Impacts of Amtrak Service Expansion in Kansas

Prepared for:

Kansas Department of Transportation
Topeka, KS

Prepared by:

Economic Development Research Group, Inc.
2 Oliver Street, 9th Floor
Boston, MA 02109

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Economic Development
RESEARCH GROUP

This report presents EDR Group's analysis of expanding Amtrak rail service between Kansas City and Oklahoma City, as described in the document *Feasibility Report of Proposed Amtrak Service: Kansas City, Missouri – Oklahoma City, Oklahoma to Fort Worth, Texas*[1](hereafter called the *Amtrak Study*). That study presents four schedule alternatives, which either extend the existing Heartland Flyer service, or provide new service along existing alignments. These alternatives are briefly described below (see Amtrak Study for detailed description):

- *ALT-1*: Extend the Heartland Flyer service from Oklahoma City to Newton, KS
- *ALT-2*: Extend the Heartland Flyer service from Oklahoma City to Kansas City
- *ALT-3*: Provide new stand-alone service from Fort Worth, TX to Kansas City
- *ALT-4*: Provide new stand-alone service from Oklahoma City to Kansas City

The analysis is described in two sections. The first presents the method, including data sources and key assumptions leading to final results. The second shows the results from the perspective of

- *Amtrak Riders* – in terms of travel cost savings
- *Society* – in terms of a benefit/cost ratio
- *The Kansas Economy* – in terms of net new sales, value added, wages, and jobs
- *The Kansas State & Local Government* – in terms of net changes in revenues and expenditures

Methodology[2]

The overall goal of the study is to determine how expanding Amtrak service in Kansas translates into benefits, costs, and economic impacts. Impacts result from both the costs associated with the project and the ongoing service provision, once the facilities are constructed and operating. Therefore, the two primary facets of the analysis are, first, to identify the costs associated with project implementation and second, to determine how the expanded service affects travel behavior, costs, and spending patterns.

Project Costs

Project costs fall into five categories:

- *Rail Costs* – capital investment in rail infrastructure including double-tracking, sidings, and grade crossings.
- *Rolling Stock Costs* – purchase of rail cars and locomotives to meet service requirements
- *Mobilization Costs* – hiring and training new personnel to operate the service

[1] Report prepared by M.W. Franke, B.E. Hillblom, and R.P. Hoffman, Amtrak, Chicago IL, March 9, 2010.
[2] This section provides a general description of the methodology. For specific intermediate calculations and other values, see accompanying spreadsheet "*KDOT Rail Study Work and Assumptions 4-14-2010.xlsx*"

- *Operating Costs* – direct costs of service provision, including fuel, wages (to conductors and other staff), rolling stock and locomotive maintenance, and other purchases.
- *Station Costs* - renovating existing stations and/or constructing new stations along the expanded service route to comply with Amtrak and Americans with Disabilities Act (ADA) requirements

The Amtrak Study provides estimates for the first four of these categories, as shown in Table 1.

Table 1: Rail and other costs associated with expanding Amtrak service in Kansas

Cost Description	ALT-1	ALT-2	ALT-3	ALT-4
Infrastructure Improvement Costs ($m)	114.40	274.80	413.20	251.20
Rolling Stock Costs ($m)	40.00	40.00	63.00	56.00
Mobilization Costs ($m)	1.50	3.00	3.10	2.10
Operating Costs ($m/year)	5.90	10.40	14.10	8.5

Source: Amtrak Study

An important goal of the analysis is to distinguish between impacts within the state of Kansas versus those occurring elsewhere. In estimating economic impacts, it is necessary to determine the location of the spending activity (this is where the impacts are). However, in estimating Kansas' return on investment, it is necessary to determine the funding source rather than the location of spending. These allocation assumptions are described accompanying each type of result.

