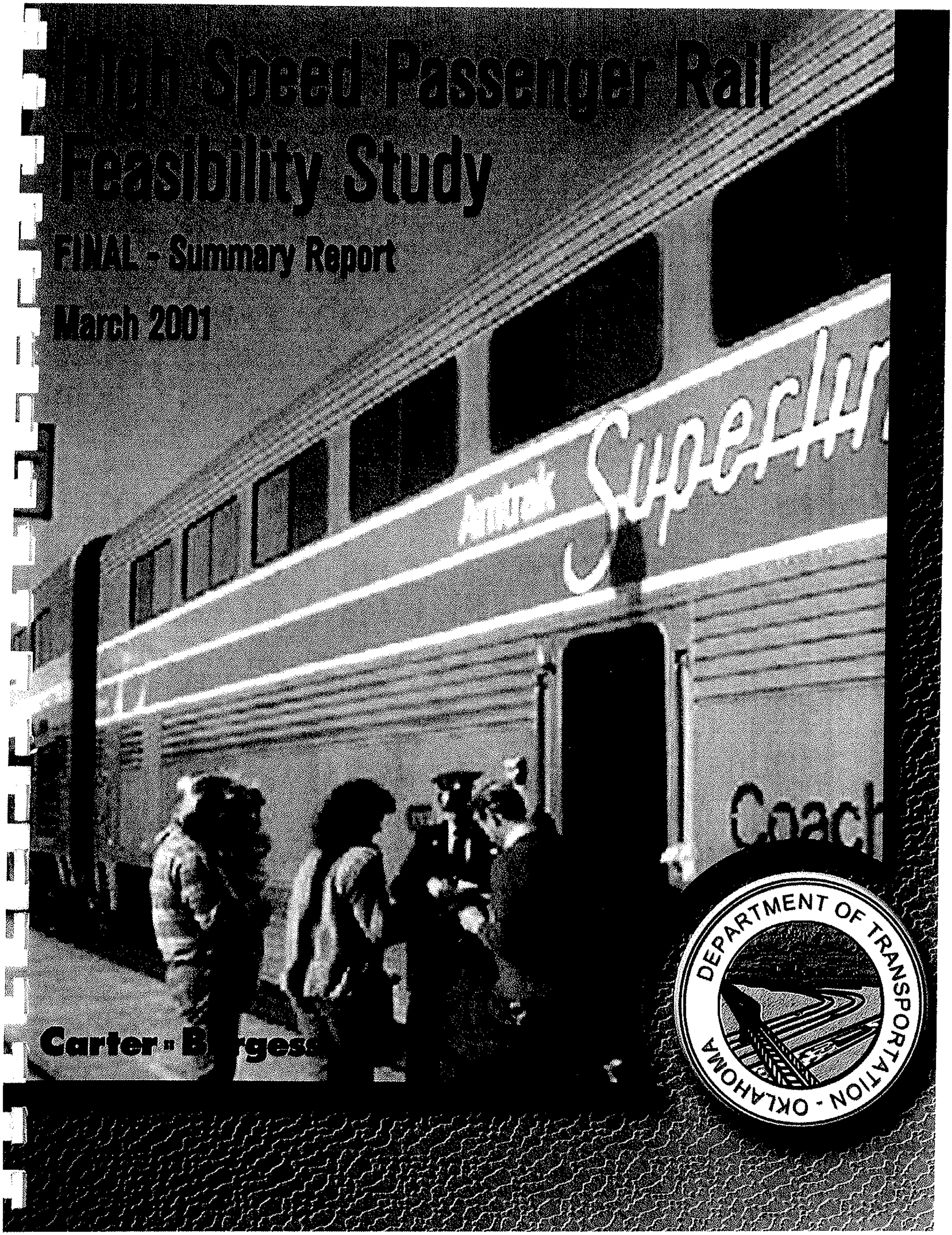
High Speed Passenger Rail Feasibility Study

FINAL - Summary Report

March 2001



Carter Burgess

HIGH SPEED PASSENGER RAIL FEASIBILITY STUDY

SUMMARY REPORT

Connecting all People all Places

Prepared for:

Oklahoma Department of Transportation
Rail Division

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Carter::Burgess

March 2001

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EXECUTIVE SUMMARY

Expanded passenger rail services would benefit both residents of Oklahoma and passengers traveling on the national passenger rail system. Short-term initiation of passenger rail service and longer-term service expansion and rail capital investments in the State of Oklahoma would connect the State passenger rail system with the national passenger rail network, providing additional mobility, potential for economic growth, and long-term air quality benefits to the citizens of Oklahoma.

Expansion of the Heartland Flyer service from Oklahoma City to Newton, Kansas would establish a connection to the national passenger system on the north end of the route. Increased passenger, mail, and freight revenues through a continuous passenger rail connection between the Southwest Chief and Texas Eagle services would improve long-term success of the Heartland Flyer. Expanded Heartland Flyer service could be accomplished using existing equipment and without any additional equipment maintenance facilities. Extension of the Heartland Flyer service, excluding any station improvements, is anticipated to be in the neighborhood of five million dollars, with 2.9 million dollars of track-related improvement in the State of Oklahoma and 2.1 million dollars of track-related improvement in the State of Kansas. The recommended schedule for the expanded service maintains existing service schedules between Oklahoma City to Ft. Worth and allows an acceptable connection to the Southwest Chief service (Los Angeles to Chicago). The ongoing railroad safety improvements coordinated by the Oklahoma Department of Transportation would be continued in an effort to reduce the travel time on the Oklahoma City to Ft. Worth and Oklahoma City to Newton segments to approximately three and a half hours each.

Longer-term expansion of the Heartland Flyer service could include extension of service through western Kansas and the foothills of southern Colorado to Denver. The most desirable alternative for expanding the Heartland Flyer service to Denver would require an additional train consist and the establishment of maintenance services in Denver. The anticipated cost for expanding the Heartland Flyer service between Oklahoma City and Denver are estimated to be an additional 37 million dollars, 24 million of which would be needed in the State of Colorado, one million in the State of Kansas, and twelve million for the additional train set. The anticipated schedule for this service would reduce the present travel time to Oklahoma City on the Southwest Chief via bus from Denver by over seven hours traveling from Denver and just under three hours traveling to Denver. Amtrak has also expressed a significant amount of interest in a north/south rail connection to Denver for the provision of enhanced priority freight and express mail delivery.

Other long-term goals include initiation of service between Tulsa and Oklahoma City, providing passenger rail connection between the two largest metropolitan areas of the State of Oklahoma. Recent designation of the existing routes from Ft. Worth to Oklahoma City and from Oklahoma City to Tulsa as high-speed corridor routes increases the potential for the availability of Federal funding to further develop and enhance rail service to Oklahoma City and Tulsa. Establishing and developing rail service between Tulsa and Oklahoma City would foster the development of an additional connection to the national passenger rail system east of Oklahoma. Kansas City appears to be the most feasible connection and could potentially be implemented on existing rail routes with only standard improvements. St. Louis is another possible connection point to the east that is more appealing to the State of Missouri; however, a connection from Tulsa to St. Louis would require extensive capital improvements for the implementation of desirable service. The success of any eastern connection by rail from Tulsa would be highly dependent on the development of an acceptable travel time and connection between Oklahoma City and Tulsa.

The findings of this study recommend expansion of the Heartland Flyer Service north to Newton, Kansas for a northern connection to the Amtrak Southwest Chief service as soon as possible to augment the success of the Oklahoma City to Ft. Worth service. The further expansion of the Heartland Flyer route to Denver should be considered to establish an additional north/south route for passenger, priority freight, and express mail delivery service on the national passenger rail network. Incremental development of service between Oklahoma City and Tulsa should also be considered to enhance the development of statewide rail transportation services and provide the impetus for a successful eastern connection to the national passenger rail system.

SECTION 1 - INTRODUCTION

Carter & Burgess, Inc. was selected by the Oklahoma Department of Transportation to evaluate components of the existing rail network in the State of Oklahoma and to assess the feasibility of providing passenger rail service throughout the state. An initial effort focused on providing technical analysis and merit of introducing passenger rail service from Oklahoma City, Oklahoma to Fort Worth, Texas. On June 14, 1999, the State of Oklahoma was successful in implementing daily passenger service via the Amtrak Heartland Flyer.

The focus of future passenger rail service then shifted to connecting Oklahoma with the national passenger rail network, providing rail connections between Oklahoma's major metropolitan areas, and evaluating other connections to suburban and rural destinations. The operational analysis included evaluations of the existing routes within the anticipated phases of implementation efforts that will be required to expand rail service throughout the State. Upon conclusion of initial discussions with representatives in the state legislature, city representatives and other stakeholders, it was determined the primary routes to be evaluated would be:

- Oklahoma City to Newton, Kansas
- Oklahoma City to Tulsa, Oklahoma,
- Tulsa to Perry and Newton, Kansas
- Tulsa to Kansas City, Missouri
- Tulsa to St. Louis, Missouri
- Oklahoma City to Ft. Reno
- Oklahoma City to Denver, Colorado via Newton, Kansas.

Operational Issues and Corresponding Assumptions

Some of the assumptions used during the operational evaluation will be important components in the final decision making for route implementation. The operating restrictions considered during the evaluation were track geometry and yard limits. Track geometry was primarily limited to the horizontal curve speed restrictions and operational restrictions associated with switching maneuvers. With the exception of the analysis of the segment between Pueblo, Colorado, and Denver Colorado the vertical alignment of the existing routes did not present significant operational issues. However, vertical alignment issues were moderately sensitive in the engineering analysis conducted to enhance the alignment between Oklahoma City and Tulsa. Speed restrictions imposed by the railroad in several yards along the route were honored but with the assumption that a passenger train could traverse those limits traveling at least 10 MPH above the imposed restriction as is common practice for passenger train operations.

The evaluation was also based on the assumption that the Burlington Northern Santa Fe (BNSF) would provide priority status to passenger operations and that any capacity issues could be overcome through infrastructure improvement. Capacity issues were evaluated in more detail on routes that presently have a significant number of freight train movements and could potentially have problems facilitating sound passenger train operations. The scheduling calculations lead to the development of schedules that would serve the citizens of Oklahoma as conveniently as possible while fitting into the present operating schedules used by Amtrak on other national routes within the region. The schedules for the existing routes were developed based on the assumption that minimum layover times would be utilized for any vehicle changes, passenger movements, or other operational necessities.

Unless otherwise specified the operational analyses were based on the assumption that existing alignments on the routes under evaluation would be utilized with a minimum number of upgrades and that the operator would use conventional equipment. The requirements assumed for implementing passenger operations on any of the routes included track resurfacing addressing tangent track sections, adjustment of superelevation within the curves, and implementation of Central Traffic Control (CTC) signalization for controlling train operations. Highway/rail grade crossing signalization was also evaluated and cost estimate for each segment was formulated, based on present signalization costs and the number of signals on each segment that would potentially require upgrade. Provisions for grade separation structures were not included in the cost estimates included in this study, under the assumption that any location requiring a grade separation could not be fully identified until passenger operations had been implemented and the effect that increased train traffic would have on each segment could be fully assessed.

Horizontal Curve Speed Restrictions

Speed restrictions associated with the horizontal geometry of a track bed are developed based on some key issues related to track layout. Track is originally laid out with a specific amount of superelevation based on the anticipated uses of the track for either freight or passenger train movements and the operating speeds that are desired. Superelevation is the difference in elevation of the outer track as compared to the inner track throughout the length of the non-spiral section of a horizontal curve. The offset in vertical elevation between the tracks (superelevation) counteracts the centrifugal force acting radially outward on the train while passing through the curve[1]. An illustration of the resultant forces associated with superelevation is provided in Figure 1.

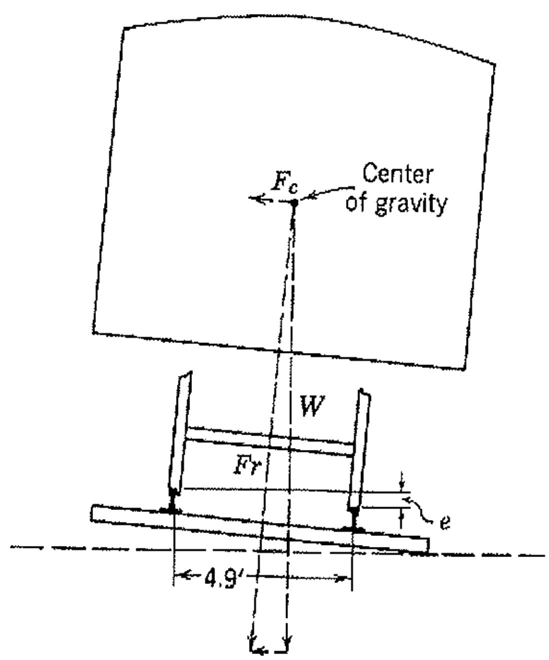


Figure 1 - Illustration of Superelevation[11]

Approximations for the amount of superelevation measured in inches (in) are derived from equation 1:

$$E=0.0007V^2D \qquad (1)$$

Where:

E = Equilibrium elevation (in) of the outer rail, center to center of rails 4' 11.5"
D = Degree of Curve
V = Speed in miles per hour

The equilibrium of various degrees of curvature for speed in miles per hour in multiples of five, which are generally used in common practice are provided in Table 1.

Table 1 - Equilibrium Elevation for Various Speeds on Curves[2]

E = Equilibrium Elevation for Various speeds on Curves																	
D = Degree of Curve	V = Speed in Miles per Hour																
	10	20	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
0° 30′	0.04	0.14	0.32	0.43	0.56	0.71	0.88	1.06	1.26	1.48	1.72	1.97	2.24	2.53	2.84	3.16	3.50
1° 00′	0.07	0.28	0.63	0.87	1.12	1.42	1.75	2.12	2.52	2.96	3.43	3.94	4.48	5.06	5.67	6.32	7.00
1° 30′	0.11	0.42	0.95	1.29	1.68	2.13	2.63	3.18	3.78	4.44	5.15	5.91	6.72	7.59	8.51	9.48	10.50
2° 00′	0.14	0.56	1.26	1.72	2.24	2.84	3.50	4.24	5.04	5.92	6.86	7.88	8.96	10.12	11.34	12.64	
2° 30′	0.18	0.70	1.58	2.14	2.80	3.54	4.38	5.29	6.30	7.39	8.58	9.84	11.20				
3° 00′	0.21	0.84	1.89	2.57	3.36	4.25	5.25	6.35	7.56	8.87	10.29	11.81					
3° 30′	0.25	0.98	2.21	3.00	3.92	4.96	6.13	7.41	8.82	10.35							
4° 00′	0.28	1.12	2.52	3.43	4.48	5.67	7.00	8.47	10.08								
5° 00′	0.35	1.40	3.15	4.29	5.60	7.09	8.75	10.59									
6° 00′	0.42	1.68	3.78	5.15	6.72	8.51	10.50										
7° 00′	0.49	1.96	4.41	6.00	7.84	9.92											
8° 00′	0.56	2.24	5.04	6.86	8.96	11.34											
9° 00′	0.63	2.52	5.67	7.72	10.08												
10° 00′	0.70	2.80	6.30	8.58	11.20												
11° 00′	0.77	3.08	6.93	9.43													
12° 00′	0.84	3.36	7.56	10.29													

"E" in Inches = $0.0007V^2D$

The appropriate superelevation causes the wheels to bear equally on the rails, with no lateral thrust under normal anticipated operating conditions. "Cant deficiency" is a result of the centrifugal force being greater than the amount of centrifugal force offset by the physical superelevation between the inner and outer rail. An illustration of the resultant forces associated with cant deficiency is provided in Figure 2.

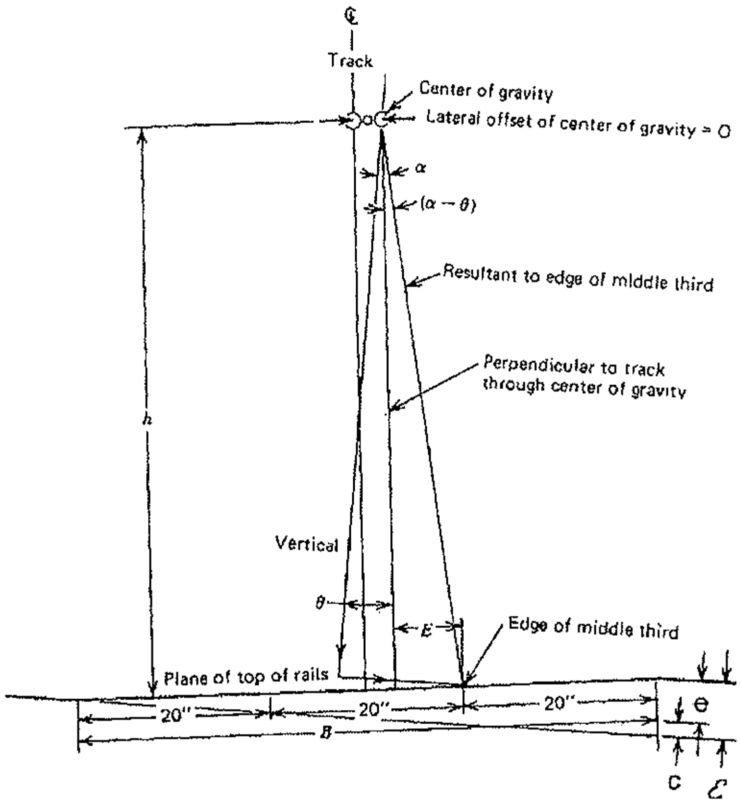


Figure 2 - Resultant forces associated with cant deficiency[1]

In Figure 2, θ is the angle of superelevation, α is the angle of the resultant of weight and centrifugal force from vertical; (α-θ) is the angle between perpendicular to track and the resultant to edge of the middle third, and E is the distance to edge of the middle third from perpendicular through the offset center of gravity[1]. Under the cant deficiency or unbalance concept, the theoretical equilibrium elevation (**E**) is the amount of superelevation that would be needed to offset all of the centrifugal force and cause the wheels to bear equally on the rails, with no lateral thrust under normal anticipated operating conditions. Historically, operating at speeds above those established as normal speeds for given amount of superelevation is allowable up to a point where the train experiences three inches of cant deficiency[3]. Cant deficiency is also often referred to as "unbalance" [1]. The cant deficiency or unbalance is a reference to the additional amount of superelevation (c) that would be required to maintain the equilibrium of the equipment when operating through a curve. The method utilized to established a quantitative value for cant deficiency is provided in equation 2:

$c = \mathbf{E} - e$ (2)

Where:

c = Cant deficiency
E = Theoretical equilibrium elevation
e = Superelevation

The amount of unbalance or cant deficiency (c) is the difference in the theoretical equilibrium elevation (**E**) minus the amount of superelevation (e) in the curve. Most engineers agree that conventional rail equipment carrying passengers can operate with up to three inches of unbalance without the ride becoming uncomfortable to passengers. Hence a speed requiring three inches more superelevation for equilibrium than is actually used is known as "comfort speed"[1]. Passenger cars with hangers and roll stabilizers can negotiate curves comfortably with four inches of unbalance[1], hence the present Federal Railroad Administration standard allows passenger operations with a total of four inches of unbalance for conventional equipment[3]. Operating at speeds that generate greater than four inches of unbalanced would result in the passengers beginning to experience an uncomfortable ride.

Operating speeds can also be increased utilizing rolling stock equipment designed to offset some of the unbalance forces through a hydraulic tilting system. The hydraulic system is used to maintain desirable levels of centrifugal force on the passengers not exceeding a total of the force equivalent to those experienced at three inches of unbalance. This type of equipment allows for operating speeds with centrifugal forces that would normally result in between six and nine inches of cant deficiency[1]. Presently the Amtrak Cascades route in Washington State is operating under a waiver from the Federal Railroad Administration with up to six inches of unbalanced operation using Talgo Pendular train technology[4]. The equipment designed using the Talgo technology presently employed on this line is actually capable of being operated using up to eight inches of unbalance. The equipment utilized for the Cascades route was manufactured in the United States based on criteria developed to enhance the original European design to meet Federal Railroad Administration standards for passenger operations in the United States. However, operation resulting in excessive unbalance introduces problems of increased rail wear, gage widening, derailed wheels, and overturned rails[5]. In most areas of the United States curved track must also be able to handle several classes of traffic operating at various speeds, which results in slow trains causing more than normal wear on the inside rail and high-speed trains more on the outside rail[2].

Other Operating Speed Restrictions

Some additional operating restrictions that will factor into the performance of each individual segment are associated with the highway/rail intersections and the fact that most of the alignments chosen for operation will continue to be freight routes. The superelevation rate allowed for horizontal curves utilized for freight movements are restricted to lower levels based on the type of freight and anticipated freight train speeds. These restrictions may limit the versatility of any route designated for high-speed operation requiring special design considerations associated with horizontal alignment constraints. Large amounts of superelevation may also pose problems at highway/rail intersections located during curves in the track requiring special design considerations.

Another issue of concern when attempting to increase passenger train speeds or facilitate both passenger and freight operations on a concurrent alignment is the consistency and amount of advanced warning time given at individual highway/rail intersections. The higher speed operation of passenger trains on existing freight routes often requires that the approach circuits for the warning devices be extended to accommodate the highest anticipated speed along the route. Dual utilization of the track by both passenger and freight operations creates a variance in operating speeds that in most cases requires the installation of a prediction or "constant" warning time system. A prediction system provides a near equivalent amount of warning to motorist at the highway/rail intersection regardless of the speed of the approaching train. An upgrade of an existing system that is not currently using a prediction type system normally requires a complete new signal installation whose cost range will be between $100, 000 and $250, 000 depending on the complexity of the circuit system needed to facilitate safe, efficient, and consistent operation.

