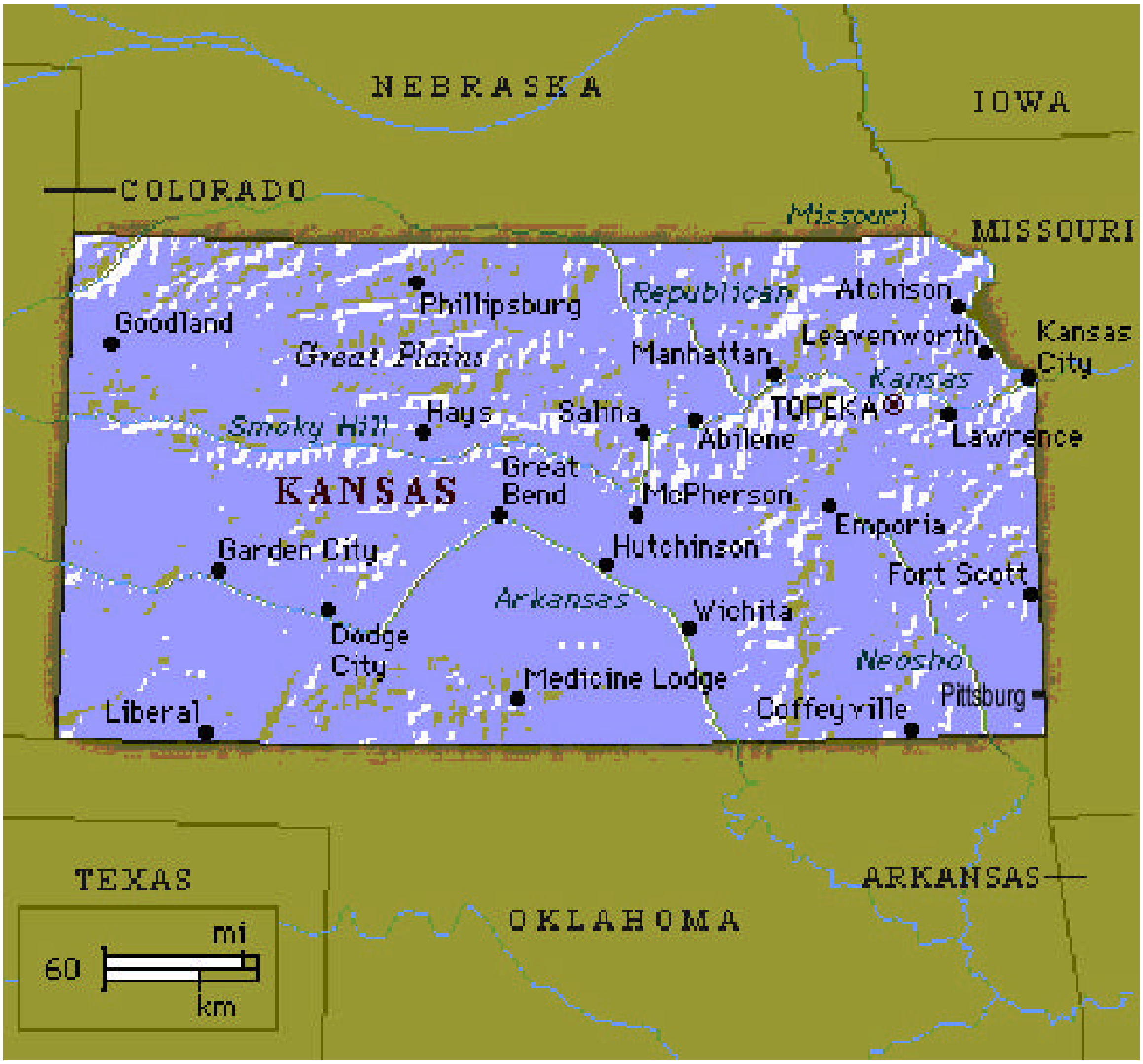
Kansas Rail Feasibility Study

Executive Report



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Kansas Department of Transportation

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Kansas Rail Feasibility Study

1.0 INTRODUCTION

Intercity passenger transportation in Kansas, as in other Midwest states, is facing enormous challenges resulting from rapidly changing market forces. These challenges include the increasing environmental and capital costs of investment in highway systems, the loss or increasing cost of air services for many cities as a result of air deregulation, and the increasing competition for the limited funding available for transport investment. The existing rail infrastructure within many states, including Kansas, has enormous capacity and may provide an alternative passenger transportation system that would provide value and utility to riders and support and encourage growth to the economy, businesses and communities in the State of Kansas.

To evaluate the potential that the rail system in the State of Kansas might offer in expanding passenger rail service, the Kansas Department of Transportation (KDOT) commissioned Transportation Economics & Management Systems (TEMS), in association with Parsons Brinckerhoff (PB), to carry out a feasibility study.

The following paragraph describes the scope of the study, which is aimed at answering the question, “Is there a market to support expanding passenger rail service in Kansas?”

The major focus of this study is to analyze potential rail corridors to identify:

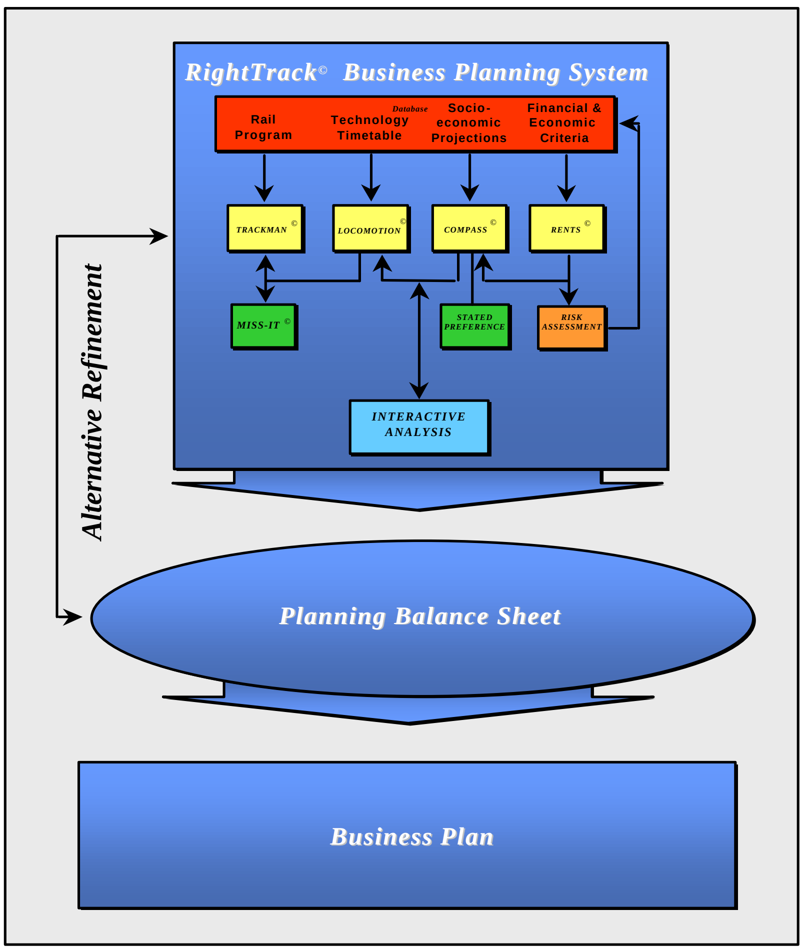
- The market share that a passenger rail service can capture in any corridor
- The capital costs of implementing, in any corridor, an expanded passenger rail system
- The levels of revenue and operating costs that would be generated by an expanded passenger rail service
- The economic benefits derived by developing an expanded passenger rail service for any given corridor.

The analysis will also assess the potential for linking with rail service outside the state of Kansas and, in particular, linking with the current operations in both the neighboring states of Oklahoma and Missouri.

2.0 THE EVALUATION PROCESS

The study employed a comprehensive evaluation process using the TEMS *RightTrack*© business passenger rail planning system. *RightTrack*© uses an interactive analysis to provide a full assessment of the engineering, operations, ridership, financial and economic returns of any set of passenger rail corridors or network options (see Exhibit 1). The process estimates for any option its overall financial and economic costs and benefits, and it identifies the most effective option for a corridor or route through a "what if" assessment of option alternatives. This interactive analysis therefore generates for any route or corridor a clear picture of its financial and economic viability by ensuring that the most effective combination of engineering, operations and market strategies is identified and assessed. Finally, the results for each option are assessed by comparing the results of different options using a Planning Balance Sheet evaluation, and both refining and selecting preferred options from this comparison.

Exhibit 1
***RightTrack*© System Interactive Analysis**



3.0 STUDY AREA

The State of Kansas is a large state with a small population. It requires a large transportation infrastructure to service its population. Because of its rural character, the lack of geographic barriers, and the fertility of its land, its population is widely scattered across the state. While ranked fourth in the United States in terms of its number of highway miles, the state has only 19 people per mile of road compared with 86 in Illinois, 65 in Texas, and 191 in California.

However, while the overall population of the state is widely distributed across its entire geographic area, the highest level of urbanization is in the east and is highest along the Kansas City to Topeka Corridor, which links Topeka, the State Capital, to the major bi-state urban area of Kansas City. The strength of this relationship is attested to by the ability of this corridor to support a toll expressway (Kansas Turnpike) that services the traffic between the two cities. At Topeka two somewhat less densely populated corridors extend to the west. The first corridor is to the southwest following Interstate Toll roads 35 and 335 via Emporia to Wichita, with southward connections via Perry to Oklahoma City; a distance of 400 miles from Kansas City. The second one extends to the direct west via Manhattan, Junction City and Salina along Interstate 70, see Exhibit 2. Past Salina the population drops significantly and there are only a few smaller cities, such as Hays, as I-70 heads to Colorado and the City of Denver, which is more than 600 miles from Kansas City and more than 400 miles from Salina.

While these two corridors represent the highest level of urbanization, a third corridor can be identified running South from Kansas City to Pittsburg, Baxter Springs and on to Tulsa in Oklahoma, a distance of 260 miles.

The major highways and expressways of the state follow these three corridors, as does the intercity bus service. Greyhound and Jefferson lines provide bus service in all three corridors, while other private carriers either feed to, from or between these corridors, see Exhibit 3.

Exhibit 2
Kansas State Highway System

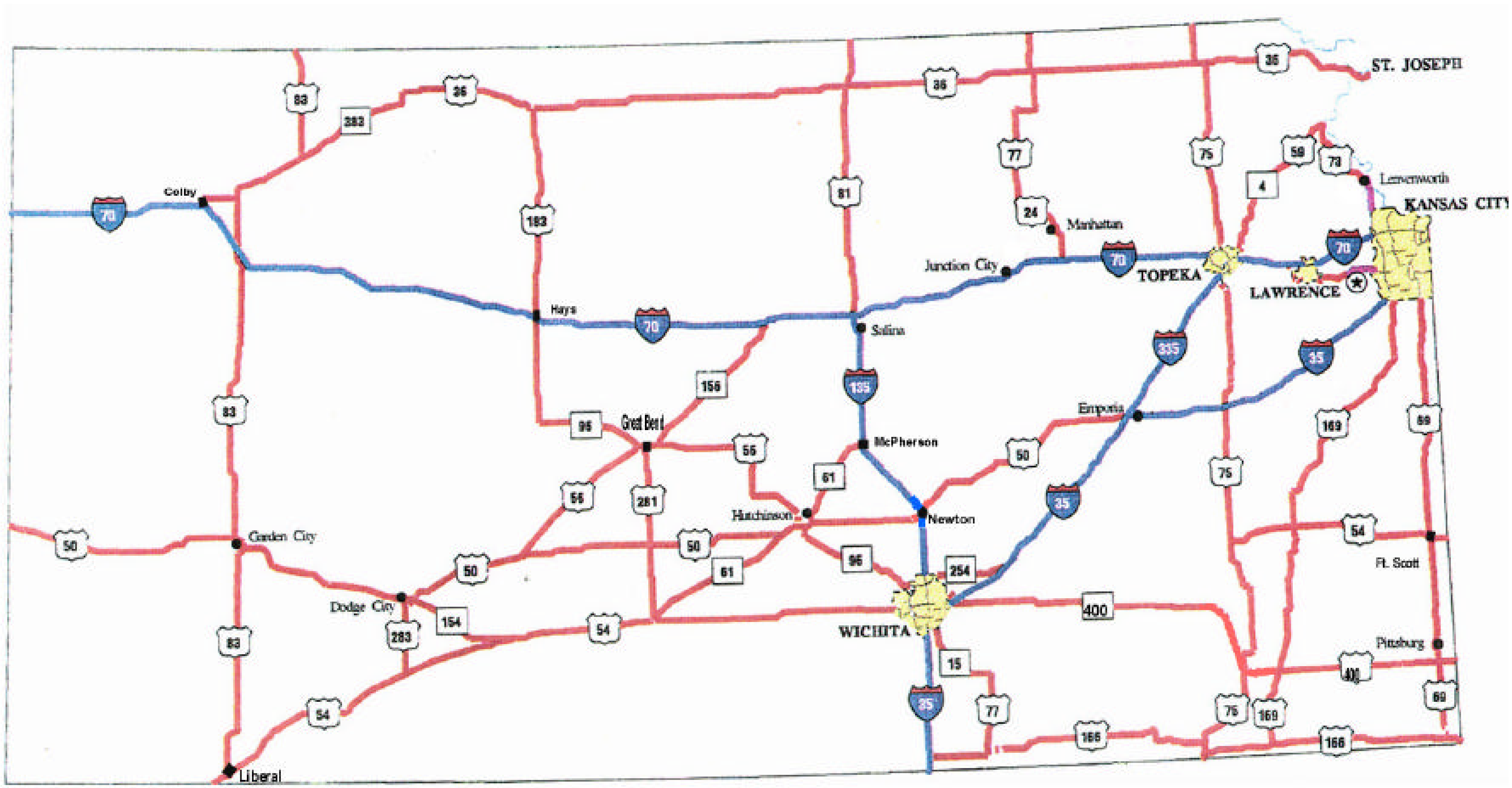
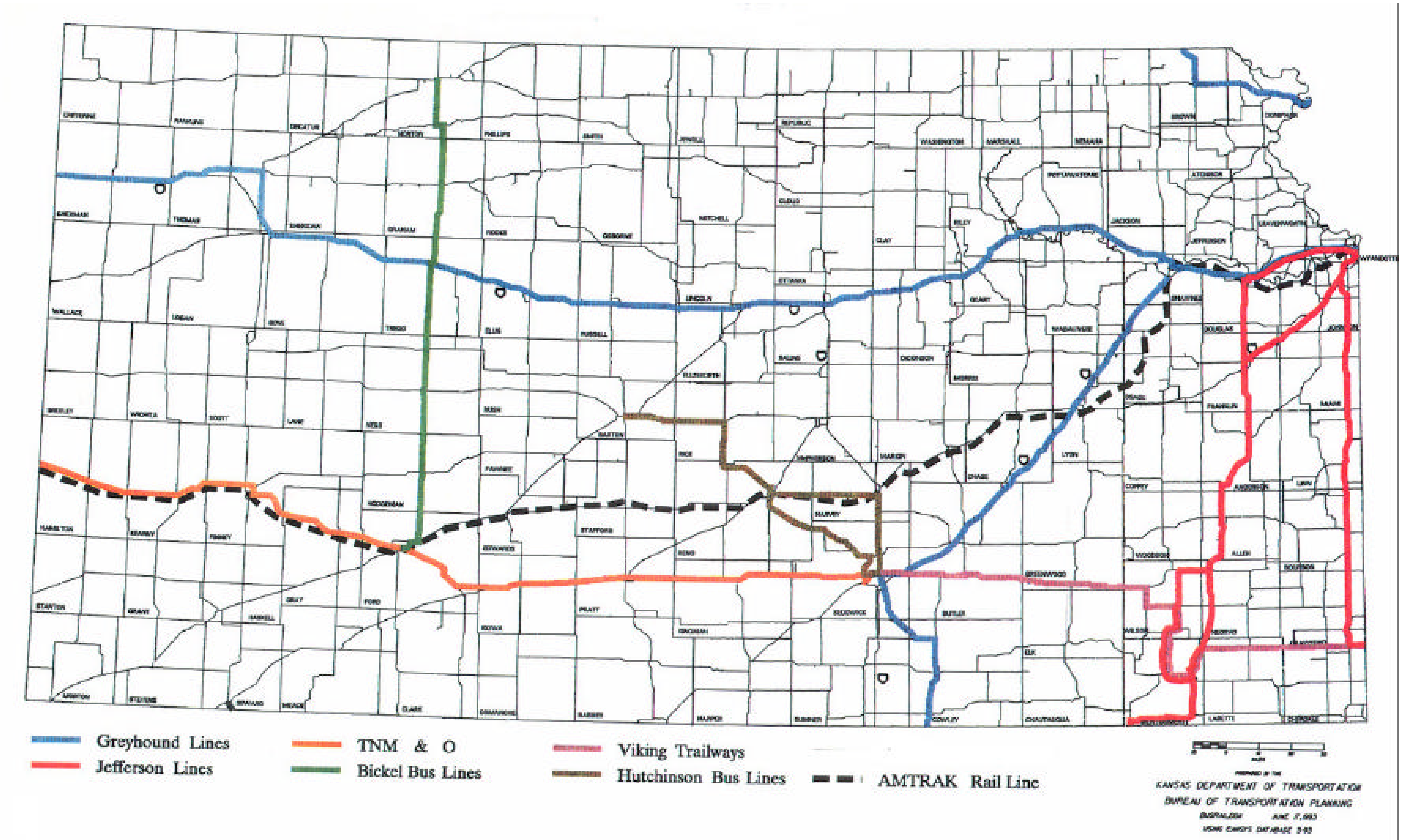


Exhibit 3
Intercity Passenger Transportation – Bus and Rail Lines



As a result, these three higher population corridors offer the greatest opportunity for the possible expansion of passenger rail service. Today these corridors are dominated by auto travel like the rest of the state. However, in these corridors it is possible that rail could play a part in offering multimodal public transportation options and provide a basis for using rail as a fast and cost-effective alternative to the auto for state residents. Finally, it should be noted that even if rail is found to be an effective alternative to auto, autos will still be the dominant carrier in the corridor because of all the short local auto trips for which rail is not competitive. Intercity rail service typically is only effective in serving trips between 20 and 500 miles in length.