Station costs were estimated by EDR Group based on (1) the population of each city along the route profile, and (2) station costs reported for similar construction projects[3]. Based on this research, minimum development costs to meet ADA platform requirements were assumed to be $3 million per station, regardless of city size. From there, station development costs were assumed to increase based on the expected usage, approximated by the population of the surrounding town/city ($100 per resident). This formula yields estimated costs for Wichita, KS – the largest of the stations needing to be reconstructed – roughly equal to Rensselaer, NY (a station of similar scale). An important assumption of the study is that all station development costs are funded by the communities in which they reside. Station costs are summarized in Table 2.

[3] Relevant construction costs were found online for recent Amtrak stations in Fort Madison IA, Rensselaer NY, and Lancaster PA

Table 2: Estimated station costs associated with expanded Amtrak service.

Station	2008 Population	Existing Stations		Station Cost ($m)	
		Southwest Chief	Heartland Flyer	ALT-1	ALTs-2, 3, & 4
Kansas City, Missouri	595,000	Y			
Lawrence, Kansas	90,000	Y			
Topeka, Kansas	120,000	Y			
Emporia, Kansas	26,000				5.60
Strong City, Kansas	527				3.05
Newton, Kansas	18,000	Y			
Wichita, Kansas	366,000			39.60	39.60
Arkansas City, Kansas	11,000			4.10	4.10
Ponca City, Oklahoma	24,000			5.40	5.40
Perry, Oklahoma	5,000			3.50	3.50
Guthrie, Oklahoma	11,000			4.10	4.10
Edmond, Oklahoma	80,000			11.00	11.00
Oklahoma City, Oklahoma	551,000		Y		
Norman, Oklahoma	107,000		Y		
Purcell, Oklahoma	5,500		Y		
Pauls Valley, Oklahoma	6,000		Y		
Ardmore, Oklahoma	25,000		Y		
Gainsville, Texas	16,000		Y		
Total Station Costs				67.7	76.35
Kansas Station Costs				43.7	52.35

Source: Station list provided by Amtrak Study; station costs estimated by EDR Group. Costs only shown for stations needing development for the specific alternative.

Project Benefits

EDR Group identifies two types of benefits associated with expanding passenger rail in Kansas. The first arises due to passengers' ability to divert to this mode from other modes, which may be less convenient, more expensive, or slower (diversion benefits). The second arises from new trip-making, and the consumer spending associated with it (induced benefits).

Diversion Benefits

Diversion benefits are estimated based on the Amtrak Study's incremental ridership projections for each alternative. These projections are based on hypothetical annual operation of each alternative's service schedule in the context of current (2009) demographic and travel demand patterns in the corridor. Additionally:

> The ridership and ticket revenue estimates […] reflect the additional or "incremental" annual 2009 ridership and ticket revenue that would have been expected to result on a stand alone basis from the implementation of each [alternative]. (p. 25)

There are two important points here. The first is that Amtrak's ridership estimates are net "incremental" increases, after controlling for any possible feedback effects on ridership of remaining (parallel) rail service. The second is that their estimates are based on 2009 trends. As such, future ridership and revenue estimates are adjusted based on background

population growth in the service corridor. Amtrak's ridership estimates, with associated ticket revenues, are summarized in Table 3.

Table 3: Incremental ridership and ticket revenue

Incremental Impact	ALT-1	ALT-2	ALT-3	ALT-4
Ridership (Annual Passenger-Trips)	92,500	118,200	174,000	65,900
Ticket Revenue ($m)	2.7	5.2	6.1	2.1

Source: Amtrak Study

In order to determine diversion benefits for each alternative, it was necessary to identify the source of incremental ridership from competing modes: passenger car, bus, and airplane. To accomplish this task, total incremental ridership (for each alternative) was allocated to origin-destination pairs along the route, as shown in Table 4.

