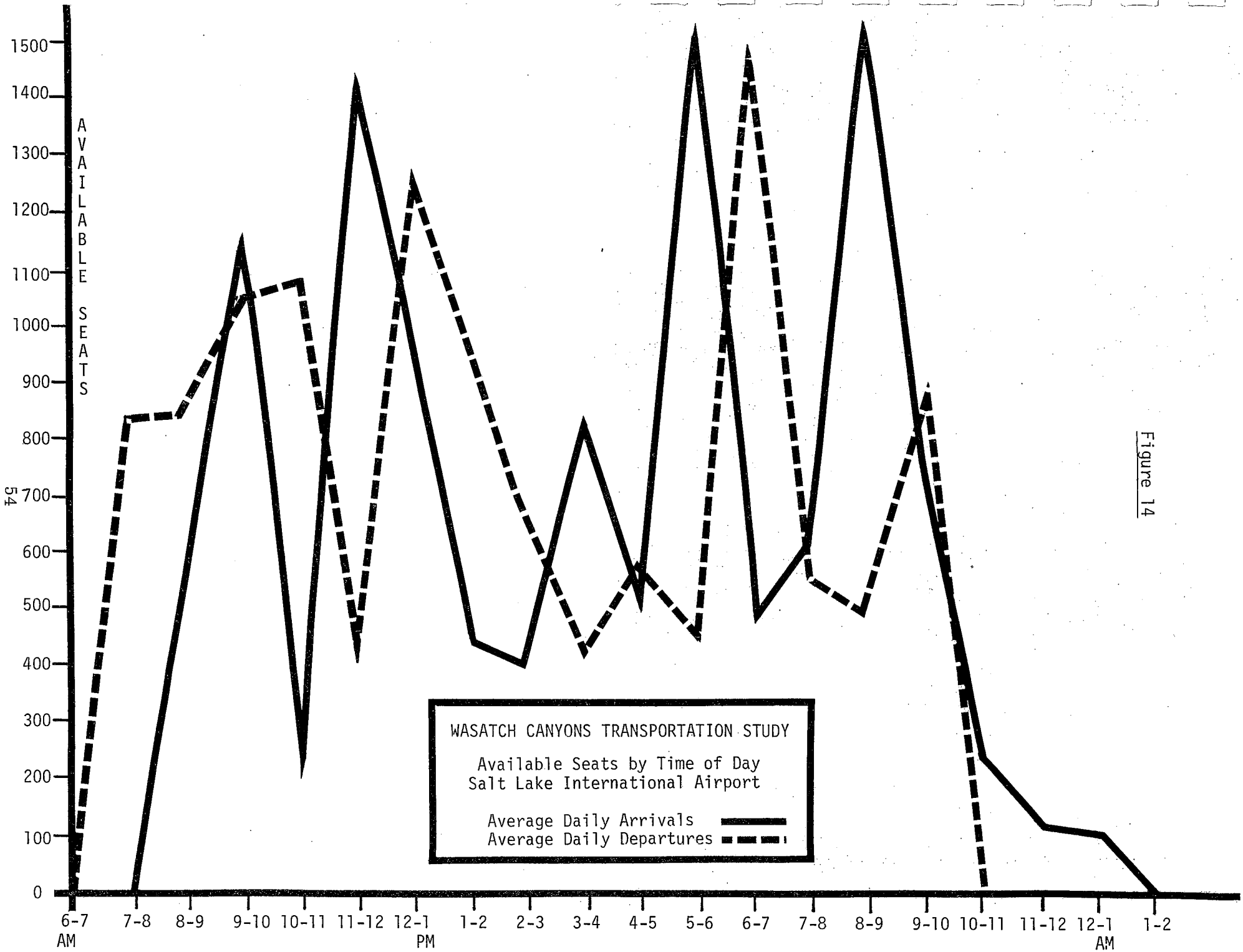

WASATCH CANYONS TRANSPORTATION STUDY
Available Seats by Time of Day
Salt Lake International Airport
Average Daily Arrivals
Average Daily Departures
AVAILABLE SEATS
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
6-7 AM
7-8
8-9
9-10
10-11
11-12
12-1 PM
1-2
2-3
3-4
4-5
5-6
6-7
7-8
8-9
9-10
10-11
11-12
12-1 AM
1-2

Figure 14

TABLE 6

SERVICE SCHEDULE

Airport - Little Cottonwood Canyon

Hour	Sunday thru Friday				Saturday			
	Airport		Alta/Snowbird		Airport		Saturday	
	Departures	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures	Arrivals
AM 6-7			1				1	
7-8	1	1			1	1	1	
8-9			1	1	1	1	2	1
9-10	1	1			1	2	1	1
10-11	1		1	1	2	1	1	1
11-12	1	1	1	1	1	1	1	2
PM 12-1	1	1		1	1	1	1	1
1-2			1	1	1	1	1	1
2-3	1	1			1	1		1
3-4			1	1			1	1
4-5	1	1	1		1	1	2	
5-6	1	1	1	1	2	2	1	1
6-7		1	1	1	2	1	2	2
7-8	1	1			1	2	1	2
8-9	1		1	1	2	1	1	1
9-10		1	1	1		1	1	2
10-11	1	1			1	1		
11-12				1				1

Daily Roundtrips: Sun-Fri 11; Sat 18

These three routes are illustrated in Figures 15, 16 and 17, respectively. Proposed service schedules are provided for Downtown/Little Cottonwood Canyon service in Table 7 and Downtown/Big Cottonwood Canyon service in Table 8.

There are a total of 20 weekday and 32 weekend round trips proposed between downtown and Alta/Snowbird. Twelve of the weekday trips and 17 of the weekend trips will operate express to Little Cottonwood Canyon, and the remainder will be via the University area. Including an estimated seasonal round trip patronage from the University area of 10,000-12,000 skiers, it is estimated this service will draw some 58,000 skiers over the course of the season.

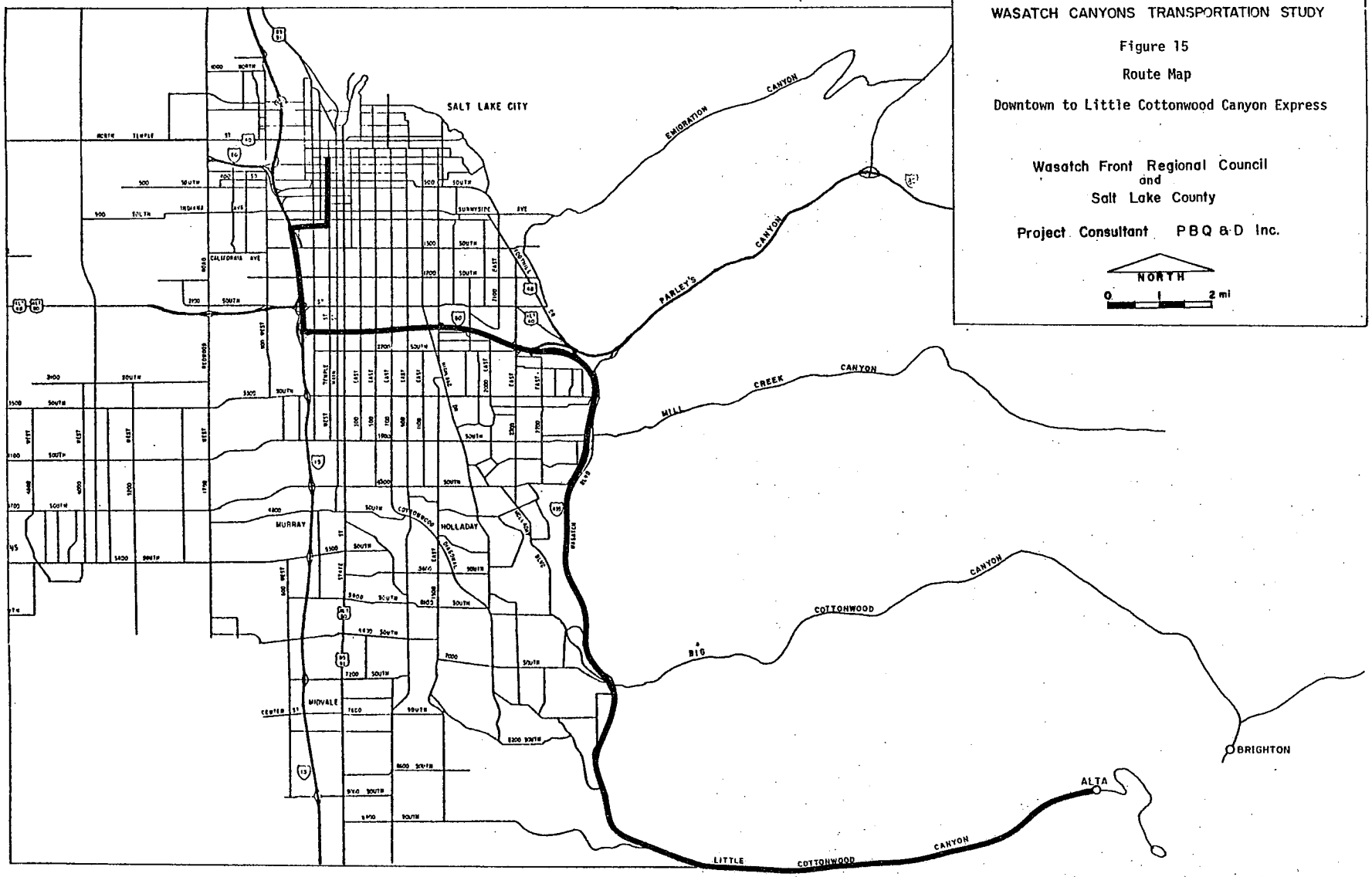
It is proposed that the fares be $1.00 one-way from downtown and $.50 one-way from the University. With an overall seasonal operating mileage of 189,000 miles, operating costs will be $302,000 and farebox revenue is estimated at $107,000. Thus, all three Downtown-Little Cottonwood Canyon services--including the University-Little Cottonwood Canyon segment--will incur a combined deficit of $195,000, or 65 percent.