In order to effectively evaluate the three high population corridors further it was necessary to adopt a study area that not only includes the state of Kansas but the adjoining states of Colorado, Oklahoma and Missouri. Only by considering the potential for onward rail service to towns outside Kansas can an effective evaluation be made of the opportunity for expanded passenger rail service (see Exhibit 4).

4.0 RAIL ROUTES

The only passenger rail service in Kansas today is the long-distance Amtrak service that crosses Kansas on its way from Chicago to Los Angeles. This once-a-day train connects the cities of Kansas City, Lawrence, Topeka, Emporia, Newton, Hutchinson, Dodge City and Garden City. Given its operating times it is not convenient for interstate travel and certainly does not provide either the frequency of service, train speed, or time of day movements that could significantly expand rail ridership in Kansas. If rail passenger service were to be expanded the frequency, quality of service and speed of trains would need to be significantly upgraded to make it successful. As a consequence the following specific routes were identified for evaluation in conjunction with the study Steering Committee.

- Route 1 Kansas City – Ft. Scott – Tulsa
- Route 2 Kansas City – Lawrence – Topeka – Wichita
- Route 3 Kansas City – Lawrence – Topeka – Hays – Denver
- Route 4 Kansas City – Lawrence – Topeka – Wichita – Perry – Tulsa
- Route 5 Kansas City – Lawrence – Topeka – Wichita – Oklahoma City
- Route 6 Kansas City – Lawrence – Topeka

See Exhibit 4 for an overview of all routes and Exhibit 5 for a schematic identifying each individual route.

Exhibit 4
Kansas Feasibility Study Route System

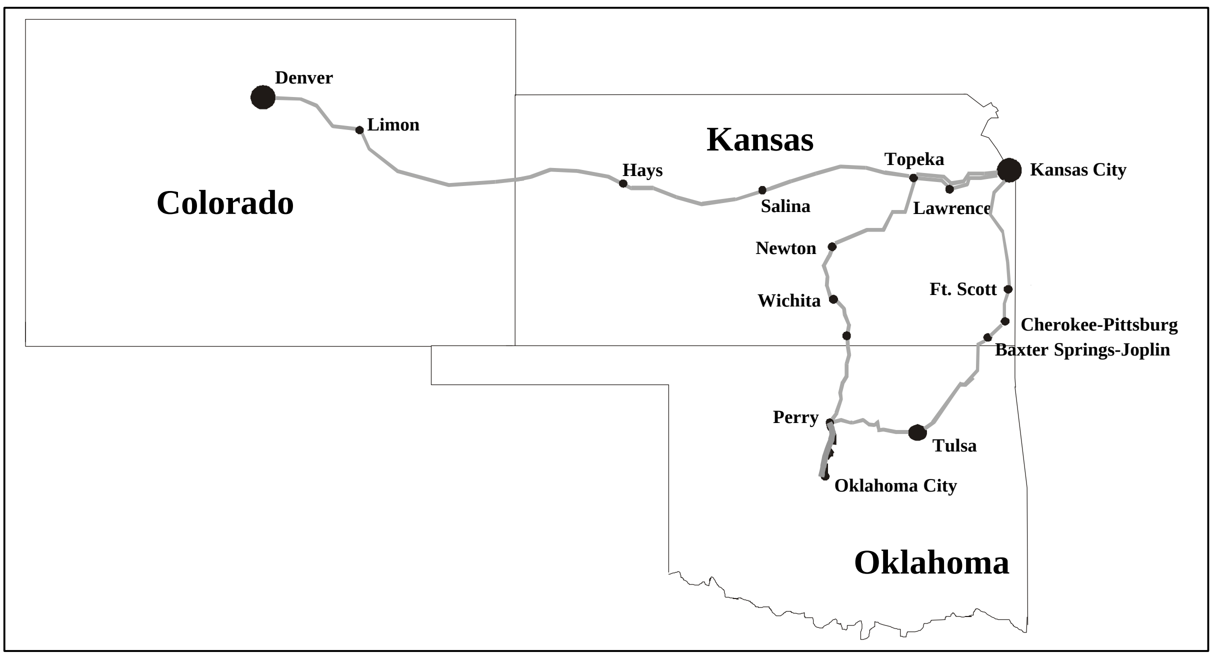
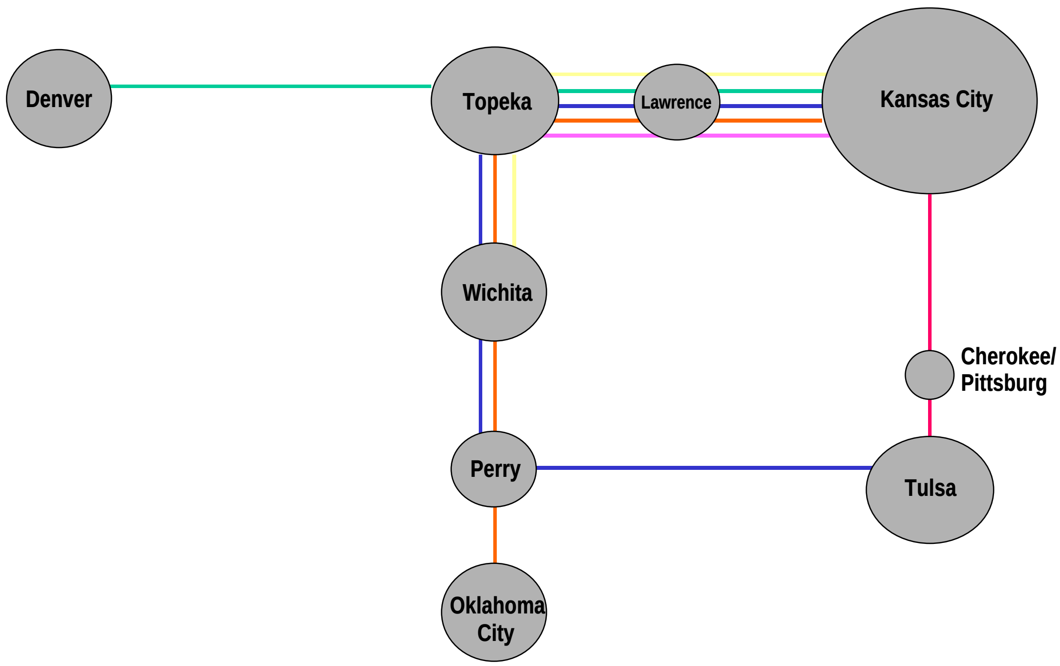


Exhibit 5
Schematic of Route Scenarios



<u>Legend:</u>

Route 1: Red - Kansas City – Ft. Scott – Tulsa
Route 2: Yellow - Kansas City – Lawrence – Topeka – Wichita
Route 3: Green - Kansas City – Lawrence – Topeka – Hays – Denver
Route 4: Blue - Kansas City – Lawrence – Topeka – Wichita – Perry – Tulsa
Route 5: Orange - Kansas City – Lawrence – Topeka – Wichita – Oklahoma City
Route 6: Pink - Kansas City – Lawrence – Topeka

5.0 THE OPERATING ALTERNATIVES

Given the proposed route options the question arises as to the level of train speed that should be adopted for each route. The Federal Railroad Administration (FRA) has established safety standards for track conditions for freight and passenger trains. Each FRA Class designates a maximum authorized speed based on minimum standards of track conditions, with Class I being the worst, and Class VII the best. Currently, the routes (except the current Amtrak route) are only used for freight operations and speeds are limited to freight traffic needs. In the case of Route 1, Route 2, and Route 5, the tracks have been maintained at or close to FRA Class IV condition and are capable of 60-mph operation. With only a modest investment in each of these lines these routes can be upgraded to a top speed of 79-mph. Currently the Route 4 track is being improved between Black Bear and Tulsa to FRA Class IV. In the case of Route 3 the route is only FRA Class II or III and not suitable for passenger rail operations in its current condition. As a result this route needs considerable upgrading to achieve 79-mph.

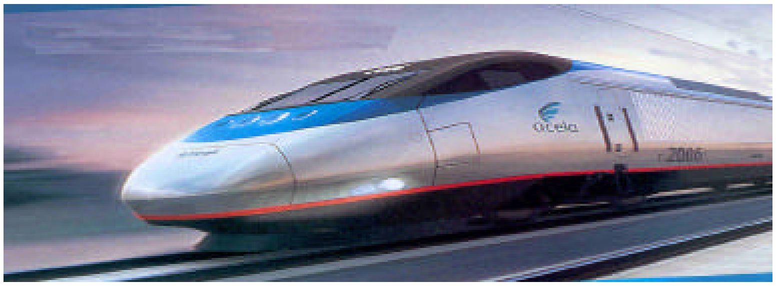
To improve the speed beyond 79-mph to a 110-mph top speed all the routes will need extensive improvement and capital investment. However, at 110-mph the train is faster than the automobile and can offer clear timesavings over the use of an automobile. The reason 110-mph is considered the next step after 79-mph is that it represents the highest speed that can be obtained before being required to grade-separate each crossing. At speeds over 110-mph the FRA has regulated that all rail crossings must be fully grade-separated and it is estimated that each separation would cost at least $2 million. With most rural areas having at least two crossings per mile, closing, diverting or bridging the crossings would double the infrastructure cost of upgrading to 110-mph operation.

As a result three investment scenarios were assessed:

A	**Base Case/Current Conditions:**	Minimum investment compatible with no improvement in current track conditions, with minor exceptions
B	**79-Mph Scenario:**	Modest investment compatible with 79-mph operation on most tangent and curved track
C	**110-mph Scenario:**	Investment compatible with achieving 110-mph on most tangent and curved track

In order to evaluate each of the adopted infrastructure scenarios a generic passenger rail technology needed to be adopted. Following discussions with the Study Steering Committee, it was agreed that a Talgo T21 train type technology should be adopted as a "generic technology" since it provides all the capabilities of a "modern train". The Talgo offers high-quality on-board services, and critical performance characteristics, such as tilt (6 inches) and steerable trucks. Tilt increases passenger comfort through a high-speed curve by physically tilting the car into the curve to reduce the sensation of "leaning into a curve". Steerable trucks (wheel and axle assemblies) permit the front and rear wheels on a single truck to turn independently, rather than operating in fixed formation. This permits higher speed in curves and reduces wear on curved track. The Talgo is also a low-cost locomotive-hauled train that is well suited for "branch line" operations along moderately populated corridors such as the Kansas corridors.

For this study other potential technologies, such as those considered by the Midwest Regional Rail Initiative, include Adtranz North American Diesel Multiple Units (DMU) technology. DMU technology is propelled by individual power units placed within the body of the train as opposed to locomotive-hauled technology whose power source is at one end of the train. DMU technology would be slightly lower in capital and operating costs, but is not locomotive-hauled. The Bombardier Gas Turbine locomotive-hauled train would be faster than the Talgo or DMU technology, but is likely to be more expensive in terms of both capital and operating cost. Any of these trains or indeed any of a wide range of modern passenger trains that are manufactured worldwide could be used in practice on the route.



Bombardier's American Flyer

Talgo on the Amtrak Cascades Service

Adtranz Flexliner IC3 Diesel Multiple Unit (DMU)

Talgo T21

6.0 CAPITAL COSTS

The capital costs for implementing expanded passenger rail service on the six routes for each of the proposed speed upgrades and operating plans is shown in Exhibit 6. It can be seen that as train speed increases, the capital investment in infrastructure (i.e., track signals and right of way), increases dramatically as the rail system is improved to meet the safety and operating needs of higher speeds. However, the costs of rolling stock stabilizes or decreases as the trains are able to perform more efficiently at higher speeds and cover more miles each day. This is particularly true for routes under 300 miles.

Exhibit 6
Capital Costs to Implement Service for Each Route and Investment Option
($ Millions)

	79-mph Scenario			110-mph Scenario		
Route	**Infra-structure**	**Rolling Stock**	**Total**	**Infra-structure**	**Rolling Stock**	**Total**
Route 1: Kansas City- Ft. Scott-Tulsa, Service Frequency D: 4 round trips/day	21	45	66	219	35	254
Route 2: Kansas City-Lawrence-Topeka-Wichita, Service Frequency D: 4 round trips/day	18	35	53	194	25	219
Route 3: Kansas City-Lawrence-Topeka-Hays – Denver, Service Frequency A: 1 round trip/day	426*	30	456	655	30	685
Route 4: Kansas City-Lawrence-Topeka-Wichita-Perry-Tulsa, Service Frequency D: 4 round trips/day	68	30	98	354	30	384
Route 5: Kansas City-Lawrence-Topeka-Wichita-Oklahoma City, Service Frequency D: 4 round trips/day	38	30	68	343	30	373
Route 6: Kansas City-Lawrence-Topeka, Service Frequency D: 4 round trips/day	9	15	24	75	15	90

*Note 1: Route 3 not inspected, therefore estimates are based on unit costs only.
*Note 2: Service frequency scenarios are from Exhibit 8, page 15.

6.1 Station Costs

Capital costs for station development are excluded from the Study's basic capital cost estimates. It is assumed that each community will work with public/private partnerships to develop and finance local stations. While station costs typically are directly proportional to the size of the community served, other factors can come into play, such as local community planning efforts, development of local multimodal transportation infrastructure, and the opportunity for local commercial development. With these factors, station development costs can range from $1 million to $10 million depending on how elaborate a community wants its station to be. Most communities see the development of a passenger rail station as an opportunity to develop a multimodal hub for the community served by rail, bus, taxi and limo service, and to provide a basis for urban redevelopment and economic growth.

7.0 THE OPERATING PLAN

In developing an operating plan for the various Kansas routes a number of different factors must be considered. First, for each infrastructure improvement train speeds are increased and overall train time in the corridor falls. Exhibit 7 shows the travel times for the various routes using 79-mph and 110-mph technology. Please refer to Appendix 3 for detailed timetables for each scenario.

Exhibit 7
Rail Times for Kansas Rail Scenarios
(in Hours and Minutes)

Route	Distance (miles)	Base Case/ Current Status (hours:minutes)	79-mph (hours:minutes)	110-mph (hours:minutes)
Route 1: Kansas City- Ft. Scott- Tulsa	263	6:05	4:56	4:02
Route 2: Kansas City- Lawrence- Topeka-Wichita	225	4:34	3:49	3:11
Route 3: Kansas City- Lawrence- Topeka-Hays - Denver	640	17:55	9:42	7:27
Route 4: Kansas City- Lawrence- Topeka-Wichita- Perry-Tulsa	420	9:20	7:19	5:51
Route 5: Kansas City- Lawrence- Topeka-Wichita- Oklahoma City	397	8:30	6:46	5:21
Route 6: Kansas City- Lawrence- Topeka	69	1:25	1:20	1:00

The second factor is the effect of reduced travel time on ridership. As travel time falls ridership rises and additional train capacity is required. This requirement is typically met by adding additional frequency, at least until the level of service meets 12 trains per day. After that level of service is achieved, larger trains with more cars would need to be considered. A range of train frequency scenarios was defined as shown in Exhibit 8.

Exhibit 8
Kansas Routes

Scenario A –	1 round trip frequency per day
Scenario B –	2 round trip frequencies per day
Scenario C –	3 round trip frequencies per day
Scenario D –	4 round trip frequencies per day

Given the train times and frequency potential for each route, the operating frequencies shown in Exhibit 9 were adopted.

Exhibit 9
Train Frequency for Different Train Speeds

Route	79-Miles Per Hour	110-Miles Per Hour
Route 1: Kansas City- Ft. Scott-Tulsa	Scenario D 4 trains per day in each direction	Scenario D 4 trains per day in each direction
Route 2: Kansas City-Lawrence-Topeka-Wichita	Scenario D 4 trains per day in each direction	Scenario D 4 trains per day in each direction
Route 3: Kansas City-Lawrence-Topeka-Hays - Denver	Scenario A 1 train per day in each direction	-
Route 4: Kansas City-Lawrence-Topeka-Wichita-Perry-Tulsa	Scenario B 2 trains per day in each direction	-
Route 5: Kansas City-Lawrence-Topeka-Wichita-Oklahoma City	Scenario B 2 trains per day in each direction	-
Route 6: Kansas City-Lawrence-Topeka	Scenario D 4 trains per day in each direction	Scenario D 4 trains per day in each direction

The challenge of developing the operating plan is to maximize the train utilization so that it covers as many miles as possible consistent with train ridership. Where ridership is heavy additional trains are required to ensure that a reasonable seat capacity is maintained. In this analysis the emphasis is on ensuring that a reasonable level of seating is provided. Equally, consideration needs to be given to the different purposes of travel; i.e., business, commuter, social and tourist, as each group has different needs. Commuters are typically short distance riders, while business and tourists typically ride for much longer distances. It is possible that this analysis has slightly overstated train capacity requirements, and if undertaken, any further analysis should more closely relate rail service to specific corridor markets.

8.0 RIDERSHIP FORECASTS

The ridership forecasts for the Kansas passenger rail corridor analysis were developed using the *COMPASS*© model benchmarking system which provides preliminary estimates for a rail corridor using socioeconomic data, proposed rail service scenarios and a direct comparison with the actual ridership associated with a range of "similar" corridors. Similar corridors in this context means low to medium density corridors elsewhere in the country, but not high-density corridors such as the Northeast Corridor.

An analysis based on 1995 socioeconomic data indicates that the corridors' performance will be at the low end of the ridership range compared with many of the existing and planned corridors in the Midwest, East Coast and California. However, the corridors show a close adherence with the critical socioeconomic factors of population, employment and income, and forecasts have been developed using these relationships. The next step in the process is to evaluate the impact of service factors such as travel time, frequency, and fare on overall ridership levels. The analysis of travel time and frequency was based on the operating scenarios developed in the operating plan, while the fares for the system were based on average Midwest economy fare levels. They exclude any analysis of the effect of first class, discounted or promotional fares on ridership. See Exhibit 10.

Exhibit 10
Typical Train Fares Between City Pairs

Route	Miles	Fare $ (One Way)
Kansas City to Topeka (Route 6)	69	17.00
Kansas City to Lawrence (Routes 2, 3, 4, 5, 6)	40	10.00
Kansas City to Wichita (Route 2)	225	56.00
Kansas City to Tulsa (Route 1)	263	65.00
Kansas City to Denver (Route 3)	640	160.00
Kansas City to Oklahoma (Route 5)	397	95.00

The ridership forecasts for each route are shown in Exhibit 11. As expected, the highest ridership is associated with the 110-mph scenario and the Kansas City – Topeka – Wichita – Oklahoma City route options. The direct Kansas City to Tulsa route is the next best corridor, with lower ridership reflecting the lower population density of the corridor. The weakest route is the Kansas City to Denver route, which reflects the very low density of population west of Topeka. Ridership forecasts were not prepared for the 110-mph long distance routes of Denver, Tulsa (via Perry) and Oklahoma as these scenarios were regarded as impractical due to high capital costs.

A critical assumption of the ridership forecasts is the ability of individuals to access destinations in the towns along the route. It is assumed in this analysis that if the rail system were to be expanded, appropriate measures would be taken to develop stations and provide multimodal transit and taxi connections.

Exhibit 11
Ridership Forecasts for 79-mph and 110-mph Scenarios
(Annual Ridership by Route in Thousands)

Route	79-mph 2000	79-mph 2020	110-mph 2000	110-mph 2020
Route 1D: Kansas City- Ft. Scott-Tulsa; 4 round trips/day	130	180	260	360
Route 2D: Kansas City- Lawrence-Topeka-Wichita; 4 round trips/day	190	240	400	500
Route 3A: Kansas City- Lawrence-Topeka-Hays –Denver; 1 round trip/day	100	127	-	-
Route 4B: Kansas City- Lawrence-Topeka-Wichita-Perry-Tulsa; 2 round trips/day	120	150	-	-
Route 5B: Kansas City- Lawrence-Topeka-Wichita-Oklahoma City; 2 round trips/day	130	165	-	-
Route 6D: Kansas City- Lawrence-Topeka; 4 round trips/day	120	155	200	280

9.0 OPERATING COSTS AND REVENUES

The operating costs for the system are highly dependent on the level of service offered, the train technology selected, and the character and size of the proposed operation. In terms of the level of service, the four operating scenarios A-D for the two train speeds 79-mph and 110-mph were assessed for each of the six routes. With respect to train technology the Talgo T21 has been used as the "generic" example of a modern train, and used for the 79-mph and 110-mph speeds. An Amtrak P32 train pulling five cars was used to model the base case (current track condition) timetable.

The other key factor impacting the operating costs is the scale of the operation proposed. Linking the Kansas corridors to a larger existing rail system has many benefits, as operating costs fall dramatically as the train miles of the operation increase. This is one of the economies of scale that prompted the creation of the Midwest Regional Rail System (MWRRS). See Exhibits 12 and 13. The Midwest Regional Rail System (MWRRS) is an ongoing effort to develop an improved and expanded passenger rail system in Illinois, Indiana, Michigan, Minnesota, Missouri, Nebraska, Ohio, and Wisconsin. This system would use existing rail right-of-way shared with freight and commuter rail trains.

If the Kansas corridors being studied are linked to the fully implemented MWRRS, and assuming a Talgo T21 train set, the operating cost per mile would be similar to the values shown towards the right side of Exhibit 12, with a cost per train mile of $25. If however, the Kansas corridors' service were operated as a freestanding system, such as that of the Oklahoma – Ft. Worth system, the operating costs would be substantially higher at $35 per train mile or more. Note the higher values on the left side of Exhibit 12. If the MWRRS is not fully implemented as a system operating costs per train mile for the MWRRS will increase from $25 a train mile up to $35 per train mile.

The Midwest Regional Rail System (MWRRS)

Exhibit 12
Variable and Fixed Cost Per Mile Volume Relationship

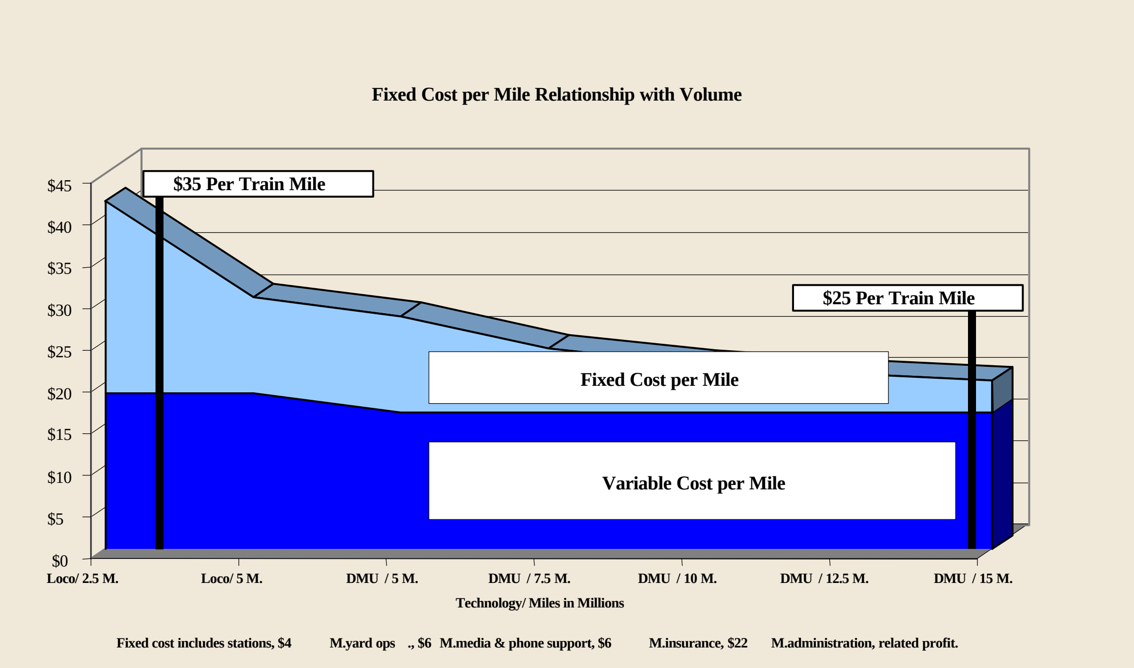


Exhibit 13
Unit Operating Costs for a Freestanding and Larger Integrated Network System

Cost		Freestanding System Costs	Integrated System Unit Costs
Crew Operations	Crew Operations	***$5.83***	***$5.83***
OBS Operations	OBS Operations	***$1.90***	***$1.60***
Station Costs	Station Costs	***$1.87***	***$1.09***
Fuel and Energy	Fuel and Energy	***$1.02***	***$1.20***
Equipment Maintenance	Equipment Maintenance Yard Operations	$4.98 $0.20 ***$5.18***	***$5.41***
Equipment Charge*		***$5.92***	**--**
Track and R.O.W. (Maintenance of Way) Costs	Track and R.O.W. (Maintenance of Way) Costs	***$5.45***	***$4.50***
Insurance Costs	Insurance Costs	***$0.48***	***$1.07***
Sales and Marketing	Sales and Marketing	***$2.85***	***$1.49***
Administration	Administration	***$4.50***	***$2.81***
Total		**$35.00**	**$25.00**

* For this Study an investment in rolling stock or equipment is depreciated for the Freestanding System whereas in the larger system it is possible that these costs would be in the form of a grant from the Federal Government which therefore would not be subject to depreciation cost.

9.1 OPERATING COSTS

The results for each operating scenario, using the two sets of operating costs, are shown in Exhibit 14. The operating costs vary with increasing distance and train frequency as follows:

- The lowest cost is $4.4 million and $6.18 million for the 69-mile Topeka to Kansas City route with four trains per day;
- $10.26 million and $14.36 million for the over 600-mile Denver route with just one train per day;
- slightly higher operating costs for Routes 4 and 5 which are shorter than the Denver route, but have two trains per day;
- the highest cost for Routes 1 and 2 which while less than 300 miles have four trains per day.

Exhibit 14
Annual Operating Costs for Kansas Corridors
(Current $ Million)

Route	Operating Scenario	Freestanding System $35 Train Mile	Integrated with a Major Passenger Rail System $25 Train Mile
Route 1: Kansas City- Ft. Scott-Tulsa	D: 4 round trips/day	23.56	16.83
Route 2: Kansas City-Lawrence-Topeka-Wichita	D: 4 round trips/day	20.16	14.40
Route 3: Kansas City-Lawrence-Topeka-Hays -Denver	A: 1 round trip/day	14.36	10.26
Route 4: Kansas City-Lawrence-Topeka-Wichita-Perry-Tulsa	B: 2 round trips/day	18.86	13.47
Route 5: Kansas City-Lawrence-Topeka-Wichita-Oklahoma City	B: 2 round trips/day	17.79	12.70
Route 6: Kansas City-Lawrence-Topeka	D: 4 round trips/day	6.18	4.41

9.2 REVENUES

The revenues for the system are shown in Exhibit 15. The largest revenues are obtained by the 110-mph speeds and routes with the most train miles. This reflects the travel time elasticities, which show that the rail options require a travel time competitive with auto travel times to be effective in obtaining ridership and revenues.

Exhibit 15
Annual Revenues for 2000 and 2020 for the 79-mph and 110-mph Scenarios
(Current $ Millions)

Route	Average Fare* ($)	79-mph 2000	79-mph 2020	110-mph 2000	110-mph 2020
Route 1: Kansas City-Ft. Scott-Tulsa	45	5.80	8.10	11.70	16.20
Route 2: Kansas City-Lawrence-Topeka-Wichita	40	7.60	9.60	16.0	20.0
Route 3: Kansas City-Lawrence-Topeka-Hays -Denver	70	7.00	8.89	-	-
Route 4: Kansas City-Lawrence-Topeka-Wichita-Perry-Tulsa	63	7.56	9.45	-	-
Route 5: Kansas City-Lawrence-Topeka-Wichita-Oklahoma City	65	8.45	10.73	-	-
Route 6: Kansas City-Lawrence-Topeka	14	1.68	2.17	3.50	3.92

*Note: Average fares equals total expected revenues divided by total ridership per route.

10.0 FINANCIAL RESULTS

The financial results for the study are shown in Exhibit 16. It is clear that the results are better at 110-mph than at 79-mph. The 110-mph train scenario shows the strongest financial performance, significantly increasing the operating ratio of all the routes evaluated at both 79-mph and 110-mph. Route Scenarios 3A, 4B, and 5B showed the strongest performance at 79-mph due to the level of intercity travel from Kansas City to the big cities at the end of each route, i.e., Denver, Tulsa, and Oklahoma City. However, this market is limited and focused largely on tourist and social travelers. Demand therefore is likely to only increases marginally if additional rail service is provided. As such, these routes simply cannot justify three or four round trips per day. Finally, it should be noted that it is possible that the forecasting process has over-stated the size of the rail market for these long distance options given the limited character of the service offered. The model assumes that travelers have flexibility in travel times during the day. When service is very limited (one or two trains per day) this may not prove to be entirely realistic, and the model will overstate the ridership for these low levels of service.

Route 6D reflects the potential for business and commuter travel between Topeka and Kansas City. Again, it is clear that as speeds increase, so the financial performance of the rail system improves. This is due to the fact that higher speeds make the rail option more competitive with the auto mode. A particularly critical factor in the assessment of this route is the assumption that anyone using the rail mode will have reasonable transit connections at the rail station. A lack of facilities could severely impact ridership. It is for this reason that the MWRRS is proposing that all stations should become multimodal hubs for transit and auto and be served by a feeder bus system, see Exhibit 3. Finally, Scenario 2D clearly performs the best at 110-mph, reflecting the higher population densities of the corridor. This scenario shows real advantages over Route 1D at both the 79-mph and 110-mph train speeds.

Exhibits 16A and 16B are included for both the 79-mph and 110-mph options. For each option, all six scenarios are provided to show capital costs, operating costs for $25 and $35 options, base revenues for 2000 and 2020, and operating ratios at $25 and $35 for 2000 and 2020.

To evaluate further the best of the six scenarios, a sensitivity analysis was made of the best route, Scenario 6D at 110-mph. Furthermore, because it had the second best result and might be considered as a first phase for Scenario 6D, Scenario 2D at 110-mph was also evaluated.

Exhibit 16
Operating Ratio for Kansas Corridors for 79-mph and 110-mph Train Speeds With Freestanding and Integrated System Operating Costs

Route	79-mph Freestanding System		79-mph Integrated System		110-mph Freestanding System		110-mph Integrated System	
	2000	2020	2000	2020	2000	2020	2000	2020
Route 1D: Kansas City-Ft. Scott-Tulsa; 4 round trips/day	0.25	0.34	0.34	0.48	0.50	0.69	0.70	0.96
Route 2D: Kansas City-Lawrence-Topeka-Wichita; 4 round trips/day	0.37	0.48	0.40	0.66	0.79	0.99	1.11	1.39
Route 3A: Kansas City-Lawrence-Topeka-Hays-Denver; 1 round trip/day	0.49	0.62	0.68	0.86	-	-	-	-
Route 4B: Kansas City-Lawrence-Topeka-Wichita-Perry-Tulsa; 2 round trips/day	0.40	0.50	0.56	0.70	-	-	-	-
Route 5B: Kansas City-Lawrence-Topeka-Wichita-Oklahoma City; 2 round trips/day	0.47	0.61	0.66	0.84	-	-	-	-
Route 6D: Kansas City-Lawrence-Topeka; 4 round trips/day	0.27	0.35	0.38	0.49	0.57	0.63	0.63	0.89

The sensitivity analysis first considered increased operating costs for each scenario. $35 per train mile was selected as a worst-case option. This is consistent with the costs of a freestanding 79-mph scenario. Secondly, revenues were enhanced to show the effect of secondary revenues such as parcel traffic and on-board services. These additional services are critical to the success of MWRRS and would be an essential part of any Kansas passenger rail service. The results show that Scenario 2D was most robust with an operating ratio of just under 1.0 with the $35 per mile operating cost and an operating cost ratio of well over 1.0 for the $25 operating cost option. This would suggest that, with the inclusion of parcel traffic, this option has a very good chance of not only paying its operating costs but of making a contribution to its capital costs i.e., it could pay for rolling stock capital costs.

Scenario 6D is less robust, but for a capital investment of $90 million could operate with an annual subsidy of between $1 and 3 million per year, and provide an effective alternative for commuters and business travelers in the Topeka, Lawrence, and Kansas City Corridor. A key issue in the use of the system for commuting would be the availability of local transit connections (bus, train, and limo) at each station along the route.

Exhibit 17 shows the result of the sensitivity analysis.

Exhibit 16A
79-mph Option Financial Results
($ Millions)

Route	Capital Cost	Operating Cost		Revenue		Operating Ratio			
						$35		$25	
		$35	$25	2000	2020	2000	2020	2000	2020
Route 1D: Kansas City-Ft. Scott-Tulsa; 4 round trips/day	66	23.56	16.83	5.80	8.10	.25	.34	.34	.48
Route 2D: Kansas City-Lawrence-Topeka-Wichita; 4 round trips/day	53	20.16	14.40	7.60	9.60	.37	.48	.40	.66
Route 3A: Kansas City-Lawrence-Topeka-Hays-Denver; 1 round trip/day	456	14.36	10.26	7.00	8.89	.49	.62	.68	.86
Route 4B: Kansas City-Lawrence-Topeka-Wichita-Perry-Tulsa; 2 round trips/day	98	18.86	13.47	7.56	9.45	.40	.50	.56	.70
Route 5B: Kansas City-Lawrence-Topeka-Wichita-Oklahoma City; 2 round trips/day	68	17.79	12.70	8.45	10.73	.47	.61	.66	.84
Route 6D: Kansas City-Lawrence-Topeka; 4 round trips/day	24	6.18	4.41	1.68	2.17	.27	.35	.38	.49

Exhibit 16B
110-mph Option Financial Results
($ Millions)

Route	Capital Cost	Operating Cost		Revenue		Operating Ratio			
						$35		$25	
		$35	$25	2000	2020	2000	2020	2000	2020
Route 1D: Kansas City-Ft. Scott-Tulsa; 4 round trips/day	254	23.56	16.83	11.70	16.20	.50	.69	.70	.96
Route 2D: Kansas City-Lawrence-Topeka-Wichita; 4 round trips/day	219	20.16	14.40	16.00	20.00	.79	.99	1.11	1.39
Route 3A: Kansas City-Lawrence-Topeka-Hays-Denver; 1 round trip/day	685	14.36	10.26	-	-	-	-	-	-
Route 4B: Kansas City-Lawrence-Topeka-Wichita-Perry-Tulsa; 2 round trips/day	384	18.86	13.47	-	-	-	-	-	-
Route 5B: Kansas City-Lawrence-Topeka-Wichita-Oklahoma City; 2 round trips/day	373	17.79	12.70	-	-	-	-	-	-
Route 6D: Kansas City-Lawrence-Topeka; 4 round trips/day	90	6.18	4.41	3.50	3.92	0.57	.63	.63	.89

Exhibit 17
Financial Sensitivity Analysis of Scenarios 2D and 6D at 110-mph by Year
($ Millions)

		Operating Cost		Base Revenue		Enhanced Revenue (includes revenues from parcel traffic)		Operating Ratio (with enhanced revenues)			
								$35		$25	
Route	**Capital Cost**	**$35**	**$25**	**2000**	**2020**	**2000**	**2020**	**2000**	**2020**	**2000**	**2020**
Route 2D	219.0	20.16	14.40	16.00	20.00	17.00	22.00	0.84	1.09	1.18	1.53
Route 6D	90.0	6.18	4.41	2.80	3.92	3.05	4.42	0.49	0.71	0.69	1.00

11.0 ECONOMIC ANALYSIS

The economic analysis for the Kansas Rail Feasibility Study was carried out using a consumer surplus analysis that measures the benefits to travelers in the corridors for which rail is being evaluated. This assessment measures the improvement in travel times and travel costs for rail, auto, bus, and as appropriate, air travelers.

Specifically, the user benefits are measured by estimating how the development of a rail corridor would provide time and cost savings to both existing rail users (if any); diverted travelers (from auto, bus, rail); and induced demand (if any). Induced demand measures the benefit gained by individuals who previously did not travel. Exhibit 18 shows graphically how the benefits are measured.

Exhibit 18
Measurement of User Benefits by the Consumer Surplus Technique

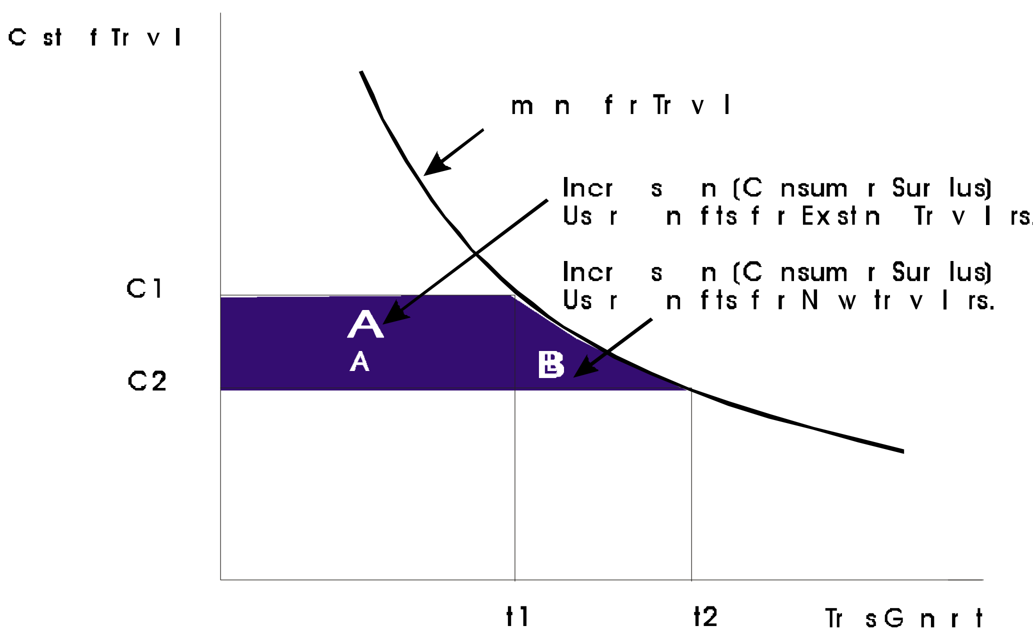


Exhibit 18 shows that if the number of trips in the "without rail" situation is t_1 and the cost of travel C_1, travelers will pay less if C_2 is the travel cost and t_2 is the number of trips generated with the rail option. Clearly, the original travelers see their cost fall from C_1 to C_2, Area A, while the new travelers t_1-t_2 get a benefit equal to Area B on the assumption that new travelers are generated at a rate reflected by the demand curve for travel, i.e. as travel costs fall demand will increase at a rate determined by the travel demand curve.

The results of this analysis for two selected routes are shown in Exhibit 19.

Exhibit 19
Economic Analysis (User Benefits) for Two Preferred Scenario
($ Millions)

	Route 2D: Kansas City-Lawrence-Topeka-Wichita; 4 round trips/day at 110-mph	**Route 6D: Kansas City-Lawrence-Topeka; 4 round trips/day at 110-mph**
Consumer Surplus Present Value (PV)	321.8	98.8
Revenue PV	214.5	43.0
Total Operating and Capital Cost PV at $35 Per Train Mile	(457.1)	(158.3)
Total Operating and Capital Cost PV at $25 Per Train Mile	(394.6)	(139.5)
Project NPV at $35 Per Train Mile	79.2	(16.5)
Project NPV at $25 Per Train Mile	141.7	2.3
Cost Benefit Ratio at $35 Per Train Mile	1.17	0.90
Cost Benefit Ratio at $25 Per Train Mile	1.35	1.01

Under the $25 per mile operating cost scenario both Route 2D and Route 6D produce positive cost benefit ratios of 1.35 and 1.01 respectively. In the worst case $35 per train mile option however, Route 6D fails to maintain a positive ratio and gives a cost benefit ratio of 0.90. Route 2D maintains a positive cost benefit ratio with a value of 1.17. Clearly, finding a way to operate the trains with costs of less than $35 per train mile is critical to the success of a project in generating positive economic benefits that more than match the costs of the project.

One way for this to be achieved is for the state to not only pay for infrastructure improvements but also for rolling stock. This would reduce the freestanding systems' operating cost to just under $30 per train mile. The integrated system network of course reduces costs further by at least $5 per train mile.

Both Route 2D and Route 6D show the importance of the Kansas City to Topeka Corridor in the expansion of a Kansas Passenger Rail System. As a commuter operation at 110 mph it can be effective in providing an economically justified alternative to existing modes. The extension of the system to Wichita would enhance the economic benefits, producing a much higher level of return by connecting Wichita and surrounding communities to the state's capital and its major bi-state urban area – Kansas City.

12.0 CONCLUSION

12.1 Results

This analysis has shown that none of the corridors, or corridor segments, can justify rail passenger service unless the substantial capital costs for the system are funded from state and federal sources. If capital is available the principal corridor for development would be the Kansas City-Lawrence-Topeka-Newton-Wichita Corridor either in total or part. The capital cost for the development of this corridor would be $219 million including infrastructure and rolling stock for the 110-mph option that provides the best economic and financial return. In terms of its economic performance, the corridor shows a positive economic return with a cost benefit ratio of 1.17 to 1.35 depending on the nature of the institutional framework adopted by KDOT. In terms of its financial return the corridor would require a subsidy of $3 million per year gradually falling to zero by 2020 if operational as a freestanding system. However, it would operate subsidy-free (except perhaps in its initial ramp-up period) if integrated with the Midwest Regional Rail System. The analysis of all other corridors reveals that they had inadequate population to support inter-city passenger rail service within reasonable financial and economic bounds.

12.2 Conclusion

The State of Kansas has asked the question "Is there a case for expanded passenger rail service in Kansas?"

The result of this preliminary analysis is that only with a very significant injection of capital can the case be made. This would include the $219 million for infrastructure and rolling stock, and additional local investment in stations and connecting transit facilities. If this investment is made this analysis suggests that, as part of a larger system such as the Midwest Regional Rail System, the Kansas City-Lawrence-Topeka-Newton-Wichita route would meet the Federal Railroad Administration financial and economic requirements for implementing rail service.

Appendix X

BENCHMARKING

A procedure called "benchmarking" was used as a planning tool for this study in order to generate a preliminary estimate of potential ridership based on local socioeconomic and demographic data. The relationship between three parameters will be critical in the determination of the feasibility of operating a Kansas Passenger Rail Service.

The benchmarking process initially establishes a correlation between socioeconomic data and passenger rail ridership for existing passenger rail service between other city pairs in the US to the ones being studied. The benchmarking process then compares the demographic and socioeconomic characteristics for the Kansas Passenger Rail Study corridors and develops initial ridership projections in order to refine the parameters in the prediction model. It then estimates the impact of service factors such as fares, frequency and travel time on the basic forecast.

A detailed description of the benchmarking methodology is provided in this section.

Overview

The three socioeconomic factors integral to the benchmarking process include:

- Employment Per Capita

  Employment per capita is defined as the ration of employed persons to the total county population for each rail corridor. The employment and population data for each county is summed and the ratio for the entire corridor is calculated.

- Population Density

  Population density is defined as the ratio of population to land area for the corridor. The population and land area for each county in which the rail corridor is located is summed and the ratio for the entire corridor is calculated.

- Per Capita Income

  Per capita income is obtained from the U.S. Bureau of the Census. The per capita income for each county is then weighted by population in order to calculate the average per capita income for each rail corridor.

Socioeconomic Factors and Ridership

The first major step in the benchmarking process involves the rank ordering of each of the benchmarked systems according to socioeconomic factors and projected ridership. Several steps comprise this procedure, as described below:

- ***Determine Socioeconomic Values***

  The values for the three key socioeconomic factors are determined for the systems to be used in the benchmark comparisons. These values are then summed to generate that socioeconomic factor's total. Finally, a ratio for each benchmarked service is then calculated that represents a system's value to the socioeconomic factor's total.

- ***Calculate the Socioeconomic Index***

  An average of the three socioeconomic values is then calculated for each benchmarked system. The average of the ratios for population density, employment per capita, and per capita income is referred to as the "Socioeconomic Index".

- ***Rank-ordering of the Socioeconomic Index***

  The "Socioeconomic Index" for each benchmarked system is then rank-ordered from a low ranking of "1" to a high ranking of "10".

- ***Rank-ordering of ridership***

  Actual or projected annual ridership is then obtained for each benchmarked service. The ridership for each service is then rank-ordered, as described above.

- ***Relationship between Socioeconomic Index and Ridership***

  Once the rank-ordering is complete, the relationship between each of the benchmarked system's Socioeconomic Index and projected ridership is determined.

- ***Selecting the Best Benchmarked Service***

  This portion of the benchmarking process selects the benchmarked service that will best serve as the basis to estimate ridership for the corridors being considered. The preferred service is the one where the ranking of the Socioeconomic Index and ridership are similar or equal.

- ***Socioeconomic Value Refinement***

  The Socioeconomic Index (i.e. – the average of the three socioeconomic values for each benchmarked service) is then added to the socioeconomic values of the benchmarked systems. This enables the calculation of new benchmark ratios that now incorporate the socioeconomic characteristics of the potential corridors to be analyzed.

- ***Generating the Base Socioeconomic Economic Ridership Estimates***

  The benchmark index for the corridor being evaluated is then divided by the revised socioeconomic index for the benchmark comparison systems. This value is then multiplied by the comparison system ridership in order to estimate the effect of socioeconomic factors on the ridership for the study corridor.

- ***Estimating the Effect of Rail Service***

  The forecasts of ridership based on socioeconomic factors is then revised to reflect service attributes of travel time, frequency air fares. Elasticities generated by the COMPASS Model are used to evaluate how time, fare and frequency factors will effect overall ridership levels. The elasticities are derived from the COMPASS Model that provides for a wide variety of corridors elasticities measuring the effects of fare, frequency and travel time.

- ***Final Benchmark Ridership Estimates***

  Using the results of the basic socioeconomic ridership estimates and the rail service elasticities benchmark ridership and revenue estimates are prepared. These estimates reflect a central case estimate that is subject to sensitivity evaluation and testing.

Appendix X

BENCHMARKING

A procedure called “benchmarking” was used as a planning tool for this study in order to generate a preliminary estimate of potential ridership based on local socioeconomic and demographic data. The relationship between three parameters will be critical in the determination of the feasibility of operating a Kansas Passenger Rail Service.

The benchmarking process initially establishes a correlation between socioeconomic data and passenger rail ridership for existing passenger rail service between other city pairs in the US to the ones being studied. The benchmarking process then compares the demographic and socioeconomic characteristics for the Kansas Passenger Rail Study corridors and develops initial ridership projections in order to refine the parameters in the prediction model. It then estimates the impact of service factors such as fares, frequency and travel time on the basic forecast.

A detailed description of the benchmarking methodology is provided in this section.

Overview

The three socioeconomic factors integral to the benchmarking process include:

- Employment Per Capita

  Employment per capita is defined as the ration of employed persons to the total county population for each rail corridor. The employment and population data for each county is summed and the ratio for the entire corridor is calculated.

- Population Density

  Population density is defined as the ratio of population to land area for the corridor. The population and land area for each county in which the rail corridor is located is summed and the ratio for the entire corridor is calculated.

- Per Capita Income

  Per capita income is obtained from the U.S. Bureau of the Census. The per capita income for each county is then weighted by population in order to calculate the average per capita income for each rail corridor.

Socioeconomic Factors and Ridership

The first major step in the benchmarking process involves the rank ordering of each of the benchmarked systems according to socioeconomic factors and projected ridership. Several steps comprise this procedure, as described below:

- ***Determine Socioeconomic Values***

  The values for the three key socioeconomic factors are determined for the systems to be used in the benchmark comparisons. These values are then summed to generate that socioeconomic factor's total. Finally, a ratio for each benchmarked service is then calculated that represents a system's value to the socioeconomic factor's total.

- ***Calculate the Socioeconomic Index***

  An average of the three socioeconomic values is then calculated for each benchmarked system. The average of the ratios for population density, employment per capita, and per capita income is referred to as the "Socioeconomic Index".

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  Actual or projected annual ridership is then obtained for each benchmarked service. The ridership for each service is then rank-ordered, as described above.

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  Once the rank-ordering is complete, the relationship between each of the benchmarked system's Socioeconomic Index and projected ridership is determined.

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  This portion of the benchmarking process selects the benchmarked service that will best serve as the basis to estimate ridership for the corridors being considered. The preferred service is the one where the ranking of the Socioeconomic Index and ridership are similar or equal.

- ***Socioeconomic Value Refinement***

  The Socioeconomic Index (i.e. – the average of the three socioeconomic values for each benchmarked service) is then added to the socioeconomic values of the benchmarked systems. This enables the calculation of new benchmark ratios that now incorporate the socioeconomic characteristics of the potential corridors to be analyzed.

- ***Generating the Base Socioeconomic Economic Ridership Estimates***

  The benchmark index for the corridor being evaluated is then divided by the revised socioeconomic index for the benchmark comparison systems. This value is then multiplied by the comparison system ridership in order to estimate the effect of socioeconomic factors on the ridership for the study corridor.

- ***Estimating the Effect of Rail Service***

  The forecasts of ridership based on socioeconomic factors is then revised to reflect service attributes of travel time, frequency air fares. Elasticities generated by the COMPASS Model are used to evaluate how time, fare and frequency factors will effect overall ridership levels. The elasticities are derived from the COMPASS Model that provides for a wide variety of corridors elasticities measuring the effects of fare, frequency and travel time.

- ***Final Benchmark Ridership Estimates***

  Using the results of the basic socioeconomic ridership estimates and the rail service elasticities benchmark ridership and revenue estimates are prepared. These estimates reflect a central case estimate that is subject to sensitivity evaluation and testing.

Appendix 2

Track Inspection Report

TRACK INSPECTION REPORT

Routes 2, 4, and 5: Kansas City-Topeka-Wichita Corridor

General Description

This corridor extends westward from Kansas City (Union Station) through Topeka, Emporia, and Newton, then southward to Wichita (Union Station). The route includes 223.4 miles (excluding track east of Santa Fe junction) of mostly single main track with sidings spaced approximately every 10 miles. There are segments of multiple main tracks near Kansas City, Emporia, Newton and Wichita. The principal commodities hauled on this route include coal and grain. Amtrak operates passenger service between Kansas City and the West Coast via Topeka through Newton at peak speeds of 79 mph. Passenger rail service was discontinued between Newton and Wichita in October 1979. Most of the alignment is owned by the Burlington Northern Santa Fe Railway Company (BNSF) and includes several subdivisions: Emporia MP1.7 to MP13.1, Topeka MP 0.0 to MP111.0, Emporia MP 111.3 to MP124.7, La Junta MP124.7 to MP185.3 and Arkansas City MP185.3 to MP212.3. Small segments in Kansas City and Wichita are owned by terminal railroads.

Track and Structure

The track between Kansas City and Wichita is in good condition. The main track ballast section is clean and the track surface and crosstie conditions are good. Over 90 percent of the route has continuous welded rail (CWR). This segment of the route includes significant sections of curved track with 116 curves (approximately 137,050 feet) of 1 degree 18 minutes or greater, of which 96 curves (approximately 113,150 feet) are 2 degrees or greater. A distribution of curves among the subdivisions is provided in Table 1. The maximum authorized track speed between Kansas City and Newton is 79 mph for passenger trains and 55 mph for freight. The maximum authorized speed for the segment between Newton and Wichita is 55 mph for freight service. Temporary speed restrictions are minimal for current train operations.

All the bridge structures observed in this segment include ballasted decks, providing a relatively constant track modulus at bridge approaches and reduced effort to maintain surface and alignment for FRA Class IV to VI conditions. The track charts and observations identified steel truss bridges, deck girder bridges, through girder bridges, wooden/concrete deck pile trestle bridges, box culverts, and pipe culverts. According to the BNSF Timetables, all structures are rated for 143-ton service. Structures appeared to be in good condition.

Signals

Most of the mainline tracks between Santa Fe Junction in Kansas City and Wichita Union Station employ centralized traffic control (CTC) with wayside color signal indications. The Topeka subdivision from Holliday to N.R. Junction, a distance of 111 miles, uses Track Warrant Control (TWC) with Automatic Block Signals (ABS) and Automatic Train Stop (ATS). A limited segment north of Wichita on the Arkansas City subdivision uses ABS. The existing signal system is suitable for passenger train operations at peak speeds of 79 mph and is currently serving that purpose. Passenger train speeds are restricted at a number of locations, occasionally due to control point locations and signal spacing, but primarily due to curvature. Most signal blocks west of Kansas City are two miles or greater in length, providing sufficient stopping distance for 79 mph speeds throughout. Simple calculations suggest that slight speed increases (without signal system modifications) are possible by running at the proposed 6 inch cant deficiency.

Grade Crossings

A total of 387 grade crossings are found in the segment between Kansas City and Wichita, 245 of which are public and 142 private. All crossings include warning devices ranging from simple crossbucks to flashers to automatic gates and flashers. Flashers and gates are provided at 84 crossings, while 19 include flashers only. Details of the activation circuits are unknown. The circuits at the automatic crossings are required to provide sufficient warning time for the maximum freight and passenger speeds in current operation. A distribution of grade crossing equipment among the subdivisions is provided in Table 2.

Passenger Stations and Maintenance Facilities

The Kansas City-Wichita corridor includes active Amtrak stations at Kansas City, Lawrence, Topeka, and Newton. Wichita has a substantial station structure, which has been converted to other business uses. Each station has multiple main tracks and/or sidings for passenger boarding.

Since Amtrak provides through service only, dedicated maintenance facilities do not exist. The track structure does not readily permit engine uncoupling or turn around at Wichita and Kansas City.

Route 4 Portion: Wichita-Tulsa Corridor

General Description

This corridor extends southward from Wichita to Arkansas City, Ponca City (OK) and Perry (OK), then eastward to Tulsa (OK). The route includes 179.9 miles of mostly single main track with sidings spaced approximately every 10 miles. There are segments of multiple main tracks near Wichita, Mulvane, and Afton. Coal and grain are the principal commodities hauled on this route. Additionally, intermodal trains travel between Arkansas City and Perry and between Perry and Tulsa. Passenger rail service was discontinued in October 1979 between Newton and Perry and before May 1971 between Perry and Tulsa. The alignment is owned by the Burlington Northern Santa Fe Railway Company (BNSF) and includes several subdivisions: Arkansas City MP212.3 to MP261.2, Red Rock MP261.2 to MP316.3, and Avard MP502.8 to MP426.9.

Track and Structure

The major portion of the track between Wichita and Tulsa is in good condition. The main track ballast section is clean and the track surface and crosstie conditions are generally good. Much of the route has continuous welded rail (CWR). The section from MP227.2 to MP249.7 (from just south of Mulvane to Winfield Junction) has been maintained less comprehensively than most of the track observed during this inspection. This rail is jointed and evidences some surface and joint deterioration. Many of the ties have exceeded their useful life.

This corridor includes significant sections of curved track with 119 curves (estimated 140,000 feet) of 1 degree 18 minutes or greater, of which 99 curves (estimated 120,000 feet) exceed 2 degrees. A distribution of curves among the subdivisions is provided in Table 1. The maximum authorized track speed between Wichita and Topeka is 55 mph for freight service. Speeds are not posted for passenger service, since none is operated. A temporary speed restriction of 25 mph exists for the previously cited section south of Mulvane, consistent with the track condition. New rails (136 lb. CWR), ties, and ballast have been installed on sections east of Morrison between Black Bear Junction and Tulsa. There is evidence of continuing track reconstruction.

Black Bear Junction does not include a northeast quadrant connecting track to permit a continuous move between Wichita and Topeka over this alignment. However, the adjacent land is agricultural without evident dwellings in close proximity, facilitating such construction.

All the bridge structures observed in this segment include ballasted decks. Existing structures appeared to be in good condition. According to the BNSF Timetables, all structures on the Arkansas City and Red Rock subdivisions north of Black Bear Junction are rated for 143-ton service. The track charts depict structures rated for 136 tons on the

Avard substation between Black Bear Junction and Tulsa, but there are new precast, prestressed concrete bridges and new concrete pile caps and timber decks constructed on sections east of Morrison, suggesting that an upgrading program is underway.

Signals

The mainline tracks on the Arkansas City and Red Rock subdivisions between Wichita Union Station and Black Bear Junction employ centralized traffic control (CTC) with wayside color signal indications. The Avard subdivision from Black Bear Junction to Cherokee Yard in Tulsa, a distance of 75.9 miles, is dark territory, operating under Track Warrant Control (TWC) rules. Signal spacing north of Black Bear Junction is generally two to three miles, suitable for passenger train operations at peak speeds of 79 mph. Since the track provides only freight service at this time, the track charts and timetables are marked for freight speeds only with a maximum permissible speed of 55 mph. The freight speeds are restricted at a number of locations, occasionally due to control point locations and signal spacing, but primarily due to curvature. Passenger speed increases (without signal system modifications) are possible by running at the proposed 6 inch cant deficiency and recognizing the inherently greater braking performance of the passenger equipment.

The track charts and timetables for the Avard subdivision mainline tracks depict peak speeds of 49 mph with restrictions in municipalities, at yards, and in curves. The peak speed is consistent with FRA regulations, which limit freight speed to 49 mph (and passenger speed to 59 mph) on unsignaled track.

Grade Crossings

A total of 255 grade crossings are found in the segment between Wichita and Tulsa, 189 of which are public and 66 private. All crossings include warning devices ranging from simple crossbucks to flashers to automatic gates and flashers. Flashers and gates are provided at 53 crossings, while 29 include flashers only. Details of the activation circuits are unknown. The circuits at the automatic crossings are required to provide sufficient warning time for the maximum freight speeds in operation. A distribution of grade crossing equipment among the subdivisions is provided in Table 2.

Passenger Stations and Maintenance Facilities

Historic passenger station structures exist at Arkansas City and Tulsa, but both have been converted to other uses over the years. The Arkansas City station is used by the BNSF as a subdivision and maintenance office. The architecturally significant Tulsa station has been converted to an office complex. Adjacent open land is available in Tulsa for siting a new station. Both sites include multiple tracks and sidings that may be used for passenger boarding. Wichita is addressed in the previous segment description.

Route 1: Kansas City-Baxter Springs-Tulsa Corridor

General Description

The corridor extends southward from Kansas City (Union Station) to Olathe to Fort Scott to Baxter Springs to Tulsa. The route includes 265.4 miles of mostly single main track with sidings spaced approximately every 10 miles. There are short segments of multiple main tracks near Kansas City, Fort Scott, and Afton. Coal and grain are the principal commodities hauled on this route. Additionally, intermodal trains travel between Kansas City and Edward and between Afton and Tulsa. No passenger service operates on this corridor. The alignment is owned by the Burlington Northern Santa Fe Railway Company (BNSF) and includes several subdivisions: Fort Scott MP2.0 to MP102.7, Afton MP 102.7 to MP186.3 and Cherokee MP347.8 to MP426.9.

Track and Structure

The major portion of the track between Kansas City and Tulsa is in good condition. The main track ballast section is clean and that track surface and crosstie conditions are generally good. Much of the route has continuous welded rail (CWR). This segment of the route includes significant sections of curved track with 119 curves (estimated 140,000 feet) of 1 degree 18 minutes or greater, of which 99 curves (estimated 120,000 feet) exceed 2 degrees. A distribution of curves among the subdivisions is provided in Table 1. The maximum authorized track speed between Kansas City and Topeka is 60 mph for freight service. Speeds are not posted for passenger service, since none operates. New double tracks including subgrade improvements, new rails (136 lb. CWR), ties, and ballast have been installed on a section of the Fort Scott subdivision north of Edward Junction. There is evidence of continuing track reconstruction.

All the bridge structures observed in this segment include ballasted decks. Existing structures appeared to be in good condition. According to the BNSF Timetables, all structures on the applicable segments of the Cherokkee, Afton and Fort Scott subdivisions are rated for 143-ton service.

Signals

The mainline tracks between Kansas City and Tulsa employ centralized traffic control (CTC) with wayside color signal indications. Signal spacing is generally one and one-half to three miles, suitable for passenger train operations at peak speeds of 79 mph. Since the track provides only freight service at this time, the track charts and timetables are marked for freight speeds only, indicating a maximum of 60 mph. The freight speeds are restricted at a number of locations, occasionally due to control point locations and signal spacing, but primarily due to curvature. Passenger speed increases (without signal system modifications) are possible by running at the proposed 6-inch cant deficiency and recognizing the inherently greater braking performance of the passenger equipment.

Grade Crossings

A total of 357 grade crossings are found in the segment between Kansas City and Tulsa, 286 of which are public and 71 private. All crossings include warning devices ranging from simple crossbucks to flashers to automatic gates and flashers. Flashers and gates are provided at 99 crossings, while 52 include flashers only. Details of the activation circuits are unknown. The circuits at the automatic crossings are required to provide sufficient warning time for the maximum freight speeds in operation. A distribution of the grade crossing equipment among the subdivisions is provided in Table 2.

Passenger Stations and Maintenance Facilities

As noted above, Kansas City is the site of an active Amtrak station with multiple tracks allowing passenger boarding and passing traffic. In Tulsa, the historic passenger station has been converted to other uses. Adjacent land is available for siting a new station. Both sites include multiple tracks and sidings that may be used for passenger boarding allowing passing traffic. Fort Scott and Baxter Springs have main tracks and sidings with adjacent open land, but no existing passenger facilities.

Since Amtrak provides through service only, dedicated maintenance facilities do not exist in Kansas City. The track structure does not readily permit engine uncoupling and turn around at Tulsa and Kansas City.

79 MPH PASSENGER SERVICE

Assumptions

Amtrak serves most of the United States with diesel electric passenger service traveling at peak speeds of 79 mph. The Department of Transportation Federal Railroad Administration (FRA) Track Safety Standards Part 213.9 allows maximum speeds of 80 mph for passenger trains and 60 mph for freight trains on Class IV track. Speeds are restricted in curves due to the centripetal acceleration imposed on the moving train. In addition, speeds may be restricted by yard limits, track maintenance conditions, signaling equipment, freight operations, special trackwork parameters or local community ordinances. Passenger trains are limited to 59 mph in unsignaled territory.

Generally, the objective of this Report is to define improvements necessary to provide passenger service achieving peak speeds of 79 mph without incurring unnecessarily large capital expenditures or project implementation delays. It is important to note that this analysis is conceptual. Meetings with the railroad and local communities may prove that some of the desired improvements are not feasible. Similarly, the local communities may desire additional safety measures, such as enhanced grade crossing warning systems increasing the cost to implement the project. Key operating and policy assumptions guiding our recommendations are as follows:

1. The train service would be provided using modern diesel electric passenger equipment with tilting coaches and steerable axles, such as the Talgo Pendular train. Infrastructure improvements would be planned for train consists of two locomotives and three or four passenger coaches, providing service for 200 passengers. Trains would be configured for bi-directional operation.

2. The rolling stock would operate at a maximum of 6 inches of cant deficiency through curves.

3. Significant changes to the railroad alignment for curve straightening would not be permitted due to capital budget limitations.

4. Similarly, capital budget limitations would not permit extensive modifications to existing grade crossings. Grade crossing warning systems complying with existing FRA regulations and serving freight traffic would be suitable for passenger service at Class IV track speeds (generally a 20 mph increase over freight speeds).

5. In the absence of a network simulation analysis, the study assumes that running a limited number of passenger trains would not significantly affect capacity or existing freight operations.

6. BNSF would accept track and signal improvements and track super-elevation adjustments (up to 5 inches maximum) as necessary to allow passenger trains to run at the maximum permissible speed.

7. In return for compensation by the passenger service operator, BNSF would provide ongoing maintenance as necessary to accommodate the passenger service.

8. Municipal speed restrictions would be lifted to allow greater speeds.

9. Passenger station facilities would be provided at the following locations: Kansas City, Lawrence, Topeka, Newton, Wichita, Arkansas City, Tulsa, Baxter Springs/Joplin and Fort Scott.

10. Maintenance facilities would be required to store, clean, service, fuel and inspect the trains. Major maintenance would be performed by a contract provider at off-site facilities.

Recommended Improvements

Track and Structures:

As noted in the inspection report, most of the track and structures are in good condition requiring very little improvement for regular passenger service at moderate speeds. Evidence exists that the owner, BNSF, is in the process of upgrading worn track, particularly the segment from Black Bear to Tulsa. Minimum recommendations and costs are provided in the following paragraphs.

Modern tilt technology passenger equipment operating at 6 inches of cant deficiency can reach speeds of 79 mph in curves up to 1 degree 22 minutes of curvature with no super-elevation. With a maximum super-elevation of 5 inches, a tilt train running at 79 mph with 6 inches of cant deficiency can negotiate a curve of 2 degrees 31 minutes. The permissible running speed drops off with degree of curvature. For example, a tilt train running through a 4 degree curve with 5 inches of super-elevation and 6 inches of cant deficiency is limited to a speed of 63 mph. Existing super-elevation in the curves is optimized for the range of freight operating speeds. While it is impractical to anticipate that the BNSF would adjust the super-elevation in every curve to optimize passenger service, a number of curves could be improved. BNSF would probably be unwilling to increase the track super-elevation beyond 5 inches. For the purpose of establishing a capital cost, we estimate that curves greater than 2 degrees would be resurfaced to improve the super-elevation for passenger service.

The 25 mile section of jointed track south of Mulvane between Wichita and Arkansas City would need to be upgraded to CWR, cropping, grinding and welding the existing rail; replacing 33 percent of the crossties; and surfacing to meet FRA Class IV standards.

At Black Bear it would be necessary to design and build a 4,500-ft. single-track connection between the Red Rock Subdivision and the Avard Subdivision to provide a direct route for trains running between Arkansas City and Tulsa. The connection must be built on a 10 ft. embankment and include: 136 lb. CWR, timber ties, ballast and two No. 20 turnouts. Approximately 50 acres of adjacent farm property would be required.

Since costly wye tracks or turnaround tracks do not exist at possible terminal stations, it is important that the equipment be suitable for bi-directional service. Storage and inspection tracks would be required for service terminating at Kansas City, Wichita and Tulsa. These tracks could be constructed with bolted relay rail, new timber ties and ballast on railroad owned property in close proximity to the passenger station site. While the actual configurations would vary with the site constraints, we estimate that 1500 feet of track for two sidings and four # 10 turnouts would be sufficient for each location.

The existing structures, including bridges, trestles and culverts, are currently serving heavy freight traffic. Prior to the beginning of passenger service, the structures should be inspected, but at this time there is no reason to believe that significant modifications or improvements would be necessary for passenger service.

Signals:

Signal modifications required to implement 79 mph are anticipated to be minimal based on our determination of adequate signal spacing throughout much of the corridor.

Interlocking modifications, two switch machines, signals and switch heaters would be required at Black Bear junction for the new connection.

Passenger rail service on unsignaled track is limited to 59 mph. In order to achieve moderate speeds on the segment between Wichita and Topeka, a signal system must be installed. A new CTC signal system for the 76 mile Avard subdivision including wayside color signals, electronic coded track circuits, solid state microprocessor interlockings, and radio communication with telephone modem backup would be required.

New interlockings, four switch machines, signals and switch heaters would be required at terminal stations.

Grade Crossings:

In track segments where passenger trains operate up to 79 mph, little modification to grade crossing warning systems would be required. Where passenger service is introduced to tracks currently subject to freight service at 55 mph, the greater speed of the passenger trains would require extensions to the track circuits to allow sufficient warning time for gate closure. In many cases, this would be a simple matter of relocating DC track circuit shunts approximately 1000 feet. At active crossings employing constant warning time systems or motion sensor systems, lower frequency AC track circuits may be required to compensate for the additional length.

In rural areas subject to freight service at speeds ranging from 49 to 60 mph, most private crossings include simple crossbuck passive warning systems. Busy public crossings with paved roads are warned by gates and flashers or simply flasher systems. Many public crossings have crossbuck warning signs alone. Increasing the train speeds to 79 mph for passenger service does not pose undue risk at most rural crossings and is consistent with passenger service standards throughout much of the United States. However, based on site specific analysis, a limited number of simple flasher systems would likely be converted to gates and flashers. We estimate that 30 such crossings would be upgraded.

Increasing train speeds through populated areas is more problematic. Many small towns along the railroad tracks include one or more siding tracks, several gated crossings and one or more public crossings with cross buck warnings. In many cases a freight train on a siding may prevent motorists from seeing a rapidly moving passenger train demanding that virtually all crossings of multiple tracks be equipped with active warning equipment. While an accurate count has not been made, this would likely result in a need for new gated crossings. Alternatively, the crossings may be closed. We estimate that 45 crossings could be gated and 45 closed over the entire 667 mile loop.

Passenger Stations and Maintenance Facilities:

Basic passenger stations including paved mainline platform, shelter, waiting room, ticket window, rest rooms, cab stand, bus stop, automobile drop off, and limited 25-space parking area would be required at most stopping points. Local communities may wish to augment these facilities with joint development to provide commercial facilities. Similarly, it is anticipated that the local communities would provide property for the facilities. Terminal facilities at larger stations including Kansas City, Wichita and Tulsa may be of grander scale.

New stations would be required at Tulsa, Baxter Springs and Fort Scott. Upgrades and modifications would be required at Wichita and Arkansas City. Stations on the existing Amtrak corridor including Kansas City, Lawrence, Topeka and Newton are suitable for improved passenger service with minor modifications for signage and communications.

Minimum maintenance facilities include storage tracks, fueling and sanding equipment, two-car inspection pit and covered inspection shed, personnel and parts building. Such facilities are envisioned at the terminal sites: Kansas City, Wichita and Tulsa.

110 MPH PASSENGER SERVICE

Assumptions

The Midwest Regional Rail Initiative Strategic Assessment and Business Plan Final Report, published in August 1998, recommended the use of light-weight, high-speed DMU equipment capable of 110 mph using trains of individually powered diesel electric car with steerable trucks, allowing 30% greater speed in curves. Recognizing that the European DMU equipment may not meet FRA mandated compressive strength requirements, this study presumes that high speed diesel electric locomotives and tilt body train sets, such as the Talgo coaches used by Amtrak in Cascades service (Eugene-Portland-Seattle-Vancouver), would be employed.

Federal Railroad Administration Track Safety Standards Part 213.307 allows maximum speeds of 110 mph for passenger trains on Class VI track. As noted above under the description of 79-mph service, speeds are restricted in curves due to the centripetal acceleration imposed on the moving train. However, the tilt body and steerable axles allow greater speeds through the curves without danger of turning over and with greater passenger comfort. Of course, speeds may be restricted by other factors including yard limits, track maintenance conditions, signaling equipment, freight operations, special trackwork parameters, or local community ordinances.

Ideally, new alignments for high-speed passenger rail service would be planned using tangent track and slight curvature to allow for high speeds with minimal acceleration through the curves. Using an existing freight railroad alignment imposes speed limitations due to the existing curvature and special trackwork. Using tilt technology trains, 110 mph is achievable in curves up to approximately 1 degree 20 minutes. The alignment evaluated in this study was built early in the 20th century, optimizing grade and minimizing civil works. Consequently the tracks include a large number of small radius (high degree) curves. The 667 miles that was inspected include approximately 354 curves that would limit the speed to a value less than 110 mph. While a number of these curves could be straightened within the existing alignment, almost 300 of the curves exceed two degrees, probably requiring that land be purchased to realign the railroad. In addition, such realignment may require costly civil work for excavation or embankment and waterway crossing structures. Due to the difficulty in evaluating the feasibility and the (high) cost of realignments, this study is limited to improvements within the existing railroad alignment.

Passenger rail speeds from 80 to 110 mph are subject to additional FRA regulations requiring that trains operating in a speed range from 80 to 110 mph must have automatic cab signal, automatic train stop or automatic train control. In addition, the American Railway Engineering and Maintenance-of-Way Association (AREMA) has been working to develop new recommended practices for high-speed rail systems, suggesting that all public and desirably all private crossings either be closed, grade-separated or equipped with gates activated with a constant warning time. Right-of-way protection (fencing) is also cited.

Key policy and operating assumptions guiding our recommendations are as follows:

1. The train service would be provided using modern diesel electric passenger equipment with tilting coaches and steerable axles, such as the Talgo Pendular train. Infrastructure improvements would be planned for train consists of two locomotives and three or four passenger coaches, providing service for 200 passengers. Trains would be configured for bi-directional operation.

2. The rolling stock would operate at a maximum of six inches of cant deficiency through curves.

3. Significant changes to the railroad alignment for curve straightening would not be permitted due to capital budget limitations.

4. The quantity of grade crossings would be substantially reduced and the remaining crossings equipped with active warning devices. Due to budget limitations, grade separations would not be provided.

5. In the absence of a network simulation analysis, the study assumes that running a limited number of high-speed passenger trains would not significantly affect capacity or existing freight operations.

6. BNSF would accept track and signal improvements and track super-elevation adjustments (up to 5 inches maximum) as necessary to allow high speed passenger trains to run at the maximum permissible speed.

7. In return for compensation by the passenger service operator, BNSF would provide ongoing maintenance as necessary to accommodate the high-speed passenger service.

8. Municipal speed restrictions would be lifted to allow greater speeds.

9. Passenger station facilities would be provided at the following locations: Kansas City, Lawrence, Topeka, Newton, Wichita, Arkansas City, Tulsa, Baxter Springs/Joplin and Fort Scott.

10. Maintenance facilities would be required to store, clean, service, fuel and inspect the trains. Major maintenance would be performed by a contract provider at off-site facilities.

11. A positive train control system meeting FRA requirements would be installed allowing operations in excess of 79 mph. While such a system does not presently exist, government and privately funded development programs are in progress, suggesting that positive train control would be in wide use within a decade.

Recommended Improvements

Track and Structures:

In order to operate at speeds above 80 mph, the track must be upgraded to FRA Class VI standards. The actual capital improvements required to achieve Class VI standards would vary throughout the corridor. For the purposes of estimating we can assume that a 33% tie replacement and surfacing program would upgrade the track structure sufficiently that Class VI tolerances may be maintained at a reasonable cost.

As noted previously, passenger service with tilt train technology can achieve speeds of 110 mph in curves up to 1 degree 18 minutes, operating at 6 inches cant deficiency on 5 inches of super-elevation. Lower radius (higher degree) curves would restrict the speeds. However, speeds would exceed those of conventional passenger equipment by approximately 10 mph due to greater tolerance of unbalanced conditions.

Operating at higher speeds in curves imposes a greater loading on the track structure, leading to loss of gage, rail wear and increased maintenance. Infrequent maintenance could lead to a danger of overturning the outside rail. Better performance is obtained through the use of premium rail and fastening systems. Based on our observations, the BNSF has been installing premium components in a number of newly rebuilt curves. We recommend that all curves greater than 1 degree 18 minutes be rebuilt with premium fasteners.

Where bolted rail is in use in mainline applications, we recommend that it be welded as part of a tie and resurfacing program.

At Black Bear it would be necessary to design and build a 4,500-ft. single-track connection between the Red Rock Subdivision and the Avard Subdivision to provide a direct route for trains running between Arkansas City and Tulsa. The connection must be built on a 10 ft. embankment and include: 136 lb. CWR, timber ties, ballast and two No. 20 turnouts. Approximately 50 acres of adjacent farm property would be required.

Since costly wye or turnaround tracks do not exist at possible terminal stations, it is important that the rolling stock be suitable for bi-directional service. Storage and inspection tracks would be required for service terminating at Kansas City, Wichita and Tulsa. These tracks could be constructed with bolted relay rail, new timber ties and ballast on railroad owned property in close proximity to the passenger station site. While the actual configuration would vary with the site constraints, we estimate that 1500 feet of track for two sidings and four #10 turnouts would be required.

Ten mile passing sidings are required on each leg (Kansas City to Wichita, Wichita to Tulsa, and Tulsa to Kansas City) to allow opposite direction passenger train passing without a speed reduction. Sidings include the construction of subgrade, drainage, bridges and waterways, high-speed track and ballast.

The existing structures including bridges, trestles and culverts are currently serving heavy freight traffic. Prior to beginning passenger service, the structures should be inspected, but at this time there is no reason to believe that significant modifications or improvements would be necessary for high-speed passenger service.

Fencing of the right-of-way would be required in segments where speeds exceed 79 mph to prevent intrusion of trespassers and farm animals. Urban areas may employ 6-ft. chain link fencing while rural areas use 4 ft. multiple strand farm fencing.

Signals:

Three positive train control demonstration projects are active in the United States. It is anticipated that a practical cost effective standard would be developed within the next five to ten years. Such a system is essential for 110-mph passenger rail service. This type of system would be applied as an overlay to existing signal systems or as the only system in dark territory. At this time, the cost is estimated at $150,000 per mile for wayside components.

Interlocking modifications, two switch machines, signals and switch heaters would be required at Black Bear junction for the new connection.

New interlockings, four switch machines, signals and switch heaters would be required at terminal stations.

An interlocking, switch machine, signal and switch heaters would be required at each new high speed passing siding turnout.

Grade Crossings:

The elimination or consolidation of grade crossings is essential. The alignment includes approximately 720 public crossings and 280 private crossings. We have assumed that the number of public crossings can be reduced to approximately 300 (a 60% reduction of the total quantity) and all private crossings eliminated. Recent high-speed rail projects have employed four quadrant gates. It is likely that this technology would become a standard for moderate traffic crossings. For the purposes of this study, we anticipate that all remaining public crossings would include four quadrant gates with trapped vehicle detection.

New grade separations, while desirable, are not required, particularly if the four quadrant gate systems are employed.

Passenger Stations and Maintenance Facilities:

Basic passenger stations including paved mainline platform, shelter, waiting room, ticket window, rest rooms, cab stand, bus stop, automobile drop off, and limited 25-space parking area would be required at most stopping points. Local communities may wish to augment these facilities with joint development to provide commercial facilities. Similarly, it is anticipated that the local communities would provide property for the facilities. Terminal facilities at larger stations including Kansas City, Wichita and Tulsa may be of grander scale.

New stations would be required at Tulsa, Baxter Springs and Fort Scott. Upgrades and modifications would be required at Wichita and Arkansas City. Stations on the existing Amtrak corridor including Kansas City, Lawrence, Topeka and Newton are suitable for improved passenger service with minor modifications for signage and communications.

Minimum maintenance facilities would include storage tracks, fueling and sanding equipment, two-car inspection pit and covered inspection shed, personnel and parts building. Such facilities are envisioned at the terminal sites: Kansas City, Wichita and Tulsa.

PRELIMINARY ENVIRONMENTAL ANALYSIS

Summary

A railroad corridor inspection was conducted January 6-8, 2000 to review environmental conditions along the proposed passenger rail alignments in Kansas and Oklahoma. Two scenarios are considered: passenger rail service at 79 mph and passenger rail service at 110 mph.

Providing passenger rail service at 79 mph would have limited environmental impacts. There would be minimal changes in track alignment; however, property acquisition would be necessary at Black Bear junction to run a loop service connecting Kansas City, Wichita and Tulsa. There may have to be property acquisition for a maintenance facility in Kansas City and turnarounds and sidings in Wichita and Topeka.

Providing passenger rail service at 110 mph would have an impact on the environment similar to that described above for 79 mph service, assuming that best available speeds would be achieved through the use of tilt technology on track within the existing right-of-way. There would be a small noise impact due to the use of high-speed train technology with slightly higher noise levels than freight locomotives. In addition, the need to achieve a sealed corridor with fencing and a manageable number of protected grade crossings would create access and traffic issues.

The environmental review was conducted to identify any “fatal flaws” along the alignment. None have been found. However, the work to date has not assessed the environmental impact of improvements necessary to achieve 110-mph service. Mitigation measures would have to be developed once the site-specific environmental impacts have been identified.

Man Made Environment

Social-Economic: The passenger rail service at 79 mph could require new right-of-way and possibly displacements. There would be property acquisition at Black Bear junction in order to run a loop service connecting Kansas City, Topeka and Wichita. There could also be property acquisition for a maintenance facility in Kansas City, a turnaround and a siding in Wichita and Topeka, and a station in Topeka if railroad owned property is not adequate.

In most of the smaller communities along the alignment there are numerous public at-grade crossings of the railroad. In addition, there are many private grade crossings used by farmers to reach their fields. Both public and private crossings are marked with signs.

High-speed (110 mph) train service would require right-of-way fencing. In the rural areas this would mean four feet high, three-strand barbed wire fencing. In cities and towns it would mean six feet high chain link fencing. Remaining farm (private) crossings would have locked gates to prevent access when a train is passing. The remaining roadway crossings (public) would have gates and flashers. The general intent is to close as many crossings as possible for safety. There would naturally be traffic impacts from closing roadways.

After reviewing size and location of cities along the right-of-way, proposed station locations would be at: Kansas City, Lawrence, Topeka, Newton, Wichita, Arkansas City, Tulsa, Baxter Springs and Fort Scott.

There are a number of passenger stations still in place along the alignment. Some of the stations are closed and it would be relatively easy to reopen them. Some of the passenger stations have been redeveloped as office buildings (Tulsa, Oklahoma) or as locations for businesses (cable company in Wichita). The Wichita station could probably be reclaimed. Because it has been completely renovated it is unlikely that the Tulsa station could be reclaimed as a passenger station.

Cultural: Since there is adequate right-of-way in the cities and towns along the alignment there should be no impact on potential historic and archaeological sites. Stations and yard facilities, which would require new right-of-way, could impact some historic sites. No historic districts were identified along the alignment. Some of the stations could qualify for National Register status. The station in Newton, Kansas, is a fine example of the English style of architecture used by the Santa Fe Railroad in the early 1900's. Some of the bridges on the alignment are quite old and could qualify for National Register status.

Contamination: A review of the alignment shows very little industrial development along the right-of-way. There is some industrial development nearby (Conoco refinery in Ponca City and a coal-fired power plant in Red Rock). It is reasonable to expect that ballast and subgrade have been contaminated by leaking petrochemical tank cars, particularly in the vicinity of Ponca City and in adjoining yards. There is no expectation that right-of-way improvements would disturb these materials. There were no gas stations or dry cleaners observed along the alignment. Facilities like industry, gas stations and dry cleaners can be indicators that contamination may be present. The lack of these types of development adjacent to the tracks means there is minimal opportunity for contamination along the right-of-way.

Noise/Air Quality: There is existing freight service on the alignment. Adding passenger service would have a slight impact on noise and air quality. There could be an impact from increased service on nearby residents. The small noise impact would be due to the use of high-speed train technology with slightly higher noise levels than freight locomotives. Air quality impacts resulting from increased train traffic are mitigated by the fact that the rail passengers are not driving their automobiles. One of the major benefits of passenger trains is the positive impacts on air quality by reducing the number of cars on the road.

Parkland: Since right-of-way expansion for rail service is limited there should be no impact on parkland and other recreation facilities. There is parkland along the alignment; for example, there is a habitat restoration area near the Lawrence station and a bike path crossing near Holiday. The field review of the alignment did not identify any parks impacted by the right-of-way.

Natural Environment

Agricultural**:** Much of the rail alignment is in rural areas, which means the land use is primarily agricultural. Many of the towns have grain elevators to store the harvested grain. Farmland would have to be acquired at the Black Bear crossing to connect the two railroads. Since there is no expansion of the right-of-way there should be no impact on other agricultural lands.

Natural Resources: The alignment does pass through forests and fields, which retain their natural character. The proposed passenger rail service would require minimal acquisition of additional right-of-way. Therefore, there should be no impact on natural resources.

Water Resources: There are a number of streams and rivers which are crossed by the rail alignment. There are no proposed improvement to these bridges so there should be no impact on water quality in the streams and rivers. Any reconstruction of bridges over streams would require a nationwide 404 permit and possibly a NPDES permit for this project.

Floodplains: It was obvious from some of the dikes located near the right-of-way that part of the alignment is in the floodplain. Topographic maps of the Black Bear crossing suggest that the adjacent land is in the floodplain. The proposed construction of a track connection at Black Bear would impact the floodplain.

Wetlands: A field check of the alignment did not identify any wetlands along the alignment. However, since not every stretch of the alignment was reviewed it is possible there could be wetlands along the alignment. Any purchase of additional right-of-way should be reviewed for impacts on wetlands.

GLOSSARY

Automatic Block Signals (ABS)	A fixed signal at the entrance of a block to govern trains and engines entering and using that block. The block signaling which does the most for increasing line capacity is automatic block signals (ABS), in which the signals are controlled by the trains themselves.
Automatic Train Stop (ATS)	A system so arranged that its operation will automatically result in the application of the brakes until the train has been brought to a stop.
Block	A length of track of defined limits, the use of which by trains is governed by block signals;
Cant Deficiency	See "Unbalance."
Centralized Traffic Control (CTC)	A term applied to a system of railroad operation by means of which the movement of trains over routes and through blocks on a designated section of track or tracks is directed by signals controlled from a designated central point. Also called TCS (Traffic Control System).
Consist	Used to describe on-track railroad equipment such as a locomotive and passenger cars, or a group of rail cars.
Continuous Welded Rail (CWR)	Rails welded together in lengths of 400 or more feet.
Curvature	The highest forces generated by trains on the track occur in the curves. The rail on the outside of the curve guides the train by resisting its tendency to go straight. This steering action results in centrifugal forces acting outward and directing the weight of the train toward the outside rail. The magnitude of the force generated is a function of the degree of curvature, train weight and speed.
Four Quadrant Gates	A system of flashers, gates and barriers that automatically blocks vehicle traffic in all directions at a grade crossing. Installation generally ranges from $450,00 to $600,000.
FRA Track Safety Classes	The Federal Railroad Administration (FRA) has established safety standards for track conditions for freight and passenger trains. Each FRA Class designates a maximum authorized speed based on minimum standards of track conditions, with Class I being the worst, and Class VII the best. Refers to whether or not the train meets Federal Railroad Administration

(FRA) regulations that details train equipment specifications and requirements for trains operating up to specific speeds.

Overbalanced When a train travels at less than equilibrium speed, the resultant force is directed toward the low rail. As more of the weight is carried by the low rail, there is an unloading of the high rail. From a track maintenance standpoint, the disproportionate loading of the low rail results in corrugation and crushing of the low rail head, gauge widening and surface degradation.

Protect Set Spare train sets held in reserve to ensure continued service in the event of mechanical breakdown or other service interruption.

Steerable Trucks A truck design that permits the front and rear wheels to turn independently, rather than operating in fixed formation. This permits higher speed in curves and reduces wear on curved track.

Super-Elevation Raising the outside rail elevation above that of the inner rail on a curve, similar to banking a curve on a highway. The centrifugal force is counteracted by super-elevating the track so the combined effect of the centrifugal and vehicle weight forces produces a resultant force that is equally distributed on both rails. When this occurs, the curve is balanced and an equilibrium speed has been reached.

Terminal Railroad A railroad acting in conjunction with the participating rail lines in the metropolitan area that manages and controls the operation of the traffic in the terminal.

Tilt System Increases passenger comfort through a high-speed curve by physically tilting the car into the curve to reduce the sensation of "leaning into a curve".

Track Warrant Control (TWC) Under the TWC system, in designated territories, crews (including work crews and track motor cars) similarly can occupy main tracks only on the basis of possession of a "track warrant" covering a precisely defined (by milepost, siding switch or designated "control point") track segment of any length – often, to the next expected meeting point.

Trucks The wheel and axle mechanism of the train, including any steering mechanisms.

Unbalance The uncompensated degree of lateral force exerted on the passenger and the track while the train negotiates a curve. When trains operate on curves at speeds which are higher (underbalanced) or lower (overbalanced) than the equilibrium speed, the super-elevation is "unbalanced." Unbalance is also referred to as "Cant Deficiency" and is usually measured in inches.

Underbalanced When a train travels a curve in excess of equilibrium speed, the combined centrifugal and weight forces are directed toward the high rail.

Appendix 3

Scenario Timetables

302 Kansas Feasibility Study Summary

Parameter		Route					
		1: Kansas City- Ft. Scott-Tulsa	2: Kansas City-Lawrence-Topeka-Wichita	3: Kansas City-Lawrence-Topeka-Hays-Denver	4:Kansas City-Lawrence-Topeka-Wichita-Perry-Tulsa	5: Kansas City-Lawrence-Topeka-Wichita-Oklahoma City	6: Kansas City-Lawrence-Topeka
Corridor Distance		263.4	225.7	641.2	421.9	397.4	69.1
Travel Time (includes 5% Recovery)	P32-5 Cars with Existing Conditions	6:05	4:34	17:55	9:20	8:30	1:25
	Talgo (B-2) with Improved Conditions (79mph)	4:56	3:55	9:42	7:19	6:46	1:20
	Talgo (B-2) with Improved Conditions (110mph)-Conservative	4:32	3:26	8:16	6:40	6:01	1:06
	Talgo (B-2) with Improved Conditions (110mph)-Aggressive	4:02	3:07	7:27	5:51	5:21	1:00
Average Speed	P32-5Cars - Existing Conditions	43.3	49.3	35.8	45.2	46.7	48.5
	Talgo (B-2) - Improved Conditions (79mph)	53.3	57.6	66.0	57.6	58.7	51.8
	Talgo (B-2) - Improved Conditions (110mph)	58.0	65.5	77.5	63.2	66.0	62.4
Trainmiles	P32-5Cars - Existing Conditions	657,446	563,397	400,121	526,556	495,980	86,212
	Talgo (B-2) - Improved Conditions (79mph)	657,446	563,397	400,121	526,556	495,980	86,212
	Talgo (B-2) - Improved Conditions (110mph)	657,446	563,397	400,121	1,053,112	991,960	86,212
Trainsets (Regular Cycling)	P32-5Cars - Existing Conditions	4	3	2	2	2	1
	Talgo (B-2) - Improved Conditions (79mph)	4	3	2	2	2	1
	Talgo (B-2) - Improved Conditions (110mph)	4	2	2	2	2	1
Trainsets (Protect)	P32-5Cars - Existing Conditions	1	1	1	1	1	0
	Talgo (B-2) - Improved Conditions (79mph)	0	0	1	1	1	0
	Talgo (B-2) - Improved Conditions (110mph)	0	0	1	0	0	0
Trainsets (Total)	P32-5Cars - Existing Conditions	5	4	3	3	3	1
	Talgo (B-2) - Improved Conditions (79mph)	4	3	3	3	3	1
	Talgo (B-2) - Improved Conditions (110mph)	4	2	3	2	2	1
Total Rolling Stock Cost ($Millions)	P32-5Cars - Existing Conditions	47.3	37.8	28.4	28.4	28.4	9.5
	Talgo (B-2) - Improved Conditions (79mph)	37.8	28.4	28.4	28.4	28.4	9.5
	Talgo (B-2) - Improved Conditions (110mph)	37.8	18.9	28.4	18.9	18.9	9.5
Annual Operating Cost in $Millions ($35/trainmile)	P32-5Cars - Existing Conditions	23.01	19.72	14.00	18.43	17.36	3.02
	Talgo (B-2) - Improved Conditions (79mph)	23.01	19.72	14.00	18.43	17.36	3.02
	Talgo (B-2) - Improved Conditions (110mph)	23.01	19.72	14.00	36.86	34.72	3.02
Annual Operating Cost in $Millions ($25/trainmile)	P32-5Cars - Existing Conditions	16.44	14.08	10.00	13.16	12.40	2.16
	Talgo (B-2) - Improved Conditions (79mph)	16.44	14.08	10.00	13.16	12.40	2.16
	Talgo (B-2) - Improved Conditions (110mph)	16.44	14.08	10.00	26.33	24.80	2.16
% with 79mph Speed Restrictions		74%	91%	85%	77%	81%	71%
% with 110mph Speed Restrictions (Superceeded)		55%	59%	61%	50%	59%	50%
% with 110mph Speed Restrictions		80%	87%	82%	87%	89%	64%

Note: Capital Costs assume $9.45 Million per trainset (Cost of Talgo) for all scenarios

Appendix 3

Scenario Timetables

Existing Track Conditions

Existing Track Conditions
Route 1 - January 28, 2000 - P32-5 Cars

Train Number			7000	7002	7004	7006
Station	Milepost	Schedule Time	Daily	Daily	Daily	Daily
Kansas City	0	0:00	7:00	11:00	15:00	18:00
Ft. Scott	98.2	2:12	9:12	13:12	17:12	20:12
Baxter Springs/Joplin	158.6	3:27	10:27	14:27	18:27	21:27
Tulsa	263.4	6:05	13:05	17:05	21:05	0:05

Train Number			7001	7003	7005	7007
Station	Milepost	Schedule Time	Daily	Daily	Daily	Daily
Tulsa	0	0:00	7:00	11:00	15:00	18:00
Baxter Springs/Joplin	104.8	2:34	9:34	13:34	17:34	20:34
Ft. Scott	165.2	3:49	10:49	14:49	18:49	21:49
Kansas City	263.4	6:05	13:05	17:05	21:05	0:05

Equipment Turns		Next Day
Trainset 1	7000-7005	7000
Trainset 2	7002-7007	7002
Trainset 3	7001-7004	7001
Trainset 4	7003-7006	7003

Existing Track Conditions
Route 2 - January 28, 2000 - P32-5 Cars

Train Number			7000	7002	7004	7006
Station	Milepost	Schedule Time	Daily	Daily	Daily	Daily
Kansas City	0	0:00	7:00	11:30	16:00	19:30
Lawrence	39.42	0:56	7:56	12:26	16:56	20:26
Topeka	64.02	1:28	8:28	12:58	17:28	20:58
Newton	198.74	3:51	10:51	15:21	19:51	23:21
Wichita	225.72	4:34	11:34	16:04	20:34	0:04

Train Number			7001	7003	7005	7007
Station	Milepost	Schedule Time	Daily	Daily	Daily	Daily
Wichita	0	0:00	6:00	9:40	13:00	18:00
Newton	26.98	0:39	6:39	10:19	13:39	18:39
Topeka	161.7	3:01	9:01	12:41	16:01	21:01
Lawrence	186.3	3:33	9:33	13:13	16:33	21:33
Kansas City	225.72	4:34	10:34	14:14	17:34	22:34

Equipment Turns		Next Day
Trainset 1	7000-7005	7002
Trainset 2	7002-7007	7001
Trainset 3	7001-7004	7003
Trainset 4	7003-7006	7005

Existing Track Conditions
Route 3 - January 28, 2000 - P32-5 Cars

Train Number			7000
Station	Milepost	Schedule Time	Daily
Kansas City	0	0:00	6:00
Lawrence	39.12	0:45	6:45
Topeka	69.08	1:20	7:20
Salina	187.52	4:50	10:50
Hays	289.72	7:46	13:46
Limon	549.32	14:55	20:55
Denver	641.22	17:55	23:55

Train Number			7001
Station	Milepost	Schedule Time	Daily
Denver	0	0:00	6:00
Limon	91.9	0:45	6:45
Hays	351.5	1:20	7:20
Salina	453.7	4:50	10:50
Topeka	572.14	7:46	13:46
Lawrence	602.1	14:55	20:55
Kansas City	641.22	17:55	23:55

Equipment Turns		Next Day
Trainset 1	7000	7001
Trainset 2	7001	7000

Existing Track Conditions
Route 4 - January 28, 2000 - P32-5 Cars

Train Number			7000	7002
Station	Milepost	Schedule Time	Daily	Daily
Kansas City	0	0:00	5:40	16:00
Lawrence	39.42	0:56	6:36	16:56
Topeka	64.02	1:28	7:08	17:28
Newton	198.74	3:51	9:31	19:51
Wichita	225.72	4:31	10:11	20:31
Arkansas City	276.92	5:47	11:27	21:47
Perry	335.42	7:05	12:45	23:05
Tulsa	421.92	9:20	15:00	1:20

Train Number			7001	7003
Station	Milepost	Schedule Time	Daily	Daily
Tulsa	0	0:00	5:40	16:00
Perry	86.5	2:11	7:51	18:11
Arkansas City	145	3:29	9:09	19:29
Wichita	196.2	4:45	10:25	20:45
Newton	223.18	5:25	11:05	21:25
Topeka	357.9	7:47	13:27	23:47
Lawrence	382.5	8:19	13:59	0:19
Kansas City	421.92	9:20	15:00	1:20

Equipment Turns		Next Day
Trainset 1	7000-7003	7000
Trainset 2	7001-7002	7001

Existing Track Conditions
Route 5 - January 28, 2000 - P32-5 Cars

Train Number			7000	7002
Station	Milepost	Schedule Time	Daily	Daily
Kansas City	0	0:00	6:00	15:30
Lawrence	39.42	0:58	6:58	16:28
Topeka	64.02	1:30	7:30	17:00
Newton	198.74	3:53	9:53	19:23
Wichita	225.72	4:33	10:33	20:03
Arkansas City	276.92	5:49	11:49	21:19
Perry	335.42	7:06	13:06	22:36
Oklahoma City	397.42	8:30	14:30	0:00

Train Number			7001	7003
Station	Milepost	Schedule Time	Daily	Daily
Oklahoma City	0	0:00	6:00	15:30
Perry	63	1:20	7:20	16:50
Arkansas City	120.5	2:36	8:36	18:06
Wichita	171.7	3:53	9:53	19:23
Newton	198.68	4:32	10:32	20:02
Topeka	333.4	6:55	12:55	22:25
Lawrence	358	7:26	13:26	22:56
Kansas City	397.42	8:30	14:30	0:00

Equipment Turns		Next Day
Trainset 1	7000-7002	7000
Trainset 2	7001-7003	7001

Existing Track Conditions

Route 6 - January 28, 2000 - P32-5 Cars

Train Number			7000	7002	*511*	*513*
Station	Milepost	Schedule Time	Daily	Daily	Daily	Daily
St. Louis	*0*	*0:00*			*14:22*	*18:18*
Kirkwood	*12.62*	*0:16*				*18:34*
Washington	*51.11*	*0:53*				*19:11*
Hermann	*80.33*	*1:22*				*19:40*
Jefferson City	*124.91*	*2:05*			*16:08*	*20:23*
Sedalia	*188.31*	*3:02*				*21:20*
Warrensburg	*217.81*	*3:29*				*21:47*
Lee's Summit	*257.44*	*4:06*				*22:24*
Independence	*270.61*	*4:22*				*22:40*
Kansas City	*282.41*	*4:40*			*18:22*	*22:58*
Kansas City	0	0:00	8:30	15:45	18:27	23:03
Lawrence	39.12	0:45	9:15	16:30	19:13	23:48
Topeka	69.08	1:25	9:55	17:10	19:53	0:28

Train Number			*508*	*510*	7001	7003
Station	Milepost	Schedule Time	Daily	Daily	Daily	Daily
Topeka	0	0:00	6:28	7:43	13:15	20:00
Lawrence	29.96	0:35	7:04	8:19	13:50	20:35
Kansas City	69.08	1:25	7:54	9:09	14:40	21:25
Kansas City	*0*	*0:00*	7:59	*9:14*		
Independence	*11.8*	*0:17*				
Lee's Summit	*24.97*	*0:33*				
Warrensburg	*64.6*	*1:10*				
Sedalia	*94.1*	*1:37*				
Jefferson City	*157.5*	*2:35*	*10:13*	*11:28*		
Hermann	*202.08*	*3:16*				
Washington	*231.3*	*3:46*				
Kirkwood	*269.79*	*4:22*				
St. Louis	*282.41*	*4:39*	*12:00*	*13:15*		

Equipment Turns		Next Day
Trainset 1	7000-7001-7002-7003	7000
Other Sets	508, 510, 511, 513	MWRRS

Appendix 3

Scenario Timetables

Upgrade Track Conditions – 79 mph

Upgrade Track Conditions (79mph)
Route 1 - January 28, 2000 - Talgo (B-2)

Train Number			7000	7002	7004	7006
Station	Milepost	Schedule Time	Daily	Daily	Daily	Daily
Kansas City	0	0:00	7:00	11:00	15:00	18:00
Ft. Scott	98.2	1:49	8:49	12:49	16:49	19:49
Baxter Springs/Joplin	158.6	2:49	9:49	13:49	17:49	20:49
Tulsa	263.4	4:56	11:56	15:56	19:56	22:56

Train Number			7001	7003	7005	7007
Station	Milepost	Schedule Time	Daily	Daily	Daily	Daily
Tulsa	0	0:00	7:00	11:00	15:00	18:00
Baxter Springs/Joplin	104.8	2:05	9:05	13:05	17:05	20:05
Ft. Scott	165.2	3:05	10:05	14:05	18:05	21:05
Kansas City	263.4	4:56	11:56	15:56	19:56	22:56

Equipment Turns		Next Day
Trainset 1	7000-7005	7000
Trainset 2	7002-7007	7002
Trainset 3	7001-7004	7001
Trainset 4	7003-7006	7003

Upgrade Track Conditions (79mph)
Route 2 - January 28, 2000 - Talgo (B-2)

Train Number			7000	7002	7004	7006
Station	Milepost	Schedule Time	Daily	Daily	Daily	Daily
Kansas City	0	0:00	6:00	11:30	16:00	19:30
Lawrence	39.42	0:51	6:51	12:21	16:51	20:21
Topeka	64.02	1:17	7:17	12:47	17:17	20:47
Newton	198.74	3:18	9:18	14:48	19:18	22:48
Wichita	225.72	3:55	9:55	15:25	19:55	23:25

Train Number			7001	7003	7005	7007
Station	Milepost	Schedule Time	Daily	Daily	Daily	Daily
Wichita	0	0:00	6:00	10:49	13:00	18:00
Newton	26.98	0:30	6:30	11:19	13:30	18:30
Topeka	161.7	2:30	8:30	13:19	15:30	20:30
Lawrence	186.3	2:57	8:57	13:46	15:57	20:57
Kansas City	225.72	3:55	9:55	14:44	16:55	21:55

Equipment Turns		Next Day
Trainset 1	7000-7003-7004	7005
Trainset 2	7001-7002-7007	7000
Trainset 3	7005-7006	7001

Trainmiles	Daily	Annual
Trainset 1	677.16	211,274
Trainset 2	677.16	211,274
Trainset 3	451.44	140,849
		563,397

Upgrade Track Conditions (79mph)
Route 3 - January 28, 2000 - Talgo (B-2)

Train Number			7000
Station	Milepost	Schedule Time	Daily
Kansas City	0	0:00	6:00
Lawrence	39.12	0:43	6:43
Topeka	69.08	1:14	7:14
Salina	187.52	3:05	9:05
Hays	289.72	4:34	10:34
Limon	549.32	8:13	14:13
Denver	641.22	9:42	15:42

Train Number			7001
Station	Milepost	Schedule Time	Daily
Denver	0	0:00	6:00
Limon	91.9	1:26	7:26
Hays	351.5	5:05	11:05
Salina	453.7	6:35	12:35
Topeka	572.14	8:28	14:28
Lawrence	602.1	8:58	14:58
Kansas City	641.22	9:42	15:42

Equipment Turns		Next Day
Trainset 1	7000	7001
Trainset 2	7001	7000

Upgrade Track Conditions (79mph)
Route 4 - January 28, 2000 - Talgo (B-2)

Train Number			7000	7002
Station	Milepost	Schedule Time	Daily	Daily
Kansas City	0	0:00	7:00	16:30
Lawrence	39.42	0:51	7:51	17:21
Topeka	64.02	1:17	8:17	17:47
Newton	198.74	3:18	10:18	19:48
Wichita	225.72	3:49	10:49	20:19
Arkansas City	276.92	4:48	11:48	21:18
Perry	335.42	5:48	12:48	22:18
Tulsa	421.92	7:19	14:19	23:49

Train Number			7001	7003
Station	Milepost	Schedule Time	Daily	Daily
Tulsa	0	0:00	7:00	16:30
Perry	86.5	1:28	8:28	17:58
Arkansas City	145	2:29	9:29	18:59
Wichita	196.2	3:28	10:28	19:58
Newton	223.18	3:59	10:59	20:29
Topeka	357.9	5:58	12:58	22:28
Lawrence	382.5	6:26	13:26	22:56
Kansas City	421.92	7:19	14:19	23:49

Equipment Turns		Next Day
Trainset 1	7000-7003	7000
Trainset 2	7001-7002	7001

Upgrade Track Conditions (79mph)
Route 5 - January 28, 2000 - Talgo (B-2)

Train Number			7000	7002
Station	Milepost	Schedule Time	Daily	Daily
Kansas City	0	0:00	7:00	16:30
Lawrence	39.42	0:51	7:51	17:21
Topeka	64.02	1:17	8:17	17:47
Newton	198.74	3:18	10:18	19:48
Wichita	225.72	3:49	10:49	20:19
Arkansas City	276.92	4:48	11:48	21:18
Perry	335.42	5:48	12:48	22:18
Oklahoma City	397.42	6:46	13:46	23:16

Train Number			7001	7003
Station	Milepost	Schedule Time	Daily	Daily
Oklahoma City	0	0:00	7:00	16:30
Perry	63	0:56	7:56	17:26
Arkansas City	120.5	1:56	8:56	18:26
Wichita	171.7	2:54	9:54	19:24
Newton	198.68	3:25	10:25	19:55
Topeka	333.4	5:25	12:25	21:55
Lawrence	358	5:52	12:52	22:22
Kansas City	397.42	6:46	13:46	23:16

Equipment Turns		Next Day
Trainset 1	7000-7003	7000
Trainset 2	7001-7002	7001

Upgrade Track Conditions (79mph)
Route 6 - January 28, 2000 - Talgo (B-2)

Train Number			7000	7002	*511*	*513*
Station	Milepost	Schedule Time	Daily	Daily	Daily	Daily
St. Louis	*0*	*0:00*			*14:22*	*18:18*
Kirkwood	*12.62*	*0:16*				*18:34*
Washington	*51.11*	*0:53*				*19:11*
Hermann	*80.33*	*1:22*				*19:40*
Jefferson City	*124.91*	*2:05*			*16:08*	*20:23*
Sedalia	*188.31*	*3:02*				*21:20*
Warrensburg	*217.81*	*3:29*				*21:47*
Lee's Summit	*257.44*	*4:06*				*22:24*
Independence	*270.61*	*4:22*				*22:40*
Kansas City	*282.41*	*4:40*			*18:22*	*22:58*
Kansas City	0	0:00	8:30	15:45	18:27	23:03
Lawrence	39.12	0:43	9:13	16:28	19:11	23:46
Topeka	69.08	1:20	9:50	17:05	19:47	0:23

Train Number			*508*	*510*	7001	7003
Station	Milepost	Schedule Time	Daily	Daily	Daily	Daily
Topeka	0	0:00	6:34	7:49	13:15	20:00
Lawrence	29.96	0:30	7:04	8:19	13:45	20:30
Kansas City	69.08	1:20	7:54	9:09	14:35	21:20
Kansas City	*0*	*0:00*	7:59	*9:14*		
Independence	*11.8*	*0:17*				
Lee's Summit	*24.97*	*0:33*				
Warrensburg	*64.6*	*1:10*				
Sedalia	*94.1*	*1:37*				
Jefferson City	*157.5*	*2:35*	*10:13*	*11:28*		
Hermann	*202.08*	*3:16*				
Washington	*231.3*	*3:46*				
Kirkwood	*269.79*	*4:22*				
St. Louis	*282.41*	*4:39*	*12:00*	*13:15*		

<u>Equipment Turns</u>		<u>Next Day</u>
Trainset 1	7000-7001-7002-7003	7000
Other Sets	508, 510, 511, 513	MWRRS

<u>Trainmiles</u>	<u>Daily</u>	<u>Annual</u>
Trainset 1	276.32	86,212

Appendix 3

Scenario Timetables

Upgrade Track Conditions – 110 mph

Upgrade Track Conditions (110mph)
Route 1 - January 28, 2000 - Talgo (B-2)

Train Number			7000	7002	7004	7006
Station	Milepost	Schedule Time	Daily	Daily	Daily	Daily
Kansas City	0	0:00	7:00	11:00	15:00	18:00
Ft. Scott	98.2	1:32	8:32	12:32	16:32	19:32
Baxter Springs/Joplin	158.6	2:16	9:16	13:16	17:16	20:16
Tulsa	263.4	4:02	11:02	15:02	19:02	22:02

Train Number			7001	7003	7005	7007
Station	Milepost	Schedule Time	Daily	Daily	Daily	Daily
Tulsa	0	0:00	7:00	11:00	15:00	18:00
Baxter Springs/Joplin	104.8	1:44	8:44	12:44	16:44	19:44
Ft. Scott	165.2	2:27	9:27	13:27	17:27	20:27
Kansas City	263.4	4:02	11:02	15:02	19:02	22:02

Equipment Turns		Next Day
Trainset 1	7000-7005	7000
Trainset 2	7002-7007	7002
Trainset 3	7001-7004	7001
Trainset 4	7003-7006	7003

Upgrade Track Conditions (110mph)
Route 3 - January 28, 2000 - Talgo (B-2)

Train Number			7000
Station	Milepost	Schedule Time	Daily
Kansas City	0	0:00	6:00
Lawrence	39.12	0:38	6:38
Topeka	69.08	1:04	7:04
Salina	187.52	2:19	8:19
Hays	289.72	3:26	9:26
Limon	549.32	6:03	12:03
Denver	641.22	7:27	13:27

Train Number			7001
Station	Milepost	Schedule Time	Daily
Denver	0	0:00	6:00
Limon	91.9	1:21	7:21
Hays	351.5	3:58	9:58
Salina	453.7	5:06	11:06
Topeka	572.14	6:22	12:22
Lawrence	602.1	6:47	12:47
Kansas City	641.22	7:27	13:27

Equipment Turns		Next Day
Trainset 1	7000	7001
Trainset 2	7001	7000

Upgrade Track Conditions (110mph)
Route 4 - January 28, 2000 - Talgo (B-2)

Train Number			7000	7002
Station	Milepost	Schedule Time	Daily	Daily
Kansas City	0	0:00	7:00	17:00
Lawrence	39.42	0:48	7:48	17:48
Topeka	64.02	1:10	8:10	18:10
Newton	198.74	2:45	9:45	19:45
Wichita	225.72	3:11	10:11	20:11
Arkansas City	276.92	3:53	10:53	20:53
Perry	335.42	4:36	11:36	21:36
Tulsa	421.92	5:51	12:51	22:51

Train Number			7001	7003
Station	Milepost	Schedule Time	Daily	Daily
Tulsa	0	0:00	7:00	17:00
Perry	86.5	1:11	8:11	18:11
Arkansas City	145	1:56	8:56	18:56
Wichita	196.2	2:38	9:38	19:38
Newton	223.18	3:02	10:02	20:02
Topeka	357.9	4:37	11:37	21:37
Lawrence	382.5	5:00	12:00	22:00
Kansas City	421.92	5:51	12:51	22:51

Equipment Turns		Next Day
Trainset 1	7000-7003	7000
Trainset 2	7001-7002	7001

Upgrade Track Conditions (110mph)
Route 5 - January 28, 2000 - Talgo (B-2)

Train Number			7000	7002
Station	Milepost	Schedule Time	Daily	Daily
Kansas City	0	0:00	7:00	17:00
Lawrence	39.42	0:48	7:48	17:48
Topeka	64.02	1:10	8:10	18:10
Newton	198.74	2:45	9:45	19:45
Wichita	225.72	3:11	10:11	20:11
Arkansas City	276.92	3:53	10:53	20:53
Perry	335.42	4:35	11:35	21:35
Oklahoma City	397.42	5:21	12:21	22:21

Train Number			7001	7003
Station	Milepost	Schedule Time	Daily	Daily
Oklahoma City	0	0:00	7:00	17:00
Perry	63	0:43	7:43	17:43
Arkansas City	120.5	1:26	8:26	18:26
Wichita	171.7	2:08	9:08	19:08
Newton	198.68	2:33	9:33	19:33
Topeka	333.4	4:07	11:07	21:07
Lawrence	358	4:30	11:30	21:30
Kansas City	397.42	5:21	12:21	22:21

Equipment Turns		Next Day
Trainset 1	7000-7003	7000
Trainset 2	7001-7002	7001

Upgrade Track Conditions (110mph)
Route 6 - January 28, 2000 - Talgo (B-2)

Train Number			7000	7002	511	513
Station	Milepost	Schedule Time	Daily	Daily	Daily	Daily
St. Louis	0	0:00			14:22	18:18
Kirkwood	12.62	0:16				18:34
Washington	51.11	0:53				19:11
Hermann	80.33	1:22				19:40
Jefferson City	124.91	2:05			16:08	20:23
Sedalia	188.31	3:02				21:20
Warrensburg	217.81	3:29				21:47
Lee's Summit	257.44	4:06				22:24
Independence	270.61	4:22				22:40
Kansas City	282.41	4:40			18:22	22:58
Kansas City	0	0:00	8:30	15:45	18:27	23:03
Lawrence	39.12	0:38	9:08	16:23	19:06	23:41
Topeka	69.08	1:00	9:30	16:45	19:27	0:03

Train Number			508	510	7001	7003
Station	Milepost	Schedule Time	Daily	Daily	Daily	Daily
Topeka	0	0:00	6:54	8:09	13:15	20:00
Lawrence	29.96	0:24	7:18	8:33	13:39	20:24
Kansas City	69.08	1:00	7:54	9:09	14:15	21:00
Kansas City	0	0:00	7:59	9:14		
Independence	11.8	0:17				
Lee's Summit	24.97	0:33				
Warrensburg	64.6	1:10				
Sedalia	94.1	1:37				
Jefferson City	157.5	2:35	10:13	11:28		
Hermann	202.08	3:16				
Washington	231.3	3:46				
Kirkwood	269.79	4:22				
St. Louis	282.41	4:39	12:00	13:15		

Equipment Turns		Next Day
Trainset 1	7000-7001-7002-7003	7000
Other Sets	508, 510, 511, 513	MWRRS

Trainmiles	Daily	Annual
Trainset 1	276.32	86,212