State-Mandated Performance Audit

2012–2015

DART

Dallas Area Rapid Transit

Prepared by

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Performance Indicators

1. Executive Summary

Section 452.454 of the Texas Transportation Code describes the requirements and purpose of the Quadrennial Performance Review. The audit is designed to provide evaluative information to the transit agency to suggest ways to improve the efficiency and effectiveness of its operations. The purpose of this section of the report is to examine Dallas Area Rapid Transit's (DART) compliance with the following performance indicators for 2012–2015 in accordance with the above-mentioned code's statutory requirements:

- Operating cost per passenger
- Operating cost per revenue hour
- Operating cost per revenue mile
- Sales and use tax receipts per passenger
- Fare recovery rate
- Average vehicle occupancy
- On-time performance
- Number of accidents per 100,000 miles
- Number of miles between mechanical road calls.

Iknow's view is that DART demonstrated strong operating cost containment and good revenue growth over the review period. In addition, improved maintenance procedures resulted in very large increase in the number of miles between mechanical road calls.

To provide perspective on how the performance indicators have changed over time, data since 2008 has been presented. Commentary has been added to note significant events that took place during the review period or to note relevant trends in the data. The last Quadrennial Performance Review was conducted by the TransTech Management Inc., which covered the period 2008–2011. Each section contains definitions and a calculation methodology and each chart and table contains sources should the reader wish to investigate further.

1.1 Sources of Data

The primary source of data used for the DART Quadrennial Performance Review is the DART Quarterly Reports, which are comprehensive reports produced by the Finance Department with input from different operating and administrative departments throughout the organization. They are publicly available documents designed to present a complete summary of DART's quarterly results of operations.

Another source of data for the DART Quadrennial Performance Review is the National Transit Database (NTD). The NTD is the nation's source for information and statistics on the transit systems of the United States. Recipients or beneficiaries of grants from the Federal Transit Administration (FTA) are required by statute to submit data to the NTD. Each year, NTD performance data are used to apportion over $5 billion of FTA funds to transit agencies in urbanized areas. Annual NTD reports are submitted to Congress summarizing transit service and safety data. FTA audits each transit agency's annual NTD data to ensure compliance with statute.

A third source of information is various DART departments. For example, accident data was provided by the Risk Department (for Bus and Light Rail) and the Paratransit Department (for Paratransit).

Mechanical service call data was provided by TRE (Trinity Railway Express), as the commuter rail is commonly known, which is jointly owned by DART and the Fort Worth Transportation Authority. Each transit authority owns a 50 percent stake in the joint rail project and contractor Herzog Transit Services operates the line. Accident report data for the commuter rail comes from the Federal Railroad Administration, which collects and analyzes accident data from the railroads. Table 1.1 lists all the data sources that were used to compile this section of the Quadrennial Performance Review.

Table 1.1   **Sources of Data for Quadrennial Performance Review, 2008–2015**

Data Element	Source			
	Bus	Light Rail	Commuter Rail	Paratransit
Annual Operating Cost	DQR	DQR	DQR	DQR
Annual Passenger Trips	DQR	DQR	DQR	NTD
Revenue Miles	DQR	DQR	NTD	NTD
Revenue Hours	NTD	NTD	TRE Office	NTD
Annual Accidents	Risk Management Department	Risk Management Department	FRA Reports	Paratransit Department
Mechanical Service Calls	DQR	DQR	TRE Office	NTD
Operating Revenue	DQR	DQR	DQR	DQR
Fare Revenue	DQR	DQR	NTD	DQR
On-Time Performance	DQR	DQR	DQR	Paratransit Department
Sales and Use Tax	DQR	DQR	DQR	DQR

DQR—DART Quarterly Report; NTD—National Transit Database; FRA Reports—Federal Railroad Administration Reports; TRE Office—Trinity Railway Express. Commuter line that is jointly operated by DART and the Fort Worth Transportation Authority.
Source: Iknow

1.2 Base Data and Performance Indicators

This section looks at the base data for each of the four modes of transportation—bus, light rail, commuter rail, and paratransit—as well as system-wide data.

1.2.1 Bus

Table 1.2 shows the base data and performance indicator data for Bus, which is defined by the Federal Transit Administration as a transit mode comprised of rubber-tired passenger vehicles operating on fixed routes and schedules over roadways. Vehicles are powered by:

- Diesel
- Gasoline

- Battery
- Alternative fuel engines contained within the vehicle.

1.2.2 Light Rail

Table 1.3 shows the base data and performance indicator data for Light Rail, which is defined by the Federal Transit Administration as vehicles that travel along fixed rails—bars of rolled steel—forming a track. The vehicles are usually electrically propelled, typically through motors on board the vehicles, but motors may also be at a central location not on board the vehicles to pull the vehicles by cables or inclined plane. Light rail vehicles are typically Rail cars with:

- Motive capability;
- Usually driven by electric power taken from overhead lines;
- Configured for passenger traffic; and
- Usually operating on exclusive rights-of-way (ROW).

1.2.3 Commuter Rail

Table 1.4 shows the base data and performance indicator data for Commuter Rail, which is defined by the Federal Transit Administration as a transit mode that is an electric- or diesel-propelled railway for urban passenger train service consisting of local short-distance travel operating between a central city and adjacent suburbs. Service must be operated on a regular basis by or under contract with a transit operator for the purpose of transporting passengers within urbanized areas (UZAs), or between urbanized areas and outlying areas.

Such rail service, using either locomotive hauled or self-propelled railroad passenger cars, is generally characterized by:

- Multi-trip tickets
- Specific station to station fares
- Railroad employment practices
- Usually only one or two stations in the central business district

It does not include:

- Heavy rail (HR) rapid transit
- Light rail (LR)/streetcar transit service

1.2.4 Paratransit

Table 1.5 shows the base data and performance indicator data for Paratransit, which is defined by the Federal Transit Administration as types of passenger transportation which are more flexible than conventional fixed-route transit but more structured than the use of private automobiles.

1.2.5 System-Wide

Table 1.6 shows the aggregate base data and performance indicator data for all four of DART's transit modes.

Table 1.2   **Base Data and Performance Indicator Data for Bus**

	2008	2009	2010	2011	2012	2013	2014	2015
Base Data								
Annual Operating Cost	$216,675,024	$213,932,275	$229,055,812	$220,628,647	$228,930,035	$235,609,720	$235,908,080	$236,409,609
Annual Passenger Trips	45,019,216	42,639,010	37,594,689	36,811,888	38,353,064	37,867,641	37,269,632	36,405,178
Annual Passenger Miles					161,289,332	154,490,411	152,224,685	144,359,836
Annual Revenue Miles	27,350,856	26,711,323	26,492,183	24,885,646	24,906,908	25,150,158	25,091,219	25,151,244
Annual Vehicle Miles	32,026,242	31,425,086	31,107,716	29,029,813	28,699,507	29,159,663	29,282,137	29,223,047
Annual Revenue Hours	2,028,437	2,021,031	2,009,486	1,953,934	2,010,240	2,100,705	2,077,637	2,148,462
Annual Accidents	559	534	471	597	546	619	716	720
Annual Mechanical Service Calls	4,858	4,228	4,755	5,749	5,274	4,933	3,674	2,929
Annual Operating Revenue	$41,016,619	$38,117,821	$35,314,925	$30,022,359	$31,635,069	$35,946,084	$36,955,215	$36,936,535
Annual Fare Revenue	$30,912,818	$27,487,909	$30,668,336	$25,737,638	$26,922,667	$30,519,898	$31,571,921	$31,615,344
Sales and Use Tax								
Performance Indicators								
Subsidy per Passenger	$3.90	$4.12	$5.15	$5.18	$5.14	$5.27	$5.34	$5.48
Operating Cost per Revenue Mile	$7.92	$8.01	$8.65	$8.87	$9.19	$9.37	$9.40	$9.40
Operating Cost per Revenue Hour	$106.82	$105.85	$113.99	$112.92	$113.88	$112.16	$113.55	$110.04
Average Vehicle Occupancy					6.5	6.1	6.1	5.7
Fare Recovery Rate	14.3%	12.8%	13.4%	11.7%	11.8%	13.0%	13.4%	13.4%
Passengers Per Revenue Hour	22.2	21.1	18.7	18.8	19.1	18.0	17.9	16.9
On-Time Performance	92.0%	93.4%	92.1%	92.4%	95.0%	95.3%	80.8%	79.2%
Accidents per 100,000 Vehicle Miles	1.75	1.70	1.51	2.06	1.90	2.12	2.45	2.46
Vehicle Miles between Mechanical Service Calls	6,592	7,433	6,542	5,050	5,442	5,911	7,970	9,977

Source: DART Quarterly Reports; National Transit Database; Risk Management Department

Table 1.3   **Base Data and Performance Indicator Data for Light Rail**

	2008	2009	2010	2011	2012	2013	2014	2015
Base Data								
Annual Operating Cost	$73,396,136	$78,790,524	$91,201,086	$118,458,256	$123,152,346	$141,733,647	$156,250,909	$158,192,882
Annual Passenger Trips	19,437,603	18,965,249	17,799,186	22,302,390	27,653,893	29,471,890	29,458,289	29,894,386
Annual Passenger Miles					214,583,584	238,107,315	242,559,921	245,940,019
Annual Passenger Car Revenue Miles	5,346,949	5,354,578	5,335,813	6,905,168	7,980,208	9,096,981	9,530,028	10,209,881
Annual Passenger Car Vehicle Miles	5,565,105	5,366,126	5,363,430	7,289,025	8,132,070	9,511,949	9,680,332	10,345,454
Annual Train Revenue Hours	123,536	126,081	163,376	187,483	381,882	451,717	452,280	468,421
Annual Accidents	6	14	8	36	11	14	17	15
Annual Mechanical Service Calls	180	270	272	368	244	267	212	253
Annual Operating Revenue	$14,831,191	$13,450,716	$16,252,159	$24,103,065	$25,691,517	$29,171,104	$32,230,076	$31,494,077
Annual Fare Revenue	$13,342,613	$12,116,343	$14,978,710	$22,769,997	$23,881,087	$26,963,207	$28,808,567	$28,848,190
Performance Indicators								
Subsidy per Passenger	$3.01	$3.45	$4.21	$4.23	$3.52	$3.82	$4.21	$4.24
Operating Cost per Passenger Car Revenue Mile	$13.73	$14.71	$17.09	$17.16	$15.43	$15.58	$16.40	$15.49
Operating Cost per Train Revenue Hour	$594.13	$624.92	$558.23	$631.83	$322.49	$313.77	$345.47	$337.72
Average Vehicle Occupancy					26.9	26.2	25.5	24.1
Fare Recovery Rate	18.2%	15.4%	16.4%	19.2%	19.4%	19.0%	18.4%	18.2%
Passengers Per Train Revenue Hour	157.3	150.4	108.9	119.0	72.4	65.2	65.1	63.8
On-Time Performance	96.6%	95.0%	95.8%	95.2%	96.7%	93.8%	95.1%	93.6%
Accidents per 100,000 Passenger Car Miles	0.11	0.26	0.15	0.49	0.14	0.15	0.18	0.14
Vehicle Miles between Mechanical Service Calls	30,917	19,875	19,718	19,807	33,328	35,625	45,662	40,891

Source: DART Quarterly Reports; National Transit Database; Risk Management Department

Table 1.4　**Base Data and Performance Indicator Data for Commuter Rail**

	2008	2009	2010	2011	2012	2013	2014	2015
Base Data								
Annual Operating Cost	$22,062,626	$23,160,833	$24,256,863	$24,035,592	$24,175,237	$24,241,482	$25,473,582	$25,463,436
Annual Passenger Trips	2,746,992	2,789,030	2,469,215	2,425,335	2,252,140	2,092,782	2,283,895	2,173,653
Annual Passenger Miles					43,186,379	40,170,296	43,549,045	41,614,453
Annual Passenger Car Revenue Miles	1,565,010	1,292,607	1,239,709	1,142,577	1,109,867	1,144,466	1,152,028	1,153,406
Annual Passenger Car Vehicle Miles	1,816,944	1,451,563	1,438,099	1,347,672	1,306,050	1,351,552	1,364,059	1,366,293
Annual Train Revenue Hours	18,534	18,173	17,658	16,949	17,048	17,490	17,593	17,569
Annual Accidents	4	2	4	7	3	3	8	5
Annual Mechanical Service Calls	8	8	12	6	11	11	6	5
Annual Operating Revenue	$4,668,871	$4,246,602	$8,979,699	$10,611,064	$11,504,176	$11,824,022	$11,851,569	$12,229,745
Annual Fare Revenue	$3,108,098	$2,910,279	$8,026,572	$10,291,475	$8,206,398	$8,822,554	$9,478,034	$9,382,708
Performance Indicators								
Subsidy per Passenger	$6.33	$6.78	$6.19	$5.54	$5.63	$5.93	$5.96	$6.09
Operating Cost per Passenger Car Revenue Mile	$14.10	$17.92	$19.57	$21.04	$21.78	$21.18	$22.11	$22.08
Operating Cost per Train Revenue Hour	$1,190.39	$1,274.46	$1,373.70	$1,418.11	$1,418.07	$1,386.02	$1,447.94	$1,449.34
Average Vehicle Occupancy					38.9	35.1	37.8	36.1
Fare Recovery Rate	14.1%	12.6%	33.1%	42.8%	33.9%	36.4%	37.2%	36.8%
Passengers Per Train Revenue Hour	148.2	153.5	139.8	143.1	132.1	119.7	129.8	123.7
On-Time Performance	97.8%	98.6%	98.1%	97.1%	97.9%	98.7%	98.6%	98.3%
Number of Accidents per 100,000 Passenger Car Vehicle Miles	0.22	0.14	0.28	0.52	0.23	0.22	0.59	0.37
Number of Vehicle Miles between Mechanical Service Calls	227,118	181,445	119,842	224,612	118,732	122,868	227,343	273,259

Number of Vehicle Miles between Mechanical Service Calls

Table 1.5   **Base Data and Performance Indicator Data for Paratransit**

	2008	2009	2010	2011	2012	2013	2014	2015
Base Data								
Annual Operating Cost	$33,276,443	$33,679,545	$35,456,461	$36,404,444	$38,307,192	$28,838,764	$31,860,940	$33,541,138
Annual Passenger Trips	737,027	750,763	772,675	790,350	801,811	763,469	753,398	781,797
Annual Passenger Miles					12,798,886	11,853,473	11,103,934	11,168,545
Annual Revenue Miles	8,109,876	7,818,699	8,458,570	8,638,492	8,813,149	7,556,040	7,083,129	7,339,812
Annual Vehicle Miles	10,759,256	11,271,213	11,478,772	11,687,304	11,950,428	9,532,597	9,088,968	10,164,186
Annual Revenue Hours	441,543	455,030	513,131	521,623	529,754	501,626	465,026	460,030
Annual Accidents	179	110	43	25	113	281	342	252
Annual Mechanical Service Calls	456	534	485	598	631	598	545	239
Annual Operating Revenue	$1,812,966	$1,976,131	$2,302,591	$2,321,874	$2,281,805	$2,118,756	$2,034,510	$2,202,011
Annual Fare Revenue	$1,812,966	$1,976,131	$2,302,591	$2,321,874	$2,281,805	$2,118,756	$2,034,510	$2,202,011
Performance Indicators								
Subsidy per Passenger	$42.69	$42.23	$42.91	$43.12	$44.93	$35.00	$39.59	$40.09
Operating Cost per Revenue Mile	$4.10	$4.31	$4.19	$4.21	$4.35	$3.82	$4.50	$4.57
Operating Cost per Revenue Hour	$75.36	$74.02	$69.10	$69.79	$72.31	$57.49	$68.51	$72.91
Average Vehicle Occupancy					1.5	1.6	1.6	1.5
Fare Recovery Rate	5.4%	5.9%	6.5%	6.4%	6.0%	7.3%	6.4%	6.6%
Passengers Per Revenue Hour	1.7	1.6	1.5	1.5	1.5	1.5	1.6	1.7
On-Time Performance					87%	89%	91%	91%
Number of Accidents per 100,000 Vehicle Miles	1.66	0.98	0.37	0.21	0.95	2.95	3.76	2.48
Number of Vehicle Miles between Mechanical Service Calls	23,595	21,107	23,668	19,544	18,939	15,941	16,677	42,528

Source: DART Quarterly Reports; National Transit Database; Risk Management Department

Table 1.6 **Base Data and Performance Indicator Data System-Wide**

	2008	2009	2010	2011	2012	2013	2014	2015
Base Data								
Annual Operating Cost	$345,410,229	$349,563,177	$379,970,222	$399,526,939	$414,564,810	$430,423,613	$449,493,511	$453,607,065
Annual Passenger Trips	67,940,838	65,144,052	58,635,765	62,329,963	69,060,908	70,195,782	69,765,214	69,255,014
Annual Passenger Miles					431,858,181	444,621,495	449,437,585	443,082,853
Annual Revenue Miles	42,372,691	41,177,207	41,526,275	41,571,883	42,810,132	42,947,645	42,856,404	43,854,343
Annual Vehicle Miles	50,167,547	49,513,988	49,388,017	49,353,814	50,088,055	49,555,761	49,415,496	51,098,980
Annual Revenue Hours	2,612,050	2,620,315	2,703,651	2,776,405	2,938,924	3,071,538	3,012,536	3,094,482
Annual Accidents	748	660	526	665	673	917	1,083	992
Annual Mechanical Service Calls	5,502	5,040	5,524	6,721	6,160	5,809	4,437	3,426
Annual Operating Revenue	$62,329,647	$57,791,269	$62,849,373	$67,058,362	$71,112,567	$79,059,966	$83,071,370	$82,862,368
Annual Fare Revenue	$49,176,495	$44,490,662	$55,976,208	$61,120,985	$61,291,957	$68,424,415	$71,893,032	$72,048,253
Sales and Use Tax Receipts	$416,147,831	$377,596,792	$375,470,797	$402,403,999	$432,478,059	$455,699,830	$485,740,400	$518,623,932
Performance Indicators								
Subsidy per Passenger	$4.36	$4.68	$5.53	$5.43	$4.97	$5.01	$5.25	$5.35
Operating Cost per Revenue Mile	$8.15	$8.49	$9.15	$9.61	$9.68	$10.02	$10.49	$10.34
Operating Cost per Revenue Hour	$132.24	$133.41	$140.54	$143.90	$141.06	$140.13	$149.21	$146.59
Average Vehicle Occupancy					10.1	10.4	10.5	10.1
Fare Recovery Rate	14.2%	12.7%	14.7%	15.3%	14.8%	15.9%	16.0%	15.9%
Passengers per Revenue Hour	26.0	24.9	21.7	22.4	23.5	22.9	23.2	22.4
On-Time Performance								
Number of Accidents per 100,000 Car Miles	1.49	1.33	1.07	1.35	1.34	1.85	2.19	1.94
Number of Vehicle Miles between Mechanical Service Calls	9,118	9,824	8,941	7,343	8,131	8,531	11,137	14,915
Sales and Use Tax Receipts per Passenger	$6.13	$5.80	$6.40	$6.46	$6.26	$6.49	$6.96	$7.49

Source: DART Quarterly Reports; National Transit Database; Risk Department; Paratransit Department; TRE Office; FRA Reports

1.3 Summary of Key Findings

- **Operating cost per passenger** rose by 9.1 percent over the review period. With passenger trips relatively flat during the period, the rise was due to an increase in operating costs. Light rail expansion was the primary driver.

- **Operating cost per revenue hour** grew 3.9 percent over the review period. Light Rail, Commuter Rail, and Paratransit all saw low single-digit growth. Cost containment and a healthy growth in revenue hours, due to new service (D-Link) and extended hours, drove down Bus operating cost per revenue hour by 3.4 percent.

- **Operating cost per revenue mile** rose 6.8 percent during the period. Paratransit saw the largest gain of the four transit modes, primarily due to a double-digit drop in revenue miles. A shift in vendors and a rise in rates were the primary factors.

- **Sales and use tax receipts per passenger** rose a healthy 19.6 percent during the period. With passenger trips essentially flat, growth was entirely due to an almost 20 percent rise in sales and use tax receipts. A steadily improving economy and greater consumer spend fueled the growth.

- **Fare recovery rate**, which is defined as annual revenue as a percent of operating cost, rose from 14.8 percent to 15.9 percent over the period. The DART across-the-board rate hike of about 25 percent in December 2012 was the primary driver. A Bus fleet size increase of over 6 percent during the period also boosted revenue.

- **Average vehicle occupancy**, which is defined as passenger miles as a percent of revenue miles, was flat during the period. Passenger miles and revenue miles both rose about 2.5 percent during the period. Bus experienced a double-digit drop in passenger miles due to a drop in passenger trips and a system redesign that focused on shorter routes.

- **On-time performance** was strong during the period. Light and Commuter Rail both experienced mid- to upper-90 percent on-time performance. Bus performance dropped considerably after 2013 as a new, more accurate measurement system was introduced. Paratransit on-time performance improved with a new service provider in 2013.

- **The number of accidents per 100,000 miles** rose dramatically during the period. All four transit modes saw accidents rise by at least 30 percent. Paratransit saw a triple-digit increase during the period, primarily due to a change in service provider and operators unfamiliar with the geography.

- **The number of miles between mechanical road calls** rose impressively across all transit modes. The system-wide 83.4 percent growth during the review period can be attributed to improved maintenance (both routine and preventative), increased training for mechanics and other service personnel and better adherence to Preventative Maintenance Instructions (PMI) standard operating procedures.

2. Performance Indicators

2.1 Operating Cost per Passenger

> Operating cost per passenger is computed by dividing the authority's annual operating cost by the passenger trips for the same period. For the purpose of reporting performance indicators, operating cost means the authority's costs of providing public transit service, including purchased transportation not performed by the authority, but excluding the costs of:
>
> - depreciation, amortization, and capitalized charges;
> - charter bus operations; and
> - coordination of carpool and vanpool activities.
>
> Passenger trips means the number of all passenger boardings, including transfers, but excluding charter passengers and carpool and vanpool passengers whose trips are only coordinated by the authority. In National Transit Database terms, the equivalent term for passenger trips is "unlinked passenger trips."

Table 1.7 shows the operating cost for each of DART's transit modes.

Overall annual operating annual cost increases system-wide averaged 4.0 percent for the period 2008–2015 and slightly less for the review period (3.0 percent). There were large increases in Light Rail operating cost, primarily due to its rapid expansion. In late 2010, DART greatly expanded the Green Line, adding 8 miles of track and 20 new stations. In 2012, DART opened 6 new stations and added 14 miles of track, extending the Blue/Red Line and the Orange Line. In 2014, an additional 5 miles of track were added as well as an additional station to the Orange Line. The aging of the light rail vehicle fleet has also resulted in additional maintenance that has added to operating costs. Finally, the light rail fleet expanded from 115 cars to 163 cars, an increase of 42 percent.

Figure 1.1 shows the annual number of passenger trips taken on DART. Figure 1.2 shows the breakdown by transit mode.

Passenger trips system-wide were largely flat during the review period, with the largest gain by Light Rail, due mainly to the increase in capacity (additional stations as well as expanded track). Also playing a role in the growth was the change in the way passenger count was tallied. In late 2012, DART began to calculate ridership exclusively from data collected from automatic passenger counters installed on 48 vehicles. Previously, DART had relied on manual data collection methods. Analysis showed that the automatic passenger counters were more accurate than the human counters, with the greatest distortions occurring during heavy passenger loads. As a result, DART had been underreporting light rail ridership by more than 15 percent.

Substitution also played a role in explaining the tepid growth in passenger trips. Gas prices dropped considerably during the period from $3.12/gallon at the start of 2012 to $1.76/gallon at the close of 2015. This made driving a more appealing option than using public transportation.[1]

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1 Energy Information Administration. See http://www.eia.gov/oil_gas/petroleum/data_publications/wrgp/mogas_history.html

Table 1.7 **Operating Cost by Transit Mode**
2008–2015, in millions

| | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | CAGR | | | Percent Change | | |
									2008–2015	2012–2015		2008–2015	2012–2015	
Bus	$216.7	$213.9	$229.1	$220.6	$228.9	$235.6	$235.9	$236.4	1.3%	1.1%		9.1%	3.3%	
Light Rail	$73.4	$78.8	$91.2	$118.5	$123.2	$141.7	$156.3	$158.2	11.6%	8.7%		115.5%	28.5%	
Commuter Rail (TRE)	$22.1	$23.2	$24.3	$24.0	$24.2	$24.2	$25.5	$25.5	2.1%	1.7%		15.4%	5.3%	
Paratransit	$33.3	$33.7	$35.5	$36.4	$38.3	$28.8	$31.9	$33.5	0.1%	–4.3%		0.8%	–12.4%	
System-wide	$345.4	$349.6	$380.0	$399.5	$414.6	$430.4	$449.5	$453.6	4.0%	3.0%		31.3%	9.4%	

Source: DART Quarterly Reports
CAGR = Combined Annual Growth Rate

Figure 1.1   **Annual Number of Passenger Trips**
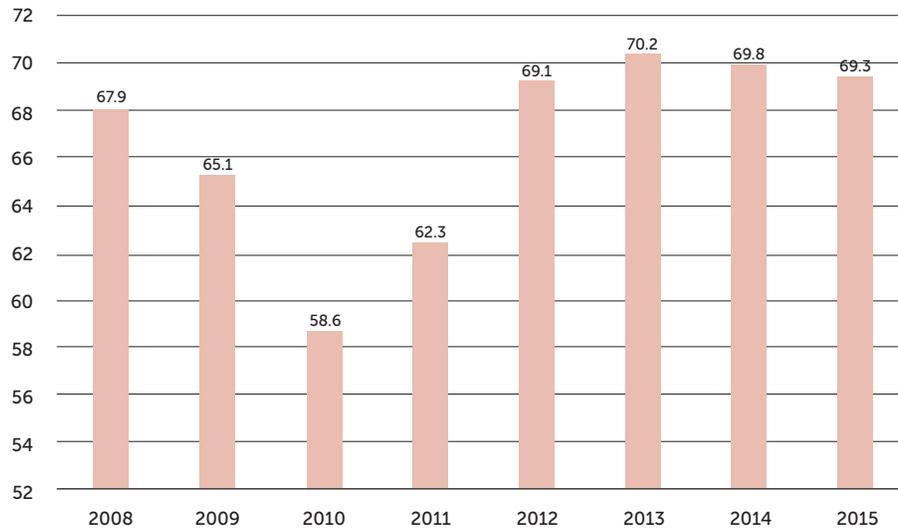
Source: DART Quarterly Reports; National Transit Database

Figure 1.2   **Passenger Trips by Transit Mode**
2008–2015, in millions
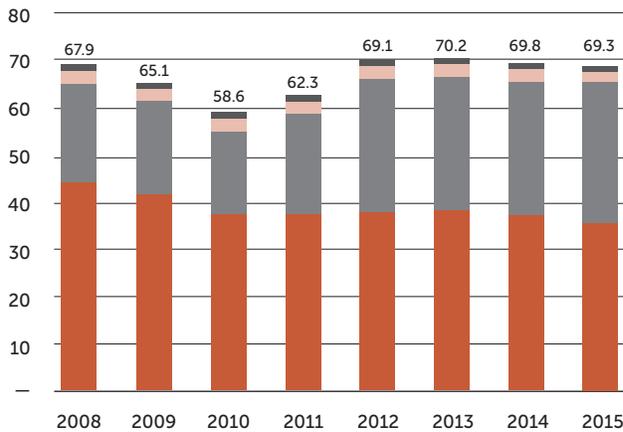
■ Bus ■ Light Rail ■ Commuter Rail ■ Paratransit

	CAGR		Percent Change	
	2008–2015	2012–2015	2008–2015	2012–2015
Bus	−3.0%	−1.7%	−19.1%	−5.1%
Light Rail	6.3%	2.6%	53.8%	8.1%
Commuter Rail	−3.3%	−1.2%	−20.9%	−3.5%
Paratransit	0.8%	−0.8%	6.1%	−2.5%
System-wide	0.3%	0.1%	1.9%	0.3%

Source: DART Quarterly Reports; National Transit Database
CAGR = Combined Annual Growth Rate

Table 1.8 shows the operating cost per passenger by transit mode.

Operating cost grew annually at an average rate of 3.0 percent for the review period. The Consumer Price Index (CPI), which is a measure of the average change in prices over time in a fixed-market basket of goods and services, grew by 1.3 percent during the period.[2] As a result, roughly half of the increase in operating costs can be attributed to natural inflation.

2.2 Operating Cost per Revenue Hour

Operating cost per revenue hour is computed by dividing the authority's annual operating cost by the total of scheduled hours that authority revenue vehicles are in revenue service for the same period. Revenue service means the time an authority revenue vehicle is in service to carry passengers, other than charter passengers. A revenue vehicle means a vehicle operated by an authority or as a purchased service that is used to carry paying passengers. Revenue hours do not include hours that a vehicle is not available for transporting passengers; for example, the time for travel to/from the operating facility and the start/end of revenue service.

Operating cost data is reported in Table 1.7 (above), and revenue hours by transit mode are reported in Table 1.9.

Overall, system-wide revenue hours grew by 5.3 percent during the review period. There was strong growth in Light Rail, due primarily to the expansion in track miles and stations (see **2.1 Operating Cost per Passenger**). Paratransit revenue hours fell by 13.2 percent during the period. This was primarily the result of trips shifting away from DART service providers to other service providers when DART implemented an Agency rate, requiring agencies, such as Medicaid brokers, to buy trips at the DART contract rate, which was considerably higher than the trip cost for the individual paratransit rider ($3). Bus revenue hours grew by almost 7 percent due to the introduction of a new service and extended hours for existing routes. In November 2012, D-Link, a two-year pilot project which is a partnership among DART, the city of Dallas, and Downtown Dallas, Inc., was introduced. The service connects major tourist attractions, dining destinations, and employment centers in downtown Dallas and neighboring districts.

Operating cost per revenue hour by transit mode appears in Table 1.10.

Overall operating cost per revenue hour grew by 3.9 percent for that period. Operating cost per revenue hour rose across all transit modes with the exception of Bus.

2.3 Operating Cost per Revenue Mile

Operating cost per revenue mile is computed by dividing the authority's annual operating cost by the number of miles traveled by authority revenue vehicles while in revenue service for the

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2 Bureau of Labor Statistics, Consumer Price Index, South Region, All Urban Consumers, Cities (population 500,000–1,500,000), 2006–2016.

Table 1.8 **Operating Cost per Passenger by Transit Mode**
2008–2015

	2008	2009	2010	2011	2012	2013	2014	2015	CAGR		Percent Change	
									2008–2015	2012–2015	2008–2015	2012–2015
Bus	$4.81	$5.02	$6.09	$5.99	$5.97	$6.22	$6.33	$6.49	4.4%	2.8%	34.9%	8.8%
Light Rail	$3.78	$4.15	$5.12	$5.31	$4.45	$4.81	$5.30	$5.29	4.9%	5.9%	40.1%	18.8%
Commuter Rail	$8.03	$8.30	$9.82	$9.91	$10.73	$11.58	$11.15	$11.71	5.5%	3.0%	45.9%	9.1%
Paratransit	$45.15	$44.86	$45.89	$46.06	$47.78	$37.77	$42.29	$42.90	–0.7%	–3.5%	–5.0%	–10.2%
System-wide	$5.08	$5.37	$6.48	$6.41	$6.00	$6.13	$6.44	$6.55	3.7%	2.9%	28.8%	9.1%

Source: DART Quarterly Reports
CAGR = Combined Annual Growth Rate

Table 1.9 **Revenue Hours by Transit Mode**
2008–2015, in thousands

	2008	2009	2010	2011	2012	2013	2014	2015	CAGR		Percent Change	
									2008–2015	2012–2015	2008–2015	2012–2015
Bus	2,028.4	2,021.0	2,009.5	1,953.9	2,010.2	2,100.7	2,077.6	2,148.5	0.8%	2.2%	5.9%	6.9%
Light Rail	123.5	126.1	163.4	187.5	381.9	451.7	452.3	468.4	21.0%	7.0%	279.2%	22.7%
Commuter Rail	18.5	18.2	17.7	16.9	17.0	17.5	17.6	17.6	–0.8%	1.0%	–5.2%	3.1%
Paratransit	441.5	455.0	513.1	521.6	529.8	501.6	465.0	460.0	0.6%	–4.6%	4.2%	–13.2%
System-wide	2,612.1	2,620.3	2,703.7	2,776.4	2,938.9	3,071.5	3,012.5	3,094.5	2.5%	1.7%	18.5%	5.3%

Source: National Transit Database; TRE Office
CAGR = Combined Annual Growth Rate

Table 1.10 **Operating Cost per Revenue Hour by Transit Mode**
2008–2015

	2008	2009	2010	2011	2012	2013	2014	2015	CAGR		Percent Change	
									2008–2015	2012–2015	2008–2015	2012–2015
Bus	$106.82	$105.85	$113.99	$112.92	$113.88	$112.16	$113.55	$110.04	0.4%	–1.1%	3.0%	–3.4%
Light Rail	$594.13	$624.92	$558.23	$631.83	$322.49	$313.77	$345.47	$337.72	–7.8%	1.5%	–43.2%	4.7%
Commuter Rail	$1,190.39	$1,274.46	$1,373.70	$1,418.11	$1,418.07	$1,386.02	$1,447.94	$1,449.34	2.9%	0.7%	21.8%	2.2%
Paratransit	$75.36	$74.02	$69.10	$69.79	$72.31	$57.49	$68.51	$72.91	–0.5%	0.3%	–3.3%	0.8%
System-wide	$132.24	$133.41	$140.54	$143.90	$141.06	$140.13	$149.21	$146.59	1.5%	1.3%	10.8%	3.9%

Source: National Transit Database; TRE Office
CAGR = Combined Annual Growth Rate

same period. Revenue service means the time an authority revenue vehicle is in service to carry passengers, other than charter passengers. A revenue vehicle means a vehicle operated by an authority or as a purchased service that is used to carry paying passengers. Revenue miles do not include miles for travel to/from the operating facility for the start/end of revenue service or other miles when the vehicle is not in service to carry passengers.

Operating cost data is reported in Table 1.7 (above), and revenue miles by transit mode are reported in Table 1.11.

Overall revenue miles increased by 2.4 percent during the review period. Light Rail revenue miles increased by almost 28 percent, due to the addition of the Orange Line in 2012. Paratransit revenue miles fell by 16.7 percent, due to the fact that when Paratransit shifted vendors in October 2012, and current contract per trip rate cost rose considerably, trips shifted to other service providers.

Table 1.12 shows the operating cost per revenue miles by transit mode.

Overall operating cost per revenue mile grew 6.8 percent during the review period, with all four transit modes experiencing growth.

2.4 Sales and Use Tax Receipts per Passenger

The sales and use tax receipts per passenger are computed by dividing the annual receipts from authority sales and use taxes by passenger trips for the same period. Passenger trips refers to unlinked passenger trips, which is the number of passengers who board public transportation vehicles.

Figure 1.3 shows the trend in DART's sales and use tax receipts for 2008−2015.

The steady increase in sales receipts during the 2012−2015 period is a function of favorable demographics and an improving economy. Population in the Dallas area has increased 8.5 percent from 2010−2015, more than double the U.S. average (4.1 percent).[3] In addition to more potential spenders, consumer spending and consumer confidence have risen during this period. Personal consumption expenditures, which is the primary measure of consumer spending on goods and services in the U.S. economy, rose 9.8 percent during the period.[4]

Average annual growth in sales and use tax receipts during the period was 6.2 percent, which is almost double the long-term annual growth rate of 3.2 percent. Passenger trips has remained relatively flat during 2012−2015, as shown in Figure 1.1.

Table 1.13 shows the sales and use tax receipts per passenger.

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3 U.S.Census Bureau, Population percent change (April 1, 2010−July 1, 2015) as quoted on: https://www.census.gov/quickfacts/table/PST045215/00

4 Bureau of Economic Analysis, Table 2.3.1. Percent Change from Preceding Period in Real Personal Consumption Expenditures by Major Type of Product, Updated on August 26, 2016.

Table 1.11 **Revenue Miles by Transit Mode**
2008–2015, in thousands

	2008	2009	2010	2011	2012	2013	2014	2015	CAGR		Percent Change	
									2008–2015	2012–2015	2008–2015	2012–2015
Bus	27,350.9	26,711.3	26,492.2	24,885.6	24,906.9	25,150.2	25,091.2	25,151.2	−1.2%	0.3%	−8.0%	1.0%
Light Rail	5,346.9	5,354.6	5,335.8	6,905.2	7,980.2	9,097.0	9,530.0	10,209.9	9.7%	8.6%	90.9%	27.9%
Commuter Rail	1,565.0	1,292.6	1,239.7	1,142.6	1,109.9	1,144.5	1,152.0	1,153.4	−4.3%	1.3%	−26.3%	3.9%
Paratransit	8,109.9	7,818.7	8,458.6	8,638.5	8,813.1	7,556.0	7,083.1	7,339.8	−1.4%	−5.9%	−9.5%	−16.7%
System-wide	42,372.7	41,177.2	41,526.3	41,571.9	42,810.1	42,947.6	42,856.4	43,854.3	0.5%	0.8%	3.5%	2.4%

Source: National Transit Database
CAGR = Combined Annual Growth Rate

Table 1.12 **Operating Cost per Revenue Miles by Transit Mode**
2008–2015

	2008	2009	2010	2011	2012	2013	2014	2015	CAGR		Percent Change	
									2008–2015	2012–2015	2008–2015	2012–2015
Bus	$7.92	$8.01	$8.65	$8.87	$9.19	$9.37	$9.40	$9.40	2.5%	0.7%	18.6%	2.3%
Light Rail	$13.73	$14.71	$17.09	$17.16	$15.43	$15.58	$16.40	$15.49	1.7%	0.1%	12.9%	0.4%
Commuter Rail	$14.10	$17.92	$19.57	$21.04	$21.78	$21.18	$22.11	$22.08	6.6%	0.4%	56.6%	1.4%
Paratransit	$4.10	$4.31	$4.19	$4.21	$4.35	$3.82	$4.50	$4.57	1.6%	1.7%	11.4%	5.1%
System-wide	$8.15	$8.49	$9.15	$9.61	$9.68	$10.02	$10.49	$10.34	3.5%	2.2%	26.9%	6.8%

Source: National Transit Database
CAGR = Combined Annual Growth Rate

Figure 1.3 **Sales and Use Tax Receipts**
2008–2015, in millions
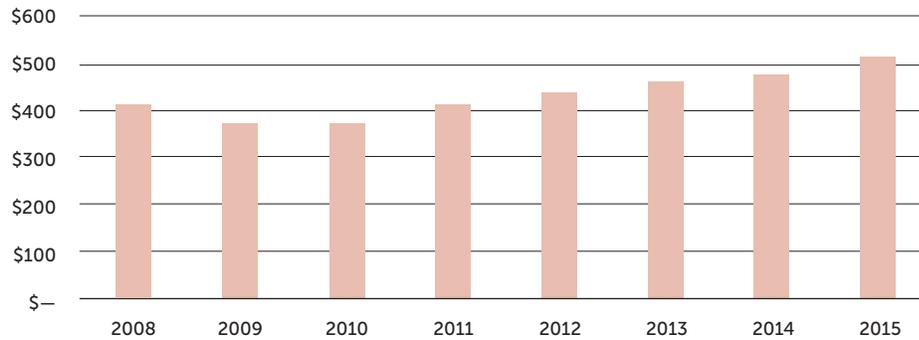
Source: DART Quarterly Reports

Table 1.13 **Sales and Use Tax Receipts per Passenger**
2008–2015

	Sales and Use Tax Receipts (in millions)	Unlinked Passenger Trips All Modes (in millions)	Tax Receipts per Passenger Trip
2008	$416.1	67.9	$6.13
2009	$377.6	65.1	$5.80
2010	$375.5	58.6	$6.40
2011	$402.4	62.3	$6.46
2012	$432.5	69.1	$6.26
2013	$455.7	70.2	$6.49
2014	$485.7	69.8	$6.96
2015	$518.6	69.3	$7.49
CAGR 2008–2015	3.2%	0.3%	2.9%
CAGR 2012–2015	6.2%	0.1%	6.1%
Percent Change 2002–2015	24.6%	1.9%	22.3%
Percent Change 2012–2015	19.9%	0.3%	19.6%

The average annual growth (6.1 percent) over the period was more than twice the long-term annual growth rate (2.9 percent). The rise in sales and use tax receipts per passenger is solely attributable to the increase in sales and use tax as described above.

2.5 Fare Recovery Rate

The fare recovery rate is computed by dividing the annual revenue (including fares, tokens, passes, tickets, and route guarantees, provided by passengers and sponsors of passengers) by the operating cost for the same period. Charter revenue, interest income, advertising income, and other operating income are excluded from revenue provided by passengers and sponsors of passengers.

Table 1.14 shows DART's annual fare revenue by transit mode.

DART's annual fare revenue grew by more than 17 percent in the 2012–2015 period. In December 2012, DART raised fares and, as a result, most local bus and rail tickets increased by about 25 percent. This represented the first rate hike since 2009 and was done primarily to address increased bus routes and rail lines and the infrastructure cost to operate these.

Bus experienced strong revenue growth during this period as total bus fleet increased by 6.2 percent (from 612 to 650). Paratransit fare revenues fell as agencies receiving funds from the State of Texas for transportation needed to pay DART at the current contract per trip rate cost not the $3/trip cost to the individual paratransit rider. This resulted in a drop in passengers trips, as shown in Figure 1.2.

Table 1.15 shows DART's annual fare recovery rate by transit mode.

Overall growth during the review period was 7.4 percent, led by double-digit growth in both Bus and Paratransit.

2.6 Average Vehicle Occupancy

Average vehicle occupancy is computed by dividing the annual passenger miles by the miles traveled by authority revenue vehicles in revenue service for the same time period. The annual passenger miles are computed by multiplying annual passenger trips by the average distance ridden per passenger during the same time period. The average distance ridden per passenger is determined by sampling the average passenger distance on a random selection of bus trips during the year. The methodology is established by the requirements for reporting passenger miles to the National Transit Database.

Table 1.16 shows the Passenger Miles by transit mode.

Light rail saw a 14.6 percent growth in passenger miles over the period, due largely to increased capacity (additional stations as well as expanded track). The drop in bus passenger miles of 10.5 percent corresponds with a 5.1 percent drop in passenger trips (Figure 1.2). The discrepancy is due to the fact that as DART has moved forward with system redesign, they have replaced long-haul bus

Table 1.14 **Annual Fare Revenue by Transit Mode**
2008–2015, in millions

	2008	2009	2010	2011	2012	2013	2014	2015	CAGR		Percent Change	
									2008–2015	2012–2015	2008–2015	2012–2015
Bus	$30.9	$27.5	$30.7	$25.7	$26.9	$30.5	$31.6	$31.6	0.3%	5.5%	2.3%	17.4%
Light Rail	$13.3	$12.1	$15.0	$22.8	$23.9	$27.0	$28.8	$28.8	11.6%	6.5%	116.2%	20.8%
Commuter Rail	$3.1	$2.9	$8.0	$10.3	$8.2	$8.8	$9.5	$9.4	17.1%	4.6%	201.9%	14.3%
Paratransit	$1.8	$2.0	$2.3	$2.3	$2.3	$2.1	$2.0	$2.2	2.8%	-1.2%	21.5%	-3.5%
System-wide	$49.2	$44.5	$56.0	$61.1	$61.3	$68.4	$71.9	$72.0	5.6%	5.5%	46.5%	17.5%

Source: DART Quarterly Reports; National Transit Database
CAGR = Combined Annual Growth Rate

Table 1.15 **Annual Fare Recovery Rate**
2008–2015

	2008	2009	2010	2011	2012	2013	2014	2015	CAGR		Percent Change	
									2008–2015	2012–2015	2008–2015	2012–2015
Bus	14.3%	12.8%	13.4%	11.7%	11.8%	13.0%	13.4%	13.4%	-1.0%	4.4%	-6.5%	13.7%
Light Rail	18.2%	15.4%	16.4%	19.2%	19.4%	19.0%	18.4%	18.2%	0.0%	-2.0%	0.2%	-6.0%
Commuter Rail	14.1%	12.6%	33.1%	42.8%	33.9%	36.4%	37.2%	36.8%	14.7%	2.8%	161.3%	8.5%
Paratransit	5.4%	5.9%	6.5%	6.4%	6.0%	7.3%	6.4%	6.6%	2.8%	3.3%	21.6%	10.2%
System-wide	14.2%	12.7%	14.7%	15.3%	14.8%	15.9%	16.0%	15.9%	1.6%	2.4%	11.9%	7.4%

Source: DART Quarterly Reports; National Transit Database
CAGR = Combined Annual Growth Rate

Table 1.16 **Passenger Miles by Transit Mode**
2012–2015

	2012	2013	2014	2015	CAGR	Percent Change
					2012–2015	2012–2015
Bus	161,289,332	154,490,411	152,224,685	144,359,836	–3.6%	–10.5%
Light Rail	214,583,584	238,107,315	242,559,921	245,940,019	4.7%	14.6%
Commuter Rail (TRE)	43,186,379	40,170,296	43,549,045	41,614,453	–1.2%	–3.6%
Paratransit	12,798,886	11,853,473	11,103,934	11,168,545	–4.4%	–12.7%
System-wide	431,858,181	444,621,495	449,437,585	443,082,853	0.9%	2.6%

Table 1.17 **Average Vehicle Occupancy**
2012–2015

	2012	2013	2014	2015	CAGR	Percent Change
					2012–2015	2012–2015
Bus	18.3	20.4	21.5	19.7	2.4%	7.5%
Light Rail	26.9	26.2	25.5	24.1	–3.6%	–10.4%
Commuter Rail (TRE)	38.9	35.1	37.8	36.1	–2.5%	–7.3%
Paratransit	1.7	1.7	1.5	1.5	–3.5%	–10.2%
System-wide	10.1	10.4	10.5	10.1	0.1%	0.2%

routes with rail service and bus rail feeder service. As more and more of the bus ridership has moved to the rail feeders, passenger miles would drop, as rail feeders tend to involve shorter trips on the bus.

Table 1.17 shows DART's average vehicle occupancy.

Overall, average vehicle occupancy was flat during this period. Drops in Light Rail, Commuter Rail, and Paratransit were offset by gains in Motor Bus.

2.7 On-Time Performance

According to the instructions for computation of performance indicators in Texas Transportation Code Section 452.455, an authority's on-time performance is computed by determining an annual percent of revenue vehicle trips that depart from selected locations at a time not earlier than the published departure time and not later than five minutes after that published time.

Table 1.18 shows the on-time performance by transit mode.

Bus on-time performance fell during the review period. This was a function of a switch to a new way that on-time performance is measured. Whereas the previous method discreetly measured time points, now, using GPS, measurements can be taken at every step. Using time points a driver could make up time between points. Using every stop does not allow for making up any times. The changes occurred as DART was able to incorporate newer, more accurate technologies for measuring on time performance. Paratransit improved throughout the period as it changed service providers and 2013 was the first year of the new contract.

2.8 Accidents per 100,000 Miles of Service

As defined by Texas statute, accidents per 100,000 miles is derived by dividing the annual number of accidents by 100,000 and dividing the product by the number of miles for all services, including charter and nonrevenue service, directly operated by the authority for the same period. According to statute, an "accident" includes:

- a collision that involves an authority's revenue vehicles, other than a lawfully parked revenue vehicle, and that results in property damage, injury, or death, and

- an incident that results in the injury or death of a person on board or boarding or alighting from an authority's revenue vehicle.

Table 1.19 shows the number of accidents by transit mode.

Paratransit saw the number of accidents increase significantly during the review period. As shown in Table 1.19, the number of accidents skyrocketed in 2013 and 2014, leading to a significant growth during the review period. The largest contributing factor to the increase in accidents would be the change in service provider in October 2012. The new provider used many drivers who were not from the operating area and thus not familiar with the geography. Inclusion of taxis into the paratransit

Table 1.18   **On-Time Performance by Transit Mode**
2012–2015

	2008	2009	2010	2011	2012	2013	2014	2015
Bus	92%	93%	92%	92%	95%	95%	81%	79%
Light Rail	97%	95%	96%	95%	97%	94%	95%	94%
Commuter Rail (TRE)	98%	99%	98%	97%	98%	99%	99%	98%
Paratransit					87%	89%	91%	91%

Source: DART Quarterly Reports; Paratransit Department

Table 1.19   **Accidents by Transit Mode**
2008–2015

	2008	2009	2010	2011	2012	2013	2014	2015	CAGR		Percent Change	
									2008–2015	2012–2015	2008–2015	2012–2015
Bus	559	534	471	597	546	619	716	720	28.8%	31.9%	3.7%	9.7%
Light Rail	6	14	8	36	11	14	17	15	150.0%	36.4%	14.0%	10.9%
Commuter Rail	4	2	4	7	3	3	8	5	25.0%	66.7%	3.2%	18.6%
Paratransit	179	110	43	25	113	281	342	252	40.8%	123.0%	5.0%	30.6%
System-wide	748	660	526	665	673	917	1,083	992	32.6%	47.4%	4.1%	13.8%

Source: DART Risk Department; Paratransit Department; FRA Reports
CAGR = Combined Annual Growth Rate

Table 1.20   **Accidents per 100,000 Miles of Service**
2008–2015

	2008	2009	2010	2011	2012	2013	2014	2015	CAGR		Percent Change	
									2008–2015	2012–2015	2008–2015	2012–2015
Bus	1.75	1.70	1.51	2.06	1.90	2.12	2.45	2.46	5.0%	9.0%	40.8%	29.5%
Light Rail	0.11	0.26	0.15	0.49	0.14	0.15	0.18	0.14	4.0%	2.3%	31.8%	7.2%
Commuter Rail	0.22	0.14	0.28	0.52	0.23	0.22	0.59	0.37	7.5%	16.8%	66.3%	59.3%
Paratransit	1.66	0.98	0.37	0.21	0.95	2.95	3.76	2.48	5.9%	37.9%	49.4%	162.2%
System-wide	1.49	1.33	1.07	1.35	1.34	1.85	2.19	1.94	3.9%	13.1%	30.3%	44.5%

Source: DART Risk Department; Paratransit Department; FRA Reports
CAGR = Combined Annual Growth Rate

delivery model also increased accident rates. Commuter Rail saw an almost 70 percent growth in accidents between 2012 and 2015, but the absolute numbers were extremely low: 3 accidents in 2012 and 5 in 2015.

Table 1.20 shows DART accidents per 100,000 miles of service.

Accidents per 100,000 miles of service increased greatly during this period, by 44.5 percent. Light Rail was the only transit mode that did not see its figures rise by double digits during the period.

2.9 Number of Miles Between Mechanical Road Calls

According to the instructions for computation of performance indicators in Texas Transportation Code Section 452.455, the number of miles between mechanical road calls is computed by dividing the annual miles for all service directly operated by an authority, including charter and nonrevenue service, by the number of mechanical road calls for the same period. For this performance indicator, mechanical road calls means an interruption in revenue service that is caused by a revenue vehicle equipment failure that requires assistance from a person other than the vehicle operator before the vehicle can be operated normally.

Table 1.21 shows the number of mechanical service calls by transit mode.

All modes, with the exception of Light Rail, saw double-digit decreases per year in the number of mechanical service calls. Light Rail saw the number of mechanical service calls rise during the period due to the institution of a Light Rail Reliability Program which established more stringent maintenance goals. The drop in bus mechanical service calls is a result of an introduction of an entire new fleet starting in 2012. Currently, more than 90 percent of the fleet is less than 5 years old.*

Table 1.22 shows the number of miles between mechanical service calls by transit mode.

Miles between mechanical service calls saw significant growth during the review period across all modes as DART's efforts to improve maintenance (both routine and preventative), increase training for mechanics and other service personnel and better adherence to PMI (Preventative Maintenance Instructions) standard operating procedures all led to improved mechanical performance of transit vehicles. Paratransit saw miles between mechanical service calls increase greatly as a new service provider, MV, took over on October 1, 2012. MV initiated specific campaigns to improve maintenance efforts and DART's contract oversight enforced greater adherence to established PMI standard operating procedures.

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*DART Fleet List, July 8, 2016; Iknow analysis.

Table 1.20 **Number of Mechanical Service Calls by Transit Mode**
2008–2015

	2008	2009	2010	2011	2012	2013	2014	2015	CAGR		Percent Change	
									2008–2015	2012–2015	2008–2015	2012–2015
Bus	4,858	4,228	4,755	5,749	5,274	4,933	3,674	2,929	-7.0%	-17.8%	-39.7%	-44.5%
Light Rail	180	270	272	368	244	267	212	253	5.0%	1.2%	40.6%	3.7%
Commuter Rail	8	8	12	6	11	11	6	5	-6.5%	-23.1%	-37.5%	-54.5%
Paratransit	456	534	485	598	631	598	545	239	-8.8%	-27.6%	-47.6%	-62.1%
System-wide	5,502	5,040	5,524	6,721	6,160	5,809	4,437	3,426	-6.5%	-17.8%	-37.7%	-44.4%

Source: DART Quarterly Reports; National Transit Database; TRE Office
CAGR = Combined Annual Growth Rate

Table 1.21 **Miles between Mechanical Service Calls**
2008–2015

	2008	2009	2010	2011	2012	2013	2014	2015	CAGR		Percent Change	
									2008–2015	2012–2015	2008–2015	2012–2015
Bus	6,592	7,433	6,542	5,050	5,442	5,911	7,970	9,977	6.1%	22.4%	51.4%	83.3%
Light Rail	30,917	19,875	19,718	19,807	33,328	35,625	45,662	40,891	4.1%	7.1%	32.3%	22.7%
Commuter Rail	227,118	181,445	119,842	224,612	118,732	122,868	227,343	273,259	2.7%	32.0%	20.3%	130.1%
Paratransit	23,595	21,107	23,668	19,544	18,939	15,941	16,677	42,528	8.8%	31.0%	80.2%	124.6%
System-wide	9,118	9,824	8,941	7,343	8,131	8,531	11,137	14,915	7.3%	22.4%	63.6%	83.4%

Source: DART Quarterly Reports; National Transit Database; TRE Office
CAGR = Combined Annual Growth Rate

Section 2

Statutory Compliance

1. Executive Summary

Section 452.454 of the Texas Transportation Code describes the requirements and purpose of the Quadrennial Performance Review. The audit is designed to provide evaluative information to the transit agency to suggest ways to improve the efficiency and effectiveness of its operations. The purpose of this section of the report is to review Dallas Area Rapid Transit's (DART) compliance with applicable state law.

Iknow's findings are that DART is in compliance with all applicable Texas state laws and that the DART Board and staff work diligently to comply with all Texas statutes that govern the Regional Transit Authority's policies, practices, and procedures. The 2016 Quadrennial Performance Review did not find any failure to comply with existing and new provisions of Texas Transportation Code 452 and other relevant State of Texas legislation as of December 2015.

1.1 Approach

Iknow started by making the following two assumptions that limited our detailed review to legislative amendments that were enrolled by the 82nd (2011), 83rd (2013) and 84th (2015) Texas Legislature Sessions:

1. Previous Quadrennial Performance Reviews assessed DART's compliance with new legislation from previous Texas Legislature sessions and that all issues raised in those reviews had been thoroughly addressed

2. DART did not regress in its policies or practices that would negatively impact the Regional Transit Authority's ability to satisfy all relevant enacted legislation.

Iknow took two approaches to identifying bills enrolled in the three relevant Texas Legislature Sessions. First, we reviewed all amendments made to the Texas Transportation Code, Section 452. This was done by reviewing each bill on Texas Legislature Online. Second, we researched amendments in all other code areas in the three Texas Legislature Sessions by identifying topics that have direct relevance to DART. Figure 2.1 lists the key words and phrases that were searched.

Figure 2.1   **Key Search Terms**

■ Alcoholic beverages	■ Drug testing	■ Public records
■ Board matters	■ HIPPA compliance	■ Records management
■ Board terms	■ Marijuana	■ System security
■ Commute rail	■ Minimum wage	■ Train maintenance
■ Competitive bidding	■ Occupational safety	■ Transportation safety
■ Conflict of interest	■ Open meeting	

After the list of relevant House and Senate enrolled bills was created, Iknow then conducted interviews with DART's staff and reviewed relevant data and documents to determine the DART's compliance with each of the identified statutes.

1.2 Sources of Information

In order to examine DART's compliance with the relevant statutes, Iknow collected and reviewed several sources of information, including:

- Texas Legislature Online, at http://www.capitol.state.tx.us/,
- Publicly available information on the DART's website, at http://www.dart.org/,
- Policies, plans and related procedures on DART's intranet site, at http://www.dartnet.org/,
- Internal policy manuals and memoranda provided by DART staff,
- Interviews with DART's personnel, and
- Where relevant, observed policies and practices in use.

1.3 Metrics

The metrics used to evaluate whether the Regional Transit Authority is meeting the Texas statutes are:

- **Compliant.** An area is considered "compliant" if during the review no findings were noted with the Authority's implementation of statute.

- **Deficient.** An area is considered "deficient" if any of the requirements of a statute were not met.

- **Not Applicable.** An area is deemed "not applicable" if during the review the Authority does not conduct activities relevant to the statute.

2. Prior Compliance Efforts

The DART Board and staff work diligently to comply with all provisions of the statutes governing the Regional Transportation Authority's policies and procedures. The 2012 Quadrennial Performance Review discovered several instances of noncompliance, but these were minor and resolved following communication with DART. Trans Tech Management Inc., who conducted the previous Quadrennial Performance Review which looked broadly at the seven categories listed below to determine compliance:

- Authority—creation of DART, tax authority, agreements with other governments

- Board Matters—board creation, composition, rules, and authority

- Contracts—small and disadvantaged business participation, competitive bidding

- Finance and Administration—bonds, annual budget, administration

- Open Meetings and Public Information—posting requirements for public meetings and response to Open Records requests

- Performance Audits—requirements for state-mandated performance audits

- Real Estate—land purchase, sale, and eminent domain issues

The 2012 Quadrennial Performance Review noted two new pieces of legislation enacted by the 82nd Texas Legislature Session. Those are discussed below. In addition, Iknow identified six other relevant amendments to Texas Transportation Code 452 and other applicable Texas legislation. They are included in this review because in most cases the law did not go into effect until the end of the previous Quadrennial Performance Review period, so compliance efforts would fall primarily in this review period.

The amendments are listed in Table 2.1 and described below.

Table 2.1   **Enrolled Amendments to the Texas Transportation Code Section 452**
82nd Texas Legislature Sessions

Ref. No.	Texas Legislature Session	Bill No.	Texas Transportation Code Chapter / Article / Section	Bill Caption
1	82 R - 2011	HB 2325, Section 3 HB 2223, Section 1	452.107(c)	Relating to the competitive bidding and notice requirements for contracts of certain mass transportation authorities.
2	82 R – 2011	SB 888, Section 1	431.003	Relating to ithe authority to create a local government corporation.
3	82 R - 2011	SB 990, Section 1	452.0613	Relating to regulation of high-occupancy vehicle lanes operated, managed, or maintained by a regional transportation authority; providing penalties.
4	82 R - 2011	HB 2195, Section 1	452.108	Relating to the requirements of certain arrangements or agreements of certain regional transportation authorities.
5	82 R - 2011	SB 18, Subchapter B, Subchapter C	Sections 2206.053, 2206.101, 22.0111, 21.023, 21.102	Relating to the use of eminent domain authority.
6	82 R - 2011	SB 758	321.2022, 321.3022	Relating to the sales and use tax information provided to certain local governmental entities.
7	82 R - 2011	HB 628, Article 3	452.1095	Relating to the application of statutes that classify political subdivisions according to population.
8	82 R - 2011	HB 2690, Section 1	272.001	Relating to authorizing local governments to convey real property interests to other local governments for less than fair market value.

2.1 HB 2325 and 2223

Ref. No.	Texas Legislative Session	Bill No.	Article / Section	Effective Date
1	82 R - 2011	HB 2325, Section 3 HB 2223, Section 1	452.107(c) 452.107(c)	9/1/2011

Bill Caption	Relating to the competitive bidding and notice requirements for contracts of certain mass transportation authorities.
Description	The bill amends existing rules and procedures regarding competitive bidding, namely that the DART Board may authorize the negotiation of a contract without competitive sealed bids or proposals if the value is not more than $50,000 as long as certain conditions are met.
Audit Findings	**Compliant.** The DART Procurement Regulation (DPR), section 3-201(2)(c), was modified by Board resolution 110129 on October 25, 2011 to increase the threshold from $25,000 to $50,000.

2.2 SB 888

Ref. No.	Texas Legislative Session	Bill No.	Article / Section	Effective Date
2	82 R - 2011	SB 888, Section 1	431.003	9/1/2011

Bill Caption	Relating to the authority to create a local government corporation.
Description	The bill amends existing rules and procedures to allow DART to form a local government corporation.
Audit Findings	**Compliant.** The DART Board of Directors has created one Local Government Corporation, named the Dallas Area Rapid Transit Bus Service, LGC. DART currently works through the Dallas Area Rapid Transit Bus Service, LGC, to manage two out-of-service area contracts: a tri-party service agreement with the City of Arlington and the Fort Worth T for services in Arlington; and an agreement with the City of Mesquite for services between Hanby Stadium and DART Lawnview Station. The Metro ArlingtonXpress (MAX) service began in August 2013 with a single weekday route connecting College Park in Arlington to CentrePort Station on the TRE line, with one stop in the Arlington Entertainment District. Under the original agreement, DART was to operate service through August 2015; the agreement has been extended through December 2016. The DART Bus Service, LGC, also manages the existing contract for emergency service in the Cities of Allen and Wylie and the Town of Fairview in Collin County. To support the regional objective to expand opportunities for transit services outside the DART Service Area, DART negotiated an umbrella agreement for access funding with the North Central Texas Council of Governments (NCTCOG). Separate agreements were negotiated with STAR Transit for access to DART's Lawnview and Buckner Stations from Balch Springs, and Texoma Area Paratransit System (TAPS) for bus access connections at Parker Road Station from McKinney, Allen, and Sherman. TAPS suspended service in January 2016.

2.3 SB 990

Ref. No.	Texas Legislative Session	Bill No.	Article / Section	Effective Date
3	82 R - 2011	SB 990, Section 1	452.0613	9/1/2011

Bill Caption	Relating to regulation of high-occupancy vehicle lanes operated, managed, or maintained by a regional transportation authority; providing penalties.
Description	The bill amends existing rules regarding setting up an administrative process for certain citations issued in DART's high-occupancy vehicle (HOV) lanes.
Audit Findings	**Compliant.** The DART Police currently enforce HOV lane infractions, which are considered Class C misdemeanors.

2.4 HB 2195

Ref. No.	Texas Legislative Session	Bill No.	Article / Section	Effective Date
4	82 R - 2011	HB 2195, Section 1	452.108	9/1/2011

Bill Caption	Relating to the requirements of certain arrangements or agreements of certain regional transportation authorities.
Description	The bill amends existing rules and procedures regarding DART and the requirement to provide an annual report to each governing body of a municipality or county in the authority regarding the status of any financial obligation of the authority to the municipality or the county to allow for longer-term price hedging contracts for commodities (e.g., diesel fuel, natural gas, electricity).
Audit Findings	**Compliant.** DART currently engages in longer-term price hedging (up to six years). Hedging is determined by performance against the 20-year financial plan. If hedging does occur, it is not speculative and limited to energy commodities only (i.e., gas, diesel, and electricity).

2.5 SB 18

Ref. No.	Texas Legislative Session	Bill No.	Article / Section	Effective Date
5	82 R - 2011	SB 18, Subchapter B, Subchapter C	Section 2206.053, 2206.101, 22.0111, 21.023, 21.102	9/1/2011

Bill Caption	Relating to the use of eminent domain authority.
Description	Bill modifies processes and requirements governing eminent domain, including evidence to be considered by special commissioners in making decisions on damages awards, the rights of property owners to repurchase taken property, the requirement of a bona fide offer to purchase property, and landowners' right to access information from an entity taking their property. Additionally, the bill adds a statutory prohibition against a government or private entity taking land that was not for a public use. The bill requires governmental entities to pay relocation expenses for displaced property owners and provide a relocation advisory service.

Audit Findings	**Compliant.** Three properties in South Oak Cliff extension were acquired by eminent domain in 2014. These acquisitions took place in accordance with statutory requirements.

2.6 SB 758

Ref. No.	Texas Legislative Session	Bill No.	Article / Section	Effective Date
6	82 R - 2011	SB 758	321.2022, 323.3022	9/1/2011

Bill Caption	Relating to the sales and use tax information provided to certain local governmental entities.
Description	The bill amends existing rules and procedures and requires the Comptroller's Office, upon request from a municipality, county, or transportation authority, to provide information on the amount of tax paid by any person doing business in the local taxing entities jurisdiction if the person's annual remittance of state and local sales taxes exceeds $5,000. This is a reduction from the current statutory threshold of $25,000.
Audit Findings	**Compliant.** No further action required.

2.7 HB 628

Ref. No.	Texas Legislative Session	Bill No.	Article / Section	Effective Date
7	82 R - 2011	HB 628, Article 3	452.1095	9/1/2011

Bill Caption	Relating to the application of statutes that classify political subdivisions according to population.
Description	The bill amends existing rules and procedures for a governmental entity regarding procedures related to a public work contract, including: reverse auctions; construction management; multiple award contracts; design and construction contracting and delivery; number of eligible public works projects in a given year; engineering oversight; and job order contracting for ongoing maintenance or minor construction projects. The provisions of this bill apply to public works projects first advertised by governmental entities on, or after, September 1, 2011.
Audit Findings	**Not Applicable.** This bill primarily addresses design-build procurements. DART received an exemption in this bill from requirements of the new statute as long as DART procedures do not materially conflict with the requirements of this Act.

2.8 HB 2690

Ref. No.	Texas Legislative Session	Bill No.	Article / Section	Effective Date
8	82 R - 2011	HB 2690, Section 1	272.001	9/1/2011

Bill Caption	Relating to authorizing local governments to convey real property interests to other local governments for less than fair market value.
Description	The bill amends existing rules and procedures.
Audit Findings	**Compliant.** DART's Real Estate Policy as approved by the DART Board as well as Real Estate Procedures (updated on 10/29/15) address this amendment to the Local Government Code.

3. 83rd Texas Legislature Session (2013)

Three amendments to the Texas Transportation Code Section 452 and related legislation were enrolled during the 83rd Texas Legislature Session. The amendments are listed in Table 2.2 and described below.

Table 2.2   **Enrolled Amendments to the Texas Transportation Code Section 452**
83rd Texas Legislature Sessions

Ref. No.	Texas Legislature Session	Bill No.	Texas Transportation Code Chapter / Article / Section	Bill Caption
9	83 R - 2013	SB 1461	452.6025	Relating to addition of certain municipalities to the territory of a regional transportation authority.
10	83 R - 2013	HB 2148, Section 3	Section 162.312	Relating to the motor fuel tax on compressed natural gas and liquefied natural gas; receiving a refund; providing penalties; imposing a tax.
11	83 R - 2013	HB 2536, Section	452.541 452.562	Relating to the composition of certain regional transportation authority subregional boards.

3.1 SB 1461

Ref. No.	Texas Legislative Session	Bill No.	Article / Section	Effective Date
9	83 R - 2013	SB 1461	Section 452.6025	9/1/2013

Bill Caption	Relating to addition of certain municipalities to the territory of a regional transportation authority.

Description	The bill clarifies ambiguity in Texas Transportation Code 452 as to whether cities in Tarrant County, such as the City of Arlington, can become a full participant in the DART service area.
Audit Findings	**Compliant.** The DART service area has not changed since 1989. The 13 original DART Service Area cities have remained in DART since the August 1983 election creating the agency. Those cities include: Addison, Carrollton, Cockrell Hill, Dallas, Farmers Branch, Garland, Glenn Heights, Highland Park, Irving, Plano, Richardson, Rowlett, and University Park.

3.2 HB 2148

Ref. No.	Texas Legislative Session	Bill No.	Article / Section	Effective Date
10	83 R - 2013	HB 2148, Section 3	Section 162.312	9/1/2013

Bill Caption	Relating to the motor fuel tax on compressed natural gas and liquefied natural gas; receiving a refund; providing penalties; imposing a tax.
Description	Bill grandfathers the existing motor fuels tax annual decal collection system for Chapter 451 and 452 transit authorities utilizing CNG (compressed natural gas) and LNG (liquefied natural gas).
Audit Findings	**Compliant.** No further action needs to be taken by DART.

3.3 HB 2536

Ref. No.	Texas Legislative Session	Bill No.	Article / Section	Effective Date
11	83 R – 2013	HB 2536, Section 1	452.541 and 452.562	9/1/2013

Bill Caption	Relating to the composition of certain regional transportation authority subregional boards.
Description	The bill amends board membership requirements to include individuals who do not reside within the authority if they are a qualified voter and reside in a municipality has entered into a contract with the regional transit authority to receive services or has adopted a sales tax to participate in the funding of a transportation project being planned, developed, or operated by the regional transit authority.
Audit Findings	**Not Applicable.** DART and the Fort Worth T are the only two subregional boards that have been created under Chapter 452 of the Texas Transportation Code. This bill only affected The T's Board appointments since that bill amended Ch. 452.562 and the change to 452.541 was also specific to The T and did not apply to DART.

4. 84th Texas Legislature Session (2015)

Five amendments to the Texas Transportation Code Section 452 were enrolled during the 84th Texas Legislature Session. The amendments are listed in Table 2.3 and described below.

Table 2.3 **Enrolled Amendments to the Texas Transportation Code Section 452**
84th Texas Legislature Sessions

Ref. No.	Texas Legislature Session	Bill No.	Texas Transportation Code Chapter / Article / Section	Bill Caption
12	84 R - 2015	HB 283, Section 1	551.128	Relating to the requirement that certain governmental bodies make audio and video recordings of open meetings available on the Internet.
13	84 R – 2015	SB 57, Section 7	452.061	Relating to information collected by a regional tollway authority, regional mobility authority, regional transportation authority, metropolitan rapid transit authority, or coordinated county transportation authority.
14	84 R - 2015	HB 685, Section 1	552.221	Relating to the production of public information under the public information law.
15	84 R - 2015	HB 1905, Section 28	162.356	Relating to certain state and local taxes, including ad valorem taxes, and to the repeal of certain of those taxes.
16	84 R - 2015	HB 3777, Sections 5–13	452.561, 452.562, 452.571	Relating to the establishment and governance of certain regional transportation authorities.

4.1 HB 283

Ref. No.	Texas Legislative Session	Bill No.	Article / Section	Effective Date
12	84 R - 2015	HB 283, Section 1	Section 551.128	1/1/2016

Bill Caption	Relating to the requirement that certain governmental bodies make audio and video recordings of open meetings available on the Internet.

Description	Bill requires a transit authority or department subject to Chapter 451, 452, 453, or 460 of the Transportation Code, certain school district boards, an elected governing body of a home-rule municipality that has a population of 50,000 or more, or a county commissioner's court for a county that has a population of 125,000 or more, to make a video and audio recording of each regularly scheduled open meeting. An archived copy of the video and audio recording of each meeting must be made available on the Internet. The governmental body is not required to establish a separate website and can post the video on an existing website, including a publicly accessible video-sharing or social networking site. If the governmental body maintains a website, the video should be on that website. The archived video recording must be available online no later than seven days after the date the recording was made and should be maintained for no less than two years. A government body is exempt if there is no recording from the result of a catastrophe or technical breakdown. A governmental body may broadcast a regularly scheduled open meeting of the body on television.
Audit Findings	**Compliant.** Video files of past Board Meetings are available on the DART website, in the Board Archive tab on the Board Meetings page (http://www.dart.org/about/board/boardvideo.asp).

4.2 SB 57

Ref. No.	Texas Legislative Session	Bill No.	Article / Section	Effective Date
21	84 R - 2015	SB 57, Section 7	452.061	9/1/2015

Bill Caption	Relating to information collected by a regional tollway authority, regional mobility authority, regional transportation authority, metropolitan rapid transit authority, or coordinated county transportation authority.
Description	Bill provides that certain personal account information collected by a regional tollway authority, regional mobility authority, regional transportation authority, metropolitan rapid transit authority, or coordinated county transportation authority is not subject to disclosure under the State's Public Information Act. Personal information includes a person's name, address, email address, phone number, account number, password, payment transaction activity, toll or charge record, credit, debit, or other payment card number and other personal financial information. This change will not prohibit law enforcement or judicial requests for information.

Audit Findings	Compliant. DART has put in place a series of policies and procedures to safeguard personal identifying information depending on the payment channel. For transactions that involve bank or credit card use, DART has gone through a PCI-compliant certification process, which is renewed annually. PCI is the globally accepted payment card industry's set of security standards designed to ensure that all companies that accept, process, store, or transmit credit card information maintain a secure environment. For mobile ticketing, DART works with a PCI-compliant third party so it does not have any access to personal identifiable information. Finally, all policies and procedures are subject to review every two years to ensure compliance with local, state, and federal statutes.

4.3 HB 685

Ref. No.	Texas Legislative Session	Bill No.	Article / Section	Effective Date
14	84 R – 2015	HB 685, Section 1	Section 552.221	6/18/2015

Bill Caption	Relating to the production of public information under the public information law.
Description	Bill allows a political subdivision of the State to refer open records requestors to the political subdivision's website in response to the request when appropriate. A requestor may be referred to an exact Internet location on a website maintained by the political subdivision and accessible to the public if the requested information is identifiable and readily available on that website. If the person requesting the information prefers a manner other than access through the Internet/website, the political subdivision must supply the information in the usual manner required, in the office or through the mail. If an officer for public information for a political subdivision provides by email an Internet location or website address, the email must contain a statement indicating that the requestor may nonetheless access the requested information in person or through the mail.
Audit Findings	Not Applicable. No action required by DART.

4.4 HB 1905

Ref. No.	Texas Legislative Session	Bill No.	Article / Section	Effective Date
15	84 R – 2015	HB 1905, Section 28	Section 162.356	9/1/2015

Bill Caption	Relating to certain state and local taxes, including ad valorem taxes, and to the repeal of certain of those taxes.

Description	Bill amends the Tax Code related to certain taxes and exempts certain motor vehicles used to provide transit services, including vehicles of a metropolitan rapid transit authority operating under Chapter 451 of the Transportation Code, or a regional transportation authority operating under Chapter 452 of the Transportation Code, from the compressed natural gas and liquefied natural gas (CNG/LNG) tax imposed. The bill exempted DART from the collection of the state motor fuels tax for CNG and LNG fuel distributed from DART fueling facilities into the fuel tanks of vehicles used in the provision of DART services.
Audit Findings	**Compliant.** This tax exemption will save the agency and service area taxpayers an estimated $250,000 annually. Refund amount for 2015 tax decals was $118,000.

4.5 HB 3777

Ref. No.	Texas Legislative Session	Bill No.	Article / Section	Effective Date
16	84 R – 2015	HB 3777, Sections 5–13	452.561, 452.562, 452.571	9/1/2015

Bill Caption	Relating to the establishment and governance of certain regional transportation authorities.
Description	Bill updated the population thresholds in Chapter 452 so that The T could remain a subchapter N regional transportation authority and not a subchapter O authority like DART. The City of Fort Worth's population was approaching the 800,000 population threshold at 794,000. Threshold was updated to 1.1 million in both subchapters N and O to accommodate future population growth.
Audit Findings	**Compliant.** The T partners with DART to operate the Trinity Railway Express (TRE), which offers commuter rail service from downtown Fort Worth to DFW Airport and downtown Dallas.

5. Findings and Recommendations

Iknow's statutory compliance review assesses compliance with 16 legislative requirements. Compliance findings documented in this report indicate that DART is in full compliance with all of the requirements that were applicable to the Regional Transit Authority during the FY2012—FY2015 audit period.

Section 3

System Maintenance

1. Executive Summary

Section 452.454 of the Texas Transportation Code describes the requirements and purpose of the Quadrennial Performance Review. The audit is designed to provide evaluative information to the transit agency to suggest ways to improve the efficiency and effectiveness of its operations. The purpose of this section of the report is to examine Dallas Area Rapid Transit's (DART) vehicle transit operation and maintenance functions.

Based on our comprehensive review, Iknow's overall assessment of DART's Maintenance Department is excellent. Our exceptional rating extends across all aspects of the Department, from the leadership and depth of experience of the management team, through the well-developed business processes and practices, to the daily documenting of routine maintenance tasks as part of a vehicle inspection. The Department's overall strategic maintenance plan, detailed standard operating procedures and work instructions, maintenance training, and thorough recordkeeping are some of the reasons for our very positive assessment. Issues that we commonly see at other transit agencies have been resolved, or are being actively addressed.

One example of the Maintenance Department's exemplary results is the significant improvement in Miles Between Road Calls (MBRC) during the review period. MBRC increased 83 percent for buses and 23 percent for light rail over the four-year audit period, to 9,977 and 40,891 miles, respectively. DART's results compare quite favorably with transit authorities from other major U.S. cities.

DART fully complies with applicable State of Texas statutes and no compliance issues were identified. In most cases, DART's maintenance programs meet and often exceed transit industry best practices.

Iknow has no improvement recommendations to offer to the Maintenance Department.

Iknow did identify two functional areas outside of maintenance whose activities have a significant impact on the ability of the Maintenance Department to perform its mission. These improvement opportunities are described in final section of this report.

2. Organization of the System Maintenance Audit Report

The System Maintenance portion of the 2016 State Mandated Performance Audit is organized into three main parts.

1. **Maintenance Department Overview.** In this section, we summarize DART's vehicle fleet and maintenance facility assets, describe the Maintenance Department's organization structure, highlight the main elements of the current maintenance environment; and describe several important improvement initiatives that are currently underway.

2. **Audit Findings.** In this section, we present our audit findings of the Maintenance Department. The findings follow our three lines of analysis—a condition assessment of DART's fleet and facilities, a review of the supporting maintenance programs, and external benchmarking. Iknow conducted detailed reviews of the maintenance activities performed for each mode and spoke with a range of DART maintenance staff about the current maintenance practices and procedures.

3. **Improvement Recommendations.** In this section, we present two improvement recommendations. Management responses to Iknow's recommendations are also presented.

3. Acronyms

The following acronyms are used in this report.

Acronym	Meaning
CMMS	computerized maintenance management system
DART	Dallas Area Rapid Transit Authority
LRV	light rail vehicle
MAP-21	Moving Ahead for Progress in the 21st Century Act
MMIS	maintenance management information system
NRV	nonrevenue vehicle
PMI	preventive maintenance inspection
SGR	state of good repair
TAMP	transit asset management plan
TRE	Trinity Railway Express
WSA	ways, structures, and amenities

4. Background

4.1 DART Overview and Scope of Operations

Dallas Area Rapid Transit (DART) is a regional transit agency authorized under Chapter 452 of the Texas Transportation Code and was created by voters and funded with a one-cent local sales tax on August 13, 1983. DART serves 13 cities (Addison, Carrollton, Cockrell Hill, Dallas, Farmers Branch, Garland, Glenn Heights, Highland Park, Irving, Plano, Richardson, Rowlett, and University Park) with modern public transit services and customer facilities. Denton County is served through a fare-sharing agreement with the Denton County Transportation Authority (DCTA) on DCTA's "A-Train" service that connects to DART rail in Carrollton. Trinity Railway Express operates in Dallas and Tarrant counties in cooperation with the Fort Wort Transportation Authority (FWTA), and there is also a fare-sharing agreement between DART and FWTA.

4.2 System Maintenance Audit Scope

The System Maintenance component of the 2016 State Mandated Performance Audit is predicated on Texas Transportation Code which states that "the purposes of the audit are to provide:

1. evaluative information necessary for the performance of oversight functions by state and local officers; and
2. information to the authority to assist in making changes for the improvement of the efficiency and effectiveness of authority operations."

The Code goes on to say that "Each audit must include an examination of:

1. one or more of the following:
    a. the administration and management of the authority;
    b. transit operations; or
    c. transit authority system maintenance;
2. the authority's compliance with applicable state law, including this chapter."

DART selected system maintenance as the area to be examined as part of the 2016 audit. DART requested a review of its bus, light rail, mobility management (paratransit and on-call services), and TRE commuter rail maintenance programs. DART requires an assessment of the condition of its fleet and related infrastructure, as well as a review of its preventive maintenance programs. The scope of work states that the contractor shall review:

1. Vehicle Preventive Maintenance Programs
2. Maintenance Staffing and Organization
3. Maintenance Training Programs
4. Warranty Programs
5. Component Rebuild Programs
6. Materials Management Support of the Maintenance Programs
7. Ways, Structures (Signals and Power), and Facilities Maintenance Programs
8. Maintenance Safety Programs
9. Maintenance Cost Elements

5. Maintenance Department Overview

DART's route network and services move more than 220,000 passengers per day across a 700-square-mile service area. As of March 2016, DART provides 140 bus or shuttle routes, nine On-Call zones, 90 miles of light rail transit (DART Rail), and paratransit service for persons who are mobility impaired.

This section provides an overview of DART's Maintenance Department. Its purpose is to satisfy Section 452.454(b)(1) of the State of Texas Transportation Code, which states one purpose of the audit is to provide "evaluative information necessary for the performance of oversight functions by state and local officers."

In this section, we:

- Provide a summary of DART's fleet assets;
- Describe the organization structure, roles, and responsibilities for managing the Maintenance Department;
- List the service contractors that have some maintenance-related responsibility; and
- Describe DART's internal maintenance environment.

5.1 Fleet Assets Summary

Table 3.1 provides important metrics about DART's fleet and facility assets.

Table 3.1 **DART's Fleet and Facility Assets**

Operating Budget, FY2016	$494.9 million
Capital Budget, FY2016	$278.3 million
System-wide Ridership (all modes), FY2015	92.5 million passenger trips
Maintenance Department Headcount	982 skilled, nonskilled, professional, management, and support staff
Value of Assets	Approximately $4.5 billion
Fleet	
1. Bus	
Number of Passengers, FY2015 (includes Charter)	36.4 million passenger trips
Number of Revenue Miles, FY2015	25,151,244 miles
Number of Bus Stops	11,411
Bus Shelters	1,186 shelters, 50 enhanced shelters, and 1,288 benches
Number of Transit Centers	14 bus transit centers, transfer centers, transfer locations, and park and rides
Fleet Size and Composition	650 revenue vehicles ■ 476 North American Bus Industries (NABI) Transit Buses (Compressed natural gas) – Vehicle length: 31 feet and 40 feet – Capacity: up to 40 seats ■ 63 North American Bus Industries (NABI) Suburban Buses (Diesel) – Vehicle length: 40 feet – Capacity: 41 seats ■ 111 ARBOC Buses (Compressed natural gas) – Vehicle length: 26 feet – Capacity: 17 seats
2. Light Rail	
Number of Passengers, FY2015	29.9 million passenger trips
Number of Revenue Car Miles, FY2015	10,209,881 miles
Length of Light Rail System	90 miles
Number of Light Rail Stations	62 stations (50 at grade; 9 aerial; 2 below grade; 1 tunnel)
Fleet Size and Composition	163 Kinkisharyo Super LRVs (light rail vehicles) – Vehicle length: 123 feet 8 inches – Capacity: 94 seats/274 crush
3. Commuter Rail	
Name	Trinity Railway Express (TRE)
Number of Passengers, FY2015	2.2 million passenger trips
Number of Revenue Car Miles, FY2015	1,153,406 miles

Track Length	33.8 miles
Number of Stations	10
Fleet Size and Composition	9 diesel locomotives - Vehicle length: 58 feet 2 inches - Capacity: N/A 17 Bombardier Bi-Level Coaches - Vehicle length: 85 feet - Capacity: 152 seats 8 Bombardier Bi-Level Cab Cars - Vehicle length: 85 feet - Capacity: 132–138 seats 13 Budd Rail Diesel Cars - Vehicle length: 85 feet - Capacity: 92 seats plus 4 wheelchairs
Maintenance Provider	Herzog Transportation Services, Inc.
4. Paratransit	
Number of Passengers, FY2015	781,797 passenger trips
Number of Revenue Hours	460,030
Fleet Size and Composition*	80 Starcraft (multiple configurations) - Vehicle length: 22 feet - Capacity: 10 seated plus 2 wheelchair or 6 seated plus 3 wheelchair 116 Braun Entervans (non-dedicated) - Capacity: 2 seated plus 1 wheelchair - Vans owned and operated by Irving Holding
Maintenance Provider	MV Transportation
Location	Paratransit Operating Facility (8998 Senate Street, Dallas)
5. Streetcar	
Fleet Size	2
Nonrevenue Vehicles (NRV)	
Fleet Size	732
Description	Nonrevenue vehicles are used to support, operate, and maintain the services and network. The fleet includes passenger automobiles, light-duty vans/pickups, police cars, larger specialized utility-type vans and trucks, hi-rail mountable vehicles, rail-mounted equipment, trailers, and sweepers.
Facilities	
Size	Approximately 70,000,000 square feet
Description	Buildings, pedestrian platforms/pathways, and parking lots

Bus Service Facilities	East Dallas Northwest South Oak Cliff
Light Rail Service Facilities	Central Rail Operating Facility (CROF; 3021 Oak Lane, Dallas) Northwest Rail Operating Facility (NWROF; 9717 Abernathy Avenue, Dallas)
Inventory	
Number of Warehouses	1
Total Inventory Value	Approximately $35.3 million
Other	
Length of DART-Owned Freight Corridors	250 miles
Number of High Occupancy Vehicle (HOV) and Managed Lanes**	10
Number of HOV and Managed Lane Miles	84
HOV Commuter Trips, FY2015	22.3 million passenger trips
Vanpool Ridership, FY2015	871,000 passenger trips

Source: DART (various documents).

*The Starcraft vehicles are titled to MV Transportation. The Braun taxi vehicles are leased by MV, and DART has an agreement to pay part of the lease. Twenty of the 116 Braun Entervans are 100 percent dedicated to the paratransit service and are painted white with a DART logo. The remaining 96 are nondedicated (they look like regular yellow taxi vans but with a DART logo) and take both paratransit pickups as well as outside fares. However, a large percentage of these handle only DART pickups.

**In 2012, the Texas Department of Transportation (TxDOT) assumed from DART responsibility for operations, maintenance, and enforcement of the regional system of high-occupancy vehicle (HOV) lanes as it transitioned to toll-managed lanes. DART remains a capital funding partner in the I-635 HOV/Managed Lanes currently under construction by TxDOT. DART is permitted to continue reporting HOV usage (i.e., ridership) and the revenue miles from DART's operation of buses on the HOV lanes within its service area to continue receiving the associated FTA formula funds that support DART's ongoing transit operations.

5.1.1 Description of Transit Modes

DART operates five transit modes: bus, light rail, commuter rail, paratransit, and streetcar.

1. **Bus.** DART operates local and express bus routes serving Addison, Carrollton, Cockrell Hill, Dallas, Farmers Branch, Garland, Glenn Heights, Highland Park, Irving, Richardson, Rowlett, Plano, and University Park.

   DART's bus fleet transition to compressed natural gas (CNG) will be complete by the end of FY16. This CNG fleet replaces the older fleet of liquefied natural gas (LNG) and clean diesel buses which began service in 1998. The next bus fleet replacement is scheduled for 2025–2028.

2. **Light Rail.** The DART Rail System is the longest light rail system in the United States and provides fast, convenient service to work, shopping, and entertainment destinations in Dallas, Carrollton, Farmers Branch, Garland, Irving, Plano, Richardson, and Rowlett and includes service to/from Dallas–Fort Worth (DFW) International Airport.

In late 2016, the DART Rail System will reach 93 miles with completion of the 2.6-mile Blue Line extension from Ledbetter Station in Southern Dallas to the University of North Texas (UNT) Dallas Campus.

3. **Commuter Rail.** DART and the Fort Worth Transportation Authority (FWTA or T) jointly operate 34 miles of commuter rail, named the Trinity Railway Express (TRE). TRE serves ten commuter rail stations in Dallas, Fort Worth, and cities in between, traversing Tarrant and Dallas counties. In 2014, TRE carried 2.3 million passengers and was the fifteenth most-ridden commuter rail system in the United States.

   DART owns and is responsible for maintenance of way, station, and other assets in Dallas County and FWTA owns and is responsible for maintenance of way, station and other assets in Tarrant County.

   Herzog Transportation Services, Inc., is the subcontractor responsible for operating the service and maintaining TRE guideway and rolling stock.

4. **Paratransit.** DART's paratransit system includes a demand-response system, in compliance with the Americans with Disabilities Act of 1990 and several general public, demand-response neighborhood services. The services are operated by MV Transportation, Inc., under the direction of six DART staff.

5. **Streetcar.** DART operates and maintains a streetcar line on behalf of the City of Dallas. The first segment of the streetcar line opened to service in 2015 and another segment came online in the second half of 2016.

5.1.2 Fleet Size and Composition

Table 3.2 provides a snapshot of DART's current bus fleet. The fleet consists of 650 total revenue vehicles. The vehicles are sourced from two manufacturers—ARBOC Specialty Vehicles (ARBOC) and NABI Bus (NABI). The fleet composition contains four different models. The largest single-model type is the NABI 40′ LFW, with 413 vehicles, which represents almost two-thirds of the total bus fleet. This model's average age is 2.7 years old.

More than 90 percent of the fleet is less than 5 years old.

Table 3.2   **Average Age and Composition of DART's Bus Fleet, July 2016**

Manufacturer	Model	Number of Vehicles	Percentage of Total Fleet	Average Age (years)
ARBOC	CG33803-2012 EX	111	17.1	4.0
NABI	31LFW	63	9.7	2.5
NABI	40LFW	413	63.5	2.7
NABI	416.14S	63	9.7	13.0
TOTAL		**650**	**100.0**	

Source: DART Fleet List, July 8, 2016; Iknow analysis.

Table 3.3 provides a snapshot of DART's current rail fleet. The fleet consists of 165 total revenue vehicles. The vehicles are sourced from two manufacturers—KINKISHARYO International (KINKISHARYO) and Brookville Equipment Corporation (BROOKVILLE). The fleet composition contains two models—one for light rail and one for streetcar.

Table 3.3   **Composition of DART's Rail Fleet, July 2016**

Manufacturer	Model	Service	No. of Vehicles	Percentage of Total Fleet
KINKISHARYO	SLRV	Light Rail	163	98.8
BROOKVILLE	LIBERTY	Streetcar	2	1.2
TOTAL			**165**	**100.0**

Source: DART Fleet List, July 8, 2016; Iknow analysis.

DART has 732 nonrevenue vehicles. The NRV fleet consists of a mix of trucks, SUVs, cargo vans, passenger vans, sedans, trailers, motorcycles, and a variety of other vehicle types.

5.2 Maintenance Department Organization Structure

The Maintenance Department is the second largest and most diverse department at DART, employing 982 skilled, nonskilled, professional, management, and support staff. The Department is responsible for maintaining a "state of good repair" of assets valued at approximately $4.5 billion. These assets include all DART-operated vehicles, operating facilities, transit centers, passenger shelters and stops, light rail right-of-way systems, and commuter rail stations.

The Maintenance Department provides preventive and corrective maintenance services for all DART-operated revenue and nonrevenue vehicles. The Department also manages major vehicle repair projects, provides technical training for maintenance employees, performs engineering studies for facility construction and rehabilitation projects, and develops specifications for vehicles, components, services, and consumable products.

The Vice President of Maintenance directs the overall activities of the department and reports directly to the Executive Vice President/Chief Operations Officer. The Department consists of three major divisions:

1. Fleet Services
2. Ways, Structures & Amenities
3. Technical Services

The Maintenance Department's organization structure is illustrated in Exhibit 3.1. The Vice President of Maintenance has three AVP direct reports that head the three major divisions and two additional business managers for projects and reporting.

Exhibit 3.1   **DART Maintenance Department Organization Structure—May 31, 2016**

Each of the three divisions is briefly described below.

5.2.1 Fleet Services Division

The Fleet Services Division is responsible for the repair, maintenance, and upkeep of all operating facilities and 650 fixed-route buses, 163 light rail cars, 2 streetcars, and 732 nonrevenue support vehicles and equipment. It includes bus fleet service facilities at the East Dallas, South Oak Cliff, and Northwest facilities; a nonrevenue vehicle maintenance facility; and rail-fleet service facilities at the Central Rail Operating (CROF) and Northwest Rail Operating facilities (NWROF). Fleet Services is also responsible for maintenance and repair of the materials management main warehouse and the mobility management operating facility. The Technical Services Division consists of five sections.

- **Bus Fleet Services.** The primary functions of the Bus Fleet Services Section are to perform preventive maintenance, corrective maintenance, campaigns, fleet modifications, servicing, fueling, and cleaning of the DART-operated bus fleet. Additionally, each operations facility is responsible for the repair and maintenance of its associated buildings and equipment, which includes air compressors, vehicle lifts, pumps, vehicle washers, service stations, and other structures.

- **Bus and Rail Central Support.** The Central Support Section is divided into three units: Body Support, Bus Central Support, and Rail Central Support. Body Support is responsible for body preventive maintenance, accident repair (minor and major), and upholstery rebuilding for the DART-operated bus, light rail, and Dallas streetcar fleets. Bus Central Support is responsible for new bus make-ready and the disposal of retired buses. Bus and Rail Central Support are responsible for fleet scheduled maintenance, rebuilding major and small vehicle components, providing major campaign modification support, and capital program support for the DART operated bus, light rail, and Dallas streetcar fleets.

- **Nonrevenue Vehicle (NRV) Services.** The Nonrevenue Vehicle (NRV) Services Section is responsible for preventive maintenance, corrective maintenance, campaigns, fleet modifications, servicing, new vehicle make ready, retired vehicle disposal, and cleaning of the DART-operated support vehicle fleet. Additionally, NRV Services is responsible for the repair and maintenance of its operating facility, including all associated buildings and equipment, which includes air compressors, vehicle lifts, pumps, and other structures.

- **Rail Fleet Services.** The primary functions of the Rail Fleet Service Section are to perform preventive maintenance inspections and repairs, corrective repairs, troubleshooting, running repairs, campaigns, electronic equipment, new vehicle qualification, and acceptance testing and fleet modifications on both DART's Light Rail Vehicles and Dallas streetcars. Additionally, the Rail Fleet Services Section is responsible for the repair and maintenance of its operating facility and equipment, which includes air compressors, vehicle lifts, pumps, vehicle washers, and other structures.

- **Fleet Services Support.** The Fleet Services Support Section is responsible for administration and compliance of services, commodities, and fuel contracts supporting bus, rail, mobility management, and NRV services operations and facilities.

5.2.2 Ways, Structures, and Amenities Division

The Ways, Structures, and Amenities Division provides maintenance for DART's 204.93 miles of light rail transit (LRT) right-of-way and systems, including the Dallas streetcar/bus/LRT/commuter rail passenger facilities, major administrative facilities, and agency-wide radio communications systems. The Ways, Structures, and Amenities Division consists of five sections.

- **Track and Right-of-Way.** The Track and Right-of-Way section inspects, maintains, and repairs 204.93 miles of track, including 2.4 miles of the Dallas streetcar track. Time-based, corrective, and condition-based maintenance and repairs are performed on all track turnouts/switches, 182 road crossings, various right-of-way, track related structures, culverts, and other rail-related facilities along the right-of-way. Additionally, this section is responsible for maintaining a zero tolerance graffiti program for DART property.

- **Passenger Amenities/Facility Services.** The Passenger Amenities/Facility Services section inspects, maintains, and repairs passenger facilities for DART's bus, rail, and commuter rail segments. Time-based, corrective, and condition-based maintenance and repairs are performed on nine transit centers, 50 LRT at-grade rail platforms, nine LRT aerial platforms, one LRT subsurface platform, six commuter rail platforms, two Park & Rides, two passenger transfer locations, two transfer centers, 20 enhanced shelters, 19 crew quarters, 1,510 bus shelters, 1,484 benches, 12,048 bus stops, multiple information pylons, Guide-a-rides, and tunnel-equipment maintenance, including fire life safety equipment. The section is also responsible for the property management of DART Headquarters, DART Police Administrative Facilities and Police Substations (building maintenance and repair), DART moving services, coffee services, cubicle configurations, furniture procurement, and space planning, as well as vending services and the parking garage management at Headquarters.

- **Traction Electrification Systems.** The Traction Electrification Systems section maintains the traction electrification system for DART's light rail transit. Time-based, corrective, and condition-based maintenance and repairs are performed on 204.93 miles of overhead catenary, including 2.4 miles for the Dallas streetcar, support structures, conductors, cable, hardware, 73 DC traction power substations (including a substation for the Dallas streetcar) that provide power to the light rail trains and to the communication and signal systems, eight AC power substations for the tunnel system and facilities maintenance, and 3,097 station canopy and tunnel lights.

- **Signal Systems.** The Signal Systems section performs inspections, tests, and conducts preventive maintenance for DART's signal systems to ensure safe scheduled train operations. The section also maintains the switches, signals, Track Warrant Controls (TWCs), and traffic pre-emption along the Dallas streetcar line segment. Time-based, corrective, and condition-based maintenance and repairs are performed on 395 main line switches, 139 automatic highway grade crossing warning signals, 867 wayside signals/indicators, train coming signals, and green bands, 134 yard switches, 64 signal power distribution centers, 114 TWC interrogators, and approximately 10,000 relays, cab signaling equipment, and other electromagnetic apparatus, cables, and train-stop apparatus.

- **Communication and Control Systems.** The Communication and Control Systems section provides two-way radio and data communications to support the operations of the Transportation, Maintenance, and DART Police Departments. Communications support is also

provided to DART Marketing Department, Information Technology Department, and the City of Dallas emergency services. The section maintains real-time data communication links from field units such as traction-power substations and signal houses via a supervisory control and data acquisition (SCADA) system to the Train Control Center (TCC) and real-time data via the Trapeze TransitMaster CAD/AVL system to Bus Dispatch. The section also maintains the SCADA, the Fiber Optics Link, and all communication devices along the right-of-way for the Dallas streetcar line segment. Time-based, corrective, and condition-based maintenance and repairs are performed on all communications-related hardware, including 57 communication houses, 142 communication interface cabinets, four remote radio sites, and a fiber-optic communications network. Other systems supported include the digital voice recording system, CCTV cameras, public address/visual message boards, Harris OpenSky Radio System, and passenger emergency call phones. The Control Systems programmers provide system administration and programming on all software applications, databases, and operating systems used to support Train Control and Bus Dispatch operations.

5.2.3 Technical Services Division

The Technical Services Division provides technical service support to the Fleet Services Division and the Ways, Structures, and Amenities Division. Additionally, it supports DART's compliance with the equipment maintenance requirements of the mobility services contract, and provides liaison and project management oversight support for all systems integration or changes to the passenger amenities, operating facilities, right-of-way, vehicles, and equipment. The Technical Services Division consists of four sections.

- **Fleet Engineering.** The Fleet Engineering section provides electrical and mechanical engineering support to the Fleet Services Division. Additionally, this section provides assistance to the Fleet Services Division for troubleshooting of all vehicle systems and components to isolate the root cause of failure, and develop and document equipment configuration changes when required. Specifications, procedures, and requirements for the purchase, maintenance, and improvement of vehicles and equipment are developed by the Section, as well as the development, review, and approval of all technical information related to the vehicles and equipment to ensure that rolling stock assets are maintained in accordance with the manufacturers' and/or industry recommended procedures.

- **Facilities and Systems Engineering.** The Facilities and Systems Engineering Section provides civil, electrical, and mechanical engineering support to the Ways, Structures & Amenities Division. Additionally, this section provides assistance to the Ways, Structures & Amenities Division to troubleshoot facility and systems structural, electrical, pneumatic, and mechanical systems, subsystems, and components to isolate the root cause of failure, and develop and document equipment configuration changes when required. Specifications, procedures, and requirements for the purchase, maintenance, and improvement of systems and facilities are developed by the section, as well as the development, review, and approval of all technical information related to the systems and facilities to ensure that fixed assets are maintained in accordance with the manufacturers' and/or industry recommended procedures. The section is also responsible for management of the On-Call Construction Services contract. This construction contract is used to complete construction projects that have a value less than $250,000 that are identified for facility repair, upgrade, expansion, reconfiguration, and new system finish-out.

- **Training and Document Management.** The Training and Document Management section develops and implements training programs for mechanics, supervisors, and other maintenance personnel. This section also has primary responsibility for assuring that training and maintenance documentation needs are met for all new systems and vehicles, and validation of maintenance documentation in support of improving vehicle and systems reliability. This includes providing direction on the development of specification requirements for new systems and vehicles, evaluating submittals related to the manuals and documentation, and approving the format, scheduling, and delivery of the training. The section is also responsible for maintenance document management through Maintenance Document Control. Specifically, this group develops and maintains the online system and the Maintenance Document Control Workflow used to review, approve, and publish all maintenance manuals and related documents.

- **Warranty & Maintenance Services.** The Warranty and Maintenance Services section maintains service quality development, analysis, and distribution of maintenance reports and data. This group has primary responsibility for the measurement tool calibration program and technical responsibility for the DART tire lease contract. In addition, the Section processes and administers all vehicle, equipment, and facility warranties and monitors fluids through wear metal and contaminant analysis to prevent system or subsystem failures.

5.2.4 Other

In addition to TRE, the DART Commuter Rail/Railroad Management Department has responsibility for the other rail right-of-way assets owned by DART in northeast Texas, outside the core DART system. This includes 250 miles of DART-owned freight rail corridors. These rail right of ways are typically maintained by the freight railroad operating on the corridor.

5.3 Use of Subcontractors for Maintenance

As described in Section 2.2, DART performs maintenance for the bus, light rail, and streetcar modes. Independent contractors perform the maintenance for the commuter rail and paratransit modes. The names of the contractors are:

- TRE (commuter rail): Herzog Transportation Services, Inc.
- Paratransit: MV Transportation, Inc.

Both contractors are required to provide specific levels of service and have a responsibility to preserve and maintain the fleet, equipment, and facilities. Contractual language and oversight by DART ensure that the contractors remain within the agreed-upon service level agreements and spending levels.

Iknow found that both contractors have the necessary facilities, tools, and personnel to accomplish their responsibilities and provide high-quality services. The facilities and vehicles are well maintained and present a professional and competent image to DART's customers and stakeholders. Close oversight by DART is evident at both operations.

5.4 Current Maintenance Environment

This section provides an overview of several important elements of DART's system maintenance environment. Specifically, the following nine topics are discussed:

1. Maintenance Business Plan
2. Standard Operating Procedures (SOPs)
3. Work Instructions (WIs)
4. MAP-21/State of Good Repair
5. Preventive Maintenance Inspections (PMIs)
6. Information Technology (IT) Infrastructure
7. Enterprise Asset Management System
8. Maintenance Assessment Findings from Parsons Brinckerhoff
9. DART Internal Audit Review of Maintenance-Related Issues

5.4.1 Maintenance Business Plan

On August 30, 2013, Mr. Michael C. Hubbell, Vice President—Maintenance, published the most recent edition of DART Maintenance Department's Five-Year Business Plan. DART's Maintenance Business Plan describes the future of the department and covers detailed operational plans, changes in staffing levels, recruitment and training forecasts, and equipment overhaul and replacement. The core of the document describes in detail the following items for each of the three Divisions (Fleet Services Division; Ways, Structures & Amenities Division; and Technical Services Division):

- Division Profile
  - Function/Responsibilities
  - Position Summary
  - Organization Chart
  - Management Team
- Strategic and Operational Plans for each Section in the Division
- Major Milestones
- Operational Goals

Additionally, in the section titled Fleet Services Division Performance Plan, performance and cost metrics are presented for the six major maintenance facilities:

- East Dallas Bus Services
- South Oak Cliff Bus Services
- Northwest Bus Services
- Rail Services
- Central Support Shops
- NRV Services

Also in the Fleet Services Performance Plan section, the strategies for performing the four established maintenance work-types (condition-based maintenance, corrective maintenance, fixed-scheduled maintenance, and campaign maintenance) are clearly documented for all transit modes and NRV.

The Technical Services Division's Performance Plan provides guidelines for resource allocation to improve performance and maintain compliance in five areas.

- Asset Availability
- Asset Management
- Regulatory Compliance
- Customer Initiatives
- Safe Workplace

5.4.2 Standard Operating Procedures (SOPs)

DART has a comprehensive set of standard operating procedures (SOPs) to guide vehicle maintenance. All SOPs are stored in a central database and available through Spear, DART's enterprise and asset management system.

As of July 2016, DART had 127 released (active) SOPs.

5.4.3 Work Instructions (WIs)

DART has 461 published Work Instructions (WIs). The WIs are grouped into five top-level groups:

1. Bus (62)
2. Rail (297)
3. Materials Management (2)
4. Facility, including Signals, Passenger Amenities, and Facility Services (8)
5. Technical Services (92)

An analysis of the WIs showed that they all had unique document control numbers, most followed a standard WI template, and all were well written and easily understood.

5.4.4 MAP-21/State of Good Repair

One of the main elements of the recently enacted legislation Moving Ahead for Progress in the 21st Century (MAP-21) is the concept of "state of good repair" (SGR). This legislation requires public transportation agencies whto receive federal assistance or grant money to develop an asset management plan. This plan needs to touch on several elements; at a minimum, it needs to address an agency's inventory, condition assessment, and investment prioritization.

The Federal Transit Administration's Asset Management Guide defines "transit assets" as rolling stock, right-of-way, stations, facilities, systems, and equipment. The Guide also defines "transit asset management" as a strategic and systematic process through which an organization procures, operates, maintains, rehabilitates, and replaces transit assets to manage their performance, risks, and costs over their lifecycle to provide safe, cost-effective, reliable service to current and future customers. It defines an "asset management business plan" as a document that outlines the implementation activities, roles, responsibilities, resources, and timelines needed to address an agency's asset management policy and strategy.

DART's Board of Directors annually reviews and approves a rolling twenty-year financial plan. The primary focus of the plan is to forecast the revenues and expenses for supporting all aspects of DART's operations. The financial planning process enables DART to meet the challenge of both maintaining its current assets in a state of good repair suitable to provide existing services, and meeting its commitments to the community for the future expansion of the regional transportation network.

5.4.5 Preventive Maintenance Inspections (PMIs)

DART evaluates vehicles and fleets with repeat failures and/or road calls (breakdowns en route) on a regular basis and with deliberate care, as required by an SOP. Monthly maintenance meetings are held by senior maintenance management with the senior managers from each of the four Fleet Services facilities. Vehicle performance is monitored and discussed at these meetings, as are possible causes for defects/breakdowns and proposed solutions. Actual mean distance between failure (MDBF) is calculated on a regular basis, discussed in these meetings, and even posted inside each of the maintenance facilities. The posting of MDBF (among other information) at each of the facilities offers a bit of healthy competition for the maintenance crews who may see that another division is encountering fewer breakdowns.

In addition to this review, senior managers use Weibull distribution modeling software (Relcode) to calculate when components will fail in the life of the bus, and thus, when they should be changed so as to minimize vehicle down time and in-service breakdowns. The software that performs this modeling allows managers to change vehicle mileage, times of repair, and other parameters to predict the effects on maintenance costs and failure rates for various scenarios. DART reports that conducting these analyses has reduced costs and improved vehicle reliability.

5.4.6 Information Technology (IT) Infrastructure

DART currently hosts internally all its enterprise-class systems (except email, calendar, and personal storage) with an on-site primary data center and an off-site secondary data center for disaster recovery. Enterprise applications are hosted predominately on virtual servers on the Windows platform, as well as on Unix. Windows servers are standard for other applications. The primary standard database management system is Oracle, with increasing use of Microsoft SQL Server. There are significant custom-developed interfaces between the various modules of different application suites. DART recently acquired and is beginning to deploy the Infor Innovative Intelligent Open Network (ION) middleware solution. In addition, DART is increasingly looking at cloud-based or externally hosted solutions where these solutions provide a value proposition for DART. For example, Kronos is currently being implemented in an Infrastructure as a Service (IaaS) model. DART has also recently transitioned to Microsoft Outlook from Google Mail.

All DART facilities are connected by a multiprotocol label switching (MPLS) wide-area network which also carries voice traffic for a voice-over internet protocol (VoIP) telephony system, with quality of service (QoS) implemented. Bandwidth can be adjusted as demand increases. There is also an active project to deploy a private wi-fi network in all operating facilities, as well as a complete renovation of the enterprise network.

The DART Information Technology Enterprise Architecture team maintains the DART Enterprise Technology Roadmap which highlights architectural, operational, and procedural enterprise technology requirements that will be considered in IT software, hardware, and service acquisitions.

5.4.7 Enterprise Asset Management System

Accurate tracking of information through the entire life cycle of an asset is critical to transit-asset management. Asset data needs to be consistently defined, captured, shared, and retained across each phase of the supporting business processes—planning, building (capital works), operations, and maintenance. Consequently, the information systems supporting each of these business areas need to be capable of accessing, capturing, and maintaining asset data for enterprise-wide needs.

DART's current computerized maintenance management system (CMMS) is a Spear 3i, a commercial software product offered by Spear Technologies, Inc. Spear Technologies provides enterprise asset management systems and services for maintenance and materials management of moving and infrastructure assets. Spear 3i helps to increase asset utilization, extend asset life cycles, increase worker productivity, improve safety, minimize inventory, and increase warranty recovery, as well as to manage moving and linear assets, such as buses, rail vehicles, aircrafts, airports, tracks, mines, and roadways. Spear Technologies, Inc., was founded in 1997 and is headquartered in San Francisco, California. As of April 20, 2006, Spear Technologies operates as a subsidiary of Hansen Information Technologies.

At DART, Spear 3i runs on a Windows 2008R2 server platform and uses an Oracle DBMS, running under Unix. The Spear CMMS interfaces directly with DART's Lawson-based Financials, Human Resource and Procurement system; DART's transportation management system based on Trapeze; an electronic parts cataloging system provided by Enigma; and, with a Fleetwatch system for monitoring and recording consumables. The CMMS is partitioned into two distinct lines of business. The first is tracking of maintenance activities; and, the second is tracking material inventory activities with seamless interaction between these two business lines on a transactional level. This system was first commissioned in 1999. Tenera was the initial developer of this client/server based software and through various acquisitions the software is now owned and supported by Infor (US), Inc., which also owns and supports the Lawson suite of products used by DART for financial, human resource and procurement management.

Spear minimizes the need for paper records and provides extensive real-time information on the status of the fleet, maintenance personnel, and schedule requirements. Almost all maintenance functions and activities are entered into this database, and all employees have access to varying levels of the data to assist them in the performance of their responsibilities. Mechanics on the shop floor enter all information pertaining to their preventive maintenance inspections, repairs, and other work orders. Mechanics are able to access repair manuals, standard operating procedures (SOPs), and other information directly pertinent to the vehicle they are repairing. A benefit of the system is that it integrates information from not only the maintenance functions, but also materials management and human resources.

Some of the features of the current system in support of maintenance operations are detailed work orders of various types; templates for more commonly used work-order types; equipment and configuration listings for vehicles, facilities, infrastructure, and linear assets; team member timekeeping; warranty and component movement; capturing costs of labor and materials for in-house rebuilt components; and cost and performance reporting from the historical database. The material inventory side of the system includes bill of materials; cycle count; inventory forecasting; material issue; material receipts, returns, adjustments and transfers; picklists; putaways; material stock requisitions; and, cost and performance reporting from the historical database. Spear supports the specific informational needs of several user departments throughout DART including Maintenance, Materials Management, Commuter Rail, Finance, Procurement, Technology, and Transportation.

The Spear system is functionally out-of-date, which presents various business challenges for the Maintenance and Materials Management departments. The extent to which Spear supports various asset-class requirements and the extent to which functionality available within Spear was implemented varies by division within the Maintenance Department. Also, the current system does not provide

true Enterprise Asset Management (EAM) capabilities—functionalities such as life cycle cost tracking, demand analysis, and asset prioritization/trade-off.

Through the implementation of a next generation EAM system, DART expects to achieve numerous business benefits. This includes direct benefits in terms of operations, utilization and capital. It also includes indirect benefits including improved performance, risk reduction, greater transparency, and sustainability. Examples of enhanced capabilities expected with a next generation EAM system include:

- **Consistent definition of asset**—The new EAM will facilitate a consistent definition of an "asset" across DART, and a consistent philosophy of hierarchy of assets (identifying appropriate parent-child relationships between assets, subassets and components) will allow all systems to track asset values systematically, resulting in more consistent tracking.

- **Improved asset hierarchies across all asset classes**—A well-established asset hierarchy will allow DART to easily identify and locate assets, allow for robust cost and reliability tracking, and aggregate information for reporting and analysis. A well-defined asset hierarchy will also serve as a building block for other asset improvements identified in this report.

- **Implementation of location referencing system**—Implementation of a location referencing system as a part of the new EAM will allow for easier tracking of asset location, primarily for linear assets.

- **Incorporate condition assessments into asset management program**—The condition assessments provide valuable information about assets, which should be linked to prior condition data as well as treatment information on those assets. This includes using a standard hierarchy of assets for condition assessment—both the five-year assessment and preventive maintenance inspections. The new EAM will allow DART stakeholders to clearly understand the benefits of this integration—and provide value to DART.

- **Implementation of automated condition assessment/asset health technologies**—DART would like to evaluate the use of automated condition assessment/health triggers that are available on many of its ways, structures, and amenities (WSA) assets and the integration of this information into EAM to support more efficient decision making.

- **Ability to carry over historical work data when an asset's "home" location is changed**—This capability does not exist at the moment in DART's Spear implementation.

- **Ability for contractors to enter work information seamlessly**—The new EAM shall allow contractors to enter work information, with a subsequent DART review and approval process.

- **Better integration between new EAM and Lawson for cost tracking**—This will allow for easier and more accurate tracking of maintenance costs.

- **Enhanced reporting capabilities**—Most CMMS reports are currently run through third-party tools (Crystal Reports, Ripplestone), and require deep knowledge of the existing data structure. As a result, only a small number of individuals can produce reports—making scheduled reporting, ad-hoc reporting, and simple queries difficult to perform. The new EAM needs to allow for more robust reporting capabilities that do not require an in-depth knowledge of the underlying data structure.

- **Track component level warranty/component serialization**—The new EAM needs to allow for better warranty tracking to enable DART to track the warranties at the component level.

- **Warranty integration with EAM**—The new EAM shall support the automatic tracking of warranty information throughout an asset's lifecycle.

- **Enhanced asset on-boarding process**—This includes implementing an on-boarding checklist and dashboard in the EAM that helps identify and track the requirements for on-boarding and the status of incoming assets. It also includes supporting the electronic transfer of asset registry and other information from contractors to the EAM during asset commissioning and hand-over.

- **Improve spare parts tracking**—Improvements to the spare parts tracking process include clearly identifying parts that can be used on multiple assets, and keeping this information up to date. This will allow for easier tracking of spare parts to identify new parts that need to be stocked as well as disposed based on changes to assets.

- **Update asset disposal process**—The system should provide for a clear indication of when assets and/or components are retired/disposed so that the assets can be marked as such in Lawson. This will require tighter integration between the new EAM system and Lawson, so that the process is automated.

- **Ability to prepare a materials forecast in EAM**—The new EAM should allow DART to prepare a materials forecast automatically based on various elements. These would include both previous material consumption (historical consumption-based forecast), and pre-defined treatments and asset condition/life cycle information (consumption demand forecast).

- **Material movement and transactions**—The new EAM will provide improvements to material movement and transactions to allow DART to not only track the materials, but also track distribution efficiency.

- **Material demand/inventory replenishment—**Improvements to material demand/inventory replenishment will allow DART to better establish and track required material levels, accounting for long lead times, seasonal changes, safety stock, and other factors. This includes forecasting demand based on both historical consumption as well as upcoming demand (e.g., major campaigns, needs for new assets).

- **Enhanced capabilities to track and issue materials**—The new EAM should allow DART to not only track materials better, but also to simplify the process of requesting and issuing materials/serialized components from inventory—steps that are not currently well supported by Spear. This includes using bar codes or other means (e.g., RFID) to track materials/components throughout their life cycle.

- **More robust performance monitoring**—A more robust performance monitoring mechanism will allow DART to pinpoint issues and resolve them faster. Reporting updates to Lawson, combined with integration of Lawson and new EAM will help DART improve its performance monitoring.

- **Better tools to assist with planning and budgeting**—The new EAM will provide tools to prioritize candidate assets for replacement as well as forecast needs based on current condition in order to assist DART staff to prepare and model operating and capital plans/budgets more easily.

5.4.8 Maintenance Assessment Findings from Parsons Brinckerhoff

In 2015, Dallas Area Rapid Transit (DART) engaged Parsons Brinckerhoff (PB) to analyze asset management, supply chain management, warehouse management and project management business processes, make recommendations to re-engineer these business practices as appropriate, and prepare system requirements to acquire and aid in the acquisition of commercial off-the-shelf-solutions to support the re-engineered business processes. The first phase of this project was to conduct an "As-Is" environment assessment. The overall findings from PB's "As-Is" Environment Report included the following statements:

Overall Findings

Our analysis indicates that DART has a good understanding of the number of assets owned, their current location/status (e.g., in service, retired), as well as the condition of the assets. Our interviews found that there is a very strong focus on maintenance management, which has resulted in the DART system being in a state of good repair as defined by the Federal Transit Administration (FTA). DART currently uses Spear as their maintenance management system, which was implemented in the late 1990s. The system is functionally out-of-date, which presents various business challenges for the maintenance and materials management departments. The extent to which Spear supports various asset-class requirements, and the extent to which functionality available within Spear was implemented, varies by division within the Maintenance Department. Spear provides robust functionality for DART's bus, light rail vehicle (LRV) and nonrevenue vehicle (NRV) fleets (which are maintained by the Fleet Services division), but the functionality for facilities and linear assets (which are supported by both the Fleet Services and WSA divisions) is not as robust. Also, the current system does not provide true Enterprise Asset Management (EAM) capabilities—functionalities such as life cycle cost tracking, demand analysis, and asset prioritization/trade-off. That said, staff members have adapted well to the existing tools and developed work arounds to ensure that their work can be conducted and recorded as efficiently as possible.

Planning, Policy, and Strategy

DART actively monitors and manages its State of Good Repair (SGR) budget. The budget is updated and tracked for each year of the DART 20-Year Financial Plan and specific projects funded from the SGR budget are defined annually as well. The SGR budget consists of seven categories, per key asset areas, and is reviewed at a minimum every five years. The SGR budget is based on the five-year condition assessment that DART conducts, detailed life cycle management plans prepared by maintenance divisions, as well as the agency's operational needs. The plans for rail and bus fleets are updated every year, but the plans for WSA division assets are not updated as often.

Spear provides very limited functionality to prepare and/or model the detailed life cycle management plans. These plans are currently prepared by extracting data from Spear and then using Excel to manage the detailed plan. In addition, Spear does not provide any capabilities to prepare an operating budget or a capital budget, which would require forecasting needs and the capability to prioritize proposed projects by year.

5.4.9 DART Internal Audit's Review of Maintenance-Related Issues

Iknow spoke with DART's Internal Audit Department about maintenance-related issues or actions that occurred during the State Mandated Performance Audit period, 2012–2015. The Internal Audit Department reported that there were no material issues or actions during the period.

5.5 Current Maintenance-Related Improvement Initiatives

DART has four important improvement initiatives related to system maintenance that are currently underway:

1. Fleet Modernization
2. Supply Chain Management Process Improvement
3. SPEAR Replacement Initiative
4. Succession Planning

5.5.1 Fleet Modernization

DART is in the middle of a fleet modernization. Starting in 2012, DART began migrating its bus fleet from diesel and liquefied natural gas to compressed natural gas. This modernization will require the training of the bus fleet maintenance personnel to repair, service, and overhaul the new engine. Along with the new engine and fuel technology, the vehicles will be equipped with cameras, electronic information signs, and other electronic components that are not part of the current fleet. This equipment will also require current and future maintenance personnel to have the requisite skills to maintain the equipment.

5.5.2 Supply Chain Management Process Improvement

In the last few years, DART has been improving its supply chain management process by moving toward larger, single contracts to maximize economy of spend, developing key performance indicators (KPIs), and implementing a supplier performance management program (using mostly manual processes).

In 2011, DART began a phased implementation of Infor's Lawson Procurement System (version 9.01), including the following submodules: Procurement, Requisition Center, Procurement Punchout, Strategic Sourcing, Contract Management, and Supplier Order Management. As new capabilities come online, DART is refining business practices to enhance its supply chain management efficiency. For example, DART is now using automated reports to monitor and report many KPIs such as administrative lead times, number of POs issued, contracts awarded, total number of transactions, etc. In spite of this progress, DART is still facing challenges in the following areas:

- Too many sole source requirements,
- Excessive lead times,
- Inconsistent supplier reliability,
- Assets down for parts,
- Fleet complexity, and
- Order size and economy.

In the future, DART would benefit from improved visibility into the entire supply-chain process across all stakeholder departments and third parties. Ideally, the system will automatically suggest

parameter adjustments which will allow DART to maintain proper supply-chain controls, optimize inventory balances, and consistently meet service-level agreements. To accomplish this vision, DART is expecting the new EAM system to provide additional capabilities such as:

- A real-time planning system for determining current and forecasting future demand that takes into account actual delivery times; and, current and future asset inventories (to assist with improved reorder points and safety stock calculations, among others);

- Optimized maintenance of stocking levels and replenishment cycles;

- A warehouse management system providing detailed planning and recommendations for warehouse space optimization and allows for proper receiving to be done including receipt-entry coding for Overages, Shortages, Damages (OS&D) and discrepant receipts;

- Ability to better track and issue materials, including serialized components;

- Streamlined reporting for procurement and materials management;

- A fully integrated, automated system for managing supplier performance (in conjunction with Lawson Procurement); and

- A system with reporting capabilities including the full spectrum of Supply Chain key performance indicators (inventory usage rates, on-time deliveries, full- or partial-receipt quantities, discrepancies, etc.)

In the future, in addition to those improvements to the overall supply chain management processes referenced above, there is a desire to improve the efficiency and effectiveness of the storage of the inventoried materials. The goals of this improvement initiative are to:

- Increase the effective cubic storage space in each facility;

- Optimize the management and distribution of "nonstocked" expensed materials;

- Reduce the receiving, retrieval, and issue transaction times of material issued to the DART Maintenance teams; and

- Minimize further the risk of occupational injuries associated with handling of the materials stored at DART.

5.5.3 Spear Replacement Initiative

In June 2015, DART initiated an effort to analyze asset management, supply chain management, warehouse management and project management business processes, make recommendations to re-engineer these business practices as appropriate and prepare system requirements to procure commercial off-the-shelf-solutions to support the re-engineered business processes. DART established a formal governance structure to manage these efforts and retained Parsons Brinckerhoff (PB) to assist with this initiative.

As part of this effort, PB is working closely with DART staff to assess and document the state of current business practices and identify business improvement opportunities in the Enterprise Asset Management (EAM), Supply Chain Management and Enterprise Project Management (EPM) business

areas. Based on the team's analysis it has been determined that there are gaps in the current systems in terms of their ability to meet DART business requirements. In addition, these current systems do not allow DART to implement industry best practices nor do the current systems provide the flexibility to easily expand to address DART's future needs.

DART's vision is to be on par with world-class business practices in both the EAM (including supply chain management) and EPM business areas. As part of this initiative, DART's key stakeholders plan to collaborate together to champion efforts to streamline EAM and EPM strategies and plans which shall align and assist in meeting the following DART-wide objectives:

- Implement asset nomenclature and data management standards;

- Implement whole-life investment programs to maintain asset performance;

- Develop a decision-making framework to assess asset life performance and costs;

- Adopt a systematic approach to asset risk management and a focus on asset criticality;

- Improve efficiency and effectiveness in terms of forecasting material requirements;

- Enhance capability to plan and manage inventory to reduce unplanned asset downtimes and potential service disruptions;

- Comply with MAP-21 and conform with industry best practices such as PAS 55 and ISO55001;

- Utilize contemporary software which incorporates industry best practices, platforms, and information reporting frameworks;

- Implement EPM portfolio best practices from conceptual planning stages to project implementation and closure for all DART projects; thereby, giving DART improved project controls and monitoring capabilities and increased transparency and visibility;

- Minimize exposure to financial risk, claims, and litigation;

- Increase DART's capacity to undertake and efficiently deliver large capital programs; and

- Create a performance-management system to measure/report on key performance indicators.

In May 2016, DART released a Request for Qualifications for Enterprise Asset Management (EAM) software. Implementation is currently targeted for FY2018.

5.5.4 Succession Planning

The Maintenance Department is facing a sizable number of retirements in its leadership ranks over the next five to eight years. To address this retiring workforce issue, the Department launched an 18-month succession planning initiative to create competency profiles for key positions (e.g., AVPs and Directors), update the job descriptions for hourly and salaried employees, and develop the individual and group training programs to help develop the Department's employees. This initiative is currently in progress.

6. Audit Findings of the Maintenance Department

In this section, we present our audit findings of the Maintenance Department. The findings follow three lines of analysis.

1. **Condition Assessment of DART's Fleet and Facilities.** Iknow spoke with DART staff and the two contracted service providers about their current maintenance procedures and practices, observed in-process maintenance activities, conducted inspections of the maintenance facilities, and performed visual examinations of the interior and exterior conditions of a sample of vehicles across all modes.

2. **Assessment of DART's Maintenance Programs.** Iknow spoke with DART staff about the supporting maintenance programs, reviewed monthly status reports, and reviewed maintenance-related documentation, including standard operating procedures, work instructions, manuals, and related internal records.

3. **External Benchmarking.** Iknow analyzed DART's reported data to the National Transit Database. Because of the Audit's focus on maintenance, we used the performance metric Miles Between Road Calls (MBRC).

6.1 Condition Assessment of DART's Fleet and Facilities

Iknow conducted numerous visual inspections of DART's revenue vehicles, maintenance facilities, yards, and passenger stations. The focus of these inspections was to personally observe the overall condition of the vehicle fleet, the maintenance work being performed, the equipment and tools used to service the vehicles, the stockrooms and inventory holding locations, and the degree of cleanliness of the facilities. During the course of the audit, Iknow personnel formally toured each location and visited each of them several times and during most shifts. Repair, fueling, cleaning and other major maintenance activities were observed and evaluated.

Iknow found that DART and its contractors had the necessary trained personnel, maintenance facilities, tools, work orders/instructions, and access to Spear to accomplish their responsibilities and provide high quality services. The facilities and vehicles are well maintained and they present a professional and competent image of DART to its riders and its stakeholders.

6.1.1 Fleet

The good physical and operating condition of the fleet, along with timely repairs and preventive maintenance inspections (PMIs), demonstrate that DART is able to define and administer a successful maintenance program. Highlights of the assessment by mode are presented below.

6.1.1.1 Bus

Iknow toured the East Dallas, Northwest, and South Oak Cliff bus maintenance facilities. We observed maintenance in progress and inspected buses in the shop and in the yard. We also rode buses on several lines and reviewed repair and maintenance service data.

We found the DART bus fleet to be in excellent condition. Bus interiors and exteriors were consistently clean. Maintenance was being done according to DART standards.

6.1.1.2 Light Rail

Iknow toured the Central Rail Operating Facility and the Northwest Rail Operating facility. We observed maintenance in progress, inspected cars in the shop and on the line, rode cars on the line, and reviewed maintenance service data. The Light Rail fleet exhibits a high level of reliability. Rolling stock appears to be in excellent condition. Interiors and exteriors of cars inspected in the shop and on the line were clean.

Riding cars on the line was uneventful; no problems were encountered. No delays were experienced and no defects were noticed in passenger-observable systems, including propulsion, braking, air conditioning, doors, and public address.

6.1.1.3 Commuter Rail

Iknow rode the TRE in service and visited several passenger stops. The TRE fleet was found to be in good working condition and presentable. Our overall impression was that proper maintenance was being performed. Note that TRE maintenance is subject to Federal Railroad Administration (FRA) standards and contractual requirements, which generally cover all of the maintenance requirements of the State of Texas.

6.1.1.4 Paratransit

Iknow toured the Paratransit Operating Facility. We observed maintenance being performed on several paratransit vehicles. The fleet was found to be in good working condition and very presentable.

6.1.2 Facilities

Overall, facility maintenance is very good. The facilities were generally clean, well lit, appropriately ventilated, and had all the necessary safety equipment (e.g., fire extinguishers, floor markings, etc.).

The administrative buildings are consistently clean. Building exteriors and grounds are well maintained.

6.2 Assessment of DART's Maintenance Programs

In this Section, we summarize our audit findings regarding the detailed review of many of the support elements of the maintenance program. Iknow assessed DART compliance with applicable State regulations by conducting a review of nine discrete maintenance program areas for DART's four major transit modes (i.e., bus, light rail, commuter rail, and paratransit) as well as non-revenue vehicles and ways, structures, and facilities. The nine program areas discussed in this section are:

1. Vehicle Preventive Maintenance Programs
2. Maintenance Staffing and Organization
3. Maintenance Training Programs
4. Warranty Programs
5. Component Rebuild Programs
6. Materials Management Support of the Maintenance Programs
7. Ways, Structures (Signals and Power), and Facilities Maintenance Programs
8. Maintenance Safety Programs
9. Maintenance Cost Elements

6.2.1 Vehicle Preventive Maintenance Programs

State of Texas State Requirement

Texas Administrative Code requires the development of a written maintenance plan, preventive maintenance inspections (PMIs) and scheduled services, management of maintenance resources, and standards for maintenance contractors.

Iknow's Compliance Assessment Summary

DART fully complies with the requirement for written maintenance plans, PMIs, scheduled services, management of resources, and setting standards for contractors. DART bus and light rail divisions have developed and applied preventive maintenance programs that are comprehensive, covering all important vehicle maintenance issues. Vehicle condition audits showed that vehicles are in good condition and that the programs are being administered properly and effectively.

Iknow reviewed preventive maintenance procedures (inspection SOPs) and found that they addressed the areas that should be inspected and followed manufacturer's recommendations and industry best practices. Iknow reviewed the intervals between inspections performed, and found that all inspections were performed on time. Iknow also found that problems were almost always repaired in one visit to the garage, indicating that mechanics diagnosed and fixed defects correctly during the bus's initial repair. No issues were identified by Iknow.

6.2.2 Maintenance Staffing and Organization

State of Texas State Requirement

N/A

Iknow's Compliance Assessment Summary

Iknow found that the maintenance staffing levels and organization effectively support the maintenance program without excessive persons or workloads on current staff. The current organization provides the proper levels of personnel to ensure that appropriate maintenance is completed on time and effectively.

Iknow observed staffing levels at all maintenance facilities throughout the course of its visits. Iknow also discussed staffing levels with Senior Managers. Iknow did not observe workers without activities, and each unique discipline (e.g. preventive maintenance inspections, running repairs, etc.) appeared to be adequately staffed. No issues were identified by Iknow.

6.2.3 Maintenance Training Programs

State of Texas State Requirement

The Texas DOT Guidelines require maintenance employee training that includes components for vehicle and facility familiarization, accessible equipment maintenance, employee safety, and agency rules and regulations.

Iknow's Compliance Assessment Summary

Maintenance training programs at DART's bus, light rail, TRE commuter rail, and paratransit operations are compliant with the State of Texas Transportation Code and DOT Guidelines. DART Maintenance makes a significant investment in training for all levels of skilled employees. Nineteen skill sets, which are defined in a training SOP, are covered. No issues were identified by Iknow.

6.2.4 Warranty Programs

State of Texas State Requirement

The Texas Administrative Code requires that the maintenance program plan address warranty compliance and recovery. DART also requires a review of warranty programs and their effectiveness.

Iknow's Compliance Assessment Summary

DART effectively pursues all warranty claims and complies with all regulatory requirements. Warranty processing and administration for all vehicles, equipment and facilities is the responsibility of the Technical Services Division. The SPEAR MMIS system is used to record, document and track warrantable activities for all DART operations. The Lawson system provides the internal verification on claim credits, debits, and receivables tracking. On work orders, mechanics are provided with a warranty check-off field for all repairs that are deemed to be covered under warranty. Since all of this information is tracked electronically, warranty administrators are able to closely manage warranty compliance. No issues were identified by Iknow.

For FY2015, DART received more than $2.2 million in bus warranty returns on 1,026 paid claims during the fiscal year. This was slightly above the budgeted warranty amount. Rail-related warranty was $26,876 on 14 paid claims in FY2015.

6.2.5 Component Rebuild Programs

State of Texas State Requirement

N/A

Iknow's Compliance Assessment Summary

DART requested a review of component rebuild programs. Iknow found that the component rebuild programs and the Central Support Services effectively use vehicle maintenance program resources. No issues were identified by Iknow.

6.2.6 Materials Management Support of the Maintenance Programs

State of Texas State Requirement

The State of Texas requires "management of maintenance resources." Effective materials management support of the maintenance program affects compliance with this requirement, and DART has identified this as a key area to be reviewed.

Iknow's Compliance Assessment Summary

DART effectively uses Spear to manage ordering and distribution of parts for vehicle repair. All DART modes are compliant with the State's requirement. No issues were identified by Iknow.

6.2.7 Ways, Structures, and Facilities Maintenance Programs

State of Texas State Requirement

The Texas Administrative Code requires that: "Subrecipients shall perform necessary maintenance and grounds keeping to preserve the value of the original investment and its physical appearance and integrity." Therefore, DART requires a review of ways, structures, and facility maintenance programs.

Iknow's Compliance Assessment Summary

Iknow found that maintenance programs for track, signals, power, and facilities to be of high quality and compliant with State of Texas requirements. Preventive maintenance inspection (PMI) and repair programs are in place that ensure that safe and reliable service is provided. No issues were identified by Iknow.

6.2.8 Maintenance Safety Programs

State of Texas State Requirement

N/A

Iknow's Compliance Assessment Summary

DART requested a review of maintenance safety programs.

Iknow found that DART has developed a comprehensive maintenance safety program that includes the use of personal protective equipment, where appropriate, and extensive safety training for employees. DART's SOPs and WIs describe the specific safety equipment required for the work being performed. No issues were identified by Iknow.

6.2.9 Maintenance Cost Elements

State of Texas State Requirement

N/A

Iknow's Compliance Assessment Summary

DART requested a review of maintenance cost elements.

As described in Section 2.4.1, DART's Maintenance Department prepares and follows a comprehensive business plan and budget. The business plan is reviewed and approved by senior management and others with oversight responsibility. Budget reports are prepared and reviewed on a regular and timely basis. Discrepancies or negative trends are identified quickly and corrected. DART's executive management also regularly reviews maintenance spending.

Iknow believes that DART's overall maintenance costs are reasonable and that all cost elements are well managed. Maintenance costs are primarily driven by Department headcount. Both salaried and hourly headcount over the period remained almost constant. FY2012 had a salaried headcount of 210 people. A Position Control Report run on June 16, 2016 showed budgeted salaried positions of 213 people and 197 actual filled positions. Hourly headcount in FY2012 was 763 people. The same Position Control Report showed 769 budgeted hourly positions and 738 actual filled positions. No issues were identified by Iknow.

6.3 Maintenance Department Performance

DART's Maintenance Department has achieved significant improvement in mechanical service calls during the review period. The results for Miles Between Road Calls (MBRCs) from 2012 to 2015 are presented in Table 3.4. We believe these results are due, in part, to the Maintenance Department's comprehensive approach to maintenance and its strong leadership team.

Table 3.4   **Miles Between Road Calls (MBRCs), 2012–2015**

	2012	2013	2014	2015	2012–2015 Percent Growth	CAGR
Bus	5,442	5,911	7,970	9,977	83.3%	22.4%
Light Rail	33,328	35,625	45,662	40,891	22.7%	7.1%
Commuter Rail	118,732	122,868	227,343	273,259	130.1%	32.0%
Paratransit	18,939	15,941	16,677	42,528	124.6%	31.0%

Source: DART Quarterly Reports; National Transit Database; TRE Office

DART's results for 2015 compare quite favorably with transit authorities from other major U.S. cities.

7. Improvement Recommendations

This section presents the improvement recommendations for DART's Maintenance Department. Its purpose is to satisfy Section 452.454(b)(2) of the State of Texas Transportation Code, which states one purpose of the audit is to provide "information to the authority to assist in making changes for the improvement of the efficiency and effectiveness of authority operations." .

Based on our comprehensive assessment, our conclusion is that DART's Maintenance Department is performing exceptionally well. Our excellent rating extends across all aspects of the Department, from the leadership and depth of experience of the management team, through the comprehensive business processes and practices, to the daily documenting of routine maintenance tasks as part of an inspection. Issues that we commonly see at other transit agencies have been resolved, or are being actively addressed.

Iknow has no improvement recommendations to offer to the Maintenance Department.

Iknow did identify two functional areas outside of maintenance whose activities have a significant impact on the ability of the Maintenance Department to perform its mission. Both improvement opportunities are described below.

7.1 Human Capital

In the 2012 State Mandated Performance Audit, TransTech Management made the following Major Recommendation (repeated verbatim):

DHR-1. New leadership in the Department of Human Resources should focus on improving a number of processes that would move HR from an average organizational unit to one that is more exemplary. Priority attention should be given to the following matters, most of which are under the direct control of the VP, Human Resources.

- **Compensation.** Compensation decisions should be expedited, whether they are accomplished in house or with vendors.

- **HR Generalists.** These individuals (4) need to focus more strategically on customer service and spend more time serving their operations constituents in the field.

- **Recruiting.** A renewed focus is called for in the recruiting area, where two individuals carry most of the workload.

- **Vacancies.** HR needs to rectify an approximate 14% vacancy ratio within its own unit (as of June 2012).

- **Customer Satisfaction.** HR should develop and deploy internal and external customer satisfaction surveys on a regular basis.

- **Performance Measures.** Maintain the Quarterly Scorecard, which is an excellent tool, and add additional measures such as Talent Bench Strength and Quality of Hire Based on Performance.

- **Employee & Labor Relations (ELR).** The strength of ELR within HR and the agency needs to be re-established.

- **Organizational charts.** DART VPs and AVPs maintain their own organizational charts, which vary in terms of format and information provided. HR should be the repository of the official organizational charts for the agency.

An interview with Mr. Michael Hubbell, Vice President—Maintenance, conducted by Iknow in mid-January 2016, captured many of the same issues. Mr. Hubbell identified the three most critical issues as:

1. **Lengthy recruiting process.**

2. **Long onboarding process.** "The cycle time is way too long from a decision to hire to the first day on the job. The onboarding process and its failures are not one person's problems. It takes forever once a decision is made to the time the person starts work. Decisions to hire are made and then they do not start the job for five months. The hardest thing in this organization is to get hired."

3. **Confusing and inaccurate compensation strategy, analysis, and bands.** "The compensation strategy and decision rules need to be made explicit and communicated to everyone. There is currently no comp strategy and one needs to be created." Mr. Hubbell gave the example of a 32-year employee who applied for a promotion. She was selected as the best candidate and then was told she could have the job at $10,000 per year salary reduction.

Further analysis conducted by Iknow in 2016 confirmed that no progress has been made in these areas. The persistent and unresolved issues in the Human Capital Department threaten the long-term health of the Maintenance Department.

Iknow's Recommendation: DART needs to allocate the funding and launch a multi-year program to address the issues in the Human Capital Department.

7.2 Information Technology

In January 2016, DART was the victim of a cyber-attack. Files on many of the Agency's servers were encrypted. The loss of the Spear MMIS and its underlying data due to a cyber-attack would seriously jeopardize the health of DART's vehicle assets and facilities.

Iknow's Recommendation: DART needs to define and implement the necessary IT security measures to protect the Spear application and data files (and any future MMIS replacement system).

Section 4

Management's Response

As required by State law, DART management was asked for its response to each recommendation made in the State-Mandated Performance Audit. Mr. David Leininger, Executive Vice President and Chief Financial Officer, submitted the following responses to Iknow on November 14, 2016.

1. Recommendation Regarding Human Capital

Prepared by Cheryl Orr, Vice President—Human Capital

In the 2012 State-Mandated Performance Audit, it was noted that priority attention should be given to several human resources processes.

I was hired in December 2015 and was immediately tasked to address these and other Human Capital (HC) issues. In January 2016, a Business Process Reengineering Consultant was engaged to assess Human Capital's entire functioning. The consultant not only interviewed all Human Capital staff, but all DART's Management staff, regarding HC services. The report was released in late summer and is being reviewed by DART's Management. Since the consultant met with me regularly, I have been able to implement some of their recommendations, as well as human resources' best practices.

I have spent much of my time since arriving at DART assessing Human Capital's culture and reorganizing for efficiency. I have also spent time meeting with all vice presidents to understand their Human Capital concerns. Many changes have been made to address those issues. Other changes will require time and focus.

There is a real and significant commitment on behalf of the Agency to implement best practices and make process improvements in Human Capital. For FY 2017, one of the Agency's goals is to "Improve performance for various administrative functions to advance DART's mission." One of the performance measures that will be used to assess progress against that goal is "implement recommendations for Human Capital processes including recruitment, compensation, and succession planning."

Over the next year, Human Capital will focus on implementing updated compensation practices, recruitment issues, staff development, and benefits redesign. Plans have been developed to address each of these issues. As a long time Human Resources professional, I am clear that Human Capital is a vital, internal partner, whose work supports departments in their efforts to achieve their business objectives.

2. Recommendation Regarding Information Technology

Prepared by Nicole Fontayne-Bárdowell, Vice President and Chief Information Officer

On January 2, 2016, DART experienced a network cyber intrusion. The impact consisted of a provisional delay to Agency functions to back-office operations and capabilities, but business was able to continue.

The DART Technology Department engaged the intrusion, deleted the threat, and implemented an aggressive security protection plan. Key elements of the Agency protection plan included hiring cyber forensic specialists, dedicated security personnel (CISO and senior analyst), encrypting and masking of critical data, improved intrusion detection and prevention tactics, refreshing recovery plans, and engaging managed security services.