Service from downtown to Big Cottonwood will be via the University. Fares will also be $1.00 from downtown and $.50 from the University. Including some 3,500 skiers from the University area, the seasonal round trip patronage for Downtown-Big Cottonwood Canyon service is estimated at about 13,000 skiers. Five round trips on weekdays and 11 on weekends are recommended, with a total seasonal operating mileage of 54,000 miles. Based on this mileage and the estimated patronage, seasonal operating costs will be about $85,000 and operating revenue about $26,000, incurring a deficit of $59,000 or 69 percent.

Salt Lake/Canyons Transit Center to Cottonwood Canyons

Figures 18 and 19 illustrate the service to Little and Big Cottonwood Canyons, respectively, from the Salt Lake/Canyons Transit Center (SL/CTC). Although a site has not yet been finalized for the location of this modal transfer facility, a location roughly in the vicinity of 70th-72nd South and 9th East has been chosen for purposes of transit route planning.

Service from the SL/CTC to the Cottonwood Canyons is geared to local skiers and Canyon employees. Presently, almost 100 percent of the local skiers drive to the ski resorts. Based on observed traffic volumes on the Canyon roads, about 40 percent of the total skier-visits to Little Cottonwood Canyon are recorded on weekends; for Big Cottonwood Canyon the figure is closer to 50 percent. Since the percentage of local skiers at Alta and Snowbird is higher on the weekends than on weekdays, it is estimated that 55 percent of all local skier-visits to Little Cottonwood Canyon are recorded on weekends. In Big Cottonwood Canyon, where almost all visitation is local, it is estimated that 50 percent of the local skier-visits occur on weekends. Of the approximate total of 260,000 local skier-visits to Little Cottonwood and 135,000 local skier-visits to Big Cottonwood, this weekly percentage distribution translates to an average daily total of local skiers as follows:



WASATCH CANYONS TRANSPORTATION STUDY

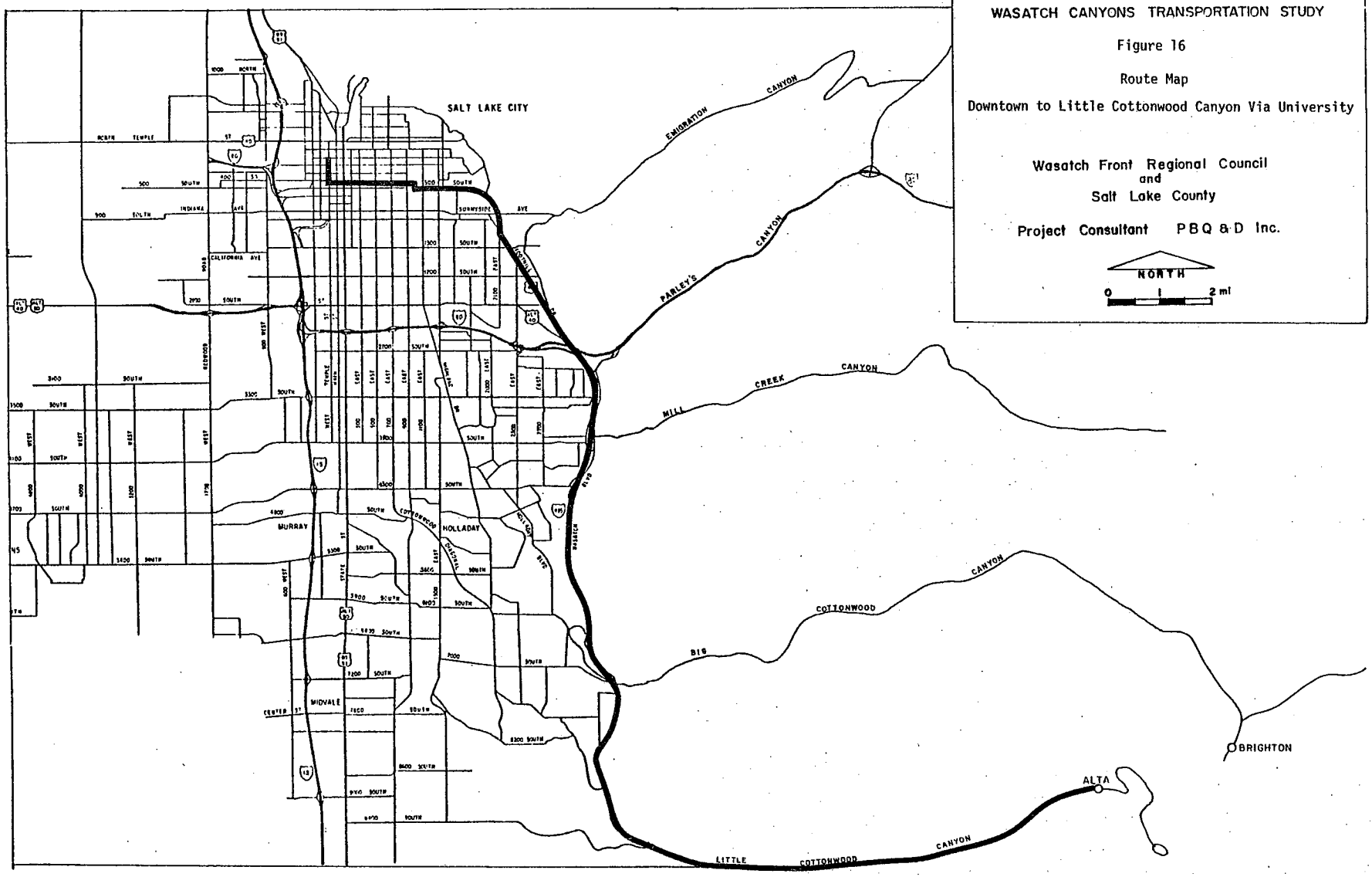
Figure 15

Route Map

Downtown to Little Cottonwood Canyon Express

Wasatch Front Regional Council
and
Salt Lake County

Project Consultant PBQ & D Inc.