SECTION 2 - OPERATIONAL ANALYSIS OF CORRIDORS

Operational Analysis of Tulsa, Oklahoma to Oklahoma City, Oklahoma Route

The original analysis conducted for this route was developed from an evaluation of the existing alignment assuming the utilization of either conventional or tilt technology equipment and that one stop would be included in the inter-city operations, most likely in either Stroud or Bristow. The most desirable attributes of this route are the fact that the State actually owns over eighty percent of the existing track between Tulsa and Oklahoma City and that the distance between the two largest metropolitan areas in the State of Oklahoma is only slightly over 100 miles. These attributes provide the opportunity for a rail connection that would be extremely competitive with other ground transportation modes and air transportation modes. The analysis indicated that 10 minutes could be reduced from the overall travel time if tilt technology equipment were utilized for this route.

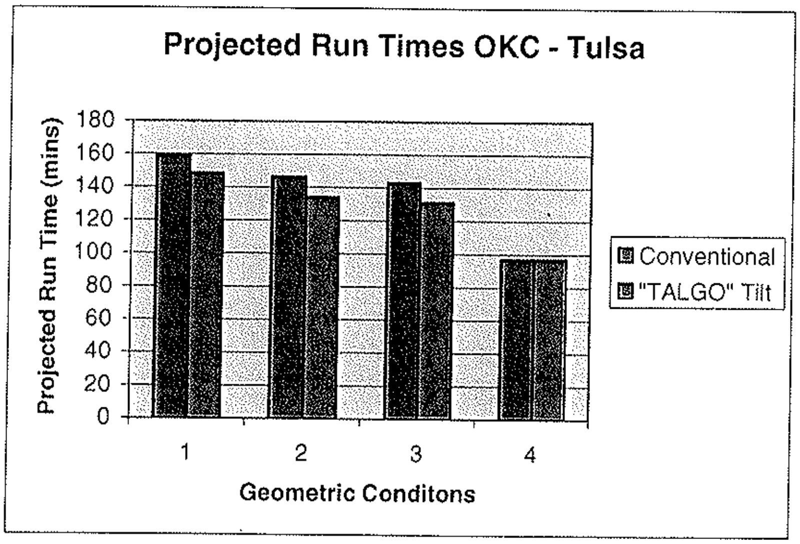
Additional analysis focused on specific geometric improvements, including the construction of a direct turn connection between the existing ODOT-owned Union Pacific route and the BNSF route from Oklahoma City to Tulsa. The existing connection between the Union Pacific and BNSF requires a reverse train movement that takes just over six minutes to complete. Other geometric improvements considered were the incremental improvement of the most restrictive or "sharpest" curves along the route. The geometric analysis indicates that there are 138 curves on the ODOT alignment between Oklahoma City and Tulsa resulting in a travel time of 2 hours and 39 minutes.

This analysis revealed that approximately 13 minutes of the travel time from Oklahoma City to Tulsa could be reduced with improvements to 43 curves, or 31 percent of the total number of curves on the ODOT alignment (Phase One improvements). Improvements to an additional 25 additional curves (Phase Two improvements) would enhance the travel time using the existing alignment and conventional equipment. The final analysis of the existing alignment indicated that a travel time of 2 hours and 23 minutes could be achieved using conventional equipment with the recommended improvements to 68 curves along the alignment (Phase One and Two improvements). The total cost for these improvements are anticipated to be approximately 92 million dollars. An additional reduction of 12 minutes could be realized for a travel time of 2 hours and 11 minutes if tilt technology equipment were utilized in conjunction with both phases of improvements. A tilt technology train set is estimated to cost somewhere in the neighborhood of an additional 18 to 20 million dollars over the cost of conventional equipment.

The anticipated benefit from the utilization of "Tilt" train technology under the various proposed implementation phases is illustrated in Figure 3.

Figure 3 - Operating Benefits of "Tilt" Train Technology

		Travel Time	
	Track Conditions	**Conventional (mins)**	**"TALGO" Tilt (mins)**
1	Existing Geometry	159	148
2	W/Phase One Improvements	146	134
3	W/Phase Two Improvements	143	131
4	W/Ideal Operating Geometry	97	97



The findings indicate that "Tilt" technology would enhance operating speed and travel times during the proposed interim implementation phases of service between Oklahoma City and Tulsa, however, the additional cost associated with establishing and maintaining a special maintenance facility for this type of equipment would not be a feasible alternative from a long term perspective. The actual run times for each proposed implementation phase will vary slightly from the values listed in Figure 3 because of potential changes in the number of station stops or other operational distractions.

The fourth option shown in Figure 3 involved a more in-depth analysis of the ODOT route between Oklahoma City and Tulsa. This option considered whether actual realignment of the rail on certain portions of the route could facilitate faster or higher levels of operation in the future. The "improved alignment" included the construction of approximately 37 miles of new track at various locations throughout the existing 119-mile alignment to reduce the number of curves and facilitate incrementally higher operating speeds as the route is further developed. The travel time calculated on the new alignment using conventional equipment was reduced to an estimated 2 hours and 3 minutes at a cost of 110 million dollars. The travel could be further reduced by an additional 10 minutes with the construction of a run-around track at the BNSF Cherokee Yard in Tulsa for an estimated cost of approximately ten million dollars. A further reduction of six additional minutes could be realized with the construction of a direction connection wye track on the Oklahoma City end of the route at an estimated cost of between five and seven million dollars. An additional travel time reduction of approximately 20 minutes could be realized on the new alignment if cab signaling was implemented to allow for speeds in excess of 79 MPH. The travel time could be reduced to approximately 1 hour and 45 minutes with the track improvements mentioned above using conventional equipment travel at 79 MPH or less for an estimated cost of approximately 139.5 million dollars. The travel time potentially possible with all of the above mentioned improvements including the implementation of cab signaling could be reduced to approximately and hour and a half.

The most reasonable and cost effective implementation of service between Tulsa and Oklahoma would most likely involve incremental improvements designed to establish the service as early as possible and progressively improve the service to desired levels. An initial service between West Tulsa (Red Fork) and Oklahoma City with a travel time of 2 hours and 39 minutes could be implemented in a relatively short time frame with an infrastructure cost excluding any needed station improvements expected not to exceed $12.5 Million. Additional equipment expenses would be required to implement the service, the cost of which would vary depending on the source of the service. The equipment costs would be expected to be between $10 and $15 million if an operator who would provide the equipment were not identified and the actual purchase of the equipment were necessary to implement service. The initial service could be either a basic peak day or daily service with one train set providing one run in each direction per day of operation.

The most logical construction improvement phasing would most likely be to first implement the improvements on both ends of the route providing access to downtown Tulsa and a smoother transition to and from the Santa Fe Depot in Oklahoma City onto the OKC to Tulsa route. Access to downtown Tulsa could be provided through the BNSF Cherokee Yard for up to four train movements per day under the current operating agreement between ODOT and the railroad. However, the construction of a run around track without the speed restrictions imposed by yard operations would reduce the travel time to downtown Tulsa by ten minutes and eliminate the present yard restrictions. For the purposes of this report, any station improvements are assumed to be coordinated at the local level, similar to the implementation activities on the Heartland Flyer service between OKC and Ft. Worth.

The next stage of development would most desirably focus on the implementation of the communication and track realignment improvements needed to ultimately facilitate maximum speed train operations utilizing either CTC or cab signal control technology. These improvements could be phased according to the amount of travel time reduction anticipated along the segment(s) selected for a particular phase of construction in an attempt to reduce the overall travel time as efficiently and quickly as possible. A commitment for the completion of the improvements proposed for the entire route would be needed in order to realize the full benefit of the proposed new alignment. The phasing for the improvements may require some rearrangement if a solid commitment for the completion of all of the realignment improvements cannot be obtained. A summary of the travel times and anticipated cost associated with each phase of development on the Tulsa to Oklahoma City corridor is provided in Table 2. The implementation plan will be covered in detail later in the report.

Table 2 - Travel Time Comparisons for Tulsa to Oklahoma City

Travel Time Comparisons (minutes)						
	Const. Phase	Signal Phase	Est. Time (minutes)	Reduction (minutes)	Est. Cost (millions)	Total Cost (millions)
Tulsa to Oklahoma City via Perry ^			161		28	28
Tulsa to Oklahoma City *			159		26	
Tulsa to Oklahoma City **	1		143	16	26	52
Tulsa to Oklahoma City ***	2	1A	130	13	56	108
Tulsa to Oklahoma City ****	3	1B	114	16	35	143
Tulsa to Oklahoma City *****		2	103	11	10	153

^ - Includes track resurfacing and control signal installation on BNSF to Perry, and one conventional train set.
* - Includes initial track resurfacing and the purchase of one conventional train set.
** - Includes the completion of Construction Phase 1.
*** - Inlcudes the completion of Construction Phase 2 and Signal installation Phase 1A.
**** - Inlcudes the completion of Construction Phase 3 and Signal installation Phase 1B.
***** - Includes the purchase of two additional train sets and the implementation of Cab Signal Control.

Operational Analysis for the Tulsa to Perry to Newton, Kansas Route

The analysis for the Tulsa to Perry route was conducted in association with the Oklahoma City to Newton analysis in an effort to evaluate the potential time saving associated with connecting Tulsa to the national rail system in Newton via Perry rather than Oklahoma City. The existing conditions of the track, the anticipated lack of capacity, and the lack of CTC signaling on the Tulsa to Perry route place significant constraints on the implementation of this service. Present and projected capacity issues would require that capital improvements be implemented on this segment of rail for desirable passenger operations. The implementation of passenger service would require the development of operating agreements with the BNSF that would most likely be better applied to routes providing better connectivity to the national system. The benefit of a Perry connection would be a reduced amount of travel time from Tulsa to a national rail system connection in Newton. However, the implementation cost of the Perry connection, and the long-range benefit of developing both Tulsa and Oklahoma City as intra-state passenger rail hubs with enhanced connecting service limit the feasibility of this option.

Operational Analysis for the Oklahoma City to Newton, Kansas Route

The analysis for this route was conducted to examine the previous routing used in conjunction with the present route for the Heartland Flyer service as the original Lone Star service route from Newton, Kansas to Fort Worth, Texas. The analysis indicated that this route could be re-implemented with a minimal amount of additional funding using the existing conventional equipment used presently in service on the Heartland Flyer route.

The construction improvements needed to revive passenger service on this particular segment were limited to some track resurfacing and other minor infrastructure improvements needed to facilitate the previous level of service. The estimated cost if the infrastructure and safety improvements is expected to be approximately $12.2 million excluding any station improvements. Planned station stops included in the travel time analysis for this segment include Guthrie, Perry, and Ponca City as well as Arkansas City, and Wichita, Kansas. The anticipated travel time for this segment was calculated at 3 hours and 30 minutes utilizing conventional equipment, the existing alignment, and including the station stops listed above. The revitalization of service on this route would provide a good connection to the remainder of the present national passenger rail system and facilitate the start of expansion efforts focused on tying the Oklahoma system to multiple destinations.

Operational Analysis for the Tulsa to Kansas City Route via Ft. Scott, Kansas

The analysis for the Tulsa to Kansas City Route indicated that an additional connection to the national rail system in Kansas City would be beneficial to the development of passenger rail service in Oklahoma. Similar to the Tulsa to Perry route the segments selected for the Tulsa to Kansas City route raise several capacity issues that would need to be addressed through negotiations with the BNSF. This proposed service would provide an alternate connection to the national rail system, and help foster the development of Tulsa as a passenger rail hub.

The route that would potentially utilize the BNSF Fort Scott subdivision through the State of Kansas presently has capacity issues that would require careful consideration and potentially require a significant amount of capital investment to gain access. A more detailed capacity analysis has been conducted on this route to illustrate some of the potential problems anticipated.

Operational Analysis for the Tulsa to Kansas City Route via Joplin, Missouri

A couple of options are available for the final routing from the Afton junction on to Kansas City. One option would maintain operation on the BNSF exclusively from Tulsa to Kansas City through Oklahoma and Kansas. The other option would involve the Kansas City Southern Railway Company (KCS) from Neosho, Missouri on north to Kansas City. Both alignments have capacity issues that may hinder the implementation of passenger service on either route. Another issue that should be considered in the final selection of the most appropriated routing will be the willingness of either the State of Kansas or the State of Missouri to participate in the implementation, operation, and maintenance of the service.

The most direct and quickest route would follow the BNSF through the eastern edge of Kansas through Ft. Scott, Kansas. Present and potential utilization of the route by the BNSF indicates that obtaining an operating agreement for passenger rail service on the Ft. Scott Subdivision from Edward, Kansas to Kansas City would be difficult. A running time of 4 hours and 40 minutes would be anticipated if an agreement could be obtained from the BNSF to operate the service on the Afton and Ft. Scott Subdivisions.

Another alternative would be to route the service from the Afton Junction over the Cherokee Subdivision to Neosho, Missouri making a connection with the KCS to run north through Joplin, Missouri on up to Kansas City, Missouri. This route would be expected to generate higher number of riders because it would pass directly through Joplin, where as, the route through Ft. Scott would require Joplin riders to board in either Baxter Springs or Pittsburg, Kansas.

Another potential connection to the KCS route would be to utilize a segment of track presently operated by the Southeast Kansas Railroad (SEKR) that provides a connection between the BNSF and the KCS near Pittsburg, Kansas. This connection would eliminate the additional time needed to connect to the KCS from the BNSF via Neosho, Missouri and avoid potential capacity

Operational Analysis for the Tulsa to St. Louis Route

The analysis of this route was developed from the existing alignment assessing the benefit of using conventional or tilt train technology. The calculations completed were based on the present horizontal alignment and no significant changes to the present alignment were considered. The segment of the Cherokee Subdivision from the Afton junction on into Springfield, Missouri was very similar to the segment from Tulsa to Afton yielding similar operating speeds. The segment from Springfield on up to Lindenwood, Missouri (St. Louis) on the Cuba Subdivision has an existing alignment very similar to the present alignment between Tulsa and Oklahoma City. The travel time from Tulsa to St. Louis would be approximately nine and a half hours with the limited speeds inherent on the Cuba Subdivision from Springfield to Lindenwood. The travel time from Oklahoma City to St. Louis was approximately eleven and one half hours. The analysis of the route using tilt train technology revealed that the travel time between Oklahoma City and St. Louis could be reduced by forty minutes. The Cuba Subdivision would require a significant number of alignment improvements to reduce the travel time similar to the Oklahoma City to Tulsa route with the exception that the alignment does not presently belong to the State.

Operational Analysis for the Route between Newton, Kansas, and Denver, Colorado via Pueblo, Colorado

The analysis for a rail connection to Denver from the south was developed from the proposed connection to Newton from Oklahoma City, the existing Southwest Chief route from Newton to La Junta, Colorado, the BNSF Pueblo subdivision from La Junta to Pueblo, Colorado, and finally the connection from Pueblo to Denver on the Pikes Peak subdivision. This analysis required an in depth look at rail capacity issues, especially on the Pikes Peak subdivision which is presently operating under a joint operating agreement between the BNSF and the Union Pacific (UP) railroads. There are a significant number of unit trains carrying coal operating on this subdivision to provide coal supplies for several of the southern states. Both the Pikes Peak and La Junta subdivisions would require signal, switch, and siding improvements to facilitate a level of operation that would provide the desirable travel time desired for successful passenger service. A more detailed capacity analysis has been conducted on this route to establish the needed improvements.

The implementation of service to Denver would most likely require that an additional train set be added so that a true extension of the Heartland Flyer route could be implemented between Oklahoma City and Denver. While the schedule could be coordinated to run in conjunction with the Southwest Chief, recent changes in Amtrak operating practices associated with the priority freight business they are now transporting indicate that a through service from Ft. Worth to Denver would be a more feasible alternative. A true extension of the Heartland Flyer route to Denver would require the addition of another full train set to facilitate the bi-directional schedules that would need to be maintained and to help facilitate the anticipated increase in priority freight. A travel time and cost analysis for the Pueblo route is provided in Table 4.

Table 4 - Travel Time and Cost Estimate for Service to Denver via Newton and Pueblo

Texas, Oklahoma, Kansas, Colorado Passenger Rail Corridor Fort Worth to Denver via Oklahoma City and Pueblo (Utilizing Existing Infrastructure and Conventional Equipment)			
Destinations	**Run Time (mins)**	**Run Time (hrs, mins)**	**Estimated Cost**
Ft. Worth/OKC	275	3 hrs, 46 mins	$2,600,000
OKC/Newton	205	3 hrs, 24 mins	$12,200,000
Newt/Peb	349	5 hrs, 49 mins	$2,500,000
Peb/Den**	195	2 hrs, 15 mins	$23,040,000
OKC/Peb/Den**	749	12 hrs, 29 mins	$35,240,000
FtW/OKC/Den**	1024	17 hrs, 05 mins	$40,340,000

**-with infrastructure and train control signal (CTC) improvements

Notes:

- OKC/Peb/Den - Oklahoma City to Denver via Pueblo, Colorado
- FtW/OKC/Den - Fort Worth to Denver via OKC and Pueblo

Operational Analysis for the Route between Newton, Kansas, and Denver, Colorado via Abilene, Kansas

A couple of options are available for the final routing from the Newton junction on to Denver. One option would follow or utilize the current Amtrak service on the BNSF from Newton to La Junta, Colorado. The other option would involve the Union Pacific (UP) from Abilene, Kansas to Denver. Both alignments have capacity issues that may hinder the implementation of passenger service on either route. The primary issues that should be considered in the final selection of the most appropriated routing are the findings provided in the capacity analysis section of this report. The cost analysis utilized to select the route to Denver is provided in Table 5.

Table 5 - Cost Comparisons for Service to Denver via Newton and Pueblo or Abilene

Newton to Denver Route Cost Comparison*	Units	$/Unit	Unit Cost	Total Cost
Newt/Ab/Den				
ABS	453	$65,000	$29,445,000	$29,445,000
Newt/Pb/Den				
CTC	65	$150,000	$9,750,000	
Pwr Switches	18	$300,000	$5,400,000	
Siding	1		$4,000,000	
Ext Siding	1		$2,000,000	
Ext Siding	1		$1,890,000	
Surfacing	1		$2,500,000	$25,540,000

New/Ab/Den	$29,445,000
New/Pb/Den	$25,540,000
Train Set	$13,000,000

* - Does not include provisions for grade crossing signal improvements

The projected travel times anticipated with each phase of the State of Oklahoma implementation plan are provided in Table 6.

Table 6 - Project Travel Times Associated with each Implementation Phase

Oklahoma Passenger Rail Projected Travel Times							
Route	Fiscal Year						
	2000-2001	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006*	2006-2007*
Oklahoma City to Tulsa		2hrs, 39 mins	2hrs, 20mins	2hrs, 10mins	2hrs, 0mins	1hrs, 50mins	1hrs, 40mins
Oklahoma City to Newton, Ks	3hrs, 30mins						
Tulsa to Kansas City, Mo				4hrs, 44min			
Newton, Ks to Denver, Co			8hrs, 45min				

* - Would require the implementation of operating speeds above 79 MPH.

The anticipated travel times are based on the projections developed from the models developed for each specific corridor. These travel time projections include the anticipated stops and other operational deterrents along each route. An evaluation of average travel speeds was also conducted to establish a means of comparing average travel times between modes in the future. The average travel speed between the desired destinations as listed in Table 7.

Table 7 - Anticipated Average Travel Speeds Associated with the Proposed Implementation Plan

Oklahoma Passenger Rail Anticipated Average Travel Speeds*						
Route	Fiscal Year					
	2000-2001	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006
Oklahoma City to Tulsa		44	49	55	59	64
Oklahoma City to Newton, Ks	57					
Tulsa to Kansas City, Mo				54		
Newton, Ks to Denver, Co			60			

* - Utilizing conventional equipment and maximum operating speeds of 79 MPH on adequate segments.

These travel times are based on the assumption that conventional equipment will be utilized on the existing alignments for most of the routes. The Tulsa to Oklahoma City projections for fiscal year 2003-2004 and beyond are based on the geometric changes recommended for the existing State owned alignment between Tulsa and Oklahoma City, which includes some realignment of the existing track.

The implementation and enhancement of passenger rail service within the State of Oklahoma will provide the impetus for establishing and reducing the travel time for interstate rail travel to surrounding States and beyond. The anticipated interstate travel times are based on the assumptions provided in the operational analysis of each segment utilizing the preferred scenario. The segment between Oklahoma City and Fort Worth was included in the analysis to evaluate connections with Ft. Worth, which has been designated as a hub for Amtrak operations. The projected travel times between all of the destinations included in this evaluation are provided in Table 8.

