

Regular Meeting of the
Board of Trustees of the Utah Transit Authority



Wednesday, July 22, 2020, 9:00 a.m.

Remote Electronic Meeting – No Anchor Location – Live-Stream at
https://www.youtube.com/results?search_query=utaride

NOTICE OF SPECIAL MEETING CIRCUMSTANCES DUE TO COVID-19 PANDEMIC:

In keeping with recommendations of Federal, State, and Local authorities to limit public gatherings in order to control the continuing spread of COVID-19, and in accordance with Utah Governor Gary Herbert’s Executive Order on March 18, 2020 suspending some requirements of the Utah Open and Public Meetings Act, the UTA Board of Trustees will make the following adjustments to our normal meeting procedures.

- All members of the Board of Trustees and meeting presenters will participate electronically via phone or video conference.
- **Public Comment** will not be taken during the meeting but may be submitted through the means listed below. Comments submitted before 4:00 p.m. on Tuesday, July 21st will be distributed to board members prior to the meeting:
 - online at <https://www.rideuta.com/Board-of-Trustees>
 - via email at boardoftrustees@rideuta.com
 - by telephone at 801-743-3882 option 5 (801-RideUTA option 5) – specify that your comment is for the board meeting.
- Meeting proceedings may be viewed remotely through YouTube live-streaming.
https://www.youtube.com/results?search_query=utaride

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| 1. Call to Order & Opening Remarks | Chair Carlton Christensen |
| 2. Safety First Minute | Sheldon Shaw |
| 3. Consent
a. Approval of July 15, 2020 Board Meeting Minutes | Chair Carlton Christensen |
| 4. Agency Report | Carolyn Gonot |
| 5. August 2020 Change Day Service Plan Approval | Mary DeLoretto,
Laura Hanson |
| 6. Resolutions
a. R2020-07-02 – Resolution Approving the Execution of an Interlocal Cooperation Agreement with West Jordan City for Provision of Additional Funds to Supplement the existing TIGER Stakeholder Agreement | Mary DeLoretto,
Heather Bening |

7. Contracts, Disbursements, and Grants

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| a. Contract: Commuter Bus Replacement
(Motor Coach Industries) | Eddy Cumins |
| b. Real Estate Contract: Box Elder Right-Of-Way
(Box Elder Federal Credit Union) | Paul Drake |
| c. Pre-Procurements | Todd Mills |
| i. FrontRunner Operational Service Analysis | |
| ii. Scheidt & Bachman TVM Service Contract – Sole
Source | |
| d. Grant Application: Federal Transit Administration
Public Transportation Innovation Program Grant - Rail
Defect Detection Research | Mary DeLoretto |

8. Other Business

- a. Next meeting: August 5, 2020 at 9:00 a.m.

Chair Carlton Christensen

9. Adjourn

Chair Carlton Christensen

Special Accommodation: Information related to this meeting is available in alternate format upon request by contacting callredge@rideuta.com or (801) 287-3536. Request for accommodations should be made at least two business days in advance of the scheduled meeting.

Real heroes wear masks, be a hero



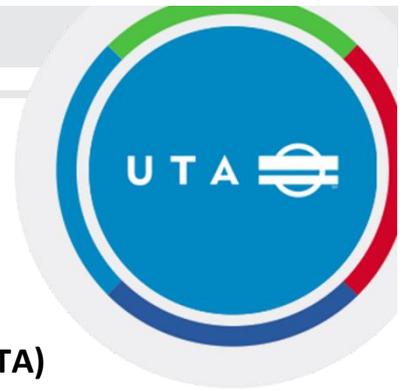


MEMORANDUM TO THE BOARD

TO: Utah Transit Authority Board of Trustees
FROM: Jana Ostler, Board Manager

BOARD MEETING DATE: July 22, 2020

SUBJECT:	Approval of July 15, 2020 Board Meeting Minutes
AGENDA ITEM TYPE:	Consent
RECOMMENDATION:	Approve the minutes of the July 15, 2020 Board of Trustees meeting
BACKGROUND:	A regular meeting of the UTA Board of Trustees was held electronically and broadcast live on YouTube on Wednesday July 15, 2020 at 9:00 a.m. Minutes from the meeting document the actions of the Board and summarize the discussion that took place in the meeting. A full audio recording of the meeting is available on the Utah Public Notice Website and video feed is available on You Tube at https://www.youtube.com/results?search_query=utaride
ATTACHMENTS:	1) 2020-07-15_BOT_Minutes_unapproved



**Minutes of the Meeting
of the
Board of Trustees of the Utah Transit Authority (UTA)
held remotely via phone or video conference
and broadcast live for the public via YouTube
July 15, 2020**

Board Members Participating:

Carlton Christensen, Chair
Beth Holbrook
Kent Millington

Also participating were members of UTA staff.

Call to Order and Opening Remarks. Chair Christensen welcomed attendees and called the meeting to order at 9:00 a.m.

Public Comment. It was noted that online comment received for the meeting was distributed to the board prior to the meeting and will be included as an appendix to the minutes of the meeting.

Safety First Minute. Sheldon Shaw, UTA Director of Safety & Security, provided a brief safety message.

Consent Agenda. The consent agenda was comprised of:

- a. Approval of July 1, 2020 Board Meeting Minutes

A motion to approve the consent agenda was made by Trustee Holbrook and seconded by Trustee Millington. The motion carried unanimously.

Agency Report.

Americans with Disabilities Act (ADA) Celebration. Carolyn Gonot, UTA Executive Director, spoke about the UTA Committee on Accessible Transportation's 30-year celebration of the passage of the ADA. Celebratory events include a UTA book club,

virtual documentary screening, and virtual grand finale event with Rachel Simon, author of “Riding the Bus with My Sister: A True Life Journey.”

Contracts, Disbursement, and Grants.

Contract: Lawncare and Landscape Services (Acer Landscape Management, LLC and The Yard Butler). Eddy Cumins, UTA Chief Operating Officer, requested approval of contracts with Acer Landscape Management, LLC and The Yard Butler to perform lawn care and associated services. Both contracts have a base term of three years with two one-year options. Acer Landscaping Management will have responsibility for 21 properties at a cost of \$105,492.80 per year and The Yard Butler will have responsibility for 8 properties at a cost of \$15,589.50 per year.

Discussion ensued. Questions on the bidding process and property oversight were posed by the board and answered by Mr. Cumins.

A motion to approve the contracts was made by Trustee Millington and seconded by Trustee Holbrook. The motion carried unanimously.

Contract: Annual Supplier Agreement for Bus Mobile Data Computer Systems (Broadcast Microwave Services). Dan Harmuth, UTA IT Director, was joined by Kyle Brimley, UTA Communications & Deployment Manager. Mr. Harmuth asked for approval of the contract, which supplies mobile data computer units, screens, mounts, and cables for new buses. The contract has a base term of one year with two one-year options. The estimated not-to-exceed value of the contract for all three years is \$450,000. Mr. Harmuth indicated that the intent of the agency is to move toward a new, less costly system of mobile computing utilizing tablets within a couple of years.

Discussion ensued. Questions on flexibility in procuring parts for the new system and installation considerations for different bus models and transportation modes were posed by the board and answered by staff.

A motion to approve the contract was made by Trustee Holbrook and seconded by Trustee Millington. The motion carried unanimously.

Grant Agreement: Federal Transit Administration FY19 Transit-Oriented Development (TOD) Planning Grant Awards for UTA Corridors at South Utah County FrontRunner and Point of the Mountain. Mary DeLoretto, UTA Chief Service Development Officer,

described the grants, which provide funds for TOD analysis along the UTA-owned corridors from Provo to Payson and from Draper to Lehi.

A motion to accept and approve execution of the grant awards was made by Trustee Millington and seconded by Trustee Holbrook. The motion carried unanimously.

Discussion Items.

South Salt Lake County Microtransit Pilot Quarterly Report. Nichol Bourdeaux, UTA Chief Communications & Marketing Officer, was joined by Jaron Robertson, UTA Director of Innovative Mobility Solutions, and Shaina Quinn, UTA Researcher – Innovative Mobility Solutions. Mr. Robertson provided a quarterly report on the South Salt Lake County Microtransit Pilot, including effects of COVID-19 and ridership and performance metrics. Ms. Quinn presented projections in ridership and performance. Mr. Robertson then concluded by reviewing data on top pick up and drop off locations, mobility enhancements, customer experience metrics, and flex route performance.

Discussion ensued. Questions on how customers are accessing the service (e.g., app, phone, etc.), potential continuation of the program, expansion to the wider system, and future plans for flex route service were posed by the board and answered by staff.

August 2020 Change Day Service Plan Overview. Ms. DeLoretto was joined by Laura Hanson, UTA Director of Planning, and Eric Callison, UTA Manager of Service Planning. Ms. Hanson summarized the service planning objectives, successes, budget, and plans associated with the August 2020 change day. She noted the board is requesting public comment prior to its meeting on July 22, 2020.

Discussion ensued. Questions on the decision-making process for route 2X, routes with improved midday service, information posted for public comment, and timeframe for consideration of future adjustments were posed by the board and answered by staff.