Table 4: Incremental ridership by origin-destination city pair

Origin/Destination Pair	ALT-1	ALT-2	ALT-3	ALT-4
Kansas City - Wichita	37,000	35,460	34,800	23,065
Kansas City - Oklahoma City	0	11,820	26,100	19,770
Kansas City - Fort Worth	4,625	47,280	34,800	13,180
Wichita - Oklahoma City	18,500	5,910	17,400	6,590
Wichita - Fort Worth	32,375	17,730	34,800	3,295
Oklahoma City - Fort Worth	0	0	26,100	0
TOTALS	**92,500**	**118,200**	**174,000**	**65,900**

Source: EDR Group estimates based on Amtrak Study

The allocations shown above were made based on (1) the qualitative description of each alternative in the Amtrak Study, and (2) a supplemental ridership document provided by Amtrak[4].

It should be noted that allocating trips to the six primary origin-destination pairs shown above was a simplifying assumption. Although there will clearly be trip-making activity to and from smaller cities, the above list is assumed to account for the majority of trips without distorting the results (and greatly simplifying the analysis).

For each of the origin-destination pairs shown above, EDR Group gathered data describing travel distance, time, and costs for competing modes. For passenger car trips, Google Maps provided travel time and distances, and the Kansas Turnpike Authority website provided toll rate information. For the bus trips, travel time and fare information was compiled from websites of Greyhound, Americanos, and Jefferson Bus lines. For air trips, time and fare information was gathered from cheaptickets.com.

This information, along with the Amtrak Study estimates of new service travel time and cost, was used to estimate modal diversion for each city pair. More specifically, diversion was estimated based on vehicle operating costs (cars only), fare and toll costs, in-vehicle travel times, and out-of-vehicle (access/wait/transfer) times. Bus and rail

[4] "Kansas DOT Study - Ridership Revenue - Supplemental PDF File 022210.pdf"

travel was assumed to require an average of 30 minutes of out-of-vehicle time per trip; for air travel, two hours was used.

Based on this methodology, the following observations can be made of the resulting diversions:

- Short distance city pairs divert heavily from passenger car trips. For example, 75% of incremental ridership between Kansas City and Wichita are estimated to shift from passenger car.
- Long distance pairs divert primarily from air trips. For example, 60% of incremental ridership between Kansas City and Fort Worth are estimated to shift from air.
- Bus trips are very price sensitive, and therefore have a relatively low and constant diversion rate among city pairs (between 5% and 15%).
- 10% of all new trips are estimated to be induced – that is, new travel not diverted from any other mode. The remaining 90% of incremental trips are diverted from other modes.

For each diverted trip, travel cost savings can be calculated by comparing the generalized cost of the trip by rail vs. the previous mode. This was done using the following monetization rates:

- In-vehicle travel time: $10.60 per hour
- Out-of-vehicle travel time: $21.20 per hour
- Passenger car operating cost: $0.58 per vehicle-mile

The savings associated with these mode switches serve as the basis for diversion benefits. Safety and environmental benefits from fewer passenger car miles were also estimated based on the monetization rates:

- Safety: $0.15 per passenger-car-mile
- Environmental: $0.028 per passenger-car-mile

Induced Benefits[5]

In addition to benefits from modal diversion, induced travel produces economic benefits from consumer spending associated with the trip-making activity (as compared to making no trip). Note that we assume no net consumer spending for diverted trips, other than the out-of-pocket savings resulting from using a less expensive mode.

In the present analysis, 10% of incremental trips are estimated to be induced – that is, new travel not diverted from any other mode. This value is estimated based on comparable ridership estimate studies as well as an assessment of the qualitative characteristics of the proposed service. In addition to the cost of the Amtrak fare, each

[5] Induced benefits – those associated with new trip-making activity – are not to be confused with induced economic impacts, which are impacts from re-spending wages in the local economy.

induced trip potentially yields consumer spending on retail, restaurants, and accommodations. Based on comparable studies, we apply the following average spending amounts (noting that some travelers will spend more and some less):

- Retail: $5 per induced trip
- Restaurant: $25 per induced trip
- Accommodations: $25 per induced trip

This spending is further assigned to Kansas only based on origin destination patterns. For example, all $55 of spending for an induced trip between Kansas City and Wichita is assigned to Kansas. For an induced trip between Wichita and Oklahoma City (or Oklahoma City to Wichita), only half of the spending is assigned to Kansas.