WASATCH CANYONS TRANSPORTATION STUDY

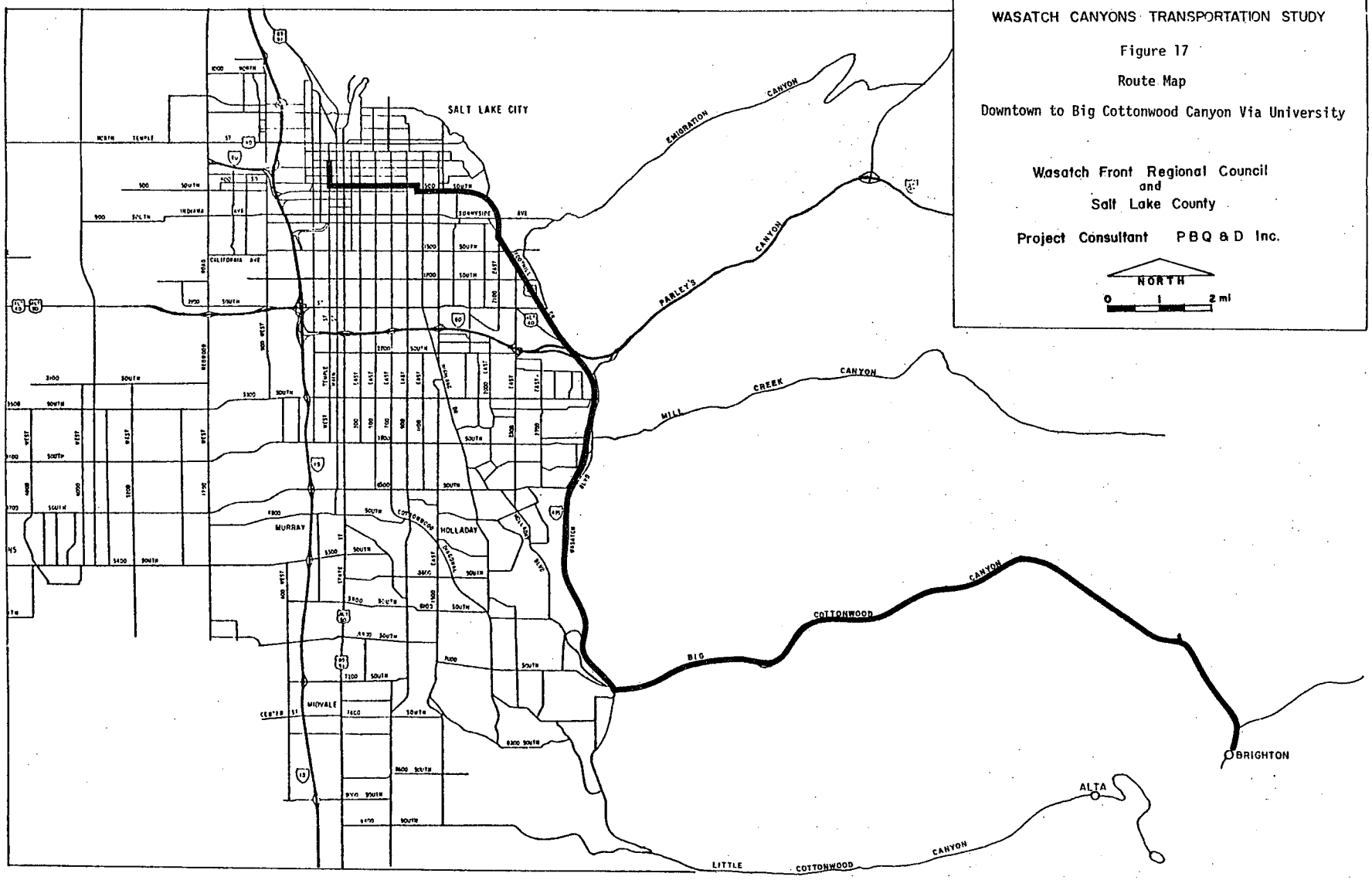
Figure 16

Route Map

Downtown to Little Cottonwood Canyon Via University

Wasatch Front Regional Council
and
Salt Lake County

Project Consultant PBQ & D Inc.



WASATCH CANYONS TRANSPORTATION STUDY

Figure 17

Route Map

Downtown to Big Cottonwood Canyon Via University

Wasatch Front Regional Council
and
Salt Lake County

Project Consultant PBQ & D Inc.

TABLE 7

SERVICE SCHEDULE

Downtown-Little Cottonwood Canyon

Hour	Monday thru Friday				Saturday and Sunday			
	Downtown		Alta/Snowbird		Downtown		Alta/Snowbird	
	Departures	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures	Arrivals
AM 6-7	2				3			
7-8	2		2	2	3		3	3
8-9	2	2	2	2	3	3	3	3
9-10	2	2	2	2	3	3	3	3
10-11		2	2	2	1	3	3	3
11-12	1	2			1	3	1	1
PM 12-1	1		1	1	2	1	1	1
1-2		1	1	1		1	2	2
2-3		1			1	2		
3-4	2				3		1	1
4-5	2		2	2	3	1	3	3
5-6	2	2	2	2	3	3	3	3
6-7	2	2	2	2	3	3	3	3
7-8	1	2	2	2	1	3	3	3
8-9		2	1	1	1	3	1	1
9-10	1	1				1	1	1
10-11			1	1	1	1		
11-12		1					1	1
						1		