Chair Christensen called for a break at 10:15 a.m.

The meeting resumed at 10:25 a.m.

Utah Transit Authority Corridor Studies with Bus Rapid Transit Alternatives. Ms. DeLoretto was joined by Janelle Robertson, UTA Project Manager II, and Hal Johnson, UTA Manager – Project Development & Systems Planning. Ms. DeLoretto outlined bus

rapid transit (BRT) corridors currently under consideration and their associated details. The projects and studies discussed include Ogden-Weber State University (WSU) BRT, Davis-Salt Lake Community Connector, Mid-Valley Connector, Southwest Salt Lake County Transit Study, Point of the Mountain Transit Study, Central Corridor Transit Study, and South Utah County Transit Analysis.

Discussion ensued. Questions on the funding gap for the Ogden-WSU BRT project, distribution of funds from the Rocky Mountain Power grant, inclusion of a connection to the University of Utah in the Davis-Salt Lake Community Connector project, capital commitments to the Mid-Valley Connector project, consideration of electric buses on the Mid-Valley Connector project, metropolitan planning organization process timeline for southwest Salt Lake County work, Lehi alignments in the Point of the Mountain Transit Study, UTA-owned right-of-way extending south of Lehi, and timeline for securing funding following the South Utah County Transit Analysis were posed by the board and answered by staff.

Other Business.

Next Meeting. The next meeting of the board will be on Wednesday, July 22, 2020 at 9:00 a.m.

Adjournment. The meeting was adjourned at 11:01 a.m. by motion.

Transcribed by Cathie Griffiths
Executive Assistant to the Board Chair
Utah Transit Authority
cgriffiths@rideuta.com
801.237.1945

This document is not intended to serve as a full transcript as additional discussion may have taken place; please refer to the meeting materials, audio, or video located at <https://www.utah.gov/pmn/sitemap/notice/616549.html> for entire content.

This document along with the digital recording constitute the official minutes of this meeting.

Appendix

Online Public Comment to the Board of Trustees of the Utah Transit Authority (UTA) Board Meeting

Received July 14, 2020 from George Chapman:

Comments to UTA Board of Trustees July 15 meeting

I am still against planning TODs from Draper to Lehi since UTA should not spend billions on a project that will, like LA, not provide much increased ridership. UTA still owes bus riders a restored robust bus system. Landowners should pay any rail or BRT projects.

The microtransit system now cost \$35 to \$44 per rider and should be stopped. UTA should practice better financial responsibility.

The BRT projects are wasteful and, like the Ogden BRT, are not cost effective. UTA still has no proof that BRT works. UVX, a free service, is not comparable. The best proof that BRT does not work is the 35 MAX that has never had more than 3200 passengers a day despite taking out two lanes of road that could handle 10,009 cars!



MEMORANDUM TO THE BOARD

TO: Utah Transit Authority Board of Trustees
FROM: Carolyn Gonot, Executive Director
PRESENTER(S): Carolyn Gonot, Executive Director

BOARD MEETING DATE: July 22, 2020

SUBJECT:	Agency Report
AGENDA ITEM TYPE:	Report
RECOMMENDATION:	Informational report for discussion
DISCUSSION:	Carolyn Gonot, UTA Executive Director will report on recent activities of the agency and other items of interest.



MEMORANDUM TO THE BOARD

TO: Utah Transit Authority Board of Trustees
THROUGH: Carolyn Gonot, Executive Director
FROM: Mary DeLoretto, Chief Service Development Officer
PRESENTER(S): Laura Hanson, Director of Planning

BOARD MEETING DATE: July 22, 2020

SUBJECT:	August 2020 Change Day Service Plan Approval
AGENDA ITEM TYPE:	Approval
RECOMMENDATION:	Approve the August 2020 Service Plan
BACKGROUND:	<p>On April 5, 2020, UTA implemented service reductions in response to the decreased ridership during the COVID-19 pandemic. The Executive Director established a Recovery Task Force and part of their mission is to guide restoration of service during the changing landscape of the pandemic and reopening of activities. UTA service planning during this recovery phase considers both the short-term demands and long-term outcomes with a focus on ridership and financial stability.</p> <p>In the presentation at the July 15, 2020 Board Meeting, staff provided an overview of the changes planned for the August Change Day scheduled for August 23, 2020, and the process through which these changes were identified.</p>
DISCUSSION:	<p>With universities planning reopening for fall and other activities gradually reopening, UTA staff has developed a service plan to initiate on August 23, 2020. This new service plan primarily restores much of the service that was reduced in April. This will be an important change day for UTA and staff will communicate and prepare for this change day similar to other UTA “change days”.</p> <p>As a temporary service change in response to the Coronavirus, these service changes do not rise to the level of a major service change that would require a Title VI service equity analysis. However, UTA service planning did review the proposed August 2020 service for equity to prevent unintentional discrimination, as requested by the Federal Transit Administration. In addition, staff requested public comments on the service plan July 15 through July 21. Comments can be submitted through email, rideuta@rideuta.com or telephone 801-RIDE-UTA (801-743-3882).</p>
ALTERNATIVES:	The Board could choose to not implement the proposed service plan, meaning that many of UTA’s routes would remain at reduced service levels. The UTA Board may also choose to implement only portions of the August 2020 plan, and hold off on others

	until further analysis can be completed. In either scenario, UTA may not be able to keep up with public demand for restored transit service and customers may experience crowding on transit vehicles.
FISCAL IMPACT:	The service restoration plans for August Change Day are estimated to cost approximately \$129 million over the course of the next year. This falls well within the agency's operational budget and includes a 2.5% contingency.
ATTACHMENTS:	<ul style="list-style-type: none">• August 2020 Service Plan Summary

August 2020 Service Plan

On April 9, 2020, UTA reduced its service levels in response to the coronavirus pandemic. This was an effort to minimize exposure to the virus for UTA operators, to respond to a dramatic decrease in ridership, and to ensure that UTA would have the resources to continue to provide a baseline of essential service to the region.

Since that time, UTA has carefully monitored ridership on all of its services, and has added additional trips back into service as ridership levels began to impact the ability for UTA customers to socially distance while on board.

The economy has continued to reopen and this August 2020 Service Plan is a corresponding restoration of transit service to meet the demands of an active Wasatch Front. While, not yet a full restoration of all of UTA's services, the August 2020 Service Plan is a significant step in that direction.

August 2020 Service Plan Highlights

1. 91% of pre-COVID service miles and hours are being restored.
 - % of pre-COVID Hours: 86% WKD, 100% SAT, 96% SUN
 - % of pre-COVID Miles: 82% WKD, 96% SAT, 85% SUN
2. 53 routes (46% of UTA's total number of routes) will have higher or the same service as pre-covid levels.
 - 9 routes will experience higher service levels than pre-covid
 - 44 routes will resume their pre-covid service levels
3. 9 routes (8%) will experience a partial restoration of service.
4. 32 routes (28%) will remain temporarily reduced. These routes are primarily those serving commuter markets that have been slow to return to transit.
5. 20 routes (18%) will remain suspended until further analysis and alternative methods of service can be properly evaluated.
6. Operator working conditions have been improved significantly by extending the span of service on certain routes allowing for better blocking.
7. TRAX and bus schedules better align on weekends to allow for smoother transfers.

Improved beyond pre-covid levels	Restored to pre-covid levels		Partial Restoration	Hold at Reduced Levels		Remain Suspended
33	2	606	612	3	F570	2X
35	4	F618	626	11	F590	35M
72	6	F620	627	17	604	307
201	9	628	701 (Blue)	41	F605	313
217	21	630	703 (Red)	45	613	320
509	39	F638	704 (Green)	47	625	354
520	F94	640	720 (S-Line)	54	645	F402
821	200	650	750 (FR)	62	833	456
871	209	667	830 (UVX)	205	834	460
	213	805		220		461
	218	806		223		462
	240	807		227		463
	451	822		232		471
	F453	831		248		472
	455	841		F400		526
	470	850		454		F534
	519	862		473		608
	F522	902		F504		616
	525	919		F514		809
	551	920		F518		864
	F578	953		F546		
	601			F547		
	603			F556		

