



New System Design

Executive Summary



Prepared for

Metropolitan Tulsa Transit Authority

Prepared by

Perteet Engineering, Inc.



September 2003

Acknowledgements

We wish to thank the following persons for their generous application of time and energy to ensure the successful completion of the Tulsa Transit New Service Design project.

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Executive Summary

Overview

Tulsa Transit has undergone a significant change in the past few years. Prior to mid-2002, service provided by Tulsa Transit grew at a modest rate, from approximately 165,000 annual service hours in 1992 to about 200,000 service hours in late 2001. *Figure 1* depicts the trend in service hours provided during that period.

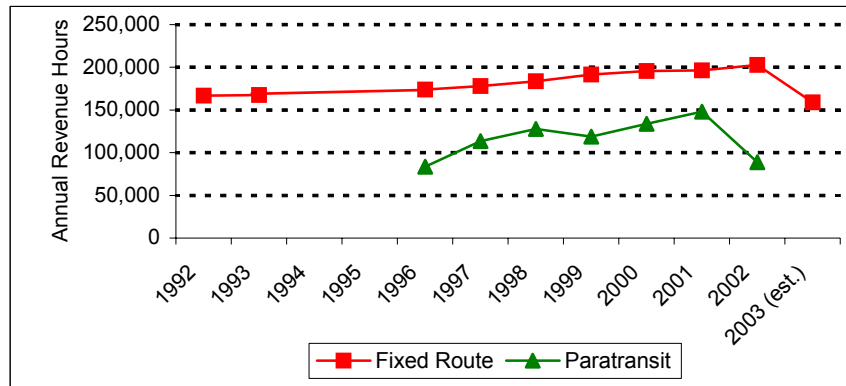


Figure 1: Tulsa Transit Annual Revenue Hours, 1992-2003

Source: Tulsa Transit

Project Background

The Tulsa Transit network in effect in late 2002 retained routes and schedules that had not kept up with changes in the Tulsa environment over the past several years. Downtown Tulsa had lost much of its dominance in the region's economic life and the economic focus of the urban area had significantly expanded to the south and east.

The result is that Tulsa Transit's route network no longer reflects the trip-making patterns of much of the region. The current project was begun in order to make the Tulsa Transit system more responsive to existing transportation patterns for purposes of increasing ridership, improving cost efficiency and improving ridership productivity.

To compound the problem, the nation-wide economic downturn that began in mid- to late-2000 resulted in the collection of significantly reduced tax revenues by the City of Tulsa beginning in 2001. By late 2002, a series of service cutbacks was mandated by those diminishing tax revenue collections.

Service cutbacks, implemented in Spring and Summer 2003, made necessary a re-evaluation of the service network in order to avoid disproportionate impacts on individual rider subgroups and the undermining of the integrity of the service network as a whole. To that end, a modified service network was developed by Tulsa Transit staff, with input from Pertee Engineering, that avoided the most egregious impacts that could have resulted from simple across-the-board service reductions.

The modified network was designed to maintain frequent service headways on the remaining routes and to continue to provide a variety of transfer connections at the two transfer centers, Denver Avenue Station and Mid-town Memorial Station. While a significant number of service

hours were pared from the Tulsa Transit network, the service that remained offered, in many cases, service frequencies superior to those in effect before the service reductions took effect.

That network represented a simplification of the system that had been in operation prior to 2003 (*Figure 2A.*) This simplified network (*Figure 2B*) became the foundation for the expanded service design.



February 2002



August 2003

Figure 2: Tulsa Transit Service

Redesign Objectives

The purpose of the New System Design project was initially to develop a new structure for the Tulsa Transit service network which could be operated with existing service resources (as of late 2002) and which would accomplish the following objectives:

- ❑ To improve transit travel times to major transit destinations,
- ❑ To improve ridership and ridership productivity when compared to the existing Tulsa Transit network,
- ❑ To improve operating cost efficiency as compared to the existing Tulsa Transit network,
- ❑ To support and promote the urban initiatives included in the City of Tulsa’s visioning process and
- ❑ To serve as the basis upon which to build an improved service network as available funding resources expanded in the future.

The project scope was later amended to include a longer-range element of improved transit service to the Tulsa region and to add a regional service element to the program.

Existing Conditions

Before redesigning the Tulsa Transit network, it was first necessary to identify the primary markets for MTTA services. Recognizing that the majority of Tulsa Transit riders are transit-dependent, it was determined to focus primarily on the travel needs of these riders and then to address the wider trip-making patterns of the general public.

Demographics

A geographic database was created which identified regions of the Tulsa metropolitan area with high concentrations of a number of demographic sub-groups that have been identified as significant sources of transit riders. These sub-groups included the following:

- ❑ persons having no access to a private car or truck for personal transportation,
- ❑ persons with incomes below the defined poverty level,
- ❑ elderly citizens,
- ❑ youthful (less than 16 years old) citizens,
- ❑ non-English-speaking individuals

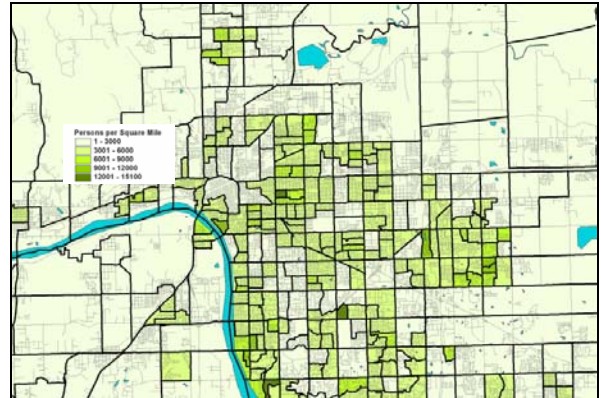


Figure 3: Population Density Distribution
Source: 2000 Census of Population

In addition, it was decided to focus resources initially on areas having a higher-than-average population density.

A series of maps was then created from information gathered in the 2000 Census of Population and from information supplied from INCOG, similar to *Figure 3*, which shows the relative population density in the Tulsa area by census block group.

Telephone Survey

A survey of the perceptions and attitudes about transit among residents of the City of Tulsa was conducted by Carolyn Browne Associates, of Bellevue, Washington in December 2002. Telephone interviews for Tulsa Transit were conducted with 201 randomly selected male and female heads of households residing within the city limits of Tulsa.

A large majority (88%) of those surveyed believes that “a good public transportation system is important to the economic vitality of the area.” Over one-half (52%) said they would be somewhat or very likely to vote for funding to provide transit improvements.

The greatest single reason Tulsa residents believe that someone uses transit is because they have no choice (64% of the respondents). Just over one-third (34%) have experience using transit in other cities in the previous five years; and 41% say they have ridden light rail in another city. Respondents supported many suggested improvements for Tulsa Transit as depicted in *Figure 4*.

Nearly one-half (48%) of those surveyed say they are very (15%) or somewhat likely (33%) to begin riding Tulsa Transit if the improvements they believe are important are made. Just over half (52%) say they are very (16%) or somewhat likely (36%) to vote for some increase in taxes to fund the transit improvements they believe are important.

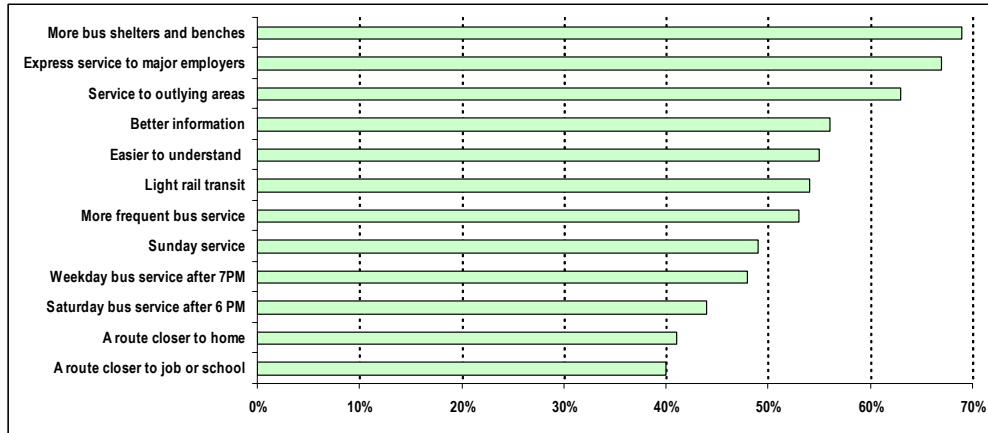


Figure 4: Survey Respondents Transit Improvement Preferences

Significant Transit Sub-Markets

One of the keys to minimizing the impacts of system operating changes on existing riders is to make sure that groups that are currently transit riders continue to have their needs met by the modified transit network. Currently, a number of lower-income commuter groups make up a significant proportion of Tulsa Transit riders:

Hotel/Motel Employees

Many existing employees of the hospitality industry are current Tulsa Transit riders. These riders regularly commute to entry-level jobs in the hotels and motels in the greater Tulsa area. Typically, these riders are included in the housekeeping staffs of these employers and a large proportion of them are not fluent in the English language.

The locations of major hotels and motels in the metro Tulsa area were added to the GIS database and mapped for later comparison with route alignments (Figure 5.)

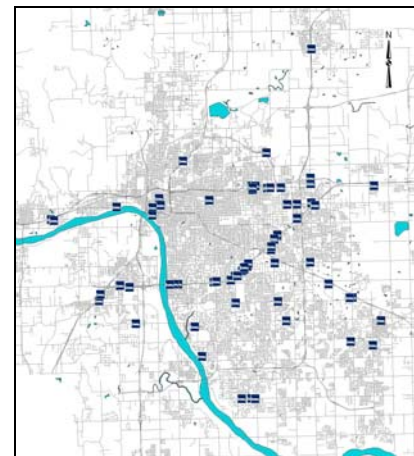


Figure 5: Hotel/Motel Locations

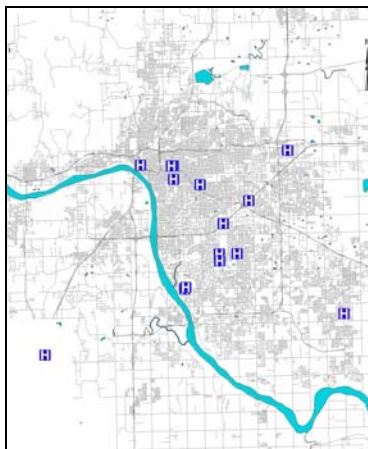


Figure 6: Distribution of Major Hospitals & Clinics

Source: INCOG

Hospital/Clinic Employees

A second major commuter group represented among Tulsa Transit riders is the healthcare industry. As with the hospitality industry employees, many of these commuters are also employed in lower-income entry-level jobs that pay wages that restrict their ability to own and/or operate a private automobile.

These commuters come from similar population groups to the hospitality industry workers and tend to live in similar areas of the region. The distribution of hospitals in the Tulsa metro

area was plotted on maps for later comparison with route alignments.

Employees of Other Major Employers

In addition to the hotels and hospitals in the region, there are a number of other major employers whose employees represent a significant proportion of Tulsa Transit riders. It is important that transit access to these major employment locations be maintained for the convenience of existing Tulsa Transit commuters.

The distribution of these major employers (100 or more employees) is depicted in *Figure 7*.

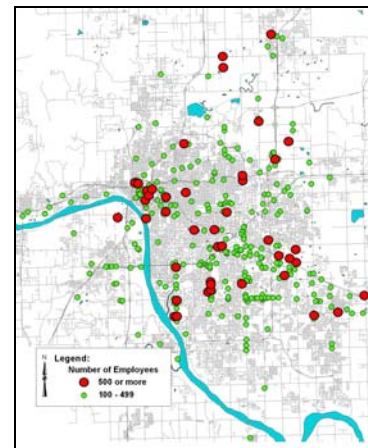


Figure 7: Major Employment Sites
Source: INCOG

Ridership and Productivity

During the period 1998 through 2001, ridership on the fixed route (bus) network of Tulsa Transit was modestly increasing, after several years of decline in the early 1990s. However, revenue shortfalls resulting from a faltering economy necessitated a significant cutback in Tulsa Transit services. These, in turn, were accompanied by a decrease in system ridership, reflected in the following figure.

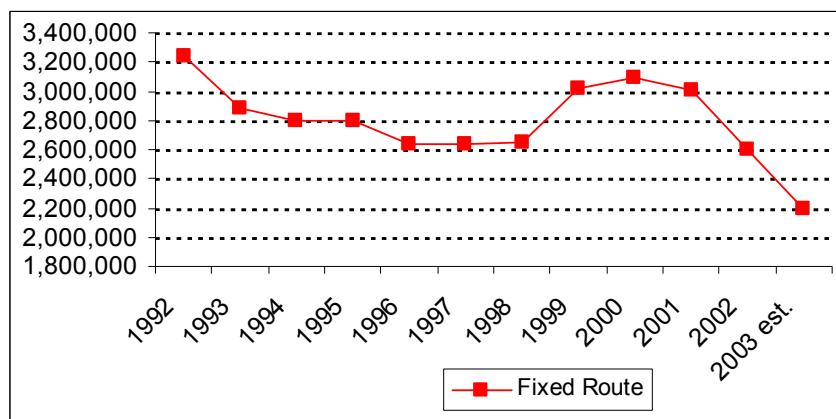


Figure 8: Annual Tulsa Transit Fixed Route Ridership, 1992-2003
Source: Tulsa Transit

This reduction in service, implemented in Fall of 2002 and Spring 2003, came directly on the heels of the opening of the Memorial Midtown Transfer Station in 2001. That opening was accompanied by an increase in transit service as reflected in *Figure 1*. Just as ridership began to rebound, a sizable reduction in services was implemented just months later, resulting in the decline in ridership depicted in *Figure 8*.

During the past several years, ridership productivity on the fixed route system has remained relatively constant, hovering about the 15 ½ riders per hour level. The significant increase in service implemented in 2002 temporarily depressed the system productivity, which is estimated to have rebounded somewhat as a result of the service cuts implemented in Spring 2003, as the more unproductive services were generally targeted for the greatest service reductions. (See *Figure 9*.)

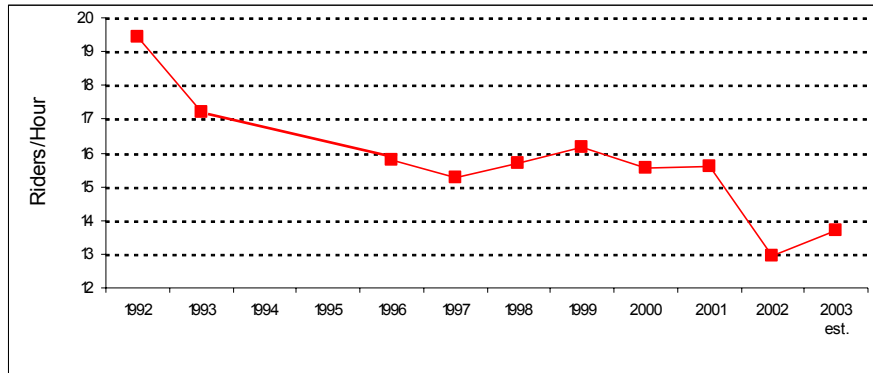


Figure 9: Annual Tulsa Transit Fixed Route Productivity, 1992-2003

New System Design

The goals for Tulsa Transit's fixed route bus network system were defined as follows:

- ❑ To provide public transportation within the service area that is safe, convenient, comfortable, accessible, and reliable
- ❑ To adopt fiscal policies which are both effective and efficient in the acquisition and utilization of public transportation funds
- ❑ To adopt operational policies that are both effective and efficient in providing quality public transportation services to all segments of the community
- ❑ To promote the continued development of public transportation services and facilities that are responsive to the needs of the public and community
- ❑ To assure a properly hired, trained and deployed work force and a supporting work environment that promotes confidence, the achievement of individual goals, and the delivery of service which is sensitive to the needs of the customer
- ❑ To promote and participate in the community to achieve community mobility, energy conservation, air quality improvements, and promotion of additional development in the City of Tulsa and its urban service area

Network Design

Because of the grid network of streets in the Tulsa region, many felt that the grid network possessed a number of distinct advantages over the service network then in place:

- ❑ Ease of understanding
- ❑ compatibility with the street and highway network
- ❑ nearly any location in the service area may be reached requiring, at most, one transfer
- ❑ travel time is minimized by eliminating meandering route alignments.

Balancing those advantages, the application of a pure grid network in the Tulsa region also has a number of drawbacks, including:

- ❑ major regional travel destinations would have no greater levels of service than other, less desirable destinations;
- ❑ transfers are dispersed throughout the service area requiring a higher level of service on all routes to minimize transfer delays.

In sum, it was determined that a pure grid network was not the most desirable design for the Tulsa Transit expanded service network. The inability to provide sufficient service frequencies on every route to minimize transfer waits, the difficulty in focusing service on major transit trip attractors and the potential for underutilization of the two existing transfer centers all weighed heavily in that decision.

It was recognized that the Tulsa Transit network should take advantage of the grid street network in the Tulsa region while focusing on major employment and retail centers and the transit center facilities. This was the basis for the hybrid system of routes selected as the basis for the modified route network.

Cost Parameters

Operating targets for the system redesign were developed based on an examination of transit operations in areas of similar size to Tulsa.

The operating targets for the redesigned system were defined as:

- ❑ Annual Revenue Hours: 370,000
- ❑ Peak Buses: 140
- ❑ Annual Fixed Route Operating Cost: \$22,000,000

City	1999 Population	Service Area (sq.mi.)	Peak Buses	Annual Hours	Weekday Riders	Hours/ Capita	Bus Index
Oklahoma City	475,000	1,265	98	194,165	21,494	0.41	20.63
Tucson	467,000	242	159	515,505	54,217	1.10	34.05
Kansas City MO	438,000	173	235	581,978	51,254	1.33	53.65
Long Beach	435,000	96	161	640,707	79,660	1.47	37.01
Albuquerque	421,000	124	116	300,461	28,007	0.71	27.55
Sacramento	407,000	295	184	584,849	66,424	1.44	45.21
Fresno	404,000	133	84	300,949	42,532	0.74	20.79
Omaha	387,000	193	114	272,411	13,207	0.70	29.46
Tulsa	382,000	184	74	196,447	10,853	0.51	19.37
Colorado Springs	350,000	644	48	148,062	10,913	0.42	13.71
Wichita	336,000	120	47	107,538	9,085	0.32	13.99
Cincinnati	331,000	262	360	874,376	82,416	2.64	108.76
Toledo	308,000	149	146	251,338	15,627	0.82	47.40
Average	395,462	298	140	382,214	37,361	0.97	35.52

Table 1: Tulsa Peer Group Comparison

Source: FTA 2001 National Transit Database; U.S. Department of Commerce

A number of transit service characteristics were recorded for each system, comparing the service area size and population, fixed route transit service hours provided, transit revenue fleet size and per capita service production and consumption. From this data, additional summary ratios were calculated for each agency as well as for the peer group as a whole: annual revenue hours per capita ("Hours/Capita" in the table above) and vehicles per capita (multiplied by 100,000 and shown as "Bus Index" in Table 1.)

Regional Services and Governance

Currently Tulsa Transit is owned and operated by the City of Tulsa. Under this funding arrangement, service is confined to the City of Tulsa unless another jurisdiction contracts with the City for the provision of services. The initial system designs assumed no change in the

funding and operating governance of the system, and therefore, that the targeted operating cost ceilings would apply to services within the City of Tulsa only.

While some services included in the preliminary urban design (Tier 1) would serve other jurisdictions, as some existing services do, they represent a small proportion of total system costs. It was assumed that additional services to outlying jurisdictions could be layered on top of the basic system design, since those services would be subject to additional funding from the jurisdictions they were designed to serve. Those additional services are identified as Tier 2 and Tier 3 services in the modified plan.

Commuter vs. Baseline Services

Most major urban transit networks are expressly designed to reflect the underlying rider priorities of the system. In many cities included in the peer group, the transit network is designed to optimize commuter travel, with a relatively high proportion of the revenue fleet active only during commuter travel hours. In other communities, the network is designed as a safety net for transit dependent riders and tends to have service levels relatively constant during most operating periods.

The peer group agencies tend to be slightly more commuter-oriented, as a group, than is Tulsa Transit. This fact is reflected in the larger fleet sizes maintained by many, as shown in *Table 1*. Of the 13 peer agencies, six have fleet sizes in excess of 140, which, given the total service provided, reflects a relatively high commitment to commuter services. In some agencies, more than half the fleet is out of service during off-peak hours. At the same time, five of those agencies have fleets with fewer than 100 buses, reflecting a more balanced level of service across all operating periods.

Tulsa currently falls into the latter category. It has been assumed, for the purposes of the system re-design, that this focus would remain relatively unchanged.

Major Employment Concentrations

In order to retain the many employees at major employment sites who are currently transit riders, an effort was made to maintain direct transit service to these major sites to the greatest extent possible from both major transfer stations. This ensures that riders will continue to be able to access these employment sites from nearly any point in the service area with at most one transfer.

Design Priorities

In summary, it was felt that a pure grid network was not the most desirable design for the Tulsa Transit expanded service network. The inability to provide sufficient service frequencies on every route to minimize transfer waits, the difficulty in focusing service on major transit trip attractors and the potential for underutilization of the two existing transfer centers all weighed heavily in that decision.

It was recognized that the Tulsa Transit network should take advantage of the grid street network in the Tulsa region while focusing on major employment and retail centers and the transit center facilities. This was the basis for the hybrid system of routes selected as the basis for the modified route network.

Most routes serve the Denver Avenue Station (11 routes), Memorial Midtown Station (5 routes) or both (5 routes.) Only one of the twenty-two urban routes serves neither facility.

Figure 10 shows the general alignment of the twenty-two urban routes. The design also designates three regions in south and east Tulsa that are proposed to be served by demand response services, connecting individual origins within these regions to the nearest transfer station or major transfer point.



Figure 11: Proposed Demand Response Service Areas

Annual variable operating costs for the urban network are calculated as \$17.6 million in 2003 dollars. Another \$4.3 million represents the system fixed costs, leaving a total operating cost of \$21.9 million in 2003 dollars for the urban portion of the modified fixed route system. This urban system would operate about 485,000 annual platform hours of service with 95 buses in service during peak periods and 75 buses during weekday off-peak periods.

The Suburban Network

Overlaid on the urban network is a secondary network of routes serving a number of outlying communities remote from the Tulsa city core. These routes are intended to be funded by the communities they have been designed to serve, according to some unspecified funding source(s).

This secondary, suburban network consists of routes serving seven additional suburban corridors:

- Catoosa
- Owasso*/Collinsville
- Skiatook
- Sapulpa
- Jenks*/Glenpool
- Bixby*
- Broken Arrow*/Coweta

In general, these routes are designed to operate every 30 minutes during peak commuter hours and every hour at other times. Operating periods are somewhat truncated from those applying

to the urban (Tier 1) services, generally from 6 AM to 7:30 PM weekdays, from 7 AM to 6 PM Saturdays and from 9 AM to 5 PM Sundays. Some of the suburban routes, identified with an asterisk (*) in the list above, have been identified as Tier 2 routes. These offer somewhat extended service hours over the remaining (Tier 3) routes. The suburban network is depicted in *Figure 12*.

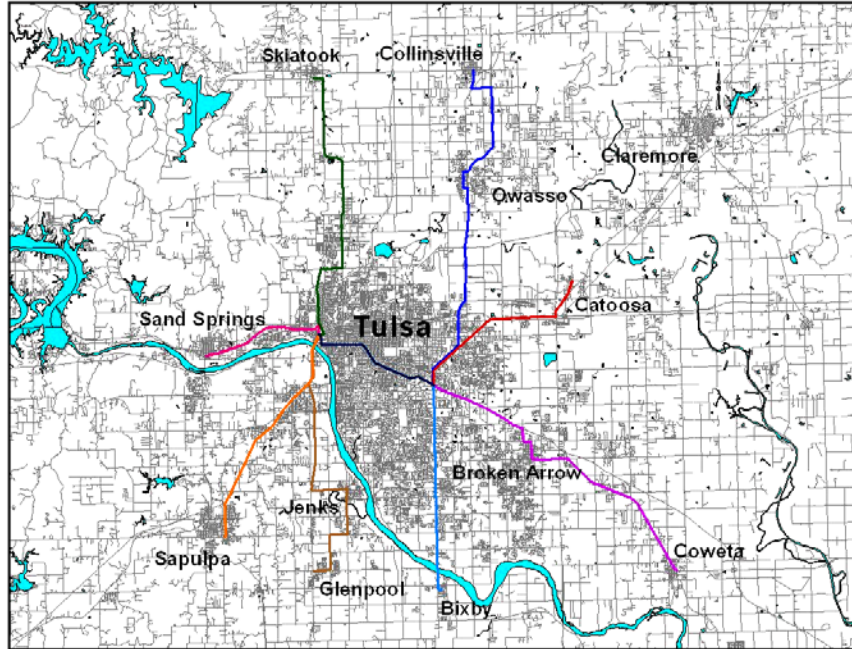


Figure 12: Recommended Tulsa Transit Suburban Network

Summary

The recommended urban network deviated somewhat from the design targets set at the beginning of the project. The 95 peak buses were significantly less than the target of 140 based on the peer transit operators. The target-setting process was described earlier in this document. The estimated 484,000 annual operating hours exceeded the original 370,000 hour target. This was made possible by Tulsa Transit’s lower variable operating costs, compared to the peer agencies. The estimated annual operating cost of \$21.9 million was right at the \$22 million target. Much of the disparity is due to a diminished focus on commuters by this network design than that exhibited by the original peer agencies. Cost and operating characteristics of the recommended system, *in 2003 dollars*, are summarized in *Table 2*.

Tier	Buses				Hours			Operating Cost			
	Peak	Base	Sat	Sun	Weekday	Saturday	Sunday	Weekday	Saturday	Sunday	Total
Tier 1	95	75	72	69	365,593	59,647	58,464	\$13,285,643	\$2,167,563	\$2,124,598	\$17,577,804
Tier 2	17	8	8	8	47,888	5,263	4,935	\$1,740,244	\$191,259	\$179,348	\$2,110,850
Tier 3	26	11	11	11	70,788	6,673	5,510	\$2,572,436	\$242,509	\$200,233	\$3,015,178
Fixed											\$4,321,834
Total	138	94	91	88	484,269	71,583	68,910	\$17,598,323	\$2,601,331	\$2,504,179	\$27,025,667

Table 2: Services and Costs, New Service Design

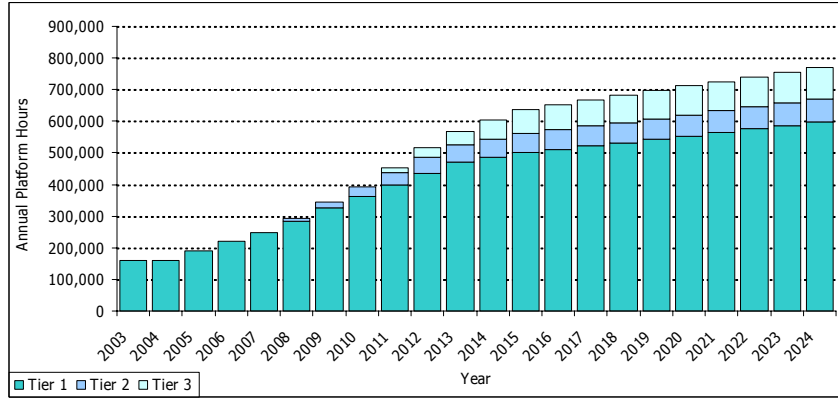


Figure 13: Proposed Service Implementation Schedule

The new service design, based on the Tulsa Transit network in effect in September 2003 is recommended for implementation in relatively small incremental stages, beginning in 2005, as depicted in Figure 13. Ridership projections are somewhat conservative, assuming average rider productivity on the urban system to increase to that of the existing peer group average by 2024. On that basis, anticipated ridership effects of that implementation from 2004 through 2024 are depicted in Figure 14.

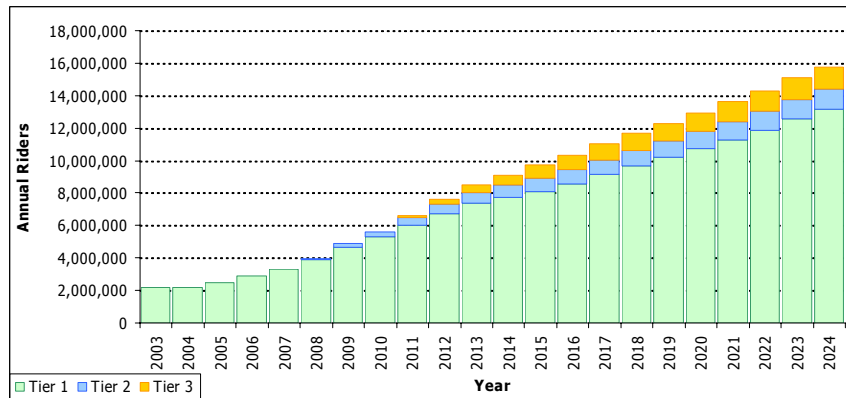


Figure 14: Estimated Ridership Growth

The total cost of system operations, based on the implementation schedule shown in Figure 13, is depicted in Figure 15. Costs are based on a 2003 variable cost per hour of \$36.34 for fixed route services and a 2003 fixed cost of \$4.3 million, inflated at an annual rate of 3% over the period 2004-2024.

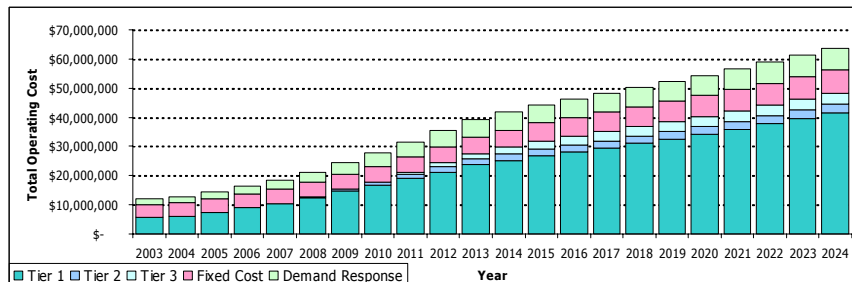


Figure 15: Projected System Operating Costs, 2003-2024

The service cuts implemented in 2003 have reduced the utilization of Tulsa Transit’s revenue fleet. At the same time, 28 vehicles have been retired from MTTA’s fleet due to advancing age. As the transit funding outlook improves, expansion of fleet services will require the addition of fleet vehicles. An estimated fixed route fleet expansion, retirement and replacement program is summarized in *Table 3*, sufficient to operate the proposed urban network. A fleet expansion and replacement capital program will need to be established in order to plan for, and fund, fleet purchases to support the service expansion program.

Model	Fiscal Year																					
Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
1985	2																					
1986	6	6																				
1987	6	6																				
1990	12	12																				
1998	16	16	16	16	16	16	16															
2000	20	20	20	20	20	20	20	20	20													
2005			32	32	32	32	32	32	32	32	32	32	32	32								
2007					6	6	6	6	6	6	6	6	6	6	6	6						
2009							9	9	9	9	9	9	9	9	9	9	9					
2010								27	27	27	27	27	27	27	27	27	27	27	27			
2012										40	40	40	40	40	40	40	40	40	40	40	40	
2017															40	40	40	40	40	40	40	40
2019																	10	10	10	10	10	10
2021																			16	16	16	16
2022																				30	30	30
2024																					40	40
Fleet	62	60	68	68	74	74	83	94	94	114	114	114	114	114	122	122	126	126	133	136	136	136
New			32		6		9	27		40					40		10		16	30		40
Retire		2	24					16		20					32		6		9	27		40

Table 3: Estimated Fixed Route Fleet Replacement/Expansion Schedule, 2003-2014

Under existing conditions in the Tulsa region, the continuation of municipal operation can continue to provide direction and funding for the urban component of the transit system. Multi-County or City-County ownership of the system would be relatively easy to create from a legal perspective, and would meet the requirements for a more regional decision-making process as the transit system becomes more regional in the provision of its services. A regional public transportation district, while often more difficult to create, may better keep a regional perspective in the planning and implementation of public transportation services in the longer term.

The management and operation of public transportation services in the Tulsa region is fundamental to the design of expanded transit services. In the short term, the network described in this document is based on the assumption that the transit system will continue to be owned and operated by the City of Tulsa.