Daily Roundtrips: Mon-Fri 20; Sat & Sun 32

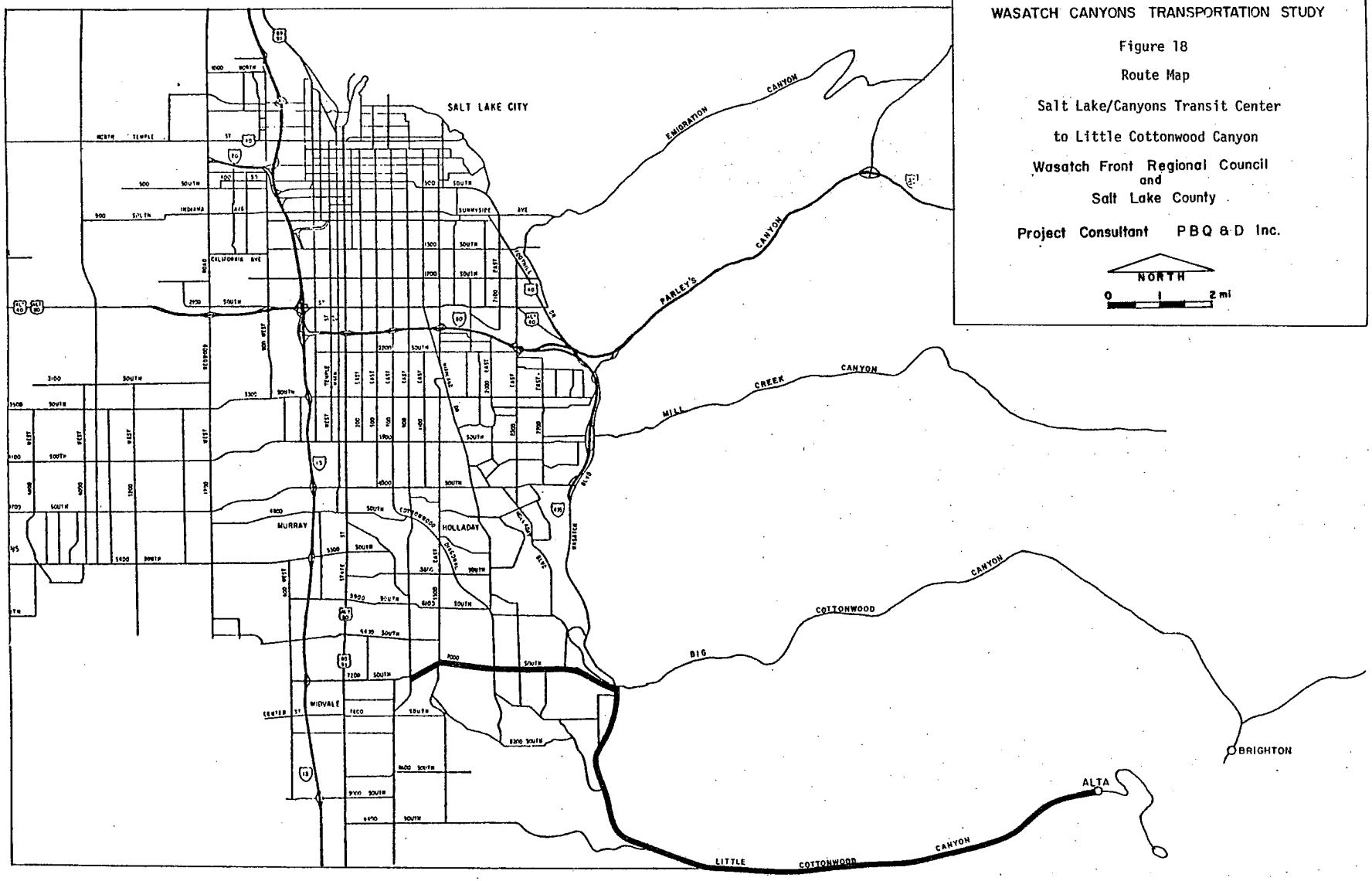
TABLE 8

SERVICE SCHEDULE

Downtown-Big Cottonwood Canyon

Hour	Monday thru Friday				Saturday and Sunday			
	Downtown		Brighton		Downtown		Brighton	
	Departures	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures	Arrivals
AM 6-7					1			
7-8	1				1		1	1
8-9	1		1	1	1	1	1	1
9-10		1	1	1	1	1	1	1
10-11		1				1	1	1
11-12	1				1	1		
PM 12-1			1	1	1		1	1
1-2		1				1	1	1
2-3					1	1		
3-4	1				1		1	1
4-5			1	1	1	1	1	1
5-6	1	1			1	1	1	1
6-7			1	1	1	1	1	1
7-8		1				1	1	1
8-9						1		
9-10								
10-11								
11-12								

Daily Roundtrips: Mon-Fri 5; Sat & Sun 11



WASATCH CANYONS TRANSPORTATION STUDY

Figure 18

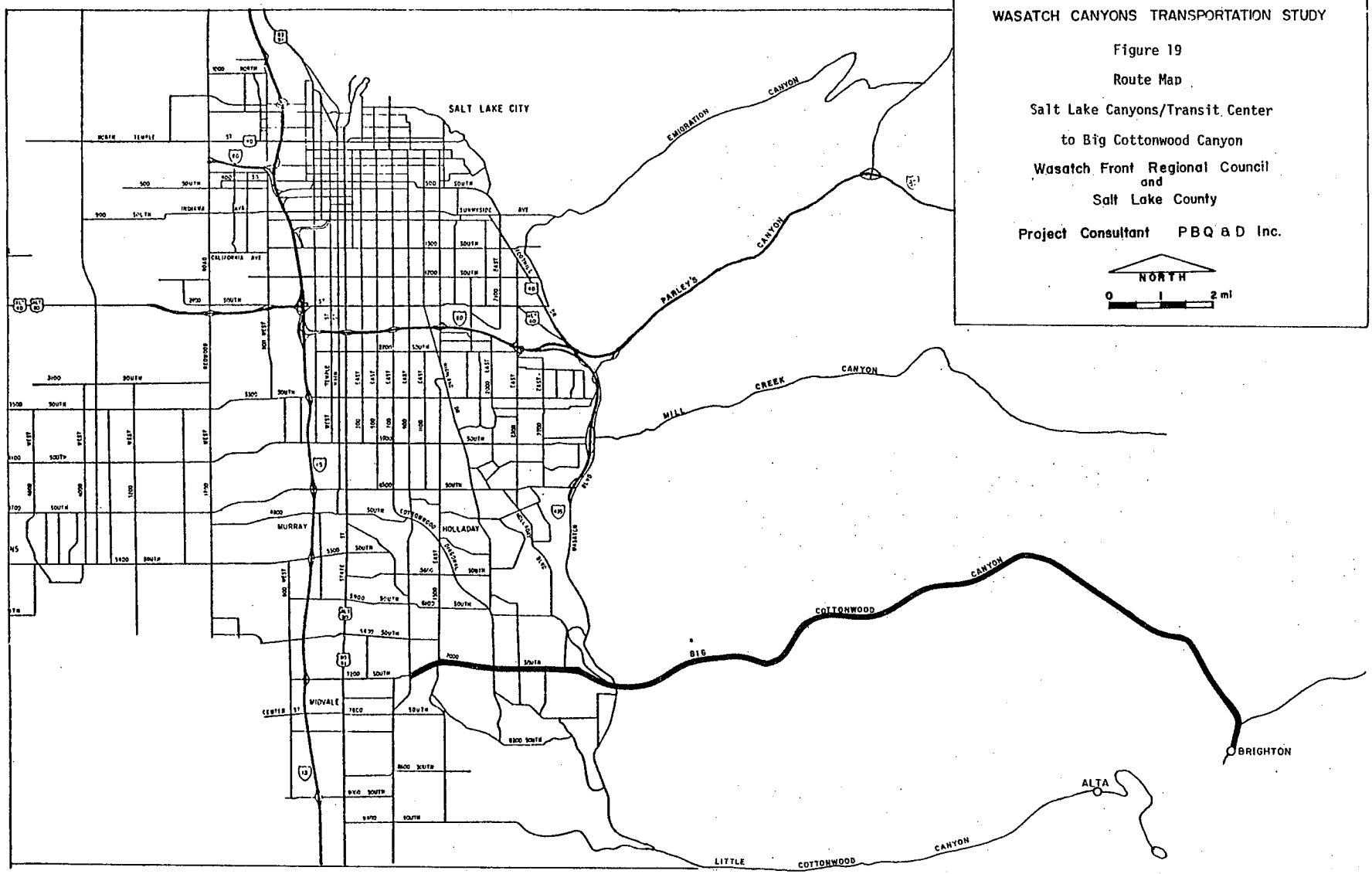
Route Map

Salt Lake/Canyons Transit Center

to Little Cottonwood Canyon

Wasatch Front Regional Council
and
Salt Lake County

Project Consultant PBQ & D Inc.



WASATCH CANYONS TRANSPORTATION STUDY

Figure 19

Route Map

Salt Lake Canyons/Transit Center

to Big Cottonwood Canyon

Wasatch Front Regional Council
and
Salt Lake County

Project Consultant PBQ & D Inc.

Little Cottonwood Canyon
Weekdays--1060 local skier-visits/day
Saturday & Sunday--3575 local skier-visits/day

Big Cottonwood Canyon
Weekdays--620 local skier-visits/day
Saturday & Sunday--1675 local skier visits/day

Using the figures derived in the description of this service market (20 percent of all local skier trips and 50 percent of all employee trips made via public transit), schedules have been developed for service from the Salt Lake/Canyons Transit Center to Little and Big Cottonwood Canyons. These schedules are included in Tables 9 and 10, respectively.

To Little Cottonwood Canyon, 24 round trips are shown on weekdays and 62 round trips on Saturday, Sunday and holidays. A one-way fare of $.50 is proposed for this service, and it is recommended that incentive programs be developed by UTA in conjunction with the ski resort operators to make the bus mode more attractive to local day skiers. The SL/CTC-Little Cottonwood Canyon service has a seasonal operating mileage of 163,000 miles, and a cost of $260,000. Operating revenue may be expected to be about $106,000, requiring a subsidy of 60 percent, or $154,000. This service will require four buses on weekdays and ten buses on weekends.

Service to Big Cottonwood Canyon will be operated only on weekends from the transfer facility; 15 round trips per day are recommended with a one-way fare set at $.50. This service will require about 20,000 seasonal operating miles with a cost of $32,000. Revenues are estimated at $10,000, creating a deficit of 69 percent, or $22,000.

University Area to Cottonwood Canyons

Schedules for service from the University area to Little Cottonwood Canyon and to Big Cottonwood Canyon are shown as Tables 11 and 12, respectively. These routes are, in all cases, segments of the routes between downtown and the Canyons. As such, the cost, revenue and patronage estimates are part of the calculations for the Downtown-Canyons service. Fares for this service are recommended at $.50 for a one-way trip.

Shuttle Services Between Alta and Snowbird

It is recommended that two buses operate on a continuous basis to provide shuttle service between the Town of Alta and Snowbird. One bus will operate from 7 a.m. to midnight, while the other will operate from 8 a.m. to 8 p.m. Thus, during peak hours, shuttle headways will be 15 minutes. The schedule for this service is shown in Table 13; there are a total of 56 daily round trips between the resorts, seven days a week. Over the ski season, operating mileage is estimated at 27,000 miles, with a cost of $43,000. Using the patronage estimate of 90,000-100,000 one-way trips over the season, revenue is estimated at $23,000, assuming a $.25 one-way fare. The operating deficit for this service is $20,000, or 47 percent.

TABLE 9

SERVICE SCHEDULE

Salt Lake/Canyons Transit Center - Little Cottonwood Canyon

Hour	Monday thru Friday				Saturday and Sunday			
	SL/CTC*		Alta/Snowbird		SL/CTC*		Alta/Snowbird	
	Departures	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures	Arrivals
AM 6-7	2				4			
7-8	3	1	3	3	8	2	6	6
8-9	2	3	3	3	6	6	8	8
9-10	2	3	2	2	6	8	6	6
10-11		2	1	1	1	6	4	4
11-12	1		1	1	1	3	1	1
PM 12-1	1	1	1	1	3	1	2	2
1-2	1	1	1	1	2	2	3	3
2-3					1	2	1	1
3-4	3		1	1	7	2	3	3
4-5	2	2	3	3	6	4	7	7
5-6	3	3	2	2	6	7	6	6
6-7	1	2	3	3	4	5	5	5
7-8	1	2	1	1	3	5	4	4
8-9	1	1	1	1	2	4	3	3
9-10		1			1	3	1	1
10-11	1		1	1	1	1	1	1
11-12		1				1	1	1

Daily Roundtrips: Mon-Fri 24; Sat & Sun 62

*Salt Lake Canyons Transit Center

TABLE 10

SERVICE SCHEDULE

Salt Lake/Canyons Transit Center - Big Cottonwood Canyon

Hour	Saturday and Sunday							
	SL/CTC		Brighton					
	Departures	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures	Arrivals
AM 6-7	1							
7-8	2	1	2	2				
8-9	2	2	2	2				
9-10	1	2	2	2				
10-11	1	1	1	1				
11-12		1						
PM 12-1	1			1				
1-2		1	1					
2-3								
3-4	2		1	1				
4-5	2	1	2	2				
5-6	2	2	2	2				
6-7	1	2	1	1				
7-8		2	1	1				
8-9								
9-10								
10-11								
11-12								

Daily Roundtrips: Sat & Sun 15

TABLE 11

SERVICE SCHEDULE

University - Little Cottonwood Canyon

Hour	Monday thru Friday				Saturday and Sunday			
	University		Alta/Snowbird		University		Alta/Snowbird	
	Departures	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures	Arrivals
AM 6-7	1				1			
7-8	1		1	1	2		1	1
8-9		1	1	1	1	1	2	2
9-10	1	1			1	2	1	1
10-11			1	1		1	1	1
11-12		1			1	1		
PM 12-1	1				1		1	1
1-2			1	1		1	1	1
2-3		1			1	1		
3-4	1				2		1	1
4-5	1		1	1	1	1	2	2
5-6	1	1	1	1	2	2	1	1
6-7		1	1	1		1	2	2
7-8	1	1			1	2		
8-9			1	1			1	1
9-10		1			1	1		
10-11							1	1
11-12						1		

Daily Roundtrips: Mon-Fri 8; Sat & Sun 15

TABLE 12

SERVICE SCHEDULE

University - Big Cottonwood Canyon

Hour	Monday thru Friday				Saturday and Sunday			
	University		Brighton		University		Brighton	
	Departures	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures	Arrivals
AM 6-7					1			
7-8	1				1		1	1
8-9	1		1	1	1	1	1	1
9-10		1	1	1	1	1	1	1
10-11		1				1	1	1
11-12	1				1	1		
PM 12-1			1	1	1		1	1
1-2		1				1	1	1
2-3					1	1		
3-4	1				1		1	1
4-5			1	1	1	1	1	1
5-6	1	1			1	1	1	1
6-7			1	1	1	1	1	1
7-8		1				1	1	1
8-9							1	
9-10								
10-11								
11-12								

Daily Roundtrips: Mon-Fri 5; Sat & Sun 11

TABLE 13

SERVICE SCHEDULE

Alta - Snowbird Shuttle

Hour	Sunday thru Saturday							
	Snowbird		Alta					
	Departures	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures	Arrivals
AM 6-7								
7-8	4	2	4	4				
8-9	4	4	4	4				
9-10	4	4	4	4				
10-11	4	4	4	4				
11-12	4	4	4	4				
PM 12-1	4	4	4	4				
1-2	4	4	4	4				
2-3	4	4	4	4				
3-4	4	4	4	4				
4-5	4	4	4	4				
5-6	4	4	4	4				
6-7	2	4	2	2				
7-8	2	2	2	2				
8-9	2	2	2	2				
9-10	2	2	2	2				
10-11	2	2	2	2				
11-12	2	2	2	2				

Daily Roundtrips: Sun-Sat 56

Operating Cost and Revenue Projections

Table 14 provides an overall summary of the proposed Wasatch Canyons Transit Service. The key service parameters for the total of all proposed winter services classes are as follows:

- Seasonal Operating Miles:	567,000
- Seasonal Operating Cost:	$905,000
- Estimated Seasonal Patronage	495,000
- Average Number of Passengers per One-Way Trip:	12.1
- Estimated Seasonal Revenue:	$319,000
- Operating Deficit:	$586,000
- Subsidy Percentage:	65%

The service season is assumed to be 150 days; the cost/revenue and patronage projections are based only on this period. While no mention is made of transit service beyond the winter season, it is recommended that limited summer service be implemented in coordination with the various programs which are becoming institutionalized in Little Cottonwood Canyon (e.g., music festival). Other transit services, for conferences, etc., may be scheduled on a demand basis. In addition, limited but basic year-round service would provide a supplemental means of access to the Town of Alta.

Estimates of ridership are based on present levels of use in the Cottonwood Canyons. Service should be sufficient, however, to meet the demands which would likely occur with the reopening of Solitude and with the development of Snowbird's planned additions in lodging and lift capacity. Such increases in use will have the effect of raising the average number of passengers-per-trip from 12.1 as presently estimated to somewhere between 15 and 20 passengers-per-trip, providing greater revenue with negligible increases in operating cost. Thus, the service recommendation should meet the anticipated five-year transit demand in the Cottonwood Canyons even in the event of significant growth in Canyon recreational use.

Calculations of operating mileages and costs are based on the assumption that all buses make round trips. For example, the buses proceeding up-Canyon in the morning will likely bring very few, if any, passengers down-Canyon. Some economies could be affected if certain buses were able to remain at the top of the Canyon, since costs were calculated on the basis of bus-miles rather than service hours.

Potential Problems and Related Improvements

There are certain necessary physical improvements and several specific problem areas associated with the provision of Canyon transit service which are beyond the scope of this Study, but which should be noted nonetheless due to their importance in assuring success in the initial year of the Short-Range Improvement Plan.

Table 14

OPERATING COSTS AND REVENUE ESTIMATES

WASATCH CANYONS TRANSIT SERVICE

Route	Day	Daily Round Trips	Roundtrip Distance (Miles)	Seasonal Operating Miles (1000's)	Seasonal Operating Cost ($1000's)	Roundtrip Time (Minutes)	Buses Required	Estimated Seasonal Patronage (1000's)	Average Passengers Per Trip	One-Way Fare	Seasonal Revenue ($1000's)	Operating Deficit ($1000's)	% Deficit
AIRPORT-CANYON SERVICE													
Airport-Little Cottonwood Canyon	Sun-Fri	11	64	91	$146	130	2	25	8.8	$1.50	$38	$108	74%
	Sat	18	64	23	$ 38	130	3	8	10.6	$1.50	$12	$ 26	68%
DOWNTOWN-CANYON SERVICE													
(a) Downtown-Little Cottonwood Canyon	Mon-Fri	20	52,56	120	$191	126,140	5	73	16.6	$.50 $1.00(b)	$67	$124	65%
	Sat, Sun	32	52,56	69	$111	126,140	7	44	17.2	$.50 $1.00	$40	$ 71	64%
(c) Downtown-Big Cottonwood Canyon	Mon-Fri	5	54	30	$ 47	124	1	16	14.5	$.50(b) $1.00	$14	$ 33	70%
	Sat, Sun	11	54	24	$ 38	124	2	14	15.9	$.50 $1.00	$12	$ 26	68%
SALT LAKE/CANYON TRANSIT CENTER-CANYON SERVICE													
SL/CTC Little Cottonwood Canyon	Mon-Fri	24	32	84	$134	94	4	105	19.9	$.50	$53	$ 81	60%
	Sat, Sun	62	32	79	$126	94	10	100	20.2	$.50	$50	$ 76	60%
SL/CTC-Big Cottonwood Canyon	Sat, Sun	15	34	20	$ 32	78	2	20	16.7	$.50	$10	$ 22	69%
CANYON SHUTTLE SERVICE													
Snowbird-Alta Shuttle	Sun-Sat	56	3.2	27	$ 43	26	2	90	5.4	$.25	$23	$ 20	47%
SYSTEM TOTALS				567	$905		14, 26, 25 (d)	495	12.1		$319	$586	65%

(a) Includes both direct service and service operated via the University. Patronage and revenue estimates include University-Little Cottonwood Canyon route segment. The route via the University has a shorter roundtrip distance (52 miles vs. 56 miles) but a longer roundtrip time (140 mins. vs. 126 mins.).
(b) Fares are $.50 for University-Cottonwood Canyons service and $1.00 for Downtown-Cottonwood Canyons service.
(c) All trips operate via the University. Patronage and revenue estimates include University-Big Cottonwood Canyon route segment.
(d) Total buses required varies by the day of the week: Mon.-Fri. 14; Sat. 26; Sun. 25.

First, it is necessary that adequate facilities for efficient and safe bus turn-around and passenger loading at the Canyon destinations be provided through coordination between the Utah Transit Authority, the Town of Alta, the Wasatch Front Regional Council, Utah DOT and the ski resorts. The specific locations of bus stops and loading/unloading stations in Big and Little Cottonwood Canyons will need to be fine-tuned by precise coordination between the Town of Alta and the resort operators, together with the UTA. At identified locations, some minor construction should be undertaken to provide the space required for bus operations as well as the facilities required for shelter, posting of information and schedules, etc.

Second, to facilitate bus operations and for possible emergencies, it is recommended that the State Department of Transportation construct several turnouts along the Canyon roads of sufficient length to accommodate buses.

Third, arrangements should be developed between the Utah Transit Authority and Alta Central in Little Cottonwood Canyon and UTA and Brighton Resort in Big Cottonwood Canyon to develop emergency procedures in the event of sudden and/or prolonged road closures. If a large number of people who are on the mountain on a particular day came up the Canyon by bus, and a sudden or unexpectedly heavy snowfall necessitates closing the road, there would be a need for a large number of buses to head up the Canyon on short notice. Alternatively, some small number of buses could remain at the top in anticipation of such an emergency, or private arrangements for car-pooling would have to be developed in order to clear out the Canyon prior to closing. It may be possible, in addition, that State Transportation Department snow removal equipment could be stored at the top of the Canyon in the anticipation of such an emergency. In any event, although the 1975-1976 ski season was much better than average in terms of the number of days on which the Canyon roads were closed due to weather, it is important that contingency plans be developed in the event that an emergency Canyon evacuation becomes warranted.

Finally, it should go without mention that all equipment to be used by UTA on Canyon runs should be fully checked out--and this includes drivers as well as buses. Specifically, although UTA indicates that the "Canyonized" buses are all specially equipped with larger engines, heavy-duty transmissions and braking systems, it seems advisable that drivers and equipment should "practice" the Canyons--especially during inclement weather and pavement icing conditions--to insure that both operators and vehicles are fully capable of handling any and all conditions.

* * * * *

ANNOTATED BIBLIOGRAPHY

Alan M. Voorhees & Associates, Inc., Preliminary Transportation Analysis, Little Cottonwood Canyon, Salt Lake County, Utah, for Snowbird Corporation, Snowbird, Utah, December 1973.

A preliminary transportation analysis of access to Little Cottonwood Canyon, intended to set the stage for a more in-depth feasibility study of transportation alternatives. The report describes three mass transportation alternatives: busway, cog-railroad, and aerial bus. Advantages and disadvantages of each alternative are outlined and a comparison of capital and annual costs is presented.

Alan M. Voorhees & Associates, Inc., A Transit Improvement Program for the Utah Transit Authority, prepared for the Salt Lake City Corporation, Salt Lake City, Utah, March 1971.

This report presents guidelines for a program to improve transit service provided by the Utah Transit Authority following its formation in 1970. Extensive use was made of planning data supplied by the Salt Lake Area Transportation Study in the development of this program. The principal elements of the report are: operating characteristics of the existing transit system; analysis of existing travel; examination of the current role of transit; evaluation of alternative courses of action; and a ten-year improvement program.

Both service and capital improvements are recommended. Service improvement recommendations feature a system of express commuter routes, expanded service area, and more east-west service. Recommendations for capital improvements identify a new garage, shop, and office facility in the primary requirement and present a bus acquisition program to reduce the average age of buses to 7.5 years within a three-year period.

Alan M. Voorhees & Associates, Inc., Wasatch Front Regional Transit Development Program, prepared for Wasatch Front Regional Council, March 1973. (Updated in March, 1975, by the Wasatch Front Regional Council.)

A report on a transit study for the region, including parts of Box Elder, Weber, Davis, Salt Lake, and Tooele Counties. The purpose of the study was two-fold: (1) to evaluate present local transit services provided by private bus companies and determine alternatives for improving service, including public acquisition of private companies ; and (2) to develop a short-range program for improving transit service in the study area to the year 1980, and integrate the improved program with the operations of the Utah Transit Authority. This report documents primarily Phase B of the Transit Study, Short-Range Transit Improvement Program. Documentation includes review of existing transit service and operations, service improvement alternatives, and their development, recommended transit improvement program including routes and operating

requirements, transit organization and management alternatives, and an implementation program for the recommended plan.

Barnard, Jean et al., Little Cottonwood Canyon: An Interdisciplinary Study, Environmental Problems and the Law Class, University of Utah.

A report of a class project to "make a thorough overview of all facets of Little Cottonwood Canyon, to identify the interests that come into play there and to describe how, when, and where decisions have been and are being made that influence the course of events in the Canyon." The report is divided into two major parts: (1) "Government Regulation of Little Cottonwood Canyon," and (2) "Little Cottonwood Canyon Reconnaissance," with (3) "Interest Groups." The reconnaissance part contains a chapter on transportation alternatives. The information presented in the report consists primarily of extractions from other reports, personal experience, and interviews with officials and individuals involved in the development and use of Little Cottonwood Canyon.

Eckbo, Dean, Austin & Williams, Inc., The Wasatch Front --A Strategy for Planning, prepared for Salt Lake County, July 1973.

This is a study design for development of a comprehensive regional plan for the Wasatch Front within Salt Lake County. The study design points to the critical and unique planning consideration involved in the study area and suggests that the single general goal of the study should be to maintain a harmonious equilibrium between the region's natural endowments and its man-made environment. The transportation planning elements of this study design constitute the basis for the Wasatch Canyons Transportation Study.

Eckbo, Dean, Austin & Williams and LeBlance & Company, Alta/Little Cottonwood Canyon General Plan, prepared for Salt Lake County and the Town of Alta, July, 1973.

This report presents a proposed General Plan for the upper portion of Little Cottonwood Canyon and documents the planning process involved. The plan addresses land use location and density allocations in conjunction with functional service systems and implementation measures. Included in the report are an assessment of the avalanche hazard and an analysis of circulation capacity in the Canyon.

EDAW Inc., Data Report, Tasks 360 and 370 of Salt Lake County Council of Governments 208 Water Quality Plan, January 1976.

A data report which, in conjunction with EDAW's Wasatch Canyons Study Data Report of June 1975, and with an upcoming report by the 208 Project Staff, covering Soils, Flood and Vegetation Data, documents data assembled for the 208 Water Quality Plan for Salt Lake County. These reports supplement a series of 1"=2000' scale data maps. This particular report documents data assembled in the

following categories: slope, geologic hazards and mineral resources, surface water, subsurface water, wildlife, climatic, historic and archeologic, land ownership and control, land use quantities and development proposals, utilities, zoning, and proposed land use data (composite of general plans).

EDAW Inc., Major Issues in the Wasatch Canyons, Task 270 of Salt Lake County Council of Governments 208 Water Quality Plan, December 1975.

The land use planning effort of the 208 Water Quality Planning Program for Salt Lake County has the objective of "devising means to direct future growth and shifts in land use which both avoid new and solve existing water pollution problems." This report identifies the issues within the Wasatch Canyons which are pertinent to development of a Water Quality Plan, particularly those issues relative to land use planning. Issues identified are grouped into broad areas of concern including: water quality; visual quality; recreation; circulation; air pollution; avalanche; economic; and land use. A number of conceptual land use alternatives for the Canyons are also presented.

EDAW Inc., Data Report, Wasatch Canyons Study, Salt Lake County, Utah, prepared for Salt Lake County Planning Commission, June 1975.

This report describes the mapped data assembled for the Wasatch Canyons Study. The mapped data described includes topographic, slope, avalanche, vegetation, wildlife, climatic, historic, archeologic, special features, land ownership and control, land use, visual quality, and visual exposure data. The descriptions include use of data, map interpretation, and mapping process.

ENTELEKI, Preliminary Report for the Snowbird Project in the Wasatch National Forest.

A verbal description of the development plan for the Snowbird Resort in Little Cottonwood Canyon. The report describes Snowbird as a "full service, destination resort area of the highest quality with an emphasis on skiing in the winter and other types of recreation opportunities in the other three seasons." The development plan calls for overnight accommodations for 5,000 to 6,000 people and lift and trail capacity for 10,000 skiers by 1980. The transportation section of the plan describes the limitation of the existing access road and the need for a mass transit access system for full utilization of planned resort capacity to be possible.

Glenne, Bard et al, Water Pollution and Recreational Use in Little Cottonwood Canyon, UTEC Report 73-123, sponsored by Biomedical Sciences Support Grant Committee, Environmental Engineering Division, College of Engineering, University of Utah, Salt Lake City, Utah.

This report addresses the questions raised whether and how the present developments in Little Cottonwood Canyon are affecting the water quantity and quality in Little Cottonwood Creek. The approach involved historical and spatial examination of the following phenomena: hydrology; water quality; traffic, use and facilities; and correlations between use and pollution. Study methodology included development of predictive models as well as water sampling and interviews with commercial facility operators. Traffic and trip making data supplied by the Utah State Highway Department and visitor-day data supplied by the U. S. Forest Service are presented in the report.

The report concludes that the physical and bacteriological water quality of Little Cottonwood Creek is definitely influenced by Canyon use. Specific observations include:

- Rapid increase in coliform bacteria levels since 1966, with inordinate origination attributed to the Alta and Snowbird areas;

- Road salt identified as the most probable cause of fairly rapid increase in chloride concentrations in Little Cottonwood Creek near its mouth;

- A strong correlation shown between traffic volumes and coliform concentrations.

The report predicts from the observed trends that coliform levels in Little Cottonwood Creek will surpass the maximum allowable for a raw water supply within four to six years.

Hunt, John D. and Perry J. Brown, Utah Resident Outdoor Recreation Participation, Final Report, 1971-1972, report to Department of Natural Resources, Outdoor Recreation Agency by the Institute for the Study of Outdoor Recreation and Tourism, Utah State University, April 1973.

This report describes the outdoor recreation participation of Utah residents from September, 1971, through August, 1972, and presents estimates of the amount of participation by activity. These estimates are based on reporting of actual participation by a sample of all ages, 12 years and older, and both sexes. Study methodology is described, including the development and conduct of questionnaire and interview surveys. The report is divided into two major sections: (1) state-wide summaries of outdoor recreation participation and (2) participation on a multi-county planning district basis.

Institute for the Study of Outdoor Recreation and Tourism, Utah State University, State-of-the-Art and Problem Analysis of Planning Data for Utah Skiing and Other Winter Sports, Logan, Utah, September 1974, submitted to the U. S. Forest Service.

This is a report to Region IV of the U. S. Forest Service on a study project of the same title conducted through the Institute for the Study of Outdoor Recreation and Tourism. The report is divided into two parts. The first deals with the state-of-the-art and presents a review and assessment of available data and research methods. It also includes an analysis of skier data from the 1972-1973 Utah Winter Sports-Ski Industry Study, historical use and facility inventory data for Utah ski areas, and preliminary projections of skier days for 1978 and 1985. Skier survey data from the 1972-1973 study are categorized by resident and non-resident skier and U. S. Forest Service areas versus private ski areas. The second part of the report describes a study plan for investigating the demand for and supply of winter recreation activity in Utah.

Institute for the Study of Outdoor Recreation and Tourism, Utah State University, Utah Ski Industry Study, 1974-1975, Preliminary Report, Logan, Utah, September 1975.

This is a preliminary--not for publication--report of the results of a study of the Utah ski industry, conducted during the 1974-1975 season. This study represents a follow-on of the study conducted during the 1972-1973 season and involved similar skier interview and questionnaire surveys. Almost 17,000 skiers were interviewed during the 1974-1975 season and 1500 completed questionnaires were returned.

The objectives of both of these studies included: collection of data on the number, expenditure patterns, origins, transportation and length of stay of both resident and non-resident skiers; description of the resort and other winter sports facilities and accommodations; and integration of data from the motor vehicle and commercial air travel studies conducted by Utah State University. As in 1972-1973, the survey of skiers constituted the most extensive part of the 1974-1975 study. Eleven ski areas were surveyed, including Alta, Brighton, and Snowbird. Utah ski areas reported a total of 1,411,000 skier visits during the 1974-1975 season, an increase of only 41,000 skier visits in the two years since the 1972-1973 study. This represents a considerable reduction in the growth rate from that of previous years, but may be only a temporary reduction due to the state of the economy. The data also indicated a drop of 25,000 skier visits by out-of-state skiers, perhaps another reflection of the state of the economy.

The results of this study and previous studies have recently been published in a volume entitled, Ski Utah A Report of the Industry, dated February 1976, and co-authored by John D. Hunt and Christie Anderson.

Institute for the Study of Outdoor Recreation and Tourism, Utah Tourism and Recreation Review, Utah State University, Logan, Utah.

The Utah Tourism and Recreation Review is a quarterly publication established in 1972 by the Institute for the Study of Outdoor

Recreation and Tourism to make available to concerned individuals, businesses, agencies, and organizations information produced by the Institute and other programs at Utah State University. Each issue contains a summary of non-resident travel data and resident recreation participation and list of new publications produced by the Institute. Articles on current and ongoing teaching, research, and extension programs also are presented. Articles of particular interest to the Wasatch Canyons Transportation Study and the issues in which they were published are: "Three Years of Non-Resident Motor Vehicle Traveler Study in Utah," Volume 1, Number 3; "Tourism, Interstate 70, and the San Rafael Swell," Volume 2, Number 2; and "The Energy Shortage and Vacation Travel," Volume 3, Number 2.

Myers, Leland and Gary, Little Cottonwood Canyon Transportation Reconnaissance, UTEC Report 74-150, sponsored by A.S.U.U. Environmental Studies Program, Department of Civil Engineering, College of Engineering, University of Utah, Salt Lake City, Utah, October 1974.

This report documents a study of transportation system alternatives for Little Cottonwood Canyon. The major objective of the study was to evaluate and analyze the environmental impact and economic and technical feasibility of alternatives. The report contains summaries of previous transportation studies of Little Cottonwood Canyon and of solutions devised elsewhere to similar problems. A review of governmental and public policies relating to transportation in Little Cottonwood Canyon also is presented. Transportatioin alternatives evaluated consist of narrow gauge railroad, an aerial bus, improved highway, a bus system and the existing system. The evaluation indicated a narrow gauge railroad, using the existing roadbed, to be the best alternative. Two basic recommendations are offered: (1) that specific objectives and constraints for the use of Little Cottonwood Canyon be established; and (2) that local, state, and Federal Agencies involved in Little Cottonwood Canyon transportation problems maintain active cooperation in coordinated problem solving.

Recreation Area Parking Study, Phase 1, Data Collection, prepared by Special Studies Unit, Systems Planning Division, Office of Planning and Programming, Utah State Department of Highways, December 1973.

This report describes an effort by the Utah State Department of Highways (now the Utah State Department of Transportation) and other agencies to define needs and identify opportunities for parking facilities at or near the entrances to Big and Little Cottonwood Canyons to promote carpooling and transit use for Canyon access. A postcard survey conducted at roadside interview stations at the mouths of the Canyons on Wednesday and Saturday, February 14 and 17, 1973, is described and the results of the 2,556 returned questionnaires are presented. Directional traffic counts taken in conjunction with the survey also are reported. Potential locations for parking and their capabilities are identified. The report also includes Highway Department estimates of road capacities and road

improvement programs for the two canyons.

Reese, Clair, Facilities for a Mass Transit System in Little Cottonwood Canyon, M. S. Thesis, University of Utah, 1972.

A thesis proposing an alternative transportation system for Little Cottonwood Canyon, based on the Transit Expressway (Skybus). The investigation considers historical and projected development within the canyon, existing transportation problems, and available alternative transportation systems. Four distinct types of facilities are identified as required to implement the Transit Expressway System. The facilities are described as to concept and design requirements.

Salt Lake Area Transportation Study, 1973 Annual Report, published by the Transportation Planning Section of the Utah State Department of Highways.

This report describes the activities of the Salt Lake Area Transportation Study (SLATS) during 1973, and briefly presents planned activities for 1974. In addition to the descriptions of activities, summaries of existing conditions and projections for 1995 are presented. These summaries include color-coded maps of population and employment densities.

Salt Lake Ranger District, Wasatch National Forest, Alternatives for Land Use, Little Cottonwood Canyon Management Area, Tri-Canyon Planning Unit.

A brief summation of objectives, alternatives, and decisions pertaining to the management of the National Forest Lands in Little Cottonwood Canyon, prepared for the purpose of obtaining public opinion as to how these lands shall be managed. The report presents particular Management Objectives for the Tri-Canyon Planning Unit, Management Alternatives for the Little Cottonwood Canyon Management Area, and Management Unit decisions which have resulted from technical studies and consultations with individuals, organized groups, local government agencies, and the academic community. A "Comment Resume" is provided to facilitate written response.

Traffic on Utah Highways, 1973, Utah State Department of Highways, Office of Planning and Programming, Systems Planning Division, Planning Statistics Section, printed April 1974.

This report presents average daily traffic (ADT) volumes on road sections of varying lengths on the Interstate, Primary, Federal-aid Secondary, and State Highways within the State of Utah. The counts presented were collected from 54 continuously operated permanent traffic recording stations, 216 traffic counting machines stationed periodically at various locations, special counts at urban control stations, numerous short-time counts for specific problems, and 96 manual classification counts. In addition to the 1973 ADT

volumes by road section, ADT volumes for previous years are given for comparative purposes. An additional section of this publication presents average volumes by month and day of week for the permanent count stations, two of which are located on the highways in Big and Little Cottonwood Canyons.

Utah Traffic Accidents and Accident Rates, 1972, 1973, and 1974, Utah State Department of Highways, Office of Planning and Programming, Systems Planning division, Planning Statistics Section.

These are the 1972, 1973 and 1974, issues of the annual report of motor vehicle accidents and accident rates on Federal-aid and State Highways in Utah. The number of accidents and accident rate (number of accidents per million vehicle miles) are given for specific highway segments. Accidents are categorized as to severity by whether they involved fatalities, injuries, or property damage only. Rates for previous two years are given for comparative purposes. A summary of accidents and rates by highway classification also is presented.

Utah, Wasatch Front Counties, Traffic Accidents by Type and Accident Rate, 1972, 1973 and 1974, Utah State Department of Highways, Office of Planning and Programming, Systems Planning Division, Planning Statistics Section.

These are the 1972, 1973 and 1974, issues of an annual report presenting information on motor vehicle accidents by type and rate for Federal-aid and State Highways in the Wasatch Front Counties--Weber, Davis, Salt Lake and Utah. This report supplements the annual report entitled, Utah Traffic Accidents and Accident Rates, and it is intended to provide a reference for locating and analyzing accident trouble spots. The report gives the number, severity, and rate of certain specific types of accidents, such as head-on, rear-end, and sideswipe, for specific highway segments.

von Allmen, Beat, Canyon Transportation Reconnaissance, submitted to the Faculty of Industrial Engineering of the University of Utah August 1973.

This is an expansion of the transportation reconnaissance presented in Little Cottonwood Canyon: An Interdisciplinary Study. In addition to the description of the existing system and abstracts of alternatives, projections of future canyon use are presented as well as various viewpoints on Canyon use. Report appendix describes a design contest for a Canyon transportation system and presents the winning proposal, a narrow-gauge railroad.

Wasatch Front Regional Council and Utah Transit Authority, Surveillance of Transit Operational and Demand Characteristics, Technical Report-- Volume 1, No. 1, April 1974.

This is the first annual report on the transit surveillance program established by the Wasatch Front Regional Council and the Utah

Transit Authority to monitor the operational and demand characteristics of the regional transit system. The report documents the data collection procedure and presents data collected since the surveillance program was initiated in December 1973. Demand characteristics surveyed include inbound and outbound patronage demands for peak and off-peak periods, seasonal variations in demand, and weekday versus weekend demands on a route-by-route basis. Operational characteristics monitored relate to overall financial status, operating cost, revenue generated, etc.

Wilbur Smith and Associates, Salt Lake Area Transportation Study, prepared for Utah State Department of Highways and other participating agencies, June 1965.

Volume I -- Current Travel Inventory
Volume II -- Future Transportation Plan
Volume III -- Engineering, Traffic, and Statistical Data
Volume IV -- Summary Report

These reports document the data base procedures and results of the comprehensive transportation study conducted for the Salt Lake area in 1965. This study was authorized to examine the character of travel within the metropolitan Salt Lake area and to determine the future transportation needs, based on anticipated 1980 travel requirements. The reports describe the conduct and results of the origin-destination surveys which were part of the study. Also documented are forecasts of 1980 travel, examination of transit operations, and a master plan for staged implementation of recommended transportation improvements. The program (also known as the Salt Lake Area Transportation Study), developed to provide continuous transportation planning for the region, is presented as part of the Future Transportation Plan.

Williams and Mocine, Demographic Analysis: The Wasatch Mountains within Salt Lake County, 1976.

This preliminary report describes existing conditions and examines potential for population and recreation growth in the Canyons of the Wasatch Front. Areas studied specifically include existing Canyon population; permanent homes, summer homes, and condominiums; the ski industry impacts; and summer outdoor recreation impacts. The study indicates that the following have a significant impact on the amount and distribution of future development:

- Population growth in the region
- Trends in demand for recreation facilities and vacation homes
- Water supply--for canyon use and protection of supply for Valley
- Sanitation facilities--practical and safe expansion limits
- Land suitability and capability
- Road capacity--total access system
- Public conservation, land use and transportation policies
- Private investment decisions

* * * * * *