Current UTA Routes July 2020

Route #	Type	Route Name	Key Destinations Served or Notes
2	Fixed	200 South	Salt Lake Central Station, Downtown SLC, University of Utah. Sponsored service with SLC
2X	Fixed	200 South Express	Salt Lake Central Station, University of Utah. Currently Suspended
3	Fixed	3rd Avenue	North Temple Station, Downtown SLC, University of Utah, VA Hospital, Research Park, This is the Place State Park
4	Fixed	400 South/Foothill Drive	Poplar Grove, Downtown SLC, University of Utah, VA Hospital, 3900 S/Wasatch Blvd Park 'n' Ride
6	Fixed	6th Avenue	Salt Lake Central Station, Downtown SLC, LDS Hospital, University of Utah
9	Fixed	900 South	Poplar Grove, Glendale, University of Utah. Sponsored service with SLC
11	Fixed	11th Avenue	Salt Lake Central Station, Downtown SLC, LDS Hospital, University of Utah
17	Fixed	1700 South	Central Pointe Station, SLCC-South City, University of Utah
21	Fixed	2100 South-2100 East	Central Pointe Station, Sugar House, University of Utah. Sponsored service with SLC
33	Fixed	3300 South	West Valley Central Station, Millcreek Station, 3900 S/Wasatch Blvd Park 'n' Ride
35	Fixed	3500 South	West Valley Central Station, Magna
35M	Fixed	MAX-3500 South	West Valley Central Station, Magna. Currently suspended
39	Fixed	3900 South	West Valley Central Station, SLCC-Redwood, Meadowbrook Station, Granite Peaks Learning Center, 3900 S/Wasatch Blvd Park 'n' Ride
41	Fixed	4100 South	West Valley Central Station, Hunter HS
45	Fixed	4500 South	Murray Central Station, Holladay Town Center, 3900 S/Wasatch Blvd Park 'n' Ride
47	Fixed	4700 South	Murray Central Station, SLCC-Redwood, Hunter HS
54	Fixed	5400 South	Murray Central Station, Taylorsville City Center, 5600 West
62	Fixed	6200 South	Fashion Place West Station, 5600 West
72	Fixed	7200 South	Midvale Ft Union Station, Cottonwood Corporate Center
200	Fixed	State Street North	North Temple Station, State Capitol, Downtown SLC, SLCC-South City, Murray Central Station
201	Fixed	State Street South	Murray Central Station, Sandy Cairns, Sandy Civic Center Station, South Jordan Station
205	Fixed	500 East	Salt Lake Central Station, St. Joseph's Villa, Granite Peaks Learning Center, Murray North Station
209	Fixed	900 East	North Temple Station, Downtown SLC, Sugar House, Fashion Place West Station
213	Fixed	1300 East-1100 East	Midvale Center Station, Sugar House, University of Utah
217	Fixed	Redwood Road	West Jordan City Center Station, Taylorsville City Center, SLCC-Redwood, Redwood Junction Station, Power Station, 1940 West Station, Westpointe
218	Fixed	Sandy - South Jordan	South Jordan Station, River Park Corporate Center, West Jordan City Center Station
220	Fixed	Highland Drive-1300 East	Salt Lake Central Station, Downtown SLC, University of Utah, East HS, Sugar House, 9400 S 2000 E Park 'n' Ride
223	Fixed	2300 East-Holladay Blvd	University of Utah, Holladay Town Center, Cottonwood Corporate Center
227	Fixed	2700 West	West Valley Central Station, UDOT Rampton Complex, Sugar Factory Road Station
232	Fixed	3200 West	West Valley Central Station, Jordan Valley Station
240	Fixed	4000 West-Dixie Valley	West Valley Central Station, Jordan Landing, Jordan Valley Station, SLCC-West Jordan
248	Fixed	4800 West	West Valley Central Station, 4800 West Station
307	Fixed	Cottonwood Heights Fast Bus	Cottonwood Heights, Downtown SLC. Currently suspended
313	Fixed	South Valley-U of U Fast Bus	Sandy, Research Park, University of Utah. Currently suspended
320	Fixed	Highland Drive Fast Bus	9400 S 2000 E Park 'n' Ride, Downtown SLC. Currently suspended
354	Fixed	Sandy - U of U Fast Bus	9400 S 2000 E Park 'n' Ride, 3900 S/Wasatch Blvd Park 'n' Ride, University of Utah. Currently suspended
451	Commuter	Tooele Fast Bus	Tooele, Stansbury Park, Downtown SLC
454	Commuter	Grantsville - Salt Lake	Grantsville, International Center, Airport, Downtown SLC
455	Commuter	U of U-Davis County-WSU	University of Utah, Downtown SLC, Lakeview Hospital, Farmington Station, Weber State University, Ogden Station, Ogden Garage
456	Commuter	Ogden-Unisys-Rock Mountain Express	Ogden Station, Rocky Mountain Power. Currently suspended
460	Commuter	Woods Cross	Woods Cross Station, Downtown SLC. Currently suspended
461	Commuter	Bountiful via State Capitol	Woods Cross Station, State Capitol, Downtown SLC. Currently suspended
462	Commuter	North Salt Lake	North Salt Lake, Downtown SLC. Currently suspended
463	Commuter	West Bountiful	Woods Cross Station, State Capitol, Downtown SLC. Currently suspended
470	Commuter	Ogden-Salt Lake Intercity	Downtown SLC, DTC, Clearfield Station, Downtown Ogden, Ogden Station, Ogden Garage
471	Commuter	Centerville	Centerville, Downtown SLC. Currently suspended
472	Commuter	Riverdale-/Salt Lake Express	Davis County, Downtown SLC. Suspended in August 2020

Route #	Type	Route Name	Key Destinations Served or Notes
473	Commuter	Ogden-Salt Lake Express via Highway 89	Ogden Station, Weber State University, Farmington Station, Downtown SLC, University of Utah, Research Park
509	Fixed	900 West Shuttle	Salt Lake Central Station, Welfare Square, UDOT TOC, West Valley Central Station
513	Fixed	Industrial Business Park Shuttle	Salt Lake Central Station, Directors' Row, UDOT TOC, Lake Park, West Valley Central Station
519	Fixed	Fairpark	Rose Park, Salt Lake Central Station
520	Fixed	Rose Park	Rose Park, Salt Lake Central Station
525	Fixed	Midvale Shuttle	Midvale Center Station, Sandy Pkwy
526	Fixed	12600 South	Draper Station, Riverton Office Complex
551	Fixed	International Center	1940 West Station, International Center
601	Fixed	Ogden Trolley	Ogden Station, Downtown Ogden
603	Fixed	Weber State University-McKay Dee	Ogden Station, Downtown Ogden, Weber State University, McKay-Dee Hospital
604	Fixed	West Ogden	Ogden Station, West Ogden, Roy Station
606	Fixed	Enable Industries	Enable Utah. Currently suspended
608	Fixed	2nd St-DTSI	DTSI. Currently suspended
612	Fixed	Washington Blvd	North Ogden, Ogden ATC, Downtown Ogden, Washington Terrace
613	Fixed	Weber Industrial Park	Ogden Station, BDO, Weber Industrial Park
616	Fixed	North Weber FrontRunner Shuttle	Pleasant View, Pleasant View Station, Ogden Station. Currently suspended
625	Fixed	ATC - Harrison Blvd - WSU	Ogden ATC, Weber State University
626	Fixed	West Roy-WSU Davis	Clearfield Station, West Roy
627	Fixed	WSU Davis-DTC	Clearfield Station, WSU Davis, Layton Hills Mall NUAMES, DTC
628	Fixed	Midtown Trolley	Clearfield Station, Layton Hills Mall, Layton Station
630	Fixed	Brigham City-Ogden Commuter	Brigham City, Ogden Station
640	Fixed	Layton Hills Mall - WSU Ogden	Layton Hills Mall, Clearfield Station, Freeport Center, Weber State University
645	Fixed	Monroe Blvd	Weber State University, McKay Dee Hospital, Ogden ATC
650	Fixed	WSU Fast Bus	Ogden Station, Weber State University
667	Fixed	Lagoon/Station Park Shuttle	Farmington Station, Station Park, Lagoon
674	Ski	Powder Mountain	Ogden Station, Powder Mountain. Seasonal only
675	Ski	Snowbasin	Ogden Station, Snowbasin. Seasonal only
677	Ski	Layton/Snowbasin	Layton Station, Snowbasin. Seasonal only
701	LRT	TRAX Blue Line	Salt Lake Central Station, Salt Lake City, South Salt Lake, Millcreek, Murray, Midvale, Sandy, Draper
703	LRT	TRAX Red Line	University of Utah, Salt Lake City, South Salt Lake, Millcreek, Murray, Midvale, West Jordan, South Jordan, Daybreak
704	LRT	TRAX Green Line	Airport, North Temple Station, Salt Lake City, West Valley City, West Valley Central Station
720	SRT Car	S-Line	Central Pointe Station, South Salt Lake, Sugar House
750	CRT	FrontRunner	Ogden, Roy, Clearfield, Layton, Farmington, Woods Cross, Salt Lake City, Murray, South Jordan, Draper, Lehi, American Fork, Orem, Provo
805	Commuter	Sanataquin-Payson-Spanish Fork-Provo Station-UVU	Santaquin, Payson, Spanish Fork, Provo Station, Utah Valley University
806	Commuter	Eagle MTN-Saratoga Springs-Lehi Station-UVU	Eagle Mountain, Saratoga Springs, Lehi Station, Utah Valley University. Currently suspended
807	Commuter	North County -Lehi Station-UVU	Lehi Station, Highland, Alpine, Pleasant Grove, Vineyard, Utah Valley University. Currently suspended
809	Commuter	Pleasant Grove / American Fork	Pleasant Grove, American Fork, American Fork Station. Currently suspended
821	Fixed	South County-Provo Station	Payson, Salem, Spanish Fork, Springville, Provo Station
822	Commuter	South Utah County-BYU-UVU Limited	Payson, Salem, Spanish Fork, Springville, Brigham Young University, Utah Valley University
830X	BRT	UVX	Provo Station, Provo Towne Centre, East Bay, Downtown Provo, Brigham Young University, University Place, Utah Valley University, Orem Station
831	Fixed	Provo Grandview	Provo Station, Brigham Young University, Utah Valley University
833	Fixed	Airport-Provo Station	Provo Station, Provo Airport
834	Fixed	Riverwoods-Provo Station	Provo Station, Riverwoods, Orem Library
841	Fixed	Orem Station	Orem Station, Utah Valley University
850	Fixed	State Street	Provo Station, University Place, Orem, Lindon, Pleasant Grove, American Fork, Lehi, Thanksgiving Park, Lehi Station
862	Fixed	Orem East-West	Orem Station, Utah Valley University, Canyon Park Technology Center, University Place