Results

Passengers' Perspective

The expanded Amtrak service makes passengers better-off by providing them with a potentially more convenient, faster, cheaper, or more reliable option versus other travel modes. Based on the methodology described above, diversion benefits are as shown in Table 5.

Table 5: Passenger benefits from Amtrak service expansion. Results are annual benefits for the first full year of service operation (assumed to be 2014)

Benefit Type	ALT-1	ALT-2	ALT-3	ALT-4
Passenger IVTT* Savings	($2,090,526)	($5,312,783)	($5,736,713)	($2,507,684)
Passenger OVTT* Savings	($182,748)	$624,231	$352,995	($18,910)
Vehicle Operation Savings	$8,504,880	$10,640,116	$15,947,639	$5,779,502
Net Toll/Fare Savings	$3,113,750	$6,058,145	$8,680,222	$3,056,241
Value of Safety Benefits	$2,517,409	$3,149,430	$4,720,435	$1,710,709
Value of Emission Reduction	$404,841	$503,192	$756,709	$274,358
Total Passenger Benefits	**$12,267,607**	**$15,662,330**	**$24,721,287**	**$8,294,216**
Benefits to Kansas Residents	**$8,060,340**	**$9,936,588**	**$14,368,735**	**$5,267,099**

Source: EDR Group summary of TREDIS results

** IVTT denotes "in-vehicle travel time", and OVTT denotes "out-of-vehicle travel time", which is comprised of access, wait, and transfer times.*

Table 5 indicates that the primary benefit of the new rail service is that it is cheaper and safer than alternative modes (recalling that ridership is drawn from car, bus, and air travel). However, it is also slower, as indicated by the negative (dis-savings) in the in-vehicle travel time category. Overall, the lower cost more than compensates travelers for the slower travel times. Of the three alternatives, ALT-3 produces the largest total passenger benefits. This is expected, as it is the most aggressive in terms of new service provided, and also is the most expensive.

Societal Perspective

By comparing passenger benefits to project costs over the life of the project, a societal benefit/cost ratio can be calculated (Table 6). To estimate this, we assumed that project construction begins in 2011 and ends in 2013, with 2014 being the first full year of service operation. Benefits are assumed to grow with background population growth in the corridor (1.5% per year), and are calculated out to 2030.

Note that benefit/cost metrics do not include any secondary economic growth from project construction or operation, but rather focus on the direct benefits to passengers (including environmental benefits), compared to costs. Furthermore, because the perspective is societal, all project costs and benefits are considered – regardless of where the benefits arise or who is responsible for the costs.

Table 6: Benefit/Cost results of Amtrak service expansion,

Metric	ALT-1	ALT-2	ALT-3	ALT-4
Present Value of Costs ($m)	$234.14	$408.43	$582.31	$412.41
Present Value of Benefits ($m)	$98.96	$103.83	$173.42	$56.63
Net Present Value ($m)	**($135.18)**	**($304.60)**	**($408.89)**	**($355.78)**
Benefit/Cost Ratio	**0.42**	**0.25**	**0.30**	**0.14**

Source: EDR Group summary of TREDIS results based on a 5% social discount rate and a service period of 2014 to 2030.

Table 6 indicates that none of the proposed service expansion alternatives generate societal benefits equivalent to costs (B/C ratio of 1). However, of the three alternatives, ALT-1 has the most favorable benefit-cost ratio. This is primarily due to its lower cost relative to the other two alternatives.

Kansas State Economy Perspective

The proposed project generates economic impacts from each phase of activity: startup construction, ongoing operation, diversion, and induced consumer spending. These economic impacts are due to different stimulating factors. For startup construction, economic impacts follow from to the spending activity of the construction and engineering firms – on wages and materials. For ongoing operations, the impacts are stimulated by the wage spending by Amtrak on personnel for service provision and maintenance, as well as direct purchases, such as re-stocking the food car. For diversion benefits, the stimulating activity is due to the net change in out-of-pocket expenses by households and businesses. Finally, induced travel stimulates the economy by creating totally new demand for retail, restaurant, and accommodations services.

In order to determine the economic impacts of these activities to the State of Kansas, it is necessary to determine how much of the total activity occurs within the state. Infrastructure costs are allocated based on the portion of track-miles needing improvement; rolling stock costs are assumed to generate no economic activity in Kansas (the new cars are purchased by out-of-state companies); mobilization costs are allocated based on the portion of new service track-miles within Kansas; For operating costs, it is assumed that Alternatives 1 and 2 are wholly serviced by the existing Heartland Flyer

maintenance facility in Fort Worth, TX. For Alternatives 3 and 4, we assume that 50% of operating costs will be spent in Kansas City, the site of an alternative facility. Table 7 summarizes the in-state portion of impacts for each activity type.

Table 7: Kansas portion of direct economic activity by type

Activity Description	Basis	ALT-1	ALT-2	ALT-3	ALT-4
Infrastructure	Portion of improved track-mi in KS	20.7%	68.4%	49.5%	65.3%
Rolling Stock	Purchased from out-of-state producer	0%	0%	0%	0%
Mobilization	Portion of new service-miles in KS	54.1%	70.5%	46.5%	70.5%
Service Operation	Location of O&M facilities	0%	0%	50%	50%
Diversion Benefits	Allocated by Trip Origin/Destination	70%	65%	60%	67.5%
Induced Benefits	Allocated by Trip Origin/Destination	70%	65%	60%	67.5%

Source: Amtrak Study

The Kansas portion of each "direct effect", in turn, generates follow-on economic activity from in-state supply-chain purchases (indirect effects) and re-spending of wages (induced effects). The total economic impacts of each of the activities described above are shown in Table 8. These results indicate that the impacts of each activity type are generally proportional to the underling stimulating activity.

Table 8: Economic impacts of proposed Amtrak service

Impact Source	Metric	Alt-1	Alt-2	Alt-3	Alt-4
Construction Impact (average over construction period)	Jobs	351	1257	1339	1,129
	Output ($m)	42.810	153.308	163.398	137.7
	Value Added ($m)	20.314	72.785	77.548	65.4
	Wages ($m)	15.211	54.505	58.070	49.0
Service O&M Impact (2030)	Jobs	0	0	97	58
	Output ($m)	0	0	14.4	8.7
	Value Added ($m)	0	0	7.079	4.3
	Wages ($m)	0	0	4.721	2.8
Travel Savings Impact (2030)	Jobs	133	181	248	103
	Output ($m)	14.299	19.622	26.853	11.175
	Value Added ($m)	7.281	9.992	13.674	5.691
	Wages ($m)	4.656	6.390	8.745	3.639
Tourism Spending Impact (2030)	Jobs	15	18	24	10
	Output ($m)	0.924	1.096	1.490	0.635
	Value Added ($m)	0.461	0.547	0.743	0.317
	Wages ($m)	0.301	0.359	0.487	0.207
Total 2030 Impact	Jobs	148	200	370	171
	Output ($m)	15.223	20.718	42.743	20.491
	Value Added ($m)	7.742	10.539	21.496	10.275
	Wages ($m)	4.958	6.748	13.953	6.692

Source: EDR Group summary of TREDIS results

State Government Perspective

Finally, all the cost and revenue information discussed above can be used to determine the return on investment from the perspective of the Kansas state and local government [*for the rest of this section, the term "Kansas" denotes the combined state and local government*].

To test the sensitivity of Kansas' return on investment, several cost sharing scenarios were developed.

- *Best Case Scenario*: 80% federal matching funds are procured for rail infrastructure costs and rolling stock purchases. The balance of infrastructure costs accrue to Kansas based on the portion of *improved* track-miles in-state. The balance of rolling stock purchases, as well as all mobilization costs and net operating loss (farebox revenues less operating costs) accrue to Kansas based on the fraction of *new service* track-miles in Kansas. Station costs accrue to Kansas based on in-state station locations.
- *Middle Scenario*: No federal matching funds are procured. Infrastructure costs accrue to Kansas based on the in-state portion of *improved* track-miles. Rolling stock purchase, mobilization costs, and net operating loss accrue to Kansas based on in-state portion of *new service* track-miles. Station costs accrue to Kansas based on in-state station locations.
- *Worst Case Scenario*: No federal matching funds are procured. Infrastructure costs accrue to Kansas based on the in-state portion of *improved* track-miles. Kansas pays 100% of rolling stock purchases, mobilization costs, and net operating loss. Station costs accrue to Kansas based on in-state station locations.

For all three scenarios, the only source of revenues to Kansas is tax receipts associated with the economic impacts (discussed in the prior section). In other words, as economic impacts increase, they generate additional income tax, sales tax and property tax receipts, along with other (smaller) revenue sources. It should be noted that these tax receipts are adjusted to account for lost fuel tax revenues due to the auto travel diverted to Amtrak.

The costs and revenues are phased in based on when they occur during the project life cycle. Infrastructure costs, station costs, rolling stock purchase, and mobilization costs – as well as tax receipts from these economic activities – all occur within the construction period, assumed to be 2011-2013. Net operating loss, and the tax receipts associated with diversion benefits, induced benefits, and operating expenses, all begin with service operation in 2014 and increase with background travel demand to the analysis end year (2030). It should be noted that operating costs are assumed to be fixed over the entire analysis period, while ticket revenues increase with background population growth (1.5% per year)[6]. As such, the net operating loss shrinks over time.

[6] This implies no marginal operating cost per passenger.

Table 9 presents the return on investment (ROI) analysis from the standpoint of the Kansas State and Local government. These are based on a private discount rate of 2.5%, reflecting the inflation-adjusted opportunity cost of capital for the State.

Table 9: Estimated increase in Kansas revenues from rail expansion

Scenario	Metric	Alt-1	Alt-2	Alt-3	Alt-4
Best Case	PV of Revenues ($m)	11.5	25.7	39.3	25.8
	PV of Costs ($m)	69.6	130.9	136.3	143.9
	Net Present Value ($m)	**-58.0**	**-105.2**	**-97.0**	**-118.1**
	Revenue/Cost Ratio	**0.166**	**0.196**	**0.288**	**0.179**
Middle	PV of Revenues ($m)	11.5	25.7	39.3	25.8
	PV of Costs ($m)	104.1	295.4	314.3	298.9
	Net Present Value ($m)	**-92.5**	**-269.7**	**-275.0**	**-273.1**
	Revenue/Cost Ratio	**0.111**	**0.087**	**0.125**	**0.086**
Worst Case	PV of Revenues ($m)	11.5	25.7	39.3	25.8
	PV of Costs ($m)	137.9	323.4	394.6	337.8
	Net Present Value ($m)	**-126.4**	**-297.7**	**-355.3**	**-312.0**
	Revenue/Cost Ratio	**0.084**	**0.079**	**0.100**	**0.076**

Source: EDR Group summary of TREDIS results based on a 2.5% private discount rate and an analysis period of 2011-2030.

Table 8 indicates that none of the alternatives generate a positive return for the State of Kansas. In the best case scenario, Alternative 3 recovers nearly 29 cents for every dollar invested. In the worst case scenario, Alternative 2 recovers about 8 cents for every dollar invested.