Table 8 - Anticipated Travel Times

Anticipated Travel Times							
Route	Fiscal Year						
	2000-2001	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007
Oklahoma City to Ft. Worth	4hrs, 35mins	3hrs, 45mins	3hrs, 45mins				
Oklahoma City to Tulsa		[illegible]	2hrs, 20mins	2hrs, 10mins	2hrs, 0mins	1hrs, 50mins	1hrs, 40mins
Tulsa to Ft. Worth		[illegible]	7hrs, 5mins	6hrs, 55mins	6hrs, 45mins	6hrs, 35mins	6hrs, 25mins
Oklahoma City to Newton, Ks	[illegible]						
Tulsa to Kansas City, Mo		[illegible]		4hrs, 45mins			
Newton, Ks to Denver, Co			8hrs, 45mins				
Oklahoma City to Kansas City	[illegible]			7hrs, 15mins	7hrs, 5mins	6hrs, 55mins	6hrs, 45mins
Oklahoma City to Denver			12hrs, 15min				
Tulsa to Denver			14hrs, 45min	14hrs, 35min	14hrs, 25min	14hrs, 15min	14hrs, 5min
Ft. Worth to Denver			19hrs, 30min				
Ft. Worth to Kansas City	[illegible]			12hrs, 0min	11hrs, 50min	11hrs, 40min	11hrs, 30min

-- Present Service

-- Implementation of New Service

-- Upgrade of Service

The information listed in Table 8 also includes the improved travel times associated with the implementation of upgraded service on each route, based on specific improvements on the route itself or improvements on routes directly connect to routes within the State of Oklahoma.

Oklahoma City to El Reno

The evaluation of the feasibility of an excursion service from Oklahoma City to Ft. Reno focused on the existing Union Pacific rail that travels through Oklahoma City just north of the North Canadian River extending to El Reno. From El Reno the proposed operations would be routed on the Austin, Todd, and Ladd on westward to Ft. Reno. The line under consideration is also presently being evaluated for realignment or enhancement associated with the I-40 Crosstown improvement project scheduled to be completed by 2010.

Operational Findings

The Union Pacific and Austin, Todd, and Ladd presently maintain what appears to be Class Two Track on the entire route under consideration. The track speeds are 25 mph or less with the majority of the route presently being operated at 20 mph or less. The segment being operated by the Union Pacific consists of 24.98 miles of track between Oklahoma City and El Reno. With average speeds of 20 mph as presently operated by the freight traffic on this line the trip to El Reno would take in the neighborhood of 1 hour and 15 minutes. The remainder of the trip on out to Ft. Reno is approximately an additional five miles that would take an additional 12 minutes running at the present freight speeds of 25 mph. Historically the Federal Railroad Administration (FRA) has allowed passenger service to be operated 10 mph faster than existing freight operations provided the infrastructure will facilitate those type of operations. The present condition of most of the alignment between Oklahoma City to El Reno indicates that the ride may be rough because of the almost continuous use of jointed rail on this segment. The present condition of the track infrastructure may limit the speed at which passenger operations would be feasible because of the potential for a rough ride for passengers.

In the event that maximum speed operation could be obtained between Oklahoma City and Ft. Reno, the trip time needed to travel to El Reno would potentially be reduced to a little less than an hour. The remainder of the trip on to Ft. Reno could be as quick as nine minutes from El Reno. These travel times are based on the assumption that no additional stops would be made on the excursion to board additional passengers. Each additional stop added to the operating schedule would be expected to add an additional five to eight minutes to the overall operating time.

Other operational constraints may come into consideration depending on the exact location of the start of the proposed service. For example, if the service is initiated at or near the Santa Fe Depot in Bricktown a reverse movement will be required to travel from the present BNSF alignment on to the Union Pacific alignment. The Santa Fe alignment is presently grade separated over the Union Pacific alignment between South 7th and 9th Streets. This movement would require that the service ascend down from the Santa Fe alignment on the west side of the tracks crossing underneath the Santa Fe alignment to initiate a reverse movement on the existing Union Pacific alignment adding an estimated total of approximately 20 minutes to the overall travel time from Bricktown to Ft. Reno. The utilization of Union Station as a starting point for the service would eliminate the reverse movement, however the anticipated increase in interest and potentially additional ridership associated with a Bricktown departure would most likely justify the additional 20 minutes of travel time.

The previous connection from the Austin, Todd, and Ladd for Fort Reno has been abandoned for years and the switch to the fort spur removed from the mainline. The remnants of the spur indicate that the entire spur would mostly likely have to be rebuilt from scratch to provide direct rail access to the fort. The estimated cost for replacing this spur would be approximately $250,000. An alternative to the reconstruction of the spur would be to unload passengers directly off of the AT&L mainline requiring approximately a quarter of a mile walk or shuttle service to gain access to the fort.

The costs of the proposed excursion service would require an investment of at least $450,000 in addition to the equipment costs needed to initiate a safe and enjoyable excursion from Oklahoma City to Ft. Reno. Additional funding would most likely be required if the service were to provide travel with no additional shuttle or other services needed for a complete trip from Bricktown to Ft. Reno. Comfortable operations would be a concern for the operator because of the present condition of some of the sections of jointed rail presently in place on this alignment. Passengers experiencing a "rough" ride would be less likely to return for another trip or to give the service a good recommendation to any potential future riders. The present proposed utilization of a substantial portion of the railroad right-of-way between Broadway and Western Avenue for the new I-40 crosstown roadway alignment would complicate any potential operators ability to sustain reliable operations during the construction period expected to extend from 2004 to 2010. The I-40 crosstown project is also expected to modify the present elevation of the track that will ultimately be left in service for the Oklahoma City to El Reno connection, to the point that the potential to facilitate arrivals and departures from Union Station will most likely be affected. The crosstown project may actually provide for a better connection from the Santa Fe alignment to the Union Pacific alignment depending on the final design of the railroad and highway network.

It appears as though this particular service would have limited feasibility given the anticipated infrastructure improvements that would be needed and the anticipated operational limitations associated with the present alignment. Funding would be another area of concern associated with this service in that a substantial amount of local participation would most likely be required to initiate and sustain an operation of this type. The improvements associated with the I-40 crosstown highway improvement project that could actually enhance some of the operational aspects of the proposed service, may also create some operational issues requiring additional attention. Any type of passenger operations on the present rail alignment from Oklahoma City to El Reno would most certainly be hindered during the construction period associated with the I-40 crosstown freeway.

SECTION 3 - STATION PARKING

The limited amount of parking available in the Bricktown area of Oklahoma City initiated some concern over potential long term parking needs for rail passengers. The decision to ultimately connect the service to downtown Tulsa alleviates the concern for long term parking needs in the Tulsa area because of the amount of parking potentially available near the tracks in the downtown Tulsa.

The present ridership on the Heartland Flyer indicates that a need for long-term parking already exists at the old Santa Fe Station in downtown Oklahoma City station. The present parking forecast for Oklahoma City indicates that approximately 90 parking spaces are needed to meet the potential demand for long-term parking associated with rail travel. With the anticipated implementation of a connection to the national passenger rail system in Newton, the projected parking needs increase by an additional 200 spaces. The implementation of rail service to Tulsa would generate the need for approximately 90 more spaces, which would be expected to increase by an additional 105 spaces as the service between Tulsa and Oklahoma City is enhanced through reductions in actual travel time and a connection from Tulsa to Kansas City is established to the east. The proposed implementation of an extension of the Heartland Flyer to Denver would be expected to generate the need for an additional 150 spaces. Referring back to the projected travel times associated with the proposed implementation plan specific consideration has been given to the present service, the implementation of new service, and upgrades to services through the year 2004 as depicted in Table 8.

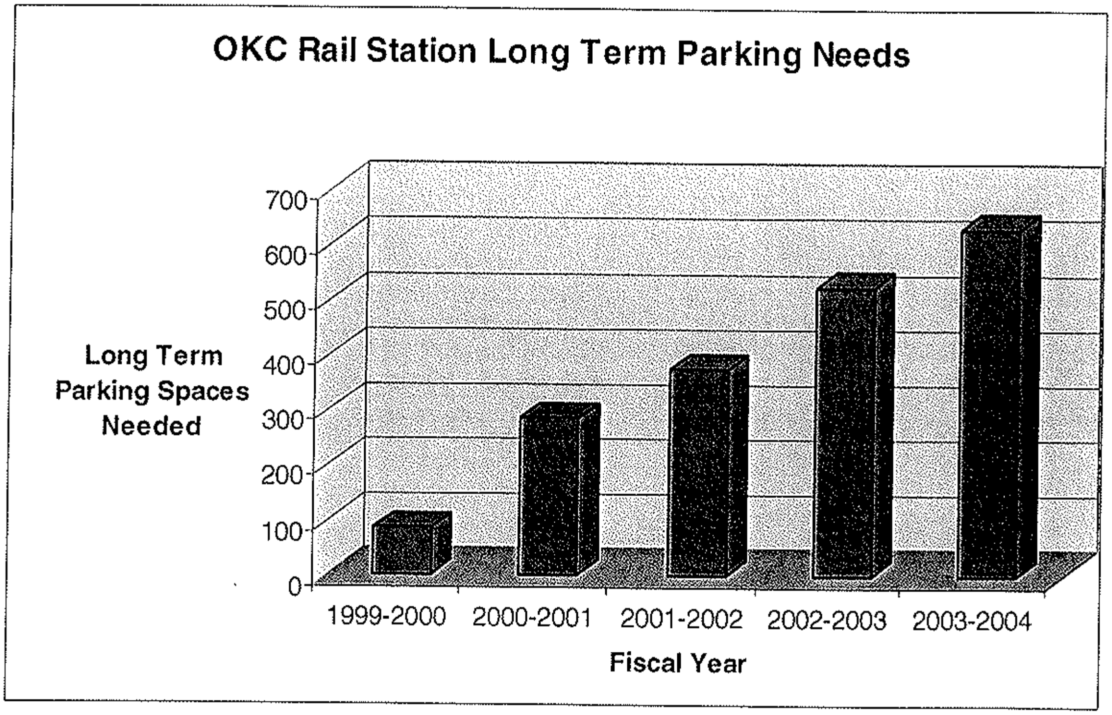
The anticipated ridership associated with the respective implementation and upgrade of service to each of the major destinations considered resulted the parking projections previously mentioned. Table 9 and Figure 4 provide a tabular and graphic illustration of the anticipated parking needs in the downtown Oklahoma City area.

Table 9 - Oklahoma City Parking Projections

Oklahoma City Passenger Rail Parking Needs

Route		Average Long Term Parking			
	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004
Oklahoma City to Ft. Worth	86				
Oklahoma City to Tulsa			90		
Oklahoma City to Newton, Ks		200			
OKC to Tulsa to Kansas City, Mo					105
Oklahoma City to Denver, Co				150	
Anticipated Parking Needs	86	200	90	150	105
Total	86	286	376	526	631

Figure 4 - Graphical Representation of Oklahoma City Parking Needs



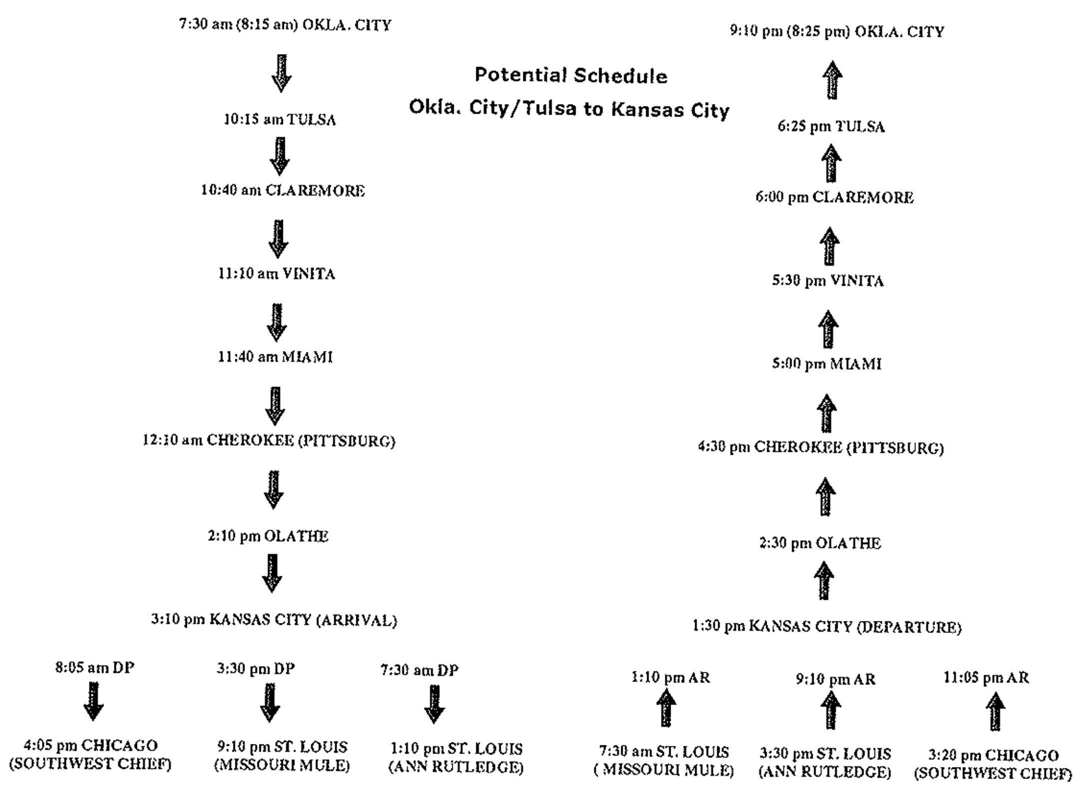
SECTION 4 - PROPOSED CORRIDOR SCHEDULES

The proposed schedules were developed based on the anticipated travel times on each segment and adjusted to coordinate with existing Amtrak scheduling on connecting routes. Any layover times associated with train changes were minimized to assess the true travel time on each segment. The layover times at some of the stations at connecting points may need to be adjusted to allow for adequate service during normal periods of delay on the connecting routes. The schedules of some of the connecting routes would also need to be assessed to determine what the optimum operating schedules would be when any new service is added to the system. The schedules also reflect the benefit that could be gained from the utilization of "Tilt Train" technology, and the expected travel time reductions associated with the initial and final phases of the proposed service implementation plans.

Services potentially available through Kansas City

The Tulsa to Kansas City route appears to have the greatest potential for a successful passenger rail connection to the East. The proposed schedule for this service is illustrated in Figure 5.

Figure 5 - Potential Train Schedule OKC/Tulsa to Kansas City

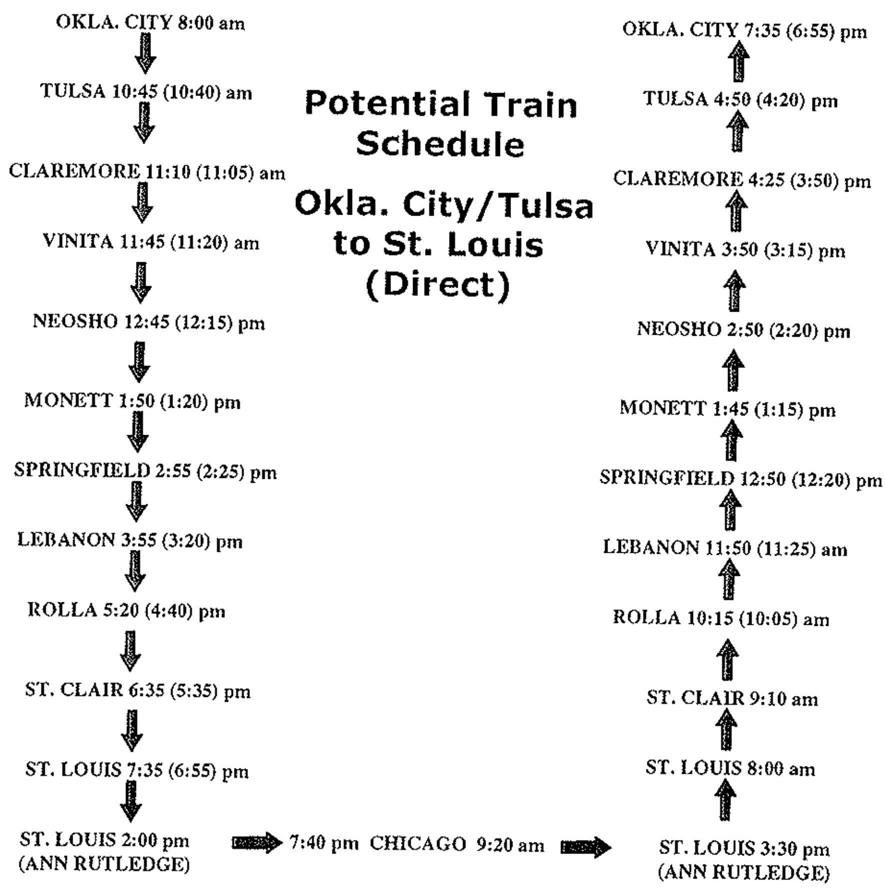


The alternate time provided for the Oklahoma City departure and arrival reflect the anticipated time saving associated with the completion of the incremental improvements between Tulsa and Oklahoma City. The results of the travel time evaluation conducted for the Tulsa to Kansas City route for this study were very similar to the findings of a recent rail study conducted by the State of Kansas.

Services potentially available through St. Louis

The route from Tulsa to St. Louis does not show as much promise as a solid connection to the East from Tulsa because of geometric track constraints between Springfield and St. Louis, Missouri. A proposed schedule taking into consideration the potential connectivity in St. Louis is provided in Figure 6.

Figure 6- Potential Train Schedule OKC/Tulsa to St. Louis

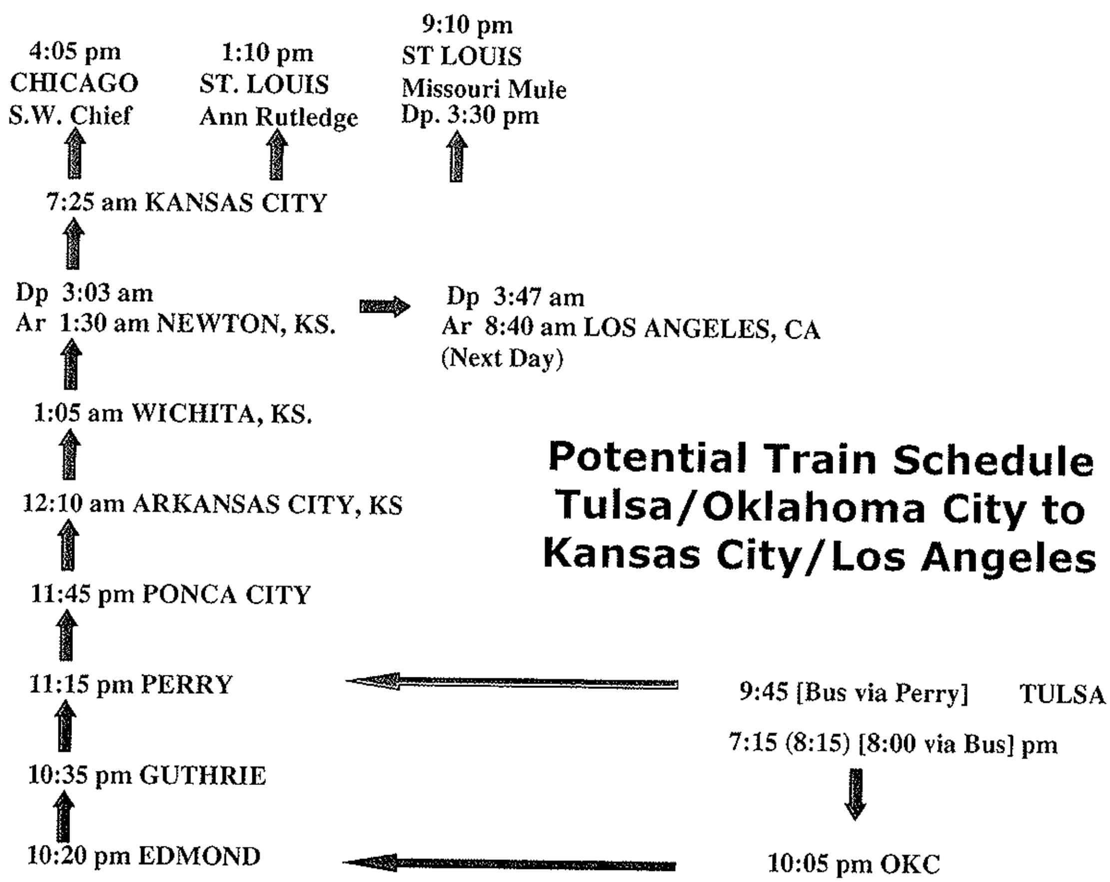


The dual travel time listings at each proposed station stop illustrate the timesaving that would be anticipated if a Tilt Train technology were utilized on this route. The State of Missouri expressed significant interest in the development of passenger rail service between St. Louis and Springfield. If service were implemented between St. Louis and Springfield the addition or extension of service from Tulsa to Springfield would become much more feasible and should be given further consideration.

Services potentially available through Newton, Kansas

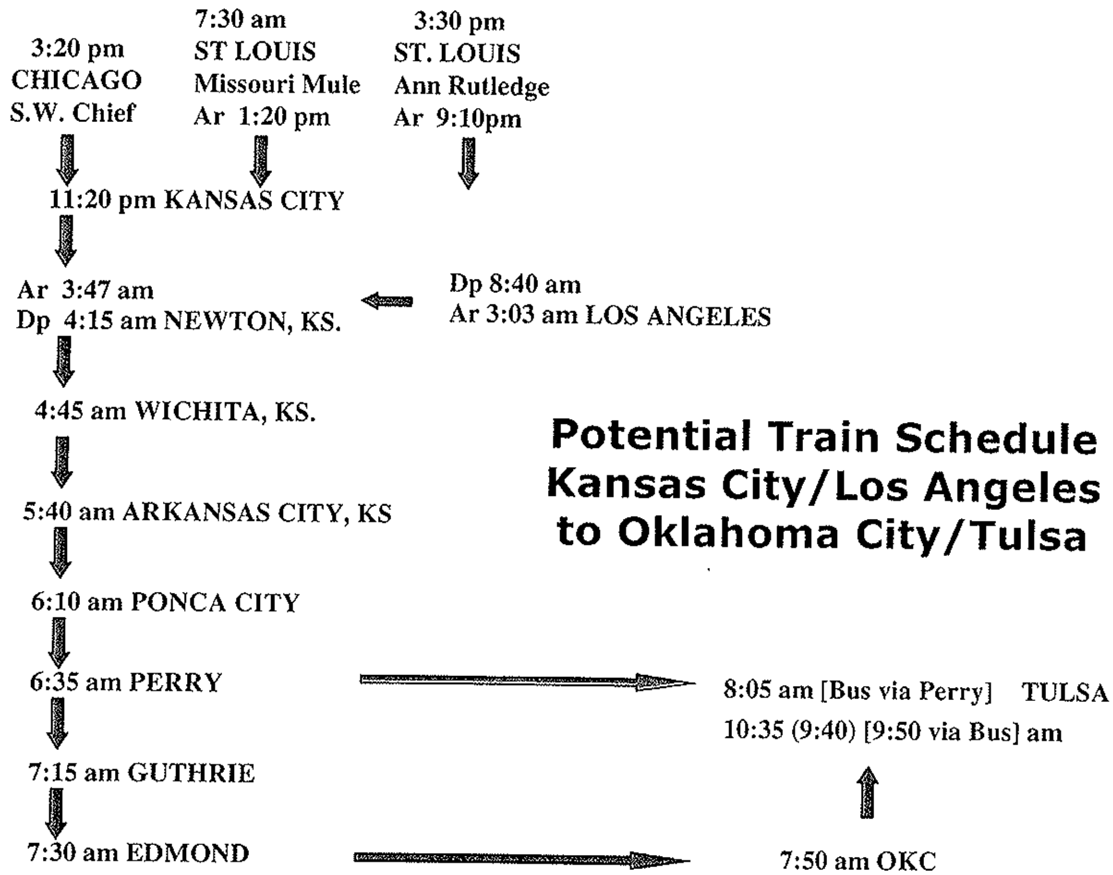
The extension of the Heartland Flyer service to Newton for a connection to the national passenger rail system would play a major role in the preservation and any potential expansion of passenger rail service in the State of Oklahoma. The development of a rail connection between Tulsa and Oklahoma City would also be a very important component of the development and expansion of passenger rail service throughout the State. The following schedule provided in Figure 7 illustrates the proposed operation of service from Tulsa and Oklahoma City utilizing Newton as the northern connection point to the national passenger rail system. This schedule includes the anticipated Tulsa arrival times associated with the initial and final phases of the proposed Oklahoma City to Tulsa rail service or a bus connection to from either Oklahoma City or Perry.

Figure 7 - Potential Train/bus Schedule Tulsa/OKC to Kansas City/Los Angeles



Consequently, the schedule provided in Figure 8 illustrates the proposed operation of service to Oklahoma City and Tulsa utilizing Newton as the northern connection point to the national passenger rail system. This schedule includes the anticipated Tulsa departure times associated with the initial and final phases of the proposed Oklahoma City to Tulsa rail service or a bus connection to either Oklahoma City or Perry.

Figure 8 - Potential Train/bus Schedule Kansas City/Los Angeles to OKC/Tulsa



Proposed operations for the Newton Connection to the Southwest Chief

The scheduling for an extension of the Heartland Flyer to connect with the Southwest Chief in Newton is a relatively good fit considering the present arrival and departure times associated with both services. The proposed schedule would require between one and a half to two hours layover time in Newton on outbound or northbound trips from Oklahoma depending on the direction of travel desired on the Southwest Chief. Some of the proposed layover time on outbound trips could be shifted to a stop that would have a higher potential for ridership. For instance, shifting the layover time to Wichita, would allow more time for boarding at a busier stop helping to minimize some of the inconvenience associated with the less than desirable time of the stop. Extended layover times for the inbound or southbound trips would not necessarily be an issue and could be adjusted to accommodate departure or arrival constraints associated with the segment from Newton to Oklahoma City. Both the northbound and southbound connections would have good flexibility to accommodate potential problems associated with the Southwest Chief's schedule. An assessment of the proposed scheduling for the connecting service between the Heartland Flyer and Southwest Chief is provided in Table 10.

Table 10 - Proposed Heartland Flyer Northern Connection

Southwest Chief Eastbound

Newton	**3:03 AM**
Hutchinson	2:24 AM
Dodge City	12:39 AM
Garden City	11:48 PM
Lamar*	9:27 PM
La Junta*	**8:39 PM**

Heartland Flyer Northbound

OKC	10:05 PM	
Edmond	10:20 PM	
G uthrie	10:35 PM	
Perry	11:15 PM	
Ponca City	11:45 PM	
Ark City	12:10 PM	
Wichita	1:05 AM	Dp 1:40 AM
Newton	**1:35 AM**	**2:10 AM**

La Junta/Denver Northbound

	Rail	Bus
La Junta*	**9:00 PM**	**9:00 PM**
Fowler*	9:25 PM	
Pueblo*	10:10 PM	10:15 PM
Colorado Springs*	11:00 PM	11:15 PM
Castle Rock*	12:35 AM	12:05 AM
Littleton*	1:20 AM	
Denver*	2:05 AM	1:15 AM

Heartland Flyer Southbound

OKC	8:20 AM
Edmond	8:00 AM
G uthrie	7:45 AM
Perry	7:05 AM
Ponca City	6:40 AM
Ark City	6:10 AM
Wichita	5:15 AM
Newton	**4:45 AM**

La Junta/Denver Southbound

	Rail	Bus
La Junta*	**8:20 AM**	**8:20 AM**
Fowler*	7:55 AM	
Pueblo*	7:10 AM	7:05 AM
Colorado Springs*	6:20 AM	6:05 AM
Castle Rock*	4:45 AM	5:15 AM
Littleton*	4:00 AM	
Denver*	3:15 AM	4:05 AM

Southwest Chief Westbound

Newton	**3:47 AM**
Hutchinson	4:24 AM
Dodge City	6:13 AM
Garden City	6:59 AM
Lamar*	7:19 AM
La Junta*	8:38 AM

* - Mountain time, all others are Central

Proposed Operations for the Potential expansion of the Heartland Flyer service to Denver, Colorado

The proposed further extension of the Heartland Flyer to provide a north/south connection in the south central region connecting Fort Worth with Denver has been evaluated using a couple of variations in operating scenarios. One option would be to utilize the existing Southwest Chief service to provide a connection between Newton and La Junta, Colorado. The utilization of the existing Southwest Chief would most likely require adding additional capacity between Newton and La Junta that would need to be transferred on both ends of the segment. This scenario would require a separate rail service connection or possibly a bus connection from La Junta to Denver. The existing connection from the Southwest Chief to Denver is through Raton, New Mexico limiting the efficiency of travel to Denver from the East. Service from La Junta would allow for a reduction in travel times to Denver resulting in up to seven hours of travel time saving. Rail service between Pueblo and Denver would require substantial infrastructure improvements, and slightly more complicated operating practices on the Southwest Chief. However, these improvements would provide the impetus for future expansion of north/south through train operations and significantly enhance any priority freight service that could potentially be operated on the entire route. The most significant shortcoming of utilizing a segmented service would be the less desirable departure and arrival times that could be expected in Denver. The proposed scheduling for segmented service between Oklahoma City and Denver is listed in Table 11.

Table 11 - Segmented operations for service between Oklahoma City and Denver

Southwest Chief Eastbound	
Newton	**3:03 AM**
Hutchinson	2:24 AM
Dodge City	12:39 AM
Garden City	11:48 PM
Lamar*	9:27 PM
La Junta*	**8:39 PM**

Heartland Flyer Northbound		
OKC	10:05 PM	
Edmond	10:20 PM	
G uthrie	10:35 PM	
Perry	11:15 PM	
Ponca City	11:45 PM	
Ark City	12:10 PM	
Wichita	1:05 AM	Dp 1:40 AM
Newton	**1:35 AM**	**2:10 AM**

La Junta/Denver Northbound	Rail	Bus
La Junta*	**9:00 PM**	**9:00 PM**
Fowler*	9:25 PM	
Pueblo*	10:10 PM	10:15 PM
Colorado Springs*	11:00 PM	11:15 PM
Castle Rock*	12:35 AM	12:05 AM
Littleton*	1:20 AM	
Denver*	2:05 AM	1:15 AM

Heartland Flyer Southbound	
OKC	8:20 AM
Edmond	8:00 AM
G uthrie	7:45 AM
Perry	7:05 AM
Ponca City	6:40 AM
Ark City	6:10 AM
Wichita	5:15 AM
Newton	**4:45 AM**

La Junta/Denver Southbound	Rail	Bus
La Junta*	**8:20 AM**	**8:20 AM**
Fowler*	7:55 AM	
Pueblo*	7:10 AM	7:05 AM
Colorado Springs*	6:20 AM	6:05 AM
Castle Rock*	4:45 AM	5:15 AM
Littleton*	4:00 AM	
Denver*	3:15 AM	4:05 AM

Southwest Chief Westbound	
Newton	**3:47 AM**
Hutchinson	4:24 AM
Dodge City	6:13 AM
Garden City	6:59 AM
Lamar*	7:19 AM
La Junta*	8:38 AM

* - Mountain time, all others are Central

Another option would be to extend the actual operation of the Heartland Flyer from Fort Worth to Denver operating a through train movement over the same route as the Southwest Chief from Newton to La Junta. This option would enhance the travel time and reduce any number of capacity issues inherent in the utilization of the Southwest Chief as the intermediate leg of the trip. The length of the trip from Fort Worth to Denver is less than one thousand miles, which would facilitate through train operations requiring maintenance stops only on the terminal ends of the route. Bi-directional daily operation similar to the present Heartland Flyer schedule would require the addition of another train set on the route. Through operations from Fort Worth to Denver would help establish a solid north/south rail connection that would provide excellent connectivity to the national passenger rail system in the south central region of the nation. This type of service would also greatly increase the number of destinations accessible from the major east/west Southwest Chief corridor. The proposed schedule for through train operations from Oklahoma City to Denver is listed in Table 12.

Table 12 - Proposed schedule for through operations from Oklahoma City to Denver

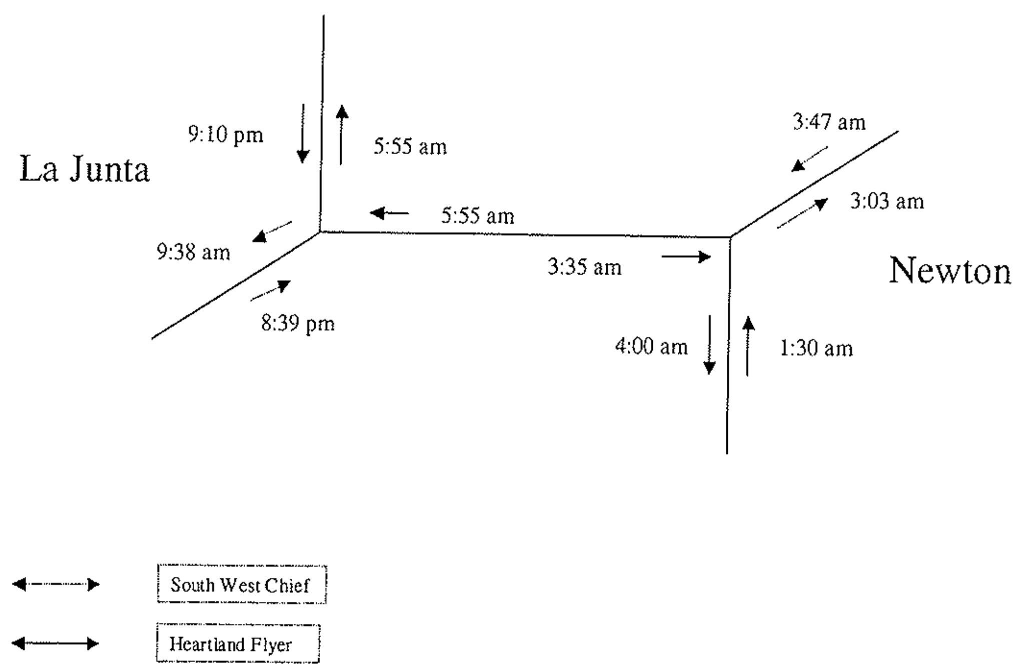
Southwest Chief Eastbound		**Heartland Flyer Westbound/Northbound**			**Heartland Flyer Eastbound/Southbound**			**Southwest Chief Westbound**	
		OKC	10:05 PM		OKC	7:35 AM			
		Edmond	10:20 PM		Edmond	7:15 AM			
		G uthrie	10:35 PM		G uthrie	7:00 AM			
		Perry	11:15 PM		Perry	6:20 AM			
		Ponca City	11:45 PM		Ponca City	5:55 AM			
		Ark City	12:10 AM		Ark City	5:25 AM			
		Wichita	1:05 AM	Dp 1:40 AM	Wichita	4:30 AM			
Newton	**3:03 AM**	Newton	**1:30 AM**	**2:10 AM**	Newton**	**3:35 AM**	Dp 4:00 AM	Newton	**3:47 AM**
Hutchinsor	2:24 AM	Hutchinson	2:10 AM		Hutchinson	2:30 AM		Hutchinson	4:24 AM
Dodge City	12:39 AM	Dodge City	4:00 AM		Dodge City	12:45 AM		Dodge City	6:13 AM
Garden Cit	11:48 PM	Garden City	4:45 AM		Garden City	11:55 PM		Garden City	6:59 AM
Lamar*	9:27 PM	Lamar*	5:05 AM		Lamar*	9:35 PM		Lamar*	7:19 AM
La Junta*	**8:39 PM**	La Junta*	**5:55 AM**		La Junta*	**8:10 PM**		La Junta*	**8:38 AM**
		Fowler*	6:20 AM		Fowler*	7:45 PM			
		Pueblo*	7:05 AM		Pueblo*	7:00 PM			
		Colorado Springs*	7:55 AM		Colorado Springs*	6:10 PM			
		Castle Rock*	9:30 AM		Castle Rock*	4:35 PM			
		Littleton*	10:15 AM		Littleton*	3:50 PM			
		Denver*	11:00 AM		Denver*	3:05 PM			

* - Mountain time, all others are Central

** - All connections between both services available in Newton

Under the proposed scheduling, complete connections for both services in each direction would be available in Newton, while maintaining the present schedules on the existing operating segments of both the Heartland Flyer and Southwest Chief. The proposed connection times are provided in Figure 9.

Figure 9 - Connection Times to Newton, Kansas



The only services requiring an overnight stay for a connection using this proposed scheduling, would be access to and from Denver on the westbound Southwest Chief. Further consideration would be required to facilitate all of the Newton and La Junta connections with no overnight stays, including potentially an alteration of the present schedule of the Southwest Chief or a layover on one leg of the proposed Fort Worth to Denver service. A graphical representation of the proposed scheduling between Oklahoma City and Denver is given in Figures 10 and 11 to help illustrate the scheduling constraints posed by the present schedule for the Southwest Chief and to better illustrate the connections available under this scenario.

Figure 11 - Potential Train Schedule for Extended Heartland Flyer Operations, OKC to Denver

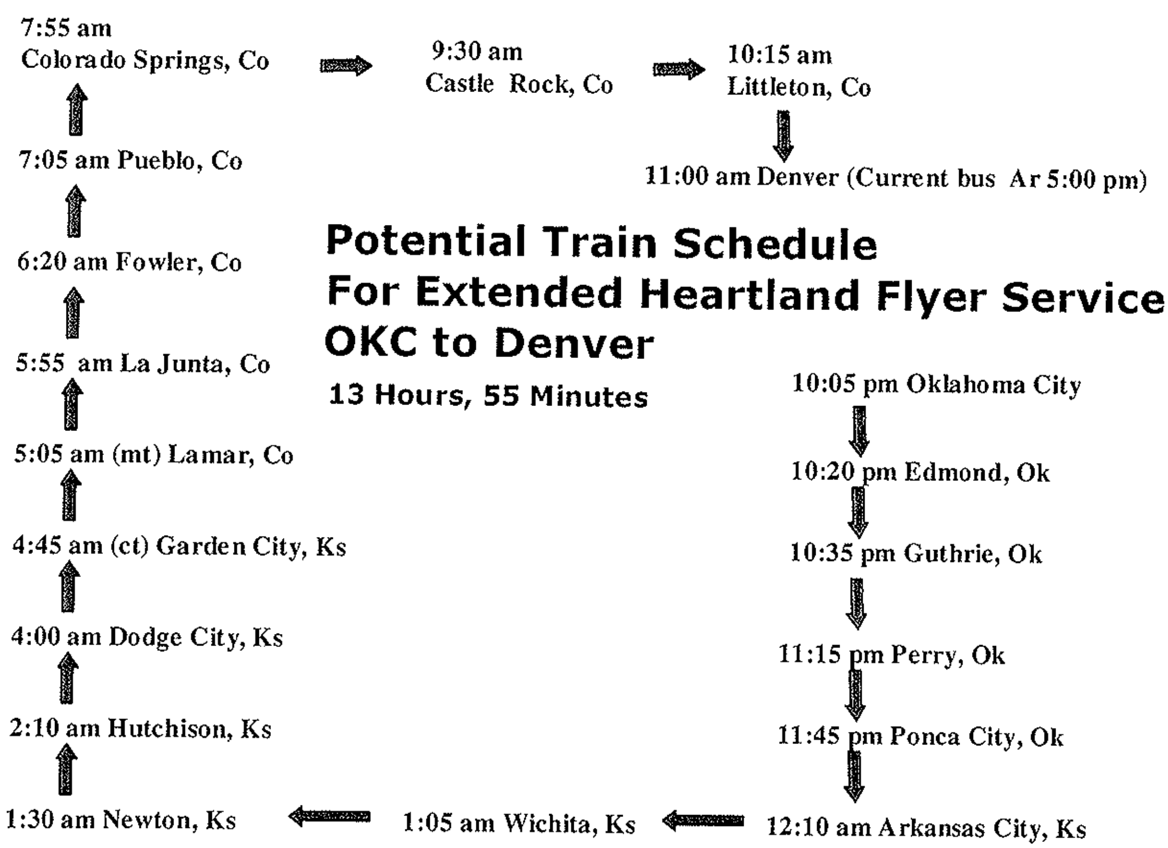
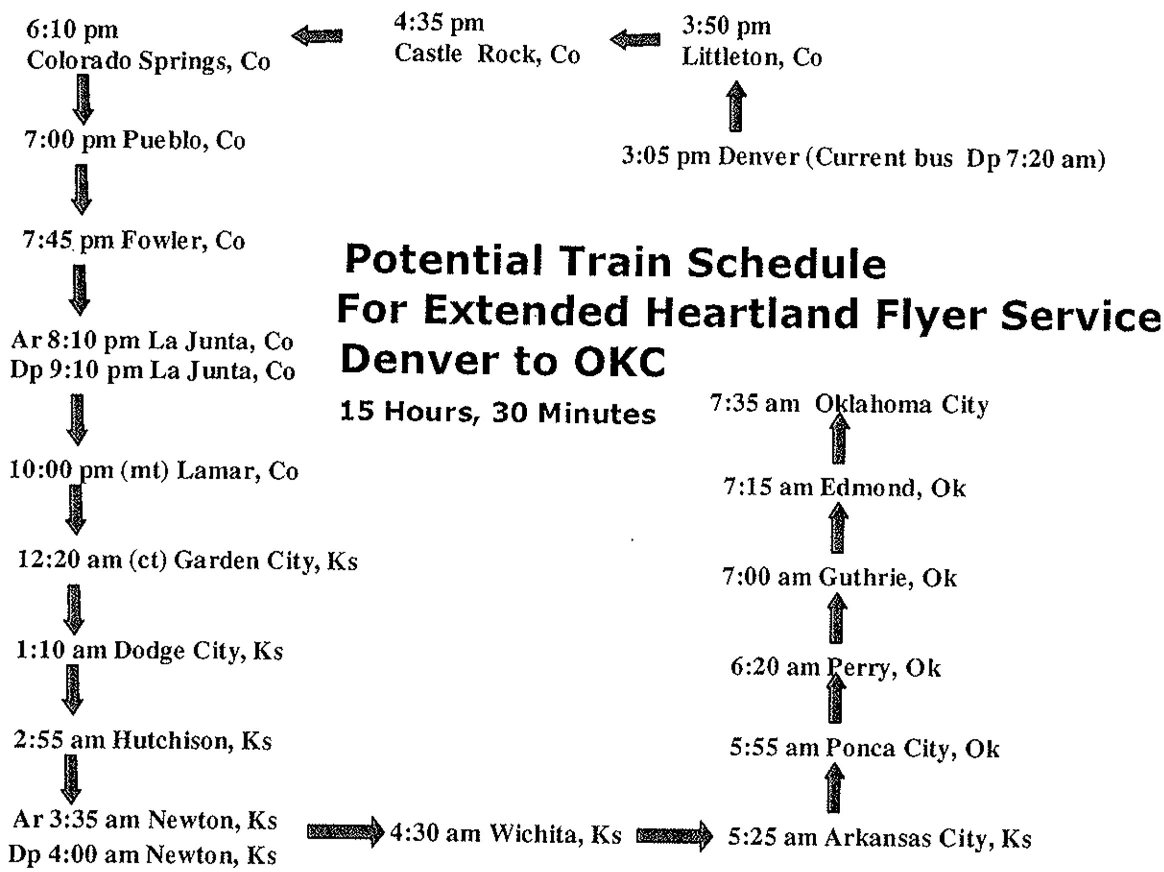


Figure 11 - Potential Train Schedule for Extended Heartland Flyer Operations, Denver to OKC



Some consideration might want to be given for maintaining the present bus connection to Denver via Raton, New Mexico in order to better facilitate connections with Denver from the westbound Southwest Chief. Another option for adapting the La Junta and Newton connections would be available if a connection were completed from Tulsa to Kansas City. The scheduling could actually be shifted to accommodate all of the connections in La Junta, however this would lead to problems with the eastbound connections in Newton, which would be more difficult to mitigate with bus connections. The proposed high-speed rail service from Wichita to Kansas City recently identified as a feasible alternative in Kansas, by a study conducted for the Kansas Department of Transportation, would greatly enhance the connections near Newton and facilitate good connectivity to Kansas City regardless of the schedules utilized for the Heartland Flyer and the Southwest Chief. The scheduling scenarios presented are based on the assumption that the present schedule for the Southwest Chief would not be altered. The connecting times for all of the movements would be easier to coordinate if the schedule on the Southwest could be adjusted by approximately two hours to better facilitate the connections in Newton and La Junta.

SECTION 5 - CAPACITY ANALYSIS OF CORRIDORS

Oklahoma City to Tulsa, Oklahoma

The segment between Oklahoma City and Tulsa is for the most part a secondary freight route. The length of the route is 112.8 miles and consists of two main sections that can be described separately.

The section between Oklahoma City and Sapulpa has been a lightly used line that BNSF has recently sold to the Oklahoma Department of Transportation for third-party operations. The section is 102.5 miles long. It presently does not have an operating signal system, utilizing Track Warrant Control (TWC) for train operations. There are five sidings on this section but only three are useful for meeting and passing trains. The route is very curvy and hilly resulting in many speed restrictions. Maximum speed on this segment is 45 mile per hour. A number of locations are identified in BNSF's special instructions as susceptible to harmonic rocking, indicating that train speeds are restricted for safe operations, when maximum train speed cannot be maintained above harmonic rocking speeds. Maintenance activities have been at minimal levels for many years because of the lack of traffic demand. Train operation over the line presently consists of a single small freight that works both directions during the week and performs additional local work as needed. Tonnage reports indicate that 3.3 million tons were moved over the line in 1998.

The Sapulpa to Tulsa section of this segment, however, is part of the heavily used BNSF main line between Tulsa and Irving, Texas. This section is 10.3 miles long, 7.7 miles of which is single track. The other 2.6 miles is double track. Train movement authority is through CTC signal control. Maximum authorized freight speed is 45 mile per hour with a 25 mile per hour speed limit over switches. Cherokee Yard, a major classification yard, is located on the North end of the line near Tulsa. Tonnage over this section in 1998 was approximately 20 million.

The amount of freight traffic over the route varies by location, day of the week and with a high degree of seasonal impact. Train volumes and types operating over the line are approximately:

	Low	High
High Priority Intermodal	**2**	**3**
General Freight	4	6
Empty/Loaded Unit Trains	2	4
Locals and Other	4	6
	12	19

While the overall line is the shortest rail route between Oklahoma City and Tulsa, the sharp curves and grades restrict train speeds on the route. With the reduction of maintenance on the Oklahoma City to Sapulpa segment over the years, considerable expense may be required to upgrade the line.

Perry to Tulsa, Oklahoma

The segment between Perry and Tulsa is part of BNSF's high priority freight route between Memphis, Tulsa, Enid, and Los Angeles. This segment is approximately 83 miles in length. The line is single track with three sidings for meeting and passing trains. Train movements are authorized through TWC rules of operation with a maximum speed of 49 miles per hour. There are a considerable number of curves over the segment, restricting maximum train speeds. The west-end of the line actually ties into Line 1 (Oklahoma City to Newton) at Black Bear, 6 miles north of Perry. The east end of the line ties into BNSF's Tulsa terminal at the north end of Cherokee Yard, a major classification yard.

Train traffic using the line has grown considerably due to of its use as a main route for east - west container trains and other priority freight. Train volumes and types operating over the line are approximately:

	Low	High
High Priority Intermodal	4	8
General Freight	2	3
Empty/Loaded Unit Trains	0	4
Locals and Other	1	1
	7	16

Tonnage reports indicate 25 million tons of traffic over the line in 1998.

BNSF has performed many studies to improve this segment because of the fast growth in high priority business utilizing the route. As mentioned in the review of Line 1, BNSF evaluated merging a five-mile section between Perry and Black Bear into a double track segment shared by both lines. Other studies recommended new sidings at Casey and at the connection into the Tulsa Terminal. Signal and switch upgrades were considered to improve train speeds and increase capacity. However, Carter & Burgess is not aware of any capital improvements planned for the immediate future.

Tulsa to Kansas City, Missouri

The segment between Tulsa and Kansas City, Missouri is a heavily used BNSF main line route and is 267.8 miles in length. The segment is fully signalized with CTC. Maximum freight speed is 60 miles per hour, although lower speeds prevalent due to geometric and speed restrictions associated with curves, terminals, and other restrictions. Most of the route is very busy and is experiencing high traffic growth, mainly Intermodal and Unit trains.

There are three major sections of the route that can best be described separately.

The Kansas City to Ft. Scott section consists of 102.7 miles of heavily used BNSF main line, connecting at Kansas City with main line routes from the Pacific Northwest; the Wyoming coal fields and northern destinations; as well as southern destinations including: Memphis, Atlanta, New Orleans, Tulsa and several locations in Texas. This section is primarily single track with six sidings to meet and pass trains. Double track sections are located from Kansas City to Bonita (26.5 miles), Hillsdale (4.5 miles), and Ft. Scott (5.9 miles) primarily to provide additional capacity through terminals and over grades.

Tonnage reports for 1998 indicate approximately 70 million tons of traffic between Kansas City and Paola (an UP connection) and 45 million tons per year from Paola to Ft. Scott. The tonnage difference results from UP trains using the BNSF main line between Kansas City and

Paola. There is also a major UP rail crossing at Paola. Train volumes and types operating over the line are approximately:

	Low	High
High Priority Intermodal	**6**	**10**
General Freight	10	12
Empty/Loaded Unit Trains	8	12
Locals and Other	4	6
	20	40

UP trains operating between Kansas City and Paola add approximately 50 percent more train volume, which is in addition to the BNSF train volumes.

Capital expansion studies have been performed for this section of the line due to freight growth and potential commuter operations. Capacity studies have considered all of the sidings for extension and/or connection into alternating double track. Signal improvements and added crossovers have been evaluated. Alternate route connections to the Transcon main line at a point near Olathe where the two main lines are close, approximately 20 miles south of Kansas City, have also been considered.

The Ft. Scott to Afton section is 85.8 miles of BNSF main line connecting the Kansas City and north main lines with points through Tulsa and the south. The section is single track with six sidings to meet and pass trains. Tonnage reports for 1988 indicate approximately 20 million tons of traffic per year. Train volumes and types operating over the line are approximately:

	Low	High
High Priority Intermodal	**2**	**3**
General Freight	2	4
Empty/Loaded Unit Trains	2	6
Locals and Other	2	4
	8	17

Alternate routing operations have been considered over this segment but expansion plans have not been finalized.

The Tulsa to Afton section is 79.3 miles of heavily used BNSF main line connecting through Tulsa from Chicago and Memphis to Texas and California. The line is primarily single track with seven sidings to meet and pass trains and has 5.7 miles of double track at the Afton connection. Tonnage reports for 1998 indicate approximately 51 million tons of traffic per year between Afton and Claremore (an UP connection) and 45 million tons per year between Claremore and Tulsa. The difference in tonnage occurs because of unit coal train deliveries by BNSF to the UP for southern Oklahoma power plants. There are two major UP rail crossings on the section - Claremore and Vinita. Train volumes and types operating over the line are approximately:

1. Denver to Pueblo, Colorado
2. Pueblo to La Junta, Colorado
3. Abilene, Kansas to Denver, Colorado

Additionally, an estimate to establish the improvements necessary to implement passenger rail service on these corridors was completed.

The analysis processes included the utilization of Burlington Northern and Santa Fe Railway (BNSF) and Union Pacific Railroad (UP) timetables, track charts, maps, train count studies, and tonnage charts. Representatives from both BNSF and UP were also interviewed to support the analysis, and to determine the project's viability in conjunction with freight operations.

Following are the analyses of the three line segments. The analysis of each line segment/route is high-level and does not include the degree of detailed analysis normally required to determine the operations and capacity implications for new or increased levels of passenger service over freight rail corridors. Each analysis describes the line segment from a track configuration and geographical perspective, followed by an overview of operations and operational issues for the segment. Finally, a recommendation and explanation is provided for proposed improvements that may be required to implement passenger operations, followed by a brief section of issues of critical importance to ODOT.

Denver to Pueblo, Colorado

Track Configuration and Grades

The route between Denver and Pueblo is operated jointly by BNSF and UP. The distance is 119 miles, and consists of various track and signaling configurations. These configurations dictate how rail traffic is directed between Denver and Pueblo. The following is a brief description of the various sections, and how the two railroads currently operate in conjunction with one another:

1. Denver to South Park Jct. (2 miles): the route is a two-track main controlled with CTC. The CTC trackage is signaled for movements in both directions and trains are directed by signal indications controlled by a remote operator or dispatcher; the control operator also controls the positions of powered switches. Trains may operate in either direction on either track across this section. The section is adjacent to the Denver terminal area, with two sets of double crossover switches between the northbound and southbound main tracks. These crossovers primarily provide access to various yard areas along the segment.

2. South Park Jct. to Littleton (8 miles): this segment consists of two main tracks, each operated in a different manner. The southward track is CTC single track, which allows trains to move over this line in either direction based upon signal indication, as provided by the dispatcher. The northward track is single track Automatic Block Signal (ABS), which requires that trains receive verbal instructions and permission to proceed over the track. ABS is considered signalized track, but generally, the switches are not remotely controlled and must be thrown by a crewmember of the train utilizing the switch, but only after receiving permission to do so. There is a single crossover from the southbound to the northbound main track at Littleton, 10 miles south of Denver.

3. Littleton to Palmer Lake (42 miles): this segment is Double Track ABS territory. On a double track ABS system, trains operate in one direction on each track similar to a highway system. Trains are allowed to operate "against the current" of traffic at the dispatchers discretion, however they must do so at reduced speeds because there are no signals to protect them from other train movements. All switches in this section are hand throw switches. There is a single crossover at Sedalia (25 miles from Denver), however trains or engines have to make a reverse move to utilize this crossover, creating an awkward movement because of grades around Sedalia.

4. Palmer Lake to Crews (32 miles): this segment is single track CTC, signalized for movement in both directions with trains movements directed from a remote location. This section contains three sidings off the main track that allow trains to meet and pass; only one of the three sidings is capable of holding a train up to 8000 feet in length. The siding at Colorado Springs is 20,000 feet and has double crossovers two miles south of the north end of the siding (74 miles from Denver). The other two sidings at Monument (57 miles from Denver) and Academy (65 miles from Denver) are 6900 and 7200 feet respectively.

5. Crews to Bragdon (24 miles): this segment is double track ABS. At Buttes (96 miles from Denver) there is a double crossover between the two main tracks. At Bragdon (108 miles from Denver), is a remotely controlled double crossover that allows trains to be routed onto either track.

6. Bragdon to Pueblo (11 miles): On this segment, the UP controls one line and BNSF controls the other line to Pueblo. Both are CTC single track, with the only meet point being a siding located at Bragdon on the BNSF route.

The Union Pacific controls the southbound main track between South Denver and Palmer Lake, between Crews and Bragdon, and finally between Bragdon and Pueblo. All movements on this track between these locations must be authorized by UP dispatchers. BNSF controls the northbound track between South Denver and Palmer Lake, the single track between Palmer Lake and Crews, and the northbound track between Crews and Pueblo.

Maximum freight speed over this route is 55 mph. Grades and curvature across the territory limit speeds in many locations to as low as 20 mph.

The main geographic feature of the Denver to Pueblo route is the grade up to Palmer Lake. From Littleton to Palmer Lake in the southward direction, the track climbs steadily, with a maximum sustained gradient of 1.4%. From Palmer Lake to Colorado Springs, the track descends at a maximum grade of 1.4%. While there are some grade issues between Denver and Littleton and between Colorado Springs and Pueblo, the grades are generally less severe, under 1%.

The single-track segment between Palmer Lake and Crews presently has three sidings that can be used for meeting trains. North Colorado Springs, however, is the only siding long enough to hold an 8000-foot coal train clear of the main track.

Traffic and Operations

The traffic mix that uses this route includes coal trains from Wyoming, Colorado and Utah, mixed intermodal and merchandise trains from Kansas City, Texas, and the Pacific Northwest, and grain loads and empties moving from Nebraska/Colorado to the Gulf of Mexico. This route is BNSF's primary corridor for coal trains moving from the Powder River Basin (PRB) area of Wyoming to Texas and their empty returning counterparts. It is also used by Union Pacific coal traffic moving from Utah and western Colorado to southern Colorado.
Grain trains operate over this line on a seasonal basis. BNSF estimates that the segment can see as many as four loaded grain trains per day in the heaviest season.

Train counts from the week of May 1 - 7, 2000 indicate an average of 30 total BNSF and UP movements on the line per day. Traditionally, May is a lighter month for traffic than the fall and spring months. Tonnage charts indicate that 55 to 60 million gross tons operate southbound and 15 to 20 million gross tons operate northbound; extrapolating from the counts provided, the total gross tonnage is only 63 million tons. This supports the assumption that the counts may be less in the month of May when the counts were collected, than what would be experienced during other periods of the year. The train types by count and carrier are as follows:

	BNSF Daily Trains		UP Daily Trains	
	Avg.	**Max**	**Avg.**	**Max**
Merchandise/Intermodal	**6**	**8**	**2**	**3**
Coal Loads	6	9	2	3
Coal Empties	5	8	1	2
Other Unit Lds/Empty	<1	1	<1	1
Helpers/Locals	7	10	N/A	N/A

The loaded unit trains and some of the merchandise trains require helper locomotives over this segment. Southbound trains require the addition of helpers at Denver. If the train requires additional braking ability, the extra locomotives remain with the train until North Colorado Springs. If the train does not require the additional braking capabilities, the locomotives may be removed at Palmer Lake. BNSF personnel indicated that the removal of the helper units often occurs while the train is on the single track, which indicates the track is blocked until the move is complete and the helper units return to the northbound main of the double track. Very few of the helper locomotives removed at Colorado Springs are added to northbound merchandise trains to assist with their movement to Denver. Pueblo has the responsibility to block northbound trains so that they generally do not need the extra power to crest the grade. On occasion, trains are sent north that require the helper locomotives. When this occurs, those locomotives are removed at Littleton while the train is on the main line, creating congestion problems. Most of the helper locomotives return from Colorado Springs and Palmer Lake to Littleton as light engine moves, adding traffic to the line.

All southward freight trains equipped with an End of Train device (ETD) must make an emergency application of their brakes at Palmer Lake to determine that they have a fully-working brake system that can be activated remotely by the ETD to allow a safe descent. This test requires the trains to stop on the mainline, record the air gauge reading from the test and then recharge the brake line before continuing the move down the mountain. Main track capacity is consumed while the trains complete this test.

The average running time for loaded unit trains between Denver and Pueblo was slightly above seven hours during 1999. The average running time for empty loaded coal trains between Pueblo and Denver for that same period was slightly over five hours. Most merchandise trains that do not require helper locomotives are expected to operate at approximately the same speed as the empty coal trains. If the trains do require the addition of helpers, the running time would be longer. Based upon track geometry and the power to weight ratios for passenger equipment, passenger trains using this corridor could make an unimpeded run in 2 hours and 15 minutes. The large variance between passenger running time and other freight traffic running times is a considerable issue with regards to implementation of passenger traffic on this route, and is discussed in the next section.

Track capacity within the Denver Terminal is also a concern of the railroads. The UP indicated that they have a locomotive service facility at Burnham Yard that serves trains arriving and departing the North Yard. These engines must use the same trackage that passenger trains would use to access the Union Terminal. The UP indicated that even light engine moves are frequently delayed in this area by other terminal movements, which led them to believe that passenger movements would seriously affect freight in this area. Additionally, it is our understanding that there is no longer a direct head-in route to the station tracks at Union Terminal; instead, the arriving passenger train would have to pull past the station and back in. The UP believed that while the right of way still existed to recreate the direct head-in route, economic development in the area would likely prevent reinstating the track.

Proposed Capacity Improvements to Allow Passenger Operations

Two factors must be considered when addressing the implementation of passenger service over this corridor. The first is dispatching technique that is used in most passenger operations and the second is the diverse range of speeds at which trains presently operate over the corridor. Both conditions must be considered to develop a plan that would allow passenger traffic onto this freight corridor.

The first factor, dispatching technique, can be explained by stating that dispatchers rarely intentionally delay passenger trains for freight movements. To make sure these delays do not occur, most dispatchers will clear the track ahead of the passenger train for up to 30 minutes prior to the train's arrival. This entails holding freight movements in yards, sidings or on a double track segment so that the passenger train has a clear route and can get past the freight train without experiencing delay. The unidirectional operation over the double track segment combined with the short sidings on the single track segment will complicate a dispatcher's ability to protect passenger trains between Denver and Pueblo.

The second factor, particularly on this line, is the wide range of speeds displayed by the various traffic types. Loaded coal trains typically move between Littleton and Palmer Lake at speeds not exceeding 20 mph; on the steepest portion of the grade, the speed reduces to 10 mph. Even after cresting the summit, coal trains are restricted to 20 mph as they descend into Colorado Springs. The only available meet points between Littleton and Colorado Springs for trains 7200 feet or longer (a 130 car coal train exceeds 8000 feet) is on a siding off the southbound main at Orsa (28 miles from Denver) or at Palmer Lake where the double track segment begins for northbound movements. Over this same segment, passenger trains should be able to operate between 45 and 70 mph, which creates overtake speeds of up to 60 mph between the two types of traffic.

Empty unit and other merchandise trains are not exempt from this variance with passenger speeds. North and southbound freight trains run between 25 and 45 mph over the Littleton to Colorado Springs section; merchandise trains that require helper units will be considerably slower. The speeds of the freight movements will make it imperative that dispatchers clear the slower trains if a passenger train is scheduled to run. It is our opinion that the delays the priority requirements of dispatching passenger trains will impose on freight traffic will not be acceptable to BNSF or UP without significant infrastructure improvements.

To mitigate the potential delays to freight traffic, a list of improvements has been identified that would likely need to be considered for the line segment if passenger operations are introduced. This list is based upon previous experience with railroad operations and is only an estimate. To determine if all the proposed improvements are necessary or if additional ones may be necessary, additional computer simulation would need to be performed to test various iterations of track configuration and traffic variability. The list of improvements and a brief explanation of benefits are as follows:

1. Consolidate dispatching to one railroad.
2. Review Denver Terminal operations and determine improvements required to allow consistent passenger operations that do not negatively affect terminal freight operations.
3. Install bi-directional ABS or CTC signaling between Littleton and Palmer Lake (43 miles).
4. Upgrade the single crossovers at Littleton and Sedalia to power double crossover switches and install CTC to control those crossovers.
5. Upgrade both ends of existing Orsa siding to power switches and install CTC to control them.
6. Construct at least one set of double crossover switches between Castle Rock and Spruce and install CTC to control it.

These improvements would create pockets that slower freight trains could be held at while meeting or being passed by faster passenger traffic. Bi-directional ABS or CTC signaling would create Two Main Track territory, replacing the Double Track, allowing a dispatcher to direct faster trains around slower or stopped trains using either track. Incumbent with these improvements, however, would be an agreement between the BNSF and UP for one railroad to dispatch the entire territory.

7. Upgrade the Colorado Springs siding to a second main track and install signals to allow trains to run at track speed (20,000 feet).
8. Construct an 8500-foot siding near Kelker (MP 78).

The improvements at Colorado Springs would allow through trains to avoid being delayed by trains adding or removing helper locomotives or working in the yard. The existing crossover at

MP 74.5 creates a 2-mile pocket on the north end of the two main tracks where a train could stop without affecting railroad or highway traffic. The siding near Kelker would provide one more meet pass point on the single track to hold slower freight traffic as passenger traffic approached.

9. Upgrade the double crossover at Buttes to power switches and install a CTC control point.

10. Install bi-directional ABS or CTC signaling between Crews and Bragdon (24 miles).

These improvements are similar to the improvements between Littleton and Palmer Lake, creating flexibility for a dispatcher to hold slower freight trains in pockets while being able to run faster passenger traffic around freight trains using either track.

Other Issues

The Union Pacific indicated that they felt passenger traffic should not be introduced on this segment without significant track improvements. They feel the segment is already capacity constrained with freight volumes and additional passenger trains would severely affect existing freight operations.

Additionally, there have been studies performed by BNSF that estimate the Texas market for PRB coal could grow by 50 to 70 million annual tons over the next 10 years. While BNSF would not likely secure the movement of all of this coal, it is likely that they would transport some portion of the tonnage, adding significant additional coal traffic to this route. With coal and other growth, some capacity improvements will most likely be required on this section of track to accommodate freight volumes. The BNSF and UP may potentially be willing to consider introducing passenger operations on this segment if Amtrak contributed to a fair percentage of the cost of these improvements or others that may be required. A final list of improvements agreeable to all parties would be based upon an acceptable methodology that determines each party's capacity demand and the resulting impact on freight operations.

Pueblo to La Junta

Track Configuration and Grades

The route between Pueblo and La Junta is controlled by BNSF, and the UP has trackage rights over the segment. The line distance is 64 miles, and consists of two distinct track and signaling configurations. The following is a brief description of the two sections.

1. Pueblo to NA Jct. (28 miles): the segment is single track CTC with sidings. There are two meet/pass sidings, each being 7500 feet in length.

2. NA Jct. to La Junta (36 miles): this segment is single track ABS with sidings. There are three usable sidings, however, none are greater than 5400 feet in length.

The route from Pueblo to La Junta gradually slopes down grade. The maximum grade is less than 0.5%, which has little effect on most freight trains. Curvature on this line is light, which will allow high passenger train speeds. Maximum freight speed on this segment is 55 mph.

Traffic and Operations

BNSF operates most of the traffic over this line, which includes mixed intermodal/merchandise, coal, and some grain trains. Traffic density charts indicate between 20 and 25 million gross tons operate over this line yearly, with BNSF moving approximately 80% of the total tonnage.

Train counts from the week of May 1 - 7, 2000 indicate an average of seven BNSF and UP movements per day on the line. The maximum daily count during this week was eleven trains. Again, it should be taken into consideration that May is traditionally a lighter month for traffic than most of the fall and spring months. The train types by count and carrier are as follows:

	BNSF		UP	
	Avg.	Max	Avg.	Max
Merchandise/Intermodal	**3**	**4**	**<1**	**1**
Coal Loads	2	3	<1	1
Coal Empties	2	2	<1	1
Other Unit Loads/Empty	<1	1	<1	1

A BNSF study indicated coal train running times over this line are approximately 2.75 hours in each direction. Running time information provided by BNSF indicates average freight running times are approximately 1.5 to 2.0 hours. Passenger train running times are estimated at approximately one hour in both directions. Again, passenger trains would frequently overtake unit train traffic on this corridor, and could overtake some merchandise train traffic as well.

There do not appear to be additional unusual operating practices or policies on this section of track.

Proposed Capacity Improvements to Allow Passenger Operations

Based on existing traffic levels and track geography, the following improvements would need to be made to implement passenger operations over this segment. Again, these recommendations are based upon previous experience, and would need to be thoroughly tested with computer simulation before either railroad would likely to agree to them. The list is as follows:

1. Lengthen Fowler (3300 feet) and Vroman (4100 feet) Sidings to 8500 feet or construct two new sidings between NA Jct. and La Junta. Upgrade the switches to ABS power assisted switches to allow trains to line themselves in after receiving instructions from the dispatcher.

If passenger operations are implemented on this segment, at least two sidings will be needed in the 36 miles between NA Jct. and La Junta so that freight trains have a location to clear the main track. Without these sidings, most trains would have to be held at La Junta or Avondale, which is the easternmost long CTC siding between Pueblo and NA Jct. Trains held in these locations could endure delays of over an hour without the proposed improvements. The power assisted ABS switches would allow a train to line itself into the siding. This type of switch automatically relines to the main track position after the train is clear in the siding.

Other Issues

Extension of sidings on this subdivision or construction of new sidings may be difficult because of numerous grade crossings at each existing siding location as well as between sidings. Private grade crossings may need to be closed or public crossings may need to be grade separated to complete the recommended improvements.

BNSF has studied the possibility of rerouting loaded coal traffic presently operating from Pueblo to Amarillo, TX via Walsenburg, CO to a routing of Pueblo to Amarillo via La Junta, turning coal traffic south at Las Animas Jct. and moving through Boise City, OK. This would allow BNSF to run coal loads to Texas via this route while the empties would remain on the existing route, creating additional capacity for the rail segment south of Pueblo. The BNSF would have to upgrade the Pueblo to La Junta and Las Animas to Amarillo track sections to implement this strategy. The capacity gained, however, may be required if the projected Texas traffic increases occur and BNSF manages to capture a significant portion of that traffic.

Should BNSF proceed with these improvements, the additional traffic and modified track structure would affect implementation of La Junta to Pueblo passenger service.

Abilene to Denver on the Union Pacific Railroad

Track Configuration and Grades

The route between Abilene, KS and Denver is controlled and operated by UP. The length is 477 miles. The line can be described as follows:

1. Abilene to Salina (22 miles): the segment is single track ABS with sidings. There are two 9000-foot sidings on this section.

2. Salina to Sharon Springs (243 miles): the segment is single-track dark territory (no signals) with sidings. Each usable siding is protected by ABS signals. There are five 9000-foot sidings on this segment, which includes one siding at Sharon Springs.

3. Sharon Springs to Denver (212 miles): the segment is also single-track dark territory with sidings. Each usable siding is protected by ABS signals. There are five 9000-foot sidings on this segment, which include a second siding at Sharon Springs.

The geography of this line is generally uphill from Abilene to Cedar Point (400 miles), then rolling grades to Denver. The maximum sustained grade on the line is 1%. The grades between Denver and Wattenberg (19 miles) and between Deer Trail and Cedar Point (21 miles) would be the limiting grade on this line for eastbound freight movements. Maximum freight speed on this segment is 40 mph.

Traffic and Operations

The Union Pacific indicated that this line is used primarily to handle overflow Utah and Colorado coal trains to Kansas City and beyond. The UP indicated that they were in the middle of a massive upgrade of the line, with the intention to run all coal trains from Utah and Colorado on this line to relieve some of the traffic on their line through North Platte, Nebraska.

The UP also indicated that this line is already severely over capacity with present freight volumes. To emphasize the point, they also indicate that most of the empty coal trains were returned to the mines via North Platte to avoid the meets they would cause on the Abilene line. UP currently handles the traffic operating across this line by fleeting trains in one direction (eastbound) to minimize meets. Evidence of this practice is supported by the tonnage charts, which indicate 15 to 20 million gross tons in the eastbound direction, but less than five million gross tons westbound.

The siding spacing between Salina and Denver currently ranges between 30 and 60 miles between sidings. Based on UP timetable information, average freight speed over this line is approximately 30 mph, with maximum speeds of 40 mph. With this siding spacing, freight trains will be delayed one hour or longer meeting a passenger train. If freights are run as a fleet, the second train could be delayed for over two hours. Delays of this magnitude will not be acceptable to UP.

The Union Pacific indicated that when the upgrade of the line was complete, they intended to run all unit loads and empties from Colorado and Utah via this route. In addition, UP indicated that they anticipated that two intermodal trains and at least one additional merchandise train, would be added. UP felt that freight volumes on the line would be over capacity for at least five years during which an upgrade of the line would continue but freight traffic volumes were expected to double.

The line is being upgraded as a 40-mph line (FRA Class 3). The line at one time had a signal system, however, it has been removed. Portions of the signal system are being reinstalled with the current track rehabilitation project.

Union Pacific stated that it is not interested in considering passenger service on this line at this time.

Based upon the UP's concerns about capacity and the overall distance of this route, the track improvements that would be necessary to implement passenger service on the Abilene to Denver line are not recommended. While it may be possible to convince the UP that passenger service is in their best interest, the cost of the necessary improvements would not justify the service at this time.

SECTION 6 - ESTIMATE OF RIDERSHIP

Estimate of Ridership

The ridership or level of travel between two cities or points of destination for a potential high-speed passenger rail service depends on the magnitude of the traffic-generating characteristics of the cities and on the characteristics of the transportation systems. To estimate the expected level of ridership

Trip Purpose

The most common trip purposes in intercity travel are business, recreation, and personal business.

Trip Purpose Ranges on Intercity Rail	
Trip Purpose	**Range**
Business	10 – 20 %
Recreational	70 – 80 %
Personal Business	5 - 10 %

- Business travel purpose is related to the traveler's work such as sales representatives, travel to business meetings, etc.
- Recreational travel is related to vacation and specific activities such as sports events or entertainments.
- Personal Business travel refers to visiting friends and relatives.

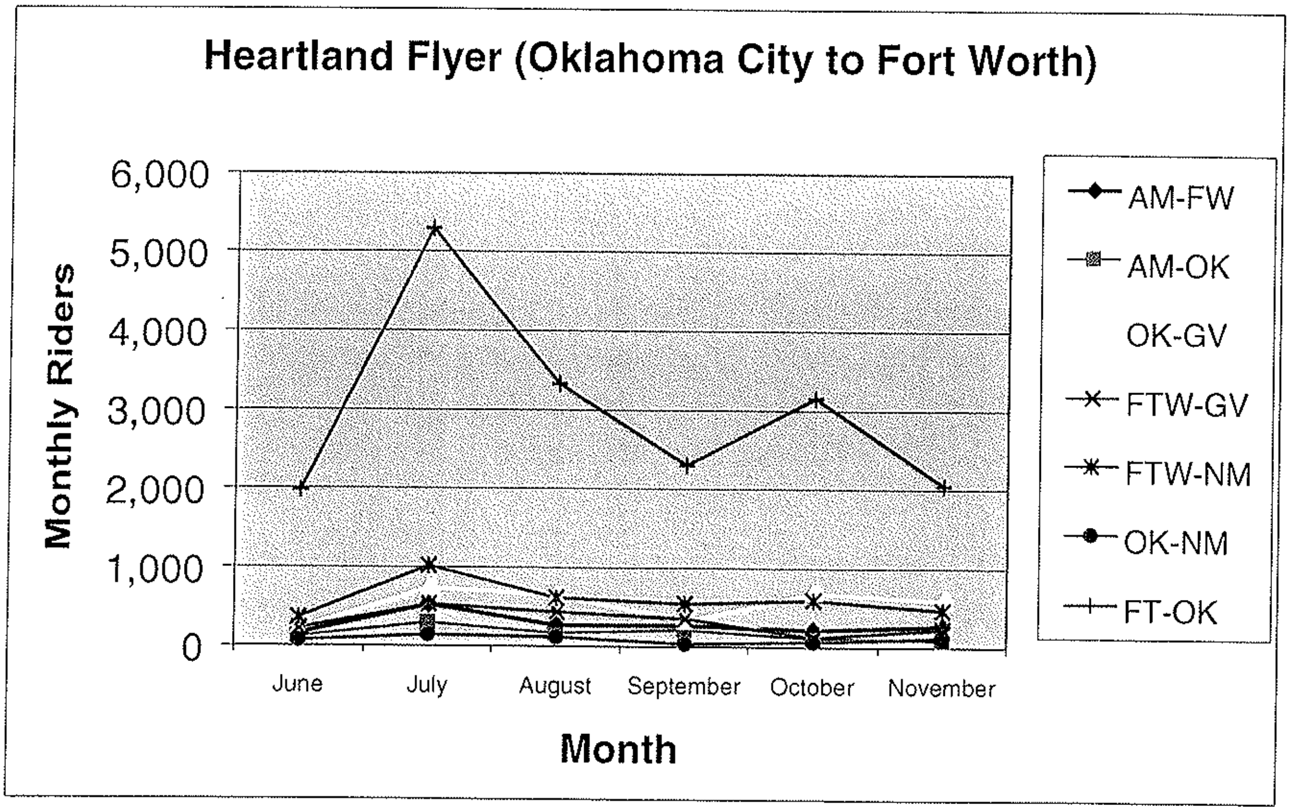
In addition, it is interesting to note the distribution and type of traveler making the daily passenger rail commute. The general occupation distribution for intercity rail is typically the following:

Occupation Distribution	
Occupation	**Percentage**
Professional / Managerial	10 – 30%
Students	15 – 25%
Retirees	10 – 20%
Homemakers	5 – 10%
Other	10 – 25%

Historically, ridership is very sensitive to the attributes or characteristics of the passenger rail service as it relates to the each potential customer. The most important attributes perceived by the customer are:

- Price of fare
- Convenience (schedules)
- Speed of total trip
- Reliability of service
- Comfort of trip

Ridership on intercity trains is traditionally seasonal. Peak ridership occurs during the summer months. For example, the present operating Heartland Flyer service from Oklahoma City to Fort Worth was found to have the highest ridership during the peak summer months during traditional family vacation time.



AM – FW = Ardmore to Fort Worth
AM – OK = Ardmore to Oklahoma City
OK – GV = Oklahoma City to Gainesville
FTW – GV = Fort Worth to Gainesville
FTW – NM = Fort Worth to Norman
OK – NM = Oklahoma City to Norman
FT – OK = Fort Worth to Oklahoma City

Heartland Flyer (AMTRAK – Oklahoma City/Fort Worth)								
Month	AM-FW Riders	AM-OK Riders	OK-GV Riders	FTW-GV Riders	FW-NM Riders	OK-NM Riders	FT-OK Riders	Total Riders
June	155	105	220	229	350	62	1,976	3,812
July	523	284	736	528	1,008	129	5,298	10,986
August	267	156	640	442	608	105	3,329	6,950
September	265	199	321	359	535	23	2,302	5,084
October	212	96	677	127	581	52	3,152	6,118
November	268	78	596	234	458	105	2,048	5,676
Total	1,690	918	3,190	1,919	3,540	476	18,105	38,626
Avg. by Month	282	153	532	320	590	79	3,018	6,438
Avg. by Day	9	5	18	11	20	3	101	215

1990 Origin - Destination Commuter Trips at the County Level

Based on surveys conducted as part of the 1990 Census, information is provided regarding the type of trip and the preferred mode of travel choice between different counties of the country. This information of the trip type and present mode choice is another piece of critical information to be used in estimating potential ridership for a high-speed passenger rail service. Following are the trip making characteristics for each of the corridors under study within the passenger rail feasibility study.

TULSA TO OKLAHOMA CITY						
From Place of Residence	To Place of Work	Workers 16 years and over (All modes)	Workers 16 years and over (DA)	Workers 16 years and over (Carpool)	Workers 16 years and over (Bus)	Workers 16 years and over (Other)
Tulsa County OK	Creek County OK	2,328	1,955	345	28	0
Tulsa County OK	Lincoln County OK	11	11	0	0	0
Tulsa County OK	Oklahoma County OK	509	389	104	0	16
Total		2,848	2,355	449	28	16

Source: 1990 Census Transportation Planning Package; Bureau of Transportation Statistics; U.S Department of Transportation

OKLAHOMA CITY TO TULSA						
From Place of Residence	To Place of Work	Workers 16 years and over (All modes)	Workers 16 years and over (DA)	Workers 16 years and over (Carpool)	Workers 16 years and over (Bus)	Workers 16 years and over (Other)
Oklahoma County OK	Lincoln County OK	225	191	34	0	0
Oklahoma County OK	Creek County OK	41	29	12	0	0
Oklahoma County OK	Tulsa County OK	619	490	106	19	4
Total		885	710	152	19	4

Source: 1990 Census Transportation Planning Package; Bureau of Transportation Statistics; U.S Department of Transportation

OKLAHOMA CITY TO NEWTON, KS						
From Place of Residence	To Place of Work	Workers 16 years and over (All modes)	Workers 16 years and over (DA)	Workers 16 years and over (Carpool)	Workers 16 years and over (Bus)	Workers 16 years and over (Other)
Oklahoma County OK	Harvey County KS	7	7	0	0	0
Oklahoma County OK	Sedgwick Count KS	112	45	67	0	0
Oklahoma County OK	Kay County OK	44	34	10	0	0
Oklahoma County OK	Noble County OK	36	25	11	0	0
Oklahoma County OK	Logan County OK	681	585	96	0	0
Total		880	696	184	0	0

Source: 1990 Census Transportation Planning Package; Bureau of Transportation Statistics; U.S Department of Transportation

NEWTON TO OKLAHOMA CITY						
From Place of Residence	To Place of Work	Workers 16 years and over (All modes)	Workers 16 years and over (DA)	Workers 16 years and over (Carpool)	Workers 16 years and over (Bus)	Workers 16 years and over (Other)
Harvey County Ks	Sedgwick County KS	2,307	1,884	411	0	12
Harvey County Ks	Sumner County KS	16	16	0	0	0
Total		2,323	1,900	411	0	12

Source: 1990 Census Transportation Planning Package; Bureau of Transportation Statistics;
U.S Department of Transportation

TULSA TO NEWTON, KANSAS						
From Place of Residence	To Place of Work	Workers 16 years and over (All modes)	Workers 16 years and over (DA)	Workers 16 years and over (Carpool)	Workers 16 years and over (Bus)	Workers 16 years and over (Other)
Tulsa County OK	Clay County MO	28	17	11	0	0
Tulsa County OK	Cass County MO	5	5	0	0	0
Tulsa County OK	Vernon County MO	16	0	16	0	0
Tulsa County OK	Craig County OK	97	91	6	0	0
Tulsa County OK	Ottawa County OK	13	13	0	0	0
Tulsa County OK	Rogers County OK	2,182	1,960	206	0	16
Total		2,341	2,086	239	0	16

Source: 1990 Census Transportation Planning Package; Bureau of Transportation Statistics;
U.S Department of Transportation

NEWTON, KANSAS TO TULSA						
From Place of Residence	**To Place of Work**	**Workers 16 years and over (All modes)**	**Workers 16 years and over (DA)**	**Workers 16 years and over (Carpool)**	**Workers 16 years and over (Bus)**	**Workers 16 years and over (Other)**
Clay County MO	Bates County MO	2	2	0	0	0
Clay County MO	Cass County MO	108	88	20	0	0
Clay County MO	Vernon County MO	10	10	0	0	0
Jackson County MO	Bates County MO	28	28	0	0	0
Jackson County MO	Cass County MO	1,715	1,493	213	0	9
Jackson County MO	Vernon County MO	33	33	0	0	0
Jackson County MO	Tulsa County OK	33	33	0	0	0
Total		1,929	1,687	233	0	9

Source: 1990 Census Transportation Planning Package; Bureau of Transportation Statistics;
U.S Department of Transportation

TULSA TO ST. LOUIS, MISSOURI						
From Place of Residence	**To Place of Work**	**Workers 16 years and over (All modes)**	**Workers 16 years and over (DA)**	**Workers 16 years and over (Carpool)**	**Workers 16 years and over (Bus)**	**Workers 16 years and over (Other)**
Tulsa County OK	St. Louis City County MO	13	5	8	0	0
Tulsa County OK	St. Louis County MO	19	12	0	0	7
Tulsa County OK	Franklin County MO	24	0	24	0	0
Tulsa County OK	Greene County MO	51	45	6	0	0
Tulsa County OK	Pulaski County MO	20	0	11	0	9
Tulsa County OK	Craig County OK	97	91	6	0	0
Tulsa County OK	Ottawa County OK	13	13	0	0	0
Tulsa County OK	Rogers County OK	2,182	1,960	206	0	16
Total		2,387	2,109	253	0	25

Source: 1990 Census Transportation Planning Package; Bureau of Transportation Statistics;
U.S Department of Transportation

ST. LOUIS, MISSOURI TO TULSA						
From Place of Residence	To Place of Work	Workers 16 years and over (All modes)	Workers 16 years and over (DA)	Workers 16 years and over (Carpool)	Workers 16 years and over (Bus)	Workers 16 years and over (Other)
St. Louis City County MO	Franklin County MO	149	123	15	11	0
St. Louis City County MO	Greene County MO	9	9	0	0	0
St. Louis City County MO	Tulsa County OK	7	7	0	0	0
St. Louis County MO	Franklin County MO	796	617	179	0	0
St. Louis County MO	Tulsa County OK	43	34	9	0	0
Total		1,004	790	203	11	0

Source: 1990 Census Transportation Planning Package; Bureau of Transportation Statistics; U.S Department of Transportation

Summary - Estimation of Ridership Demand

With the information as described above, the level of expected ridership demand for a high-speed passenger rail service can be estimated. Following are the results of the analysis of potential ridership for each corridor under consideration.

From	To	Average Daily Ridership	Distance (miles)
Oklahoma City	Fort Worth, TX	215[6]	200
Oklahoma City	Tulsa, OK	600[7]	120
Oklahoma City	Newton, KS	500[3]	180
Tulsa	Kansas City, MS	700[3]	280
Tulsa	St. Louis, MS	500[3]	400

6 1998 Amtrak Report. Missouri Department of Transportation, Dec. 1998
7 Heartland Flyer; Oklahoma Dept. of Transportation, Rail Program Division.

SECTION 7 - IMPLEMENTATION PLAN AND ANTICIPATED FUNDING NEEDS

The proposed implementation plan takes into consideration the attributes of each segment including: potential ridership, ease of implementation, and present or future designation as a high-speed corridor. This implementation plan is presented in tabular form in Table 13.

Table 13 - Proposed Implementation Plan for Passenger Rail Service Operating in the State of Oklahoma

Oklahoma Passenger Rail Implementation Plan							
Route	Fiscal Year						
	2000-2001	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007
Oklahoma City to Tulsa	EP, TR	EP, C1, **PS**	EP, C1, S1	EP, C2, S1	EP, C2, S1	EP, C3, S2	EP, C3, S2
Oklahoma City to Newton, Ks	EP,TR, **PS**						
Tulsa to Kansas City, Mo			EP	TR, **PS**			
Newton, Ks to Denver, Co	EP	EP, C1, S1	TR, C1, **PS**				

Where: EP -- Engineering / Planning
TR -- Track Resurfacing
PS -- Implementation of Passenger Service
S# -- Control Signal Improvement Phases
C# -- Construction Implementation Phases
IS# -- Connecting Intra-State Services

The implementation of passenger service on the existing Heartland Flyer route through Newton would be one of the least expensive and would require the least amount of infrastructure improvement. A reasonable projection to establish service would be approximately one year after the implementation of the engineering/planning needed to establish the segments of track that would require resurfacing. The enhancements needed would focus on resurfacing the track and the implementation of a program to systematically update the grade crossing warning devices over the entire route as needed to facilitate safe and efficient operations throughout the implementation phases.

The Oklahoma City to Tulsa segment would require approximately one and half years to implement passenger service that would facilitate a two and a half hour travel time between downtown Oklahoma City and Red Fork (West Tulsa), depending on the number of stops included along the route. Reductions in the travel time between the greater Oklahoma City and Tulsa areas would be required to establish service that is competitive enough to lure the business sector toward the utilization of rail transportation on this segment. Construction phase one would be focused on establishing the initial service including track resurfacing, structural improvements, rail replacement essential to the implementation of service, and the appropriate maintenance of the existing grade signals. Construction phase two would focus on infrastructure improvements to facilitate more efficient arrival and departures from the downtown Oklahoma City and provide a direct connection to the existing rail station in downtown Tulsa. This phase would also include the implementation of horizontal track improvements along the route identified to provide the greatest reduction in travel time along the route without the

HIGH SPEED PASSENGER RAIL FEASIBILITY STUDY

SUMMARY REPORT

Connecting all People all Places

Prepared for:

Oklahoma Department of Transportation
Rail Division

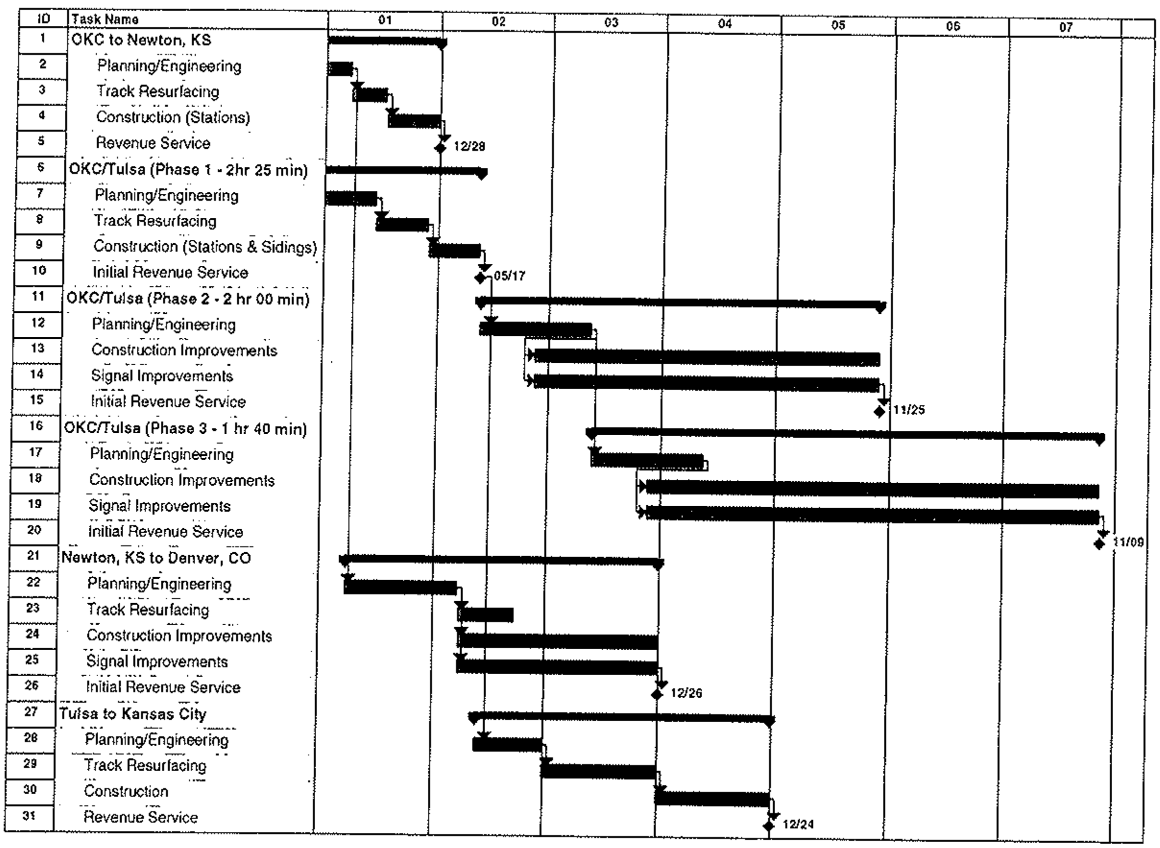
Prepared by:

Carter::Burgess

March 2001

purchase of additional right-of-way. Signal Phase one would be directed toward establishing centralized train control (CTC) along the State owned portion of the route from Oklahoma City to Sapulpa to allow for higher travel speeds. Construction phase three would address the realignment improvements needed to facilitate high speed operation over the entire route which would be implemented in conjunction with signal phase two focused on establishing in-cab train control to facilitate operations at 90 MPH and above. All of the construction phases and signaling phases for the Oklahoma City to Tulsa route have been developed as phased implementation improvements that would facilitate and improve ongoing operations during construction. The estimated time of completion for all three phases is approximately seven years for a system that would facilitate 90 mph or potentially faster operations reducing the travel time from downtown Oklahoma City to downtown Tulsa to approximately 1 hour and 45 minutes. A projected travel time of two hours should be expected after the completion of construction phase two in 2005 would provide the level of competitive travel time needed to begin to attract business traveler. A graphical representation of the implementation plan is provided in Figure 12.

Figure 12 - Graphical Representation of the Proposed Implementation Plan



An implementation plan for the further extension of the Heartland Flyer route to Denver was also included in the evaluation. This service could be implemented in approximately three years and would be relatively inexpensive in the States of Oklahoma and Kansas. The majority of the infrastructure improvements needed to facilitate service to Denver would be in the State of Colorado between Pueblo and Denver. The implementation of the service from Newton to La Junta, Colorado is anticipated to be relatively inexpensive, considering the fact that the new service would follow the route utilized by the existing service provided by the Southwest Chief to La Junta. Another option for service between La Junta and Denver would be the utilization of a bus connection. Similar to most bus/rail connections this option is anticipated to be less desirable, especially in winter months where the ease of making the connections would be harder and the reliability would potentially suffer based on roadway conditions.

The proposed implementation plan for service from Tulsa to Kansas City focuses on the preferred route through Ft. Scott on the BNSF. The time needed for the implementation of this service is anticipated to be a year to a year and a half. The improvements included in the proposed implementation plan include track resurfacing and the signal upgrades needed on the Oklahoma segments of the corridor for safe operation. The recommended implementation of this service is scheduled after the implementation of service to Oklahoma City from Tulsa. While this service is anticipated to be one of the less expensive to initiate, the ridership and revenue potential would be greatly enhanced by a connection to Oklahoma City facilitating a through movement between connections to the national passenger rail system and the movement of priority freight.

SECTION 8 - POTENTIAL FINANCIAL PLAN

The funding for each segment was evaluated under the assumption that service could be initiated on the existing infrastructure without the immediate need for the construction of overpass structures. The existing infrastructure consists of several highway and rail overpasses in the most congested areas on segments previously utilized for passenger rail service. The anticipated funding needs for each segment are provided in Table 14.

Table 14 - Proposed Implementation Plan Funding Needs

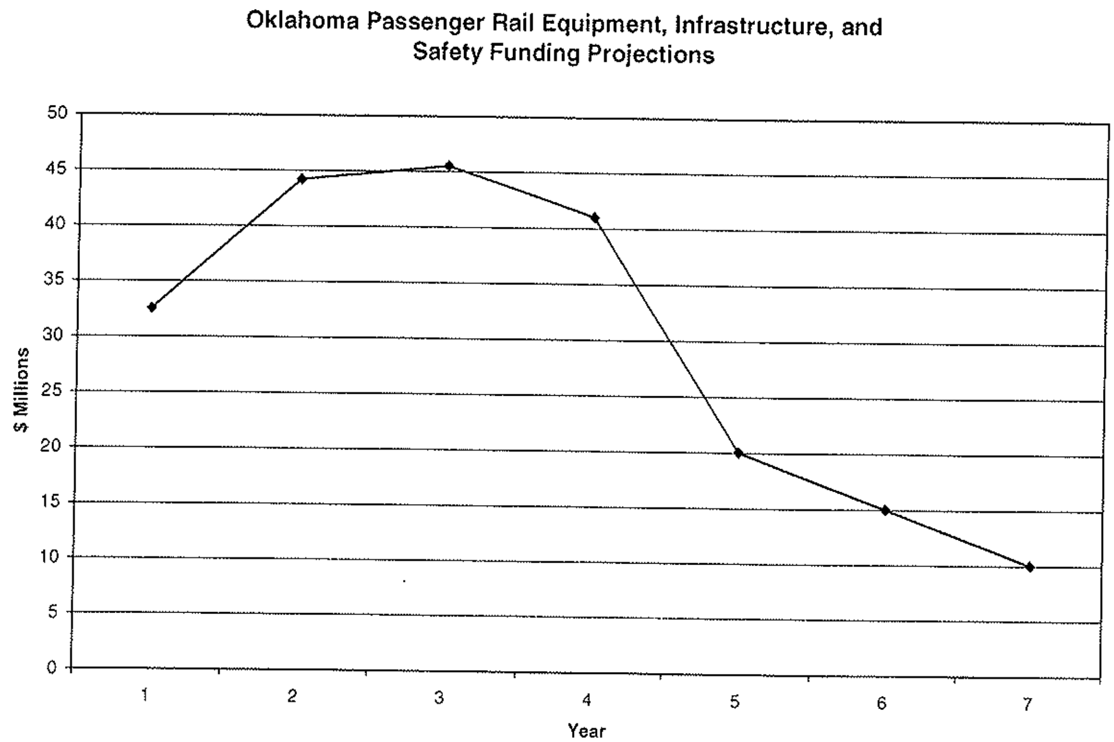
Oklahoma Passenger Rail Implementation Plan Funding Needs*

Route	Fiscal Year ($ Millions)							
	2000-2001	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	Total/Route
Oklahoma City to Tulsa	25	26	30	26	20	15	10	152
Oklahoma City to Newton, Ks	7	5.2						12.2
Tulsa to Kansas City, Mo			3.5	15				18.5
Newton, Ks to Denver, Co	0.5	13	12					25.5
								0
Anticipated Funding Needs	32.5	44.2	45.5	41	20	15	10	208.2

*- Includes grade crossing signal upgrades within the State of Oklahoma, does not include provisions for grade separation structures

These anticipated funding needs taken into consideration include all of the rail and signal infrastructure improvements considered vital to the implementation and safe operation of passenger rail service on the identified routes. A graphical representation of the anticipated funding requirements distributed over the proposed seven-year implementation plan is illustrated in Figure 13.

Figure 13 - Funding Projections



The anticipated costs for rail grade crossing safety improvements in the State of Oklahoma were also included in the funding projections for the implementation plan. Some of the funding for these types of improvements could be obtained from existing rail grade crossing safety allocations if necessary. A breakdown of the anticipated safety improvement funding is provided in Table 15. The table also indicates the number of signals on each segment as well as a breakdown of the types of warning devices presently employed on the route.

Table 15 - Anticipated Grade Crossing Safety Funding Needs within the State of Oklahoma

Tulsa-Kansas City						
County	Gates	F. Lights	Cants	X-bucks	All	Est. $
Tulsa	13	0	0	0		
Rogers	17	9	1	17		
Craig	8	2	1	3		
Ottawa	3	12	1	20		
Total	41	23	3	40	107	$7,970,453
Percent	38%	21%	3%	37%		
			Signals	63%		

Tulsa-Oklahoma City						
County	Gates	F. Lights	Cants	X-bucks	All	
Tulsa	5	2	2	0		
Creek	9	11	0	24		
Lincoln	5	2	0	27		
Oklahoma	3	11	4	14		
Total	22	26	6	65	119	$12,430,763
Percent	18%	22%	5%	55%		
			Signals	45%		

Oklahoma City-Newton						
County	Gates	F. Lights	Cants	X-bucks	All	
Oklahoma	18	12	3	0		
Logan	11	9	0	11		
Noble	9	9	0	15		
Kay	15	7	1	11		
Total	53	37	4	37	131	$7,676,854
Percent	40%	28%	3%	28%		
			Signals	72%		

Oklahoma City-Ft. Worth						
County	Gates	F. Lights	Cants	X-bucks	All	
Oklahoma	8	1	0	0		
Cleveland	16	8	4	0		
McClain	4	4	0	0		
Garvin	14	3	0	3		
Murray	6	2	0	3		
Carter	10	5	1	2		
Love	12	2	0	1		
Total	70	25	5	9	109	$2,600,000
Percent	64%	23%	5%	8%		
			Signals	92%		

References

1) Hay, W.W., Professor Emeritus of Railway Civil Engineering, University of Illinois, *Railroad Engineering,* Second Edition, Wiley, New York, 1982, Chapter 26.

2) *AREMA Manual for Railway Engineering,* American Railway Engineering and Maintenance-of-Way Association, Volume II, Chapter 2, section 1.5, 1999.

3) *Track Safety Standards,* Office of Safety, FRA, United States Department of Transportation, Washington, D.C., 1975, Rule 213.57, p. 13.

4) Washington Department of Transportation, Public Transportation and Rail Division Website: http://www.wsdot.wa.gov/pubtran/cascades/library/talgo.htm

5) Kizzia, Tom, "Watching Washington," *Railway Age,* Vol. 184, No. 24, December 29, 1980.

6) 1998 Amtrak Report. Missouri Department of Transportation, Dec. 1998.

7) Heartland Flyer; Oklahoma Dept. of Transportation, Rail Program Division.

Appendix A:

Application for Additional Corridor Designation of
High Speed Passenger Service Serving Oklahoma, Texas, and Kansas

Department of Transportation

Federal Railroad Administration/Federal Highway Administration

FRA Docket No. FRA-1998-4759

63 FR 68499

Financial Assistance To Eliminate Highway-Railroad Grade Crossing Hazards on Designated High-Speed Rail Corridors

Application for Additional Corridor Designation of High Speed Passenger Service Serving Oklahoma, Texas, and Kansas

The Oklahoma Department of Transportation has been conducting an evaluation of components of the existing rail network in the State of Oklahoma to assess the feasibility of expanding passenger rail service and the potential for the implementation of high-speed rail operations. The study has been focused primarily on connecting the State of Oklahoma with the national passenger rail network; provide rail connections between the Oklahoma's major metropolitan areas, and to establish other connections to suburban and rural destinations.

The operational analysis conducted has included evaluations of the existing routes anticipating various phases of implementation efforts focused on expanding rail service throughout the State including high-speed operations. The primary routes evaluated were between Tulsa and Oklahoma City, Oklahoma; Ft. Worth, Texas and Newton, Kansas; Tulsa and Kansas City, Missouri; Tulsa and St. Louis, Missouri; and Oklahoma City via Newton, Kansas to Denver, Colorado.

Issues Previously Investigated

The primary operating restrictions considered during the evaluation was present and future railroad freight traffic, track geometry and yard limits. A capacity analysis was conducted on segments under evaluation. The segments evaluated for capacity issues were routes known to have a significant amount of freight traffic that could

Response to Specific Questions Required for Application in FRA Docket No. FRA-1998-4759, Federal Register/Vol. 65, No. 136/Friday, July 14, 2000/Notices

The Oklahoma Department of Transportation has conducted a feasibility study over the last two years and evaluated several corridors for future high-speed passenger rail service. As a result of this study and analysis, three corridors have shown significant merit and benefits of introducing high-speed passenger rail service. Those three corridors are:

- Fort Worth, Texas to Newton, Kansas via Oklahoma City, Oklahoma
- Tulsa, Oklahoma to Kansas City, Missouri
- Tulsa, Oklahoma to Oklahoma City, Oklahoma

This application requests the designation of these three (3) corridors under the Section 104(d)(2) program for "Applications From States for Additional Corridor Designations." As required by Section 104(d)(2), six issues are to be considered. The following information is provided for each of the six issues under each of the three corridors the State of Oklahoma is requesting for high-speed passenger rail corridor designation.

Corridor 1 - Ft. Worth, Texas to Newton, Kansas

1) *Whether the proposed corridor includes rail lines where railroad speeds of 90 miles or more per hour are occurring, or can reasonably be expected to occur in the future, as specifically mandated by Section 104(d)(2).*

The corridor from Ft. Worth, Texas to Newton, Kansas traverses a topography that would facilitate train operations in excess of 90 mph with a relatively low number of track upgrades over most of the route. The vertical geometry of the route does not present any specific constraint to obtaining 90 mph operations and the only significant horizontal geometric constraints are on a fourteen-mile segment through the Arbuckle Mountains in Murray County, Oklahoma. Additional improvements to obtain 90 miles per hour operation would constraints of the route and establish estimated travel times and average speeds with 90 mph operation under present conditions. Because the State maintains ownership of this route, the preliminary engineering data compiled for this route is much more detailed than the other routes evaluated, and includes the information needed to implement a full scale design of the realignment and any associated construction. The estimated travel times, average speeds, and proposed number of stops on the route are provided in table 9:

Table 9

Summary of Travel Times and Average Speed for 90 mph Operation Under Present and Proposed Conditions				
Segment	**Miles**	**Avg. Speed (mph)**	**Travel Time (mins)**	**No. Stops**
Tulsa to Oklahoma City	116.90	52.80	132.90	1
Tulsa to Oklahoma City*	116.90	70.80	100.70	1

*- Includes the proposed upgrades between Tulsa and Oklahoma City

The proposed upgrade information is provided to illustrate how an incremental implementation plan has been developed to establish passenger rail service between Tulsa and Oklahoma City. The costs associated with the implementation of 79 miles per hour operation would require the bulk of the funding needed for this route excluding any potential grade separation costs. The establishment of rail service between Tulsa and Oklahoma City would foster the development of both metropolitan areas as hubs for passenger rail travel, greatly enhancing the development of a statewide system.

The unique situation presented by the geographic location of the two largest economic centers in the State, provides the opportunity to establish both through passenger rail and commuter passenger rail services that would complement any type of passenger rail or other transportation mode in the State. A rail connection between these two areas would bolster the development of passenger rail service from either metropolitan area significantly. The proposed educational, tourist, and sports facilities, is indicative of Oklahoma City's commitment to a full cultural life for the community and state.

- Tulsa is a center of education, and education is important to Oklahoma: 59.8 percent of the eligible population is enrolled in college full-time, compared to 57.0 percent for the national average. Tulsa is home to the Oklahoma State University Center for Health Policy Research, College of Osteopathic Medicine, and Telemedicine Center, as well as the University of Tulsa and Oral Roberts University.

Tulsa to Oklahoma City service has significant potential, due to the size of the cities, their proximity, and the extensive interaction between the two cities. This corridor has a lot of potential for competing with other transportation modes including: automobile, bus, and air travel. Initial ridership estimates for this corridor show a travel demand of 600 daily riders. A preliminary sketch analysis completed for this corridor shows the following potential demand illustrated in Table 10.

Table 10

Travel From	Travel To	Avg. Daily Ridership	Avg. Yearly Ridership
Tulsa, OK	Oklahoma City, OK	600	204,000

3) The percentage of the corridor over which trains will be able to operate at maximum cruise speed, taking into account such factors as topography and other traffic on the line.

The evaluation to determine the percentage of the route capable of sustaining speeds in excess of 90 mph was conducted in an effort to assess the potential maximum cruise speeds on the Tulsa to Oklahoma City route. No reductions in the percentage of the route capable of sustaining maximum cruise

The proposed realignment would increase to a total of 118.70 miles with 85.2 miles or 72 percent of the route capable of 90 miles per hour operation. The new alignment would reduce the number of horizontal curves to approximately 129, with only 25 anticipated to have a degree of curvature in excess of three degrees. No capacity issues are anticipated initially, however, the fact that a substantial percentage of the route is expected to be upgraded or realigned to facilitate higher speed operations may increase interest in freight shipping on the route.

4) *The projected benefits to non-riders, such as congestion relief on other modes of transportation servicing the corridor (including congestion in heavily traveled air passenger corridors).*

The Tulsa to Oklahoma City corridor for passenger rail service would be within State-owned former Burlington Northern Railroad right-of-way, which runs adjacent to and parallel to the existing Interstate Highway 44 Turner Turnpike. Presently, Interstate Highway 44 carries a daily traffic volume of ____. With the introduction of a parallel high-speed passenger rail service, providing same destination service and quicker travel time, Interstate Highway 44 could witness significant traffic volume reductions. With these traffic volume reductions, the nonriders would benefit from measurable congestion relief and potential quicker travel time.

Additionally, the introduction of high-speed passenger rail service in this corridor would provide improvements to the environment, air quality, and quality of life for those same nonriders, with the reduction of overall automobile demand travel.

5) *The amount of State and local financial support that can reasonably be anticipated for the improvement of the line and related facilities.*

The route evaluated during this analysis is currently owned by the State of Oklahoma with the exception of approximately nine miles owned by the Burlington Northern Santa Fe Railway Company on the Tulsa end of the route. The Oklahoma Department of Transportation would be in total control of over 90 percent of the route, and a detailed preliminary analysis of the track and signal improvements potentially needed for desirable operation has been completed. Preliminary negotiations with the BNSF RR have also been conducted to establish mitigation measures that would allow for suitable operations around the Cherokee Rail Yard in Tulsa. The estimates for 79 mph operation include the construction of a run-around track to alleviate operational problems associated with the humping operation at Cherokee yard. The construction of an additional track around the yard with higher travel speeds that could potentially be used for freight operations in between passenger train movements is very appealing to the BNSF, and full cooperation is anticipated.

Appendix B:

Presentation to the Oklahoma State Senate

OKLAHOMA passenger rail system

Connecting all People all Places

Completing Oklahoma's Transportation System for the 21st Century

Carter & Burgess

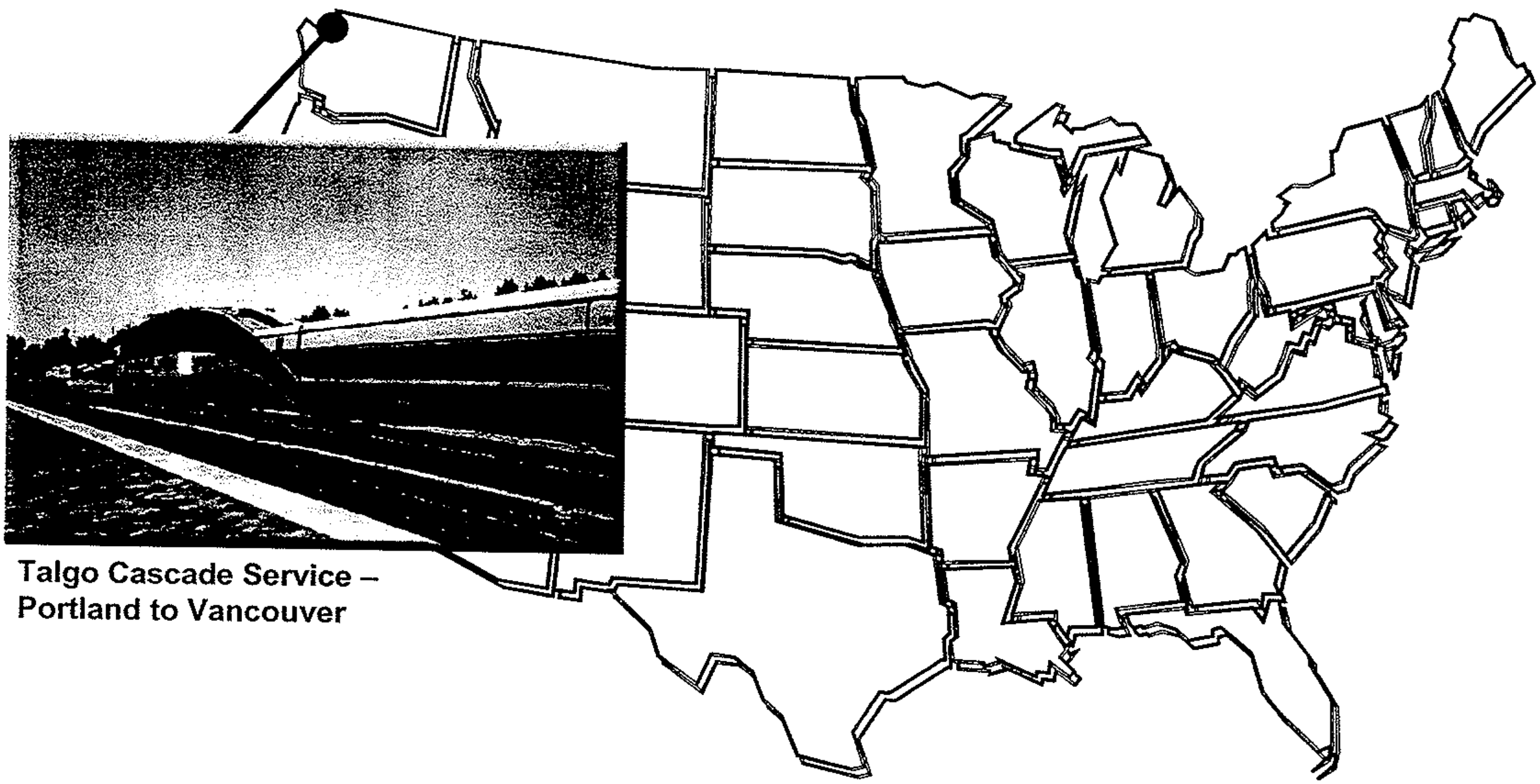
May 15, 2000

Is There A Need?

In the Short-term & Long-term . . .

- Highways & roadways need another mode to assist in relieving growing congestion
- Need transportation mode that assists in improving air quality
- Need to always look for transportation investments that assist in economic development

States Proceeding with High Speed Passenger Rail Development

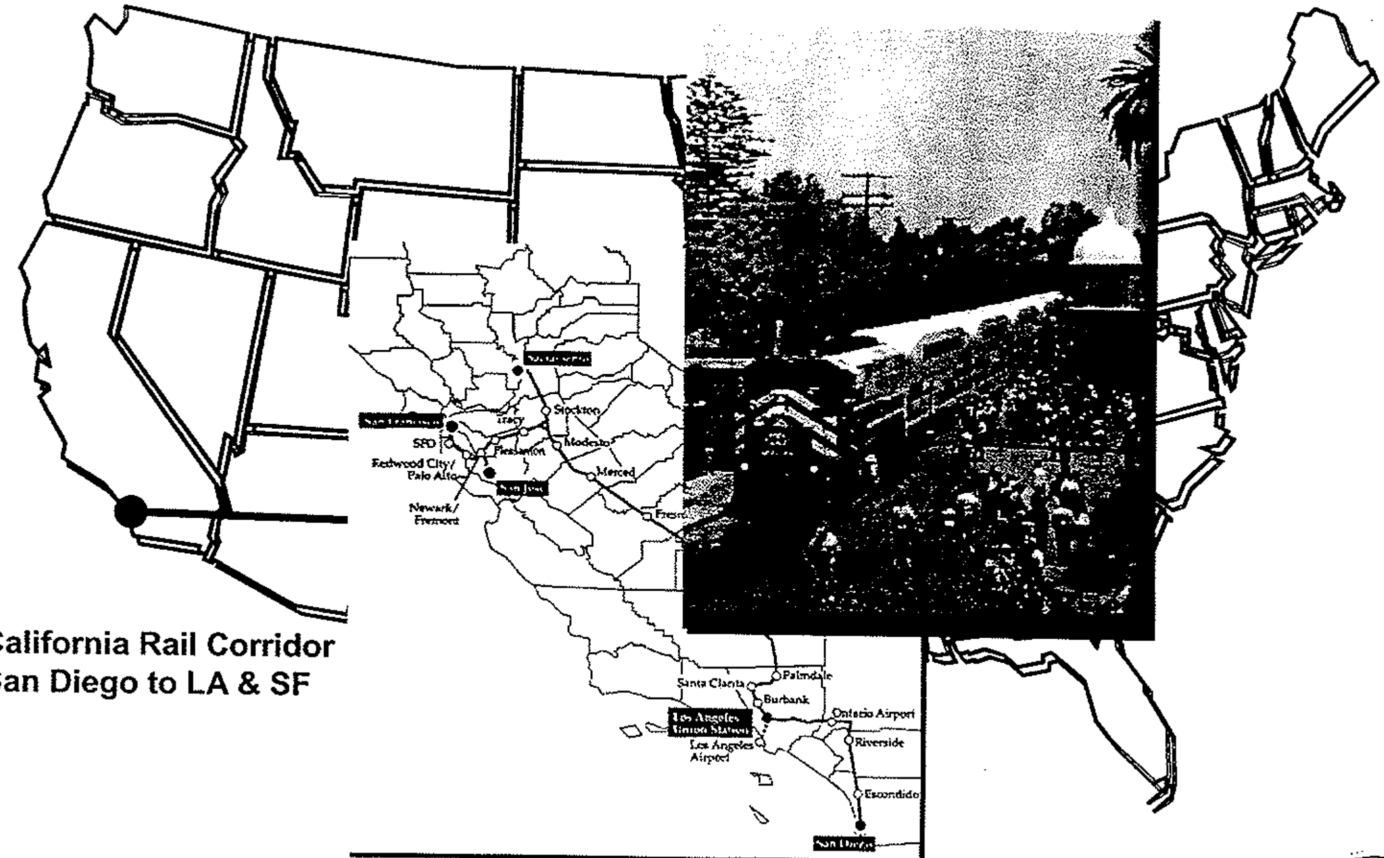


Talgo Cascade Service –
Portland to Vancouver

Completing Oklahoma's Transportation
System for the 21st Century

Connecting
People
Places

States Proceeding with High Speed Passenger Rail Development

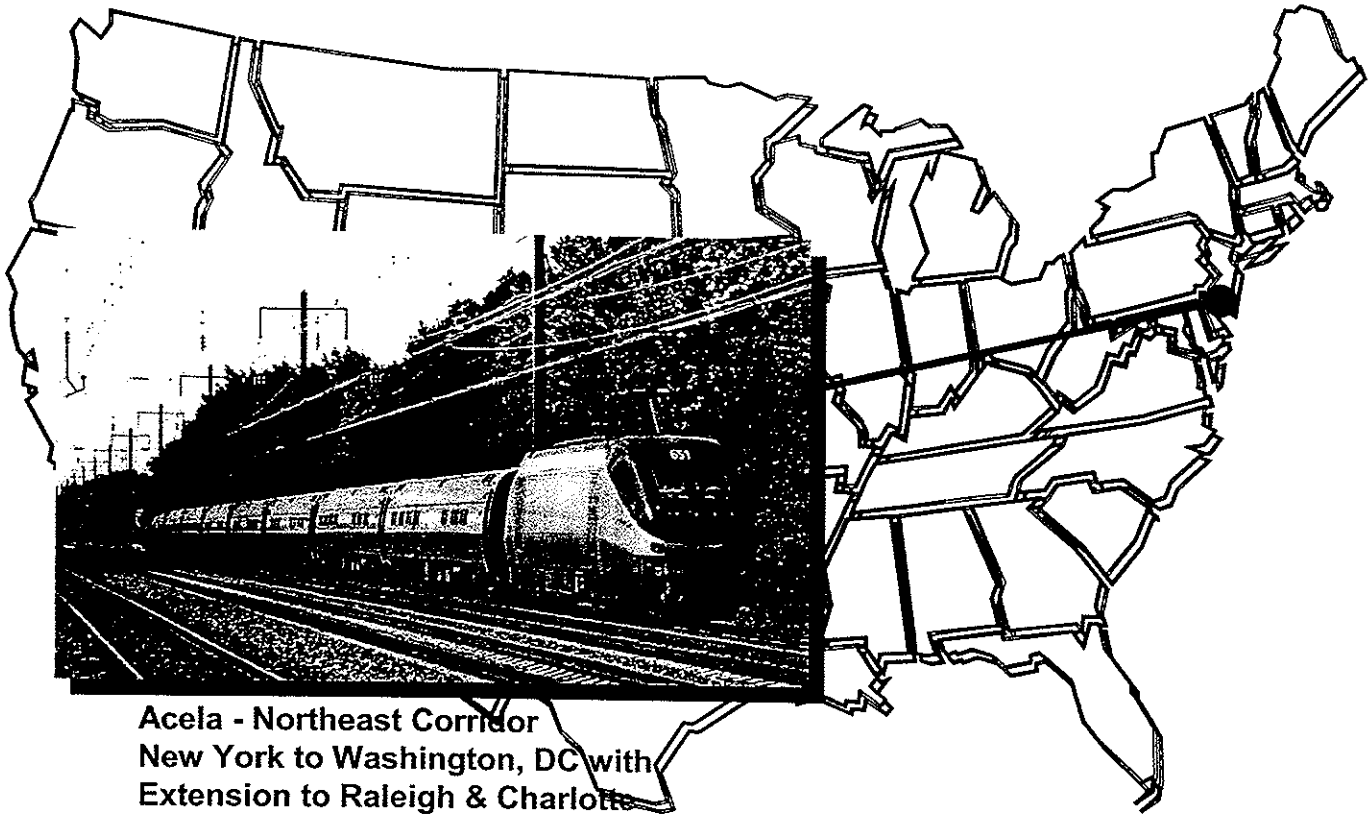


California Rail Corridor
San Diego to LA & SF

Completing Oklahoma's Transportation
System for the 21st Century

Connecting
People
Places

States Proceeding with High Speed Passenger Rail Development



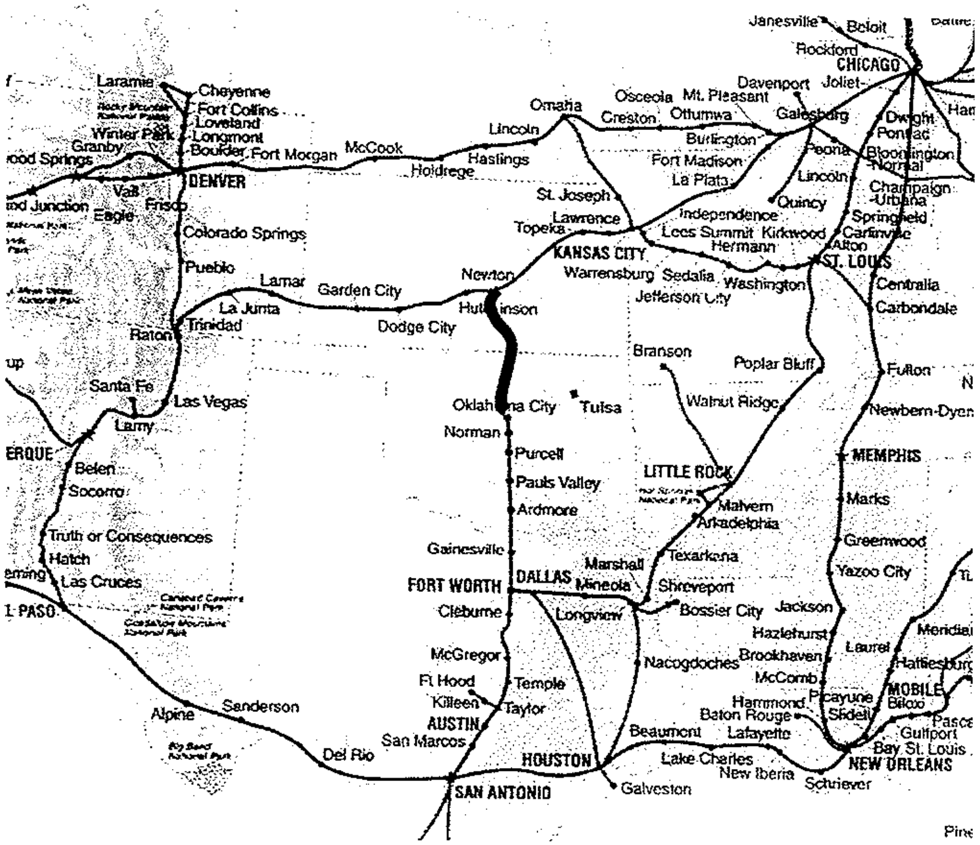
Connecting People Places

Three Phases of Service

- Phase 1 – Intercity Connections
  - OKC to Newton, KS
  - OKC to Tulsa
  - Tulsa to Kansas City, MO
  - OKC to Newton, Kansas to Denver, CO
- Phase 2 – Regional Connections
  - OKC to El Reno
  - Tulsa to Broken Arrow
- Phase 3 – Excursion Connections

Heartland Flyer Extension

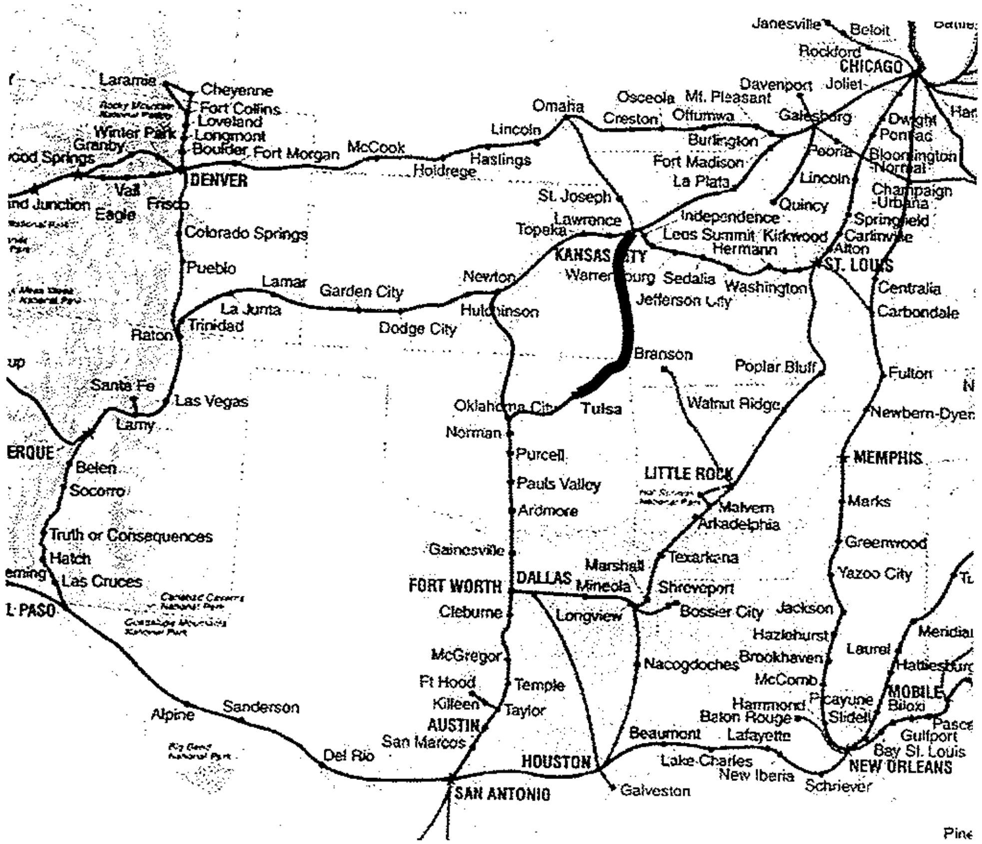
Oklahoma City to Newton, KS



Completing Oklahoma's Transportation System for the 21st Century

Connecting People Places

Connecting Tulsa to the East to Kansas City, MO

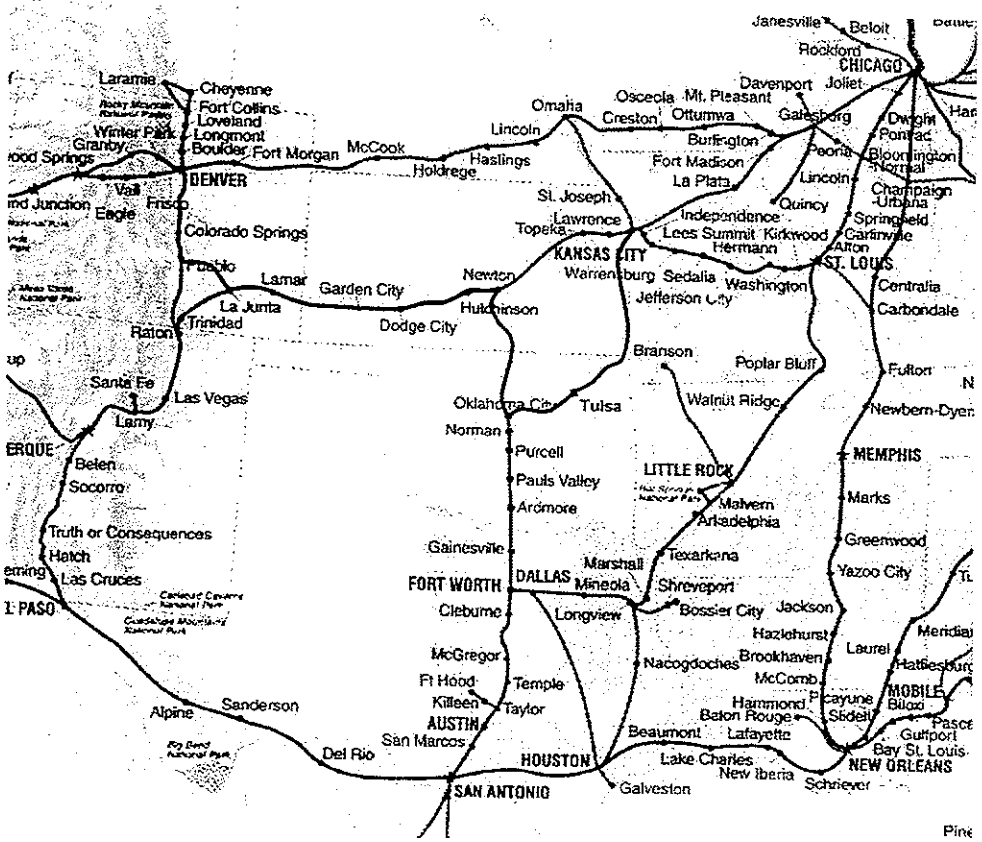


Completing Oklahoma's Transportation
System for the 21st Century

Connecting
People
Places

Oklahoma Passenger Rail System

Intercity Connections



Completing Oklahoma's Transportation System for the 21st Century

Connecting People Places

Heartland Flyer
Actual Ridership to Date

As of April 30, 2000 . . .

- Heartland Flyer has carried 54,600 riders
- Amtrak estimated 24,000 riders for "successful" service in first year
- 225% of projected ridership

Passenger Rail Investments

Lead to spin-off benefits:

- Freight rail improvements

  Increased train speeds and improved highway/railroad grade crossing safety resulting from track capacity and signal improvements

- Community Development

  Impetus for new station and station area development opportunities and retail opportunities

  Improved transportation choices for regional travelers

Challenge We Face

- Current Amtrak contract terminates May 31, 2002 for Heartland Flyer service
- No funding in place for service continuation
- If not this year; next election year too late for voter referendum – Heartland will quit running
- Revenue Source must be identified