Route #	Type	Route Name	Key Destinations Served or Notes
864	Fixed	Lehi Station / Thanksgiving Point	Thanksgiving Park, Lehi Station
871	Fixed	Tech Corridor Rail Connector	Lehi Station, Thanksgiving Park, Draper Town Center Station
880	Ski	Sundance	University Place, Sundance. Seasonal only
901	Express	PC-SLC Connect	Meadowbrook Station, 3900 South/Wasatch Park 'n' Ride, Kimball Junction, Park City. Seasonal only
902	Express	PC-SLC Connect	Park City, Kimball Junction, University of Utah, Downtown Salt Lake City, Salt Lake Central Station
919	Fixed	Fairpark / West HS	West High School
920	Fixed	Rose Park / West HS	West High School
953	Ski	Midvale Ft Union Station to Snowbird/Alta	Midvale Ft Union Station, Snowbird, Alta
972	Ski	Midvale Ft Union Station to Solitude/Brighton	Midvale Ft Union Station, Solitude, Brighton. Seasonal only
994	Ski	Historic Sandy Station to Snowbird/Alta	Historic Sandy Station, Snowbird, Alta. Seasonal only
F94	FLEX	Sandy Flex	Historic Sandy Station, 9400 South 2000 East Park 'n' Ride
F400	FLEX	Tooele Flex	Tooele
F402	FLEX	Tooele City Circulator	Tooele, Tooele ATC. Currently suspended
F453	FLEX	Tooele-SLC Flex	Tooele, Stansbury Park, 1940 West Station
F504	FLEX	South Jordan Flex	Daybreak, Daybreak Parkway Station
F514	FLEX	300 West Flex	Sandy Civic Center Station, South Jordan Station, 300 West, Draper Station
F518	FLEX	Riverton Flex	Daybreak Parkway Station, Riverton Office Complex
F522	FLEX	2200 West Flex	1940 West Station, 2200 West
F534	FLEX	Herriman Flex Shuttle	Herriman, Riverton, South Jordan, South Jordan Station
F546	FLEX	Draper Flex	Sandy Civic Center Station, 1300 East, Draper Town Center Station
F547	FLEX	Herriman Flex	Daybreak Parkway Station, Herriman
F556	FLEX	5600 West Flex	5600 West
F570	FLEX	7000 South Flex	Midvale Ft Union Station, Bingham Junction Station, Jordan Landing
F578	FLEX	7800 South Flex	Midvale Center Station, Bingham Junction Station, Jordan Landing
F590	FLEX	9000 South Flex	Historic Sandy Station, SLCC-West Jordan
F605	FLEX	Bountiful / Centerville Flex	Woods Cross Station, Lakeview Hospital, Bountiful, Centerville
F618	FLEX	Ogden BDO Flex	Ogden Station, BDO
F620	FLEX	West Haven Flex	Ogden Station, West Haven, Roy Station
F638	FLEX	Brigham City Flex	Brigham City



MEMORANDUM TO THE BOARD

TO: Utah Transit Authority Board of Trustees
THROUGH: Carolyn Gonot, Executive Director
FROM: Mary DeLoretto, Chief Service Development Officer
PRESENTER(S): Mary DeLoretto, Chief Service Development Officer

BOARD MEETING DATE: July 22, 2020

SUBJECT: R2020-07-02 Resolution Approving the Execution of an Interlocal Cooperation Agreement with West Jordan City for Provision of Additional Funds to Supplement the Existing TIGER Stakeholder Agreement

AGENDA ITEM TYPE: Resolution

RECOMMENDATION: Approve Resolution R2020-07-02 approving the execution of an Interlocal Cooperation Agreement with West Jordan City comprising the initial Stakeholder Agreement, Supplement No. 1, and Supplement No. 2. Supplement No. 2 provides additional funds for the West Jordan Sidewalk and Railroad Pedestrian Crossing Project as part of the TIGER First/Last Mile Program.

BACKGROUND: TIGER Stakeholder Agreement and Supplement No. 1 between UTA and West Jordan City (Stakeholder Agreement 18-2658BM) were executed on March 30, 2018 between UTA and West Jordan City for the Sidewalk and Railroad Pedestrian Crossing and the Wayfinding Signage to Gardener Village and Jordan River Parkway Trail Project as part of the TIGER First/Last Mile Program with a total budget of \$104,191, of which \$81,991 is from TIGER grant funding, \$12,000 is from West Jordan City, \$600 is from Salt Lake County CATNIP funds, and \$9,600 is funded by UTA. Supplement No. 2 is to increase the budget of the West Jordan Sidewalk and Railroad Pedestrian Crossing Project by \$137,776, of which \$55,000 is UDOT Section 130 Funds and \$82,776 is to be funded by West Jordan City. The total West Jordan City Projects budget with Supplement No. 2 will be \$241,967.

DISCUSSION: The additional funding is required for construction of the West Jordan Sidewalk and Railroad Pedestrian Crossing Project under the TIGER First/Last Mile Grant Project. The UDOT Section 130 funds have already been secured by UTA. West Jordan City will be invoiced for Supplement No. 2 City participation funds (\$82,776) based on actual construction costs incurred following Final Completion.

ALTERNATIVES: Without the additional funding, there would not be enough budget to pay for construction of the West Jordan Sidewalk and Railroad Pedestrian Crossing Project.

FISCAL IMPACT:	The additional UDOT and local project partner funding will increase the overall TIGER Grant Project Budget by up to \$137,776. The additional funds will be included in the 2021 TIGER project budget.
ATTACHMENTS:	1) R2020-07-02 Approving West Jordan Interlocal Cooperation Agreement, including: <ul style="list-style-type: none">• Exhibit A - ILA• Exhibit B - Supplement 1• Exhibit C - Supplement 2

**RESOLUTION OF THE BOARD OF TRUSTEES OF THE UTAH
TRANSIT AUTHORITY APPROVING THE EXECUTION OF AN
INTERLOCAL COOPERATION AGREEMENT WITH WEST JORDAN
CITY FOR PROVISION OF ADDITIONAL FUNDS TO SUPPLEMENT
THE EXISTING TIGER STAKEHOLDER AGREEMENT**

R2020-07-02

July 22, 2020

WHEREAS, Utah Transit Authority (the "Authority") is a large public transit district organized under the laws of the State of Utah and was created to transact and exercise all of the powers provided for in the Utah Limited Purpose Local Government Entities – Local Districts Act and the Utah Public Transit District Act; and

WHEREAS, West Jordan City ("West Jordan") and the Authority are "public agencies" as defined by the Utah Interlocal Cooperation Act, UTAH CODE § 11-13- 101 *et seq.* (the "Cooperation Act"), and, as such, are authorized by the Cooperation Act to each enter into an interlocal cooperation agreement to act jointly and cooperatively on the basis of mutual advantage; and

WHEREAS, the Authority and West Jordan previously executed a TIGER Stakeholder Agreement (the "Agreement"), UTA Contract Number 18-2658BM on March 30, 2018 for West Jordan's TIGER First/Last Mile Projects: the Sidewalk and Railroad Pedestrian Crossing; 4773 W Old Bingham Hwy Project (WEJ_RRX_2) and the Wayfinding Signage to Gardner Village and Jordan River Parkway Trail Project (WEJ_WAY_1). The Agreement contemplated execution of a Supplement outlining specific details for the City projects; and

WHEREAS the Authority and West Jordan previously executed Supplement Number 1 to the Agreement on March 30, 2018, for the design and construction of the Sidewalk and Railroad Pedestrian Crossing; 4773 W Old Bingham Hwy Project (WEJ_RRX_2) and the Wayfinding Signage to Gardner Village and Jordan River Parkway Trail Project (WEJ_WAY_1), and a budget for the projects of \$104,191; and

WHEREAS, West Jordan and the Authority now desire to enter into an Interlocal Cooperation Agreement, the Supplement Number 2, which is attached hereto as Exhibit C, to increase the budget of the Sidewalk and Railroad Pedestrian Crossing; 4773 W Old Bingham Hwy Project (WEJ_RRX_2) by \$137,776 for a total budget of \$241,967; and

WHEREAS, of the \$241,967 budgeted for this project, \$81,991 will come from TIGER Grant funds, \$600 from Salt Lake County CATNIP funds, \$94,776 from West Jordan City funds, \$9,600 from UTA Local funds, and \$55,000 from UDOT Section 130 funds; and

NOW, THEREFORE, BE IT RESOLVED by the Board of the Authority:

1. That the Board hereby approves the Interlocal Cooperation Agreement with West Jordan City, comprising of the Agreement, as set forth in Exhibit A; Supplement Number 1, as set forth in Exhibit B; and Supplement Number 2, as set forth in Exhibit C.
2. That the Board authorizes the Executive Director and her designee(s) to execute the Interlocal Cooperation Agreement (Supplement No. 2) with West Jordan in substantially the same form as attached as Exhibit C.
3. That the Board hereby ratifies any and all actions previously taken by the Authority's management, staff, and counsel to prepare the Interlocal Cooperation Agreement, comprising of the Agreement, Supplement Number 1, and Supplement Number 2.
4. That the corporate seal be attached hereto.

Approved and adopted this 22nd day of July 2020.

Carlton Christensen, Chair
Board of Trustees

ATTEST:

Robert K. Biles, Secretary/Treasurer

(Corporate Seal)

Approved As To Form:

Legal Counsel

Exhibit A
(Interlocal Cooperation Agreement)

**STAKEHOLDER AGREEMENT
WEST JORDAN CITY**

TIGER GRANT

TIGER 2016 GRANT NO. 2018-02	UTA CONTRACT NO. 18-2658 BM	STAKEHOLDER CONTRACT NO.
SUMMARY OF CITY PROJECTS: WEJ_RRX_2: SIDEWALK AND RR PED CROSSING; 4773 WOLD BINGHAM HWY WEJ_WAY_1: WAYFINDING SIGNAGE TO GARDNER VILLAGE & JORDAN RIVER PKWY TRAIL		PROJECT VALUE OF CITY PROJECTS \$ 104,191
		CITY REPRESENTATIVE: BILL BARANOWSKI

This Stakeholder Agreement (“Agreement”) is entered into this 30th day of MARCH 2018 by and between the Utah Transit Authority, a public transit district (“UTA”) and West Jordan City (“City”).

RECITALS

WHEREAS, UTA provides public transit services in all or parts of Salt Lake, Davis, Weber, Box Elder, Utah and Tooele Counties, and certain interlocal public transit within portions of Summit County;

WHEREAS, Wasatch Front Regional Council (“WFRC”) and Mountainland Association of Governments (“MAG”) are the Metropolitan Planning Organizations for the areas included within the UTA service district;

WHEREAS, in 2016, UTA, in cooperation with the City, WFRC, MAG, the Utah Department of Transportation (“UDOT”) and approximately 30 other public entities (collectively the “Stakeholders”), submitted a grant application (the “Grant Application”) to the United States Department of Transportation seeking a Transportation Investment Generating Economic Recovery (“TIGER”) discretionary grant;

WHEREAS, on or about July 29, 2016, the United States Department of Transportation published notice of its intent to award UTA a TIGER discretionary grant (the “TIGER Grant”) in the amount of \$20 million;

WHEREAS, the eligible scope of the TIGER Grant will be to fund a portion of the design and construction of several multimodal projects (the “TIGER Projects”) that improve transportation connections to UTA’s commuter rail and light rail systems;

WHEREAS, City is a project funding partner with respect to one or more of the TIGER Projects (such subset of the TIGER Projects hereinafter referred to as the “City Projects”) referenced in the Grant Application;

WHEREAS, City has committed to provide or secure local matching funds for the City Projects;

WHEREAS, several other Stakeholders have committed to provide local matching funds for additional TIGER Projects and it is contemplated that UTA will execute identical agreements with such other Stakeholders;

WHEREAS, UTA has committed to provide local matching funds for additional TIGER Projects to be constructed at UTA stations;

WHEREAS, it is economically and logistically in the best interests of UTA and City (as well as the Stakeholders with respect to other TIGER Projects) for UTA to complete both the City Projects and other TIGER Projects

under one set of design and construction contracts, with UTA managing the TIGER Grant funds and managing the contractual relationships with selected contractors; and

WHEREAS, the parties and the other Stakeholders all intend that the TIGER Projects will be coordinated and managed in a collaborative manner that reflects good regional planning, the consistent treatment of all Stakeholders and the coordination of all TIGER Projects as one regional first/last mile connection strategy.

NOW, THEREFORE, in consideration of the mutual covenants and agreements herein set forth, the mutual benefits to the parties to be derived herefrom, and for other valuable consideration, the receipt and sufficiency of which the parties hereto acknowledge, the parties agree as follows:

1. PROJECT DESCRIPTION.

- A. All of the Stakeholders intend to collaborate to complete the TIGER Projects (including the City Projects), over the course of approximately five (5) years, with UTA responsible for project management and TIGER Grant oversight.
- B. City has committed to provide funds and/or in-kind contributions, as more particularly set forth herein, for the City Projects.

2. PROJECT ADMINISTRATION AND MANAGER. UTA shall be responsible for administration of the design and construction contracts for the TIGER Projects, and any additional contracts as deemed necessary by UTA. In no event shall UTA be expected or required to enter into contracts, or to take on any obligations, committing UTA to pay amounts in excess of funds that have already been committed to the TIGER Projects. UTA shall administer these contracts in accordance with its procurement and contracting policies and all TIGER Grant requirements.

UTA will assign a Project Manager to manage and administer the TIGER Projects. The Project Manager will be responsible to report to the Policy Committee for oversight and management of the TIGER Projects. The Project Manager shall be Richard Miller.

City will assign a City Representative to coordinate with and participate in decisions with the Project Manager. The City Representative shall be as set forth in the introductory table of this Agreement. The City Representative will have the authority to approve design submittals and make or cause to be made the decisions required of City under this Agreement.

- 3. TERM. This Agreement shall remain in full force and effect until the TIGER Grant funds, together with the committed local funds, are fully expended and the TIGER Grant has been closed out.
- 4. PROJECT POLICY COMMITTEE. A Policy Committee has been established for the TIGER Projects, consisting of one individual from each of UTA, UDOT, WFRC, and MAG. The initial representatives are Jerry Benson for UTA, Carlos Braceras for UDOT, Andrew Gruber for WFRC, and Andrew Jackson for MAG. In the event one of the representatives leaves his or her position with an above-referenced agency, such agency will be responsible for appointing a new representative to the Policy Committee and communicating that to the Stakeholders. The Policy Committee will focus on the overall results and ongoing work of the TIGER Projects, will address any disputes among the Stakeholders involving the TIGER Projects, will seek additional funding as needed and will review and approve budgeting, accounting and other project oversight. All actions of the Policy Committee shall be taken by a majority determination of UTA, UDOT, WFRC, and MAG. All members of the Policy Committee shall be equal in authority. It is acknowledged that all actions of the Project Policy Committee must comply with applicable laws and with the scope, conditions and other requirements

applicable to the TIGER Grant, as ultimately executed between UTA and the United States Department of Transportation.

5. **WORK SCOPE.** A general description of the City Projects to be included in the TIGER Projects, together with the City's financial commitment to each of the City Projects, is set forth in Exhibit "A", attached hereto and incorporated herein by this reference. Specific scopes of work will be developed for the City Projects and will be included in a separate Supplement to Stakeholder Agreement ("Supplement"), in the form of Exhibit "B", attached hereto and incorporated herein by reference. The Supplement will identify a budget for design and construction (which shall include a reasonable apportionment of the project management and construction management costs, and a reasonable allocation of the total contingency budget for all TIGER Projects). The budget will be determined based upon information furnished by City and UTA will not be required to verify the accuracy or sufficiency of such information prior to commencing design of each City Project. Each Supplement will also identify a schedule for each City Project. Each Supplement will include appropriate national and/or local standards, including but not limited to NACTO, APWA, AASHTO, UDOT and MUTCD.
6. **PAYMENT/ACCOUNTING.** The local matching funds for each of the City Projects, for each fiscal year as committed by the Stakeholder, will be due to UTA in advance on July 1 of such year, or as otherwise designated in a Supplement. Funds shall be delivered to UTA, payable to "Utah Transit Authority", and delivered c/o Chief Financial Officer, 669 West 200 South, Salt Lake City, Utah. Each specific City Project will not be commenced until the local matching funds for that City Project have been delivered to UTA. To the extent that the Supplement for a City Project indicates additional funding sources (in addition to the TIGER Grant proceeds and corresponding local matching funds), City shall also be responsible for ensuring that the proceeds from such additional funding sources are also delivered to UTA in advance on July 1 or as otherwise designated in a Supplement. UTA shall maintain a financial database of all City funds, additional funding source proceeds, and all expenditures toward the City Projects.

City shall be responsible for any cost overruns (to the extent such overruns are not mitigated by value engineering or scope modifications) with respect to the City Projects. Payment for any cost overruns, as well as any additional scope or modifications requested by City (as more specifically described in Section 11 of this Agreement), shall be made promptly, in the same manner as described herein, and in the case of modifications, in advance, upon receipt of an invoice for the same from UTA. UTA may defer or suspend performance with respect to any City Project for which UTA has not received payment as indicated above. If City is unable to either secure additional funding for a City Project or modify the scope of City Project to fit within the available funding, then City may request that UTA not move forward with the City Project. Upon receipt of such request, UTA shall employ commercially reasonable efforts to remove the City Project from the scope of TIGER Projects and mitigate the incurrence of further costs toward such City Project. City shall be responsible for all costs previously incurred with respect to the City Project and any change order costs or partial termination costs incurred in conjunction with the removal of the City Project from the scope of the TIGER Projects. As applicable, City shall be entitled to any engineering deliverables previously prepared with respect to such City Project in their then-current condition.

To the extent that the actual total cost of designing and constructing the City Projects (exclusive of apportioned project management and construction management costs) is less than the budget indicated in the Supplement, City shall be entitled to a proportionate refund of the local matching funds committed for design and construction costs pursuant to the Supplement. Any such refund shall be payable within a reasonable time after the TIGER Grant has been closed out.

7. **APPROVALS; FEES.** Throughout the Term hereof, City shall expedite any required processes or approval steps to facilitate commencement of work on the City Projects; and further shall pay or waive any and all filing fees, impact fees, or other charges in completing the approvals and permitting necessary or required for a City Project.
8. **TIGER PROJECTS CONTRACTOR; SELECTION.** City acknowledges that, in accordance with the quantity and diversity of the TIGER Projects, a contractor or contractors shall be selected to complete the work contemplated hereunder. UTA, City, and the other Stakeholders anticipate selection of a contractor and a contracting method that will maximize efficiency in designing and constructing the various separate City Projects and TIGER Projects. UTA will prepare and distribute a Request for Qualifications and/or Request for Proposals for the TIGER Projects. UTA shall assemble a selection committee to review proposals by qualified firms and to select a designer and/or contractor to complete the TIGER Projects. The selection committee shall consist of representatives of UTA and one representative designated by each other member of the Policy Committee. The procurement and selection of a designer and/or contractors will be conducted in compliance with applicable state and federal procurement requirements, as well as applicable UTA policies and procedures for procurement. Negotiations will be conducted with the designer and/or contractor to establish a final work program and fee for the TIGER Projects. Upon selection of the designer and/or contractor, UTA will enter into a contract with the selected designer and/or contractor. UTA shall coordinate with the Policy Committee in such matters as issuing notices to proceed, change orders, accepting the work products of the designer and/or contractor, and similar items.
9. **FEDERAL REQUIREMENTS.** Any and all procurements, contracts and subcontracts related in any way to the City Projects shall be subject to all applicable state and federal laws, rules, regulations and requirements, including but in no way limited to, Buy-America requirements, payment of Davis-Bacon wages, Utah contractor insurance requirements, etc.
10. **UTILITIES; RIGHT-OF-WAY.** City and UTA do not contemplate any necessary property acquisitions or utility relocations for the City Projects. In the event any property acquisition or utility relocation is necessary, such acquisition or relocation shall be completed by City. Any such acquisitions or relocations shall be completed prior to such City Project being placed on that fiscal year's project list; and further all such acquisitions shall be completed in accordance with all applicable federal and state property acquisition rules, regulations, and guidelines, including but not limited to the requirements of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended, and regulations promulgated thereunder, and in accordance with UTA (and where applicable, UDOT) policies and procedures. Full documentation of the acquisition process shall be delivered to UTA prior to commencement of work on such City Project.
11. **COMPLETION OF CITY PROJECTS; SCOPE MODIFICATIONS.** No work shall be completed on any City Projects without a fully-executed Supplement, and without payment having been received for the same by UTA, in advance, as outlined herein. The Stakeholders acknowledge that, as a result of the number and scope of City Projects included within the TIGER Projects, any changes to standardized design and plans will likely result in increased costs and schedule impacts. Any changes or additions requested by a Stakeholder to any of the City Projects shall be reviewed by the Policy Committee, and in the Policy Committee's sole discretion, unless necessitated by a critical safety concern, will only be approved if the Stakeholder requesting the change enters into a Modification Supplement, substantially in the form attached hereto as Exhibit "C", agreeing to pay one hundred percent of the cost of such change.
12. **COORDINATION.** City and UTA shall keep each other, and other Stakeholders as appropriate, abreast of substantive communications and activities related to the City Projects.

13. **TIGER FUNDING A CONDITION PRECEDENT.** The terms of this Agreement, and the commitments and obligations hereunder, are conditioned upon and subject to UTA executing a final grant agreement with the Federal Transit Administration, committing the TIGER Grant funds. UTA and the City agree to execute amendments to any Supplement executed pursuant to this Agreement that may be necessary to conform to the final requirements of the TIGER Grant agreement.
14. **AMENDMENTS.** Alterations, extensions, supplements or modifications to the terms of this Agreement as detailed herein shall be agreed to in writing by the parties concerned, incorporated as amendments to this Agreement, and made a part hereof.
15. **COMPLETION/CONTINUING CONTROL.** UTA and City acknowledge that the City Projects are being or will be constructed on City (or, in the case of certain roadway rights-of-way, County or State) property. Except as otherwise indicated in a Supplement, UTA will not have title to any of such property. Nevertheless, the Federal Transit Administration rules and regulations require that UTA, as "grantee" under the TIGER Grant, maintain continuing control over the City Projects. Upon completion of each of the City Projects, UTA will prepare a proposed bill of sale transferring to City (or, if appropriate, the County or State) ownership and maintenance responsibility with respect to the improvements constructed as part of the City Projects and providing for the City's acceptance of such improvements. Final transfer of the improvements will be subject to FTA approval. The bill of sale will contain an acknowledgement and agreement by City to operate, maintain and repair the improvements constructed as part of City Projects in a manner that protects FTA's investment in the City Projects (for the full useful life of such improvements as defined in FTA Circular 5010.1E, and set forth in the bill of sale). Thereafter, City shall provide UTA with an annual report, in the form attached hereto as Exhibit "D", throughout the life of the City Projects (as further described on the report) that will (a) account for the City Projects and include City Project inventory records, (b) detail procedures for asset management and adequate maintenance of equipment and facilities that are a part of the City Projects, (c) ensure that effective and continuing control and accountability are maintained by City for all City Projects, and (d) ensure that the City Projects are properly used and safeguarded, and used solely for their authorized and intended purposes. In the event City shall not complete and provide UTA with the annual report, or in the event City shall not properly maintain the City Projects throughout the life of such City Projects, City shall reimburse the depreciated amount of TIGER Grant funds remaining in the City Projects. Upon completion, any warranty provided by the contractor or manufacturer of any materials, as applicable, shall be transferred to City.
16. **RECORDS.** The Stakeholders acknowledge disclosure and retention of records pursuant to this Agreement is subject to the Utah Government Records Access and Management Act, Utah Code Ann. §63G-7-101, et seq.

IN WITNESS WHEREOF, UTA and City have entered into this Agreement effective the date first set forth herein.

UTAH TRANSIT AUTHORITY

By [Signature]
Title CEO
Date: 4-3-18

By [Signature]
Title ACTING I/P, OCA
Date: 4/3/18

Approved as to Form:

[Signature]
UTA Legal Counsel

WEST JORDAN CITY

By [Signature]
Title Mayor
Date: 2-16-18

By _____
Title _____
Date: _____

ATTEST:
[Signature]
DEPUTY CITY CLERK



EXHIBIT "A"

**TIGER Projects
City Projects/Financial Commitments**

Project_ID	Project Description	Project Type	MUNICIPALITY	Project Status Cost	Program Management	Contingency	Construction Engineering + Project Management Costs	Design	Construction Engineering	Funding Bucket	\$ for Funding Source #1	Funding Source #1	\$ for Funding Source #2	Funding Source #2	\$ for Funding Source #3	Funding Source #3	Matching Funds Available(\$)	Tiger Funding (\$)	Year Funds Available	Construction Year
WEJ_WAY_1	Wayfinding signage to Gardner Village and Jordan River Parkway	Wayfinding	West Jordan	\$2,692	\$222	\$119	\$353	\$1,030	\$131	TIGER	\$600	County - Local					\$600	\$2,092	2018	2018
				\$104,191	\$8,603	\$8,731	\$15,336	\$21,519	\$6,734		\$12,600		\$9,600				\$22,200	\$81,991		

EXHIBIT "B"

Form of Supplement to Stakeholder Agreement

**SUPPLEMENT NO. __ TO
STAKEHOLDER AGREEMENT
_____ CITY**

TIGER GRANT

TIGER 2016 GRANT NO.	UTA CONTRACT NO.	STAKEHOLDER CONTRACT NO.
SUMMARY OF CITY PROJECTS INCLUDED IN THIS SUPPLEMENT:		VALUE OF CITY PROJECTS
		\$
		CITY REPRESENTATIVE:

THIS SUPPLEMENT NO. __ TO STAKEHOLDER AGREEMENT (“Supplement”), made and entered into this ___ day of _____, 201_, by and between **UTAH TRANSIT AUTHORITY**, a public transit district (“UTA”), and _____ (“City”).

The parties hereto entered in to a Stakeholder Agreement dated _____, (the “Agreement”), which Agreement contemplated execution of this Supplement outlining specific details for the City Projects to be completed thereunder. All definitions and terms of the Agreement remain in full force and effect unless otherwise specified herein.

The parties hereto agree to the specific City Projects, including scope, schedule and budget as follows:

Description of work to be performed, including proposed location:
(Plans/Plan Sheets Attached)

Anticipated duration of work:

Estimated Total Cost of Work:
(Detailed Estimate Attached)

ESTIMATED BUDGET OF THIS SUPPLEMENT: \$ _____

ESTIMATED AMOUNT OF TIGER GRANT PARTICIPATION: \$ _____

ESTIMATED AMOUNT OF CITY PARTICIPATION: \$ _____

ADDITIONAL FUNDING SOURCES: \$ _____

Upon full execution of this Supplement and receipt by UTA of the City participation funds to UTA, the contractor will be authorized to proceed with the work covered herein.

IN WITNESS WHEREOF, the parties hereto have caused these presents to be executed by their duly authorized officers as of the day and year first written above.

UTAH TRANSIT AUTHORITY

By _____
Title _____
Date: _____

By _____
Title _____
Date: _____

Approved as to Form:

UTA Legal Counsel

_____ CITY

By _____
Title _____
Date: _____

By _____
Title _____
Date: _____

EXHIBIT "C"

Form of Modification Supplement

**MODIFICATION SUPPLEMENT TO
STAKEHOLDER AGREEMENT**

This Modification Supplement to Stakeholder Agreement (“Modification”) is made and entered into this ____ day of _____ 2018 by and between Utah Transit Authority, a public transit district (“UTA”), and _____ City, a political subdivision of the laws of the State of Utah (the “City”). UTA and the City are hereinafter collectively referred to as the “parties” and either may be referred to individually as “party,” all as governed by the context in which such words are used.

RECITALS

WHEREAS, the parties hereto entered in to a Stakeholder Agreement dated _____, (the “Agreement”) regarding the construction of TIGER Projects;

WHEREAS, the Agreement contemplated execution of this Supplement outlining specific details for the City Projects to be completed as part of the TIGER Projects;

WHEREAS, the City desired to enhance, modify and/or increase the scope of certain of one or more of the City Projects (the “Modifications”);

WHEREAS, UTA, as the contracting party for the TIGER Projects, is willing to cause the TIGER Projects contractor to complete the Modifications provided that the City pay for the incremental costs associated with the Modifications; and

WHEREAS, this Modification is consistent with, and entered in accordance with, the Agreement.

AGREEMENT

NOW THEREFORE, on the stated Recitals, which are incorporated herein by reference, and for and in consideration of the mutual covenants and agreements hereinafter set forth, the mutual benefits to the Parties to be derived herefrom, and for other valuable consideration, the receipt and sufficiency of which the Parties acknowledge, it is hereby agreed as follows:

1. _____ Modifications. The City desires to include additional Modifications to the City Projects described and set forth in Supplement No. ____ to the Agreement, as such Modifications are described on Schedule 1, attached hereto and by this reference made a part hereof. UTA will manage and monitor the work consistent with the other construction performed in conjunction with the TIGER Projects.

[ALTERNATIVE PARAGRAPH 1 – 1. _____ Modifications. Contractor and/or UTA have determined that the City _____

2. Costs of Modifications. The City will be solely responsible for all actual, allocable and reasonable incremental costs attributable to the Modifications including, without limitation, labor, materials, construction, administrative overhead, taxes and other out of pocket expenses. Payment shall be made to UTA as described in the Agreement; or in the event that such modifications occur or arise as a result of changed conditions, (including by way of example only, soil conditions affecting footings, unidentified utilities, schedule delays, contractor-

requested change orders, etc.), within thirty (30) days of execution of this Modification Supplement.

IN WITNESS WHEREOF, the parties hereto have caused this Modification Supplement to be executed in duplicate as of the date first herein written.

UTAH TRANSIT AUTHORITY

(CITY)

By: _____
Title: _____

By: [Signature]
Title: Mayor 2-15-18

By: _____
Title: _____

ATTESTED AND COUNTERSIGNED

By: [Signature]
DEPUTY CITY CLERK

Reviewed and Approved as to Form

UTA Engineering

UTA Legal



EXHIBIT "D"

Annual City Projects Maintenance Report

This report shall be submitted on an annual basis, addressed to UTA as follows:

Utah Transit Authority
Asset Management Group
669 West 200 South
Salt Lake City, UT 84101

This report shall be submitted for ten years from the completion of the City Property, or such longer period as may be requested by UTA.

This report will include the following information submitted in a format reasonably acceptable to UTA:

- A description of the assets constructed as part of the City Project.
- Current photographs of such assets.
- Most recent inspection date.
- Summary of maintenance activities conducted since last report.
- Summary of long term maintenance and capital replacement plan.

Exhibit B

(Supplement Number 1 to Interlocal Cooperation Agreement)

**SUPPLEMENT NO. 1 TO
STAKEHOLDER AGREEMENT
WEST JORDAN CITY**

TIGER GRANT

TIGER 2016 GRANT NO. 2018-02	UTA CONTRACT NO. 18-2658BM	STAKEHOLDER CONTRACT NO.
SUMMARY OF CITY PROJECTS INCLUDED IN THIS SUPPLEMENT: WEJ_RRX_2: SIDEWALK AND RR PED CROSSING; 4773 W OLD BINGHAM HWY WEJ_WAY_1: WAYFINDING SIGNAGE TO GARDNER VILLAGE & JORDAN RIVER PKWY TRAIL		PROJECT VALUE OF CITY PROJECTS \$ 104,191
		CITY REPRESENTATIVE: BILL BARANOWSKI

THIS SUPPLEMENT NO. 1 TO STAKEHOLDER AGREEMENT ("Supplement"), made and entered into this 30th day of MARCH, 2018, by and between UTAH TRANSIT AUTHORITY, a public transit district ("UTA"), and West Jordan City ("City").

The parties hereto entered in to a Stakeholder Agreement dated MARCH 30, 2018, (the "Agreement"), which Agreement contemplated execution of this Supplement outlining specific details for the City Projects to be completed thereunder. All definitions and terms of the Agreement remain in full force and effect unless otherwise specified herein.

The parties hereto agree to the specific City Projects, including scope, schedule and budget as follows:

Description of work to be performed, including proposed location:
(Plans/Plan Sheets Attached)

Anticipated duration of work:

2018 TIGER Projects will begin once the funding partners deposit their City participation funds on or before March 1, 2018. 2020 TIGER Projects will begin once the funding partners deposit their City participation funds on or before July 15, 2019. UTA commits the pre-design meeting to occur no later than 2 months upon receipt of participation funds. At the yearly pre-design meeting, project milestones will be set for each City project funded within the funding year.

Estimated Total Cost of Work:
(Detailed Estimate Attached)

ESTIMATED BUDGET OF THIS SUPPLEMENT:	<u>\$ 104,191</u>
ESTIMATED AMOUNT OF TIGER GRANT PARTICIPATION:	<u>\$ 81,991</u>
ESTIMATED AMOUNT OF CITY PARTICIPATION:	<u>\$ 12,000</u>
ADDITIONAL FUNDING SOURCES (CATNIP Salt Lake County):	<u>\$ 600</u>
ADDITIONAL FUNDING SOURCES (UTA-Local):	<u>\$ 9,600</u>

Upon full execution of this Supplement and receipt by UTA of the City participation funds to UTA, the contractor will be authorized to proceed with the work covered herein.

IN WITNESS WHEREOF, the parties hereto have caused these presents to be executed by their duly authorized officers as of the day and year first written above.

UTAH TRANSIT AUTHORITY

By [Signature]
Title CEO
Date: 4-3-18

By [Signature]
Title ACTING VP, QA
Date: 4/3/18

Approved as to Form:

[Signature]
UTA Legal Counsel

WEST JORDAN CITY

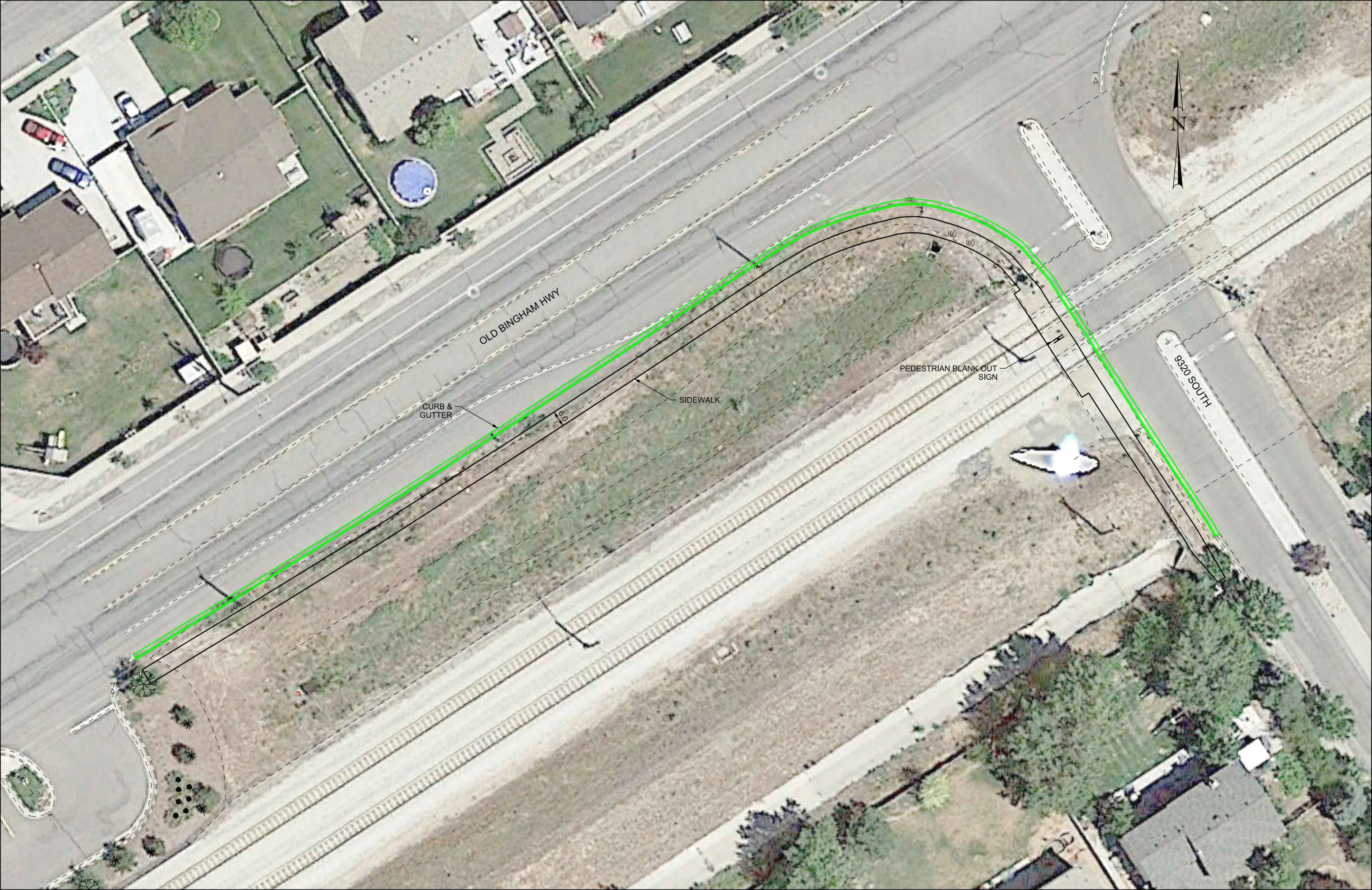
By [Signature]
Title Mayor
Date: 2.16.18

By _____
Title _____
Date: _____

ATTEST:
[Signature]
CAROL HERMAN
DEPUTY CITY CLERK



Project_ID	Project Description	Project Type	MUNICIPALITY	Project Status Cost	Program Management	Contingency	Construction Engineering + Project Management Costs	Design	Construction Engineering	Funding Bucket	\$ for Funding Source #1	Funding Source #1	\$ for Funding Source #2	Funding Source #2	\$ for Funding Source #3	Funding Source #3	Matching Funds Available(\$)	Tiger Funding (\$)	Year Funds Available	Construction Year
WEJ_WAY_1	Wayfinding signage to Gardner Village and Jordan River Parkway	Wayfinding	West Jordan	\$2,692	\$222	\$119	\$353	\$1,030	\$131	TIGER	\$600	County - Local					\$600	\$2,092	2018	2018
				\$104,191	\$8,603	\$8,731	\$15,336	\$21,519	\$6,734		\$12,600		\$9,600				\$22,200	\$81,991		



OLD BINGHAM HWY

9320 SOUTH

CURB & GUTTER

SIDEWALK

PEDESTRIAN BLANK OUT SIGN

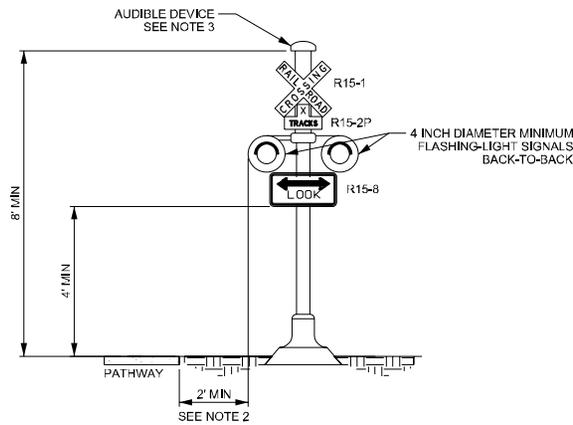


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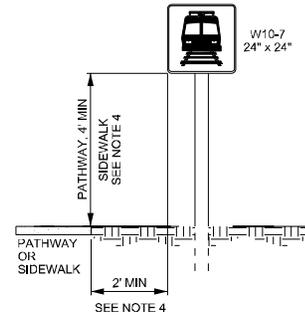
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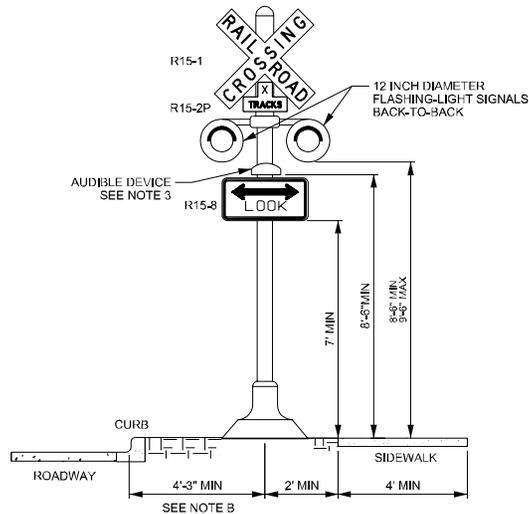


**PATHWAY FLASHING-LIGHT SIGNALS
DETAIL A**



**TRAIN ACTIVATED
BLANKOUT SIGN
DETAIL B**

TABLE 1 SIGN SIZES		
SIGN	DETAIL A	DETAIL C
R15-1	24" X 4 1/2"	48" X 9"
R15-2P	13 1/2" X 9"	27" X 18"
R15-8	18" X 9"	36" X 18"



**SHARED ROADWAY/PEDESTRIAN
FLASHING-LIGHT SIGNALS
DETAIL C**

DESIGN-ONLY NOTES:

- A. DEFINITIONS:
1. STREET RUNNING ALIGNMENT - A RAILROAD ALIGNMENT IN WHICH TRAINS OPERATE IN MIXED TRAFFIC WITH ALL TYPES OF ROAD USERS. THE ALIGNMENT IS TYPICALLY SEPARATED FROM TRAFFIC BY A CURB OR STRIPING.
 2. SEMI-EXCLUSIVE ALIGNMENT - A RAILROAD ALIGNMENT THAT IS IN A SEPARATE RIGHT-OF-WAY OR ALONG A ROADWAY WHERE MOTOR VEHICLES, PEDESTRIANS, AND BICYCLES HAVE LIMITED ACCESS AND CROSS AT DESIGNATED LOCATIONS ONLY. THE ALIGNMENT IS TYPICALLY SEPARATED BY FENCING OR BARRIERS BETWEEN CROSSINGS.
 3. DYNAMIC ENVELOPE - THE CLEARANCE REQUIRED FOR THE TRAIN OR LIGHT RAIL TRANSIT EQUIPMENT OVERHANG.
 4. SIDEWALK - THAT PORTION OF A STREET BETWEEN THE CURB LINE OR THE LATERAL LINE OF A ROADWAY AND THE ADJACENT PROPERTY LINE THAT IS PAVED OR IMPROVED AND INTENDED FOR USE BY PEDESTRIANS.
 5. PATHWAY - A PUBLIC WAY OUTSIDE OF THE TRAVELED WAY AND PHYSICALLY SEPARATED FROM THE ROADWAY BY OPEN SPACE OR BARRIER. PATHWAYS DO NOT INCLUDE SIDEWALKS.
 6. PEDESTRIAN ACCESS ROUTE - CAN BE EITHER A SIDEWALK OR A PATHWAY.
- B. USE A LATERAL OFFSET OF A MINIMUM OF 4 FT 3 INCHES FROM THE FACE OF CURB AND A MINIMUM OF 8 FT 3 INCHES FROM THE EDGE OF THE TRAVELED WAY TO THE CENTER OF THE VEHICLE GATE SIGNAL POLE WHEN NO CURB IS PRESENT.
- C. USE A NUMBER OF TRACKS (R15-2P) PLAQUE WHEN THERE IS MORE THAN 1 TRACK.
- D. SEE TABLE 1 FOR SIGN SIZES.

NOTES:

1. DIRECT FLASHING-LIGHT SIGNALS TO ALL PEDESTRIAN APPROACHES. INSTALL ADDITIONAL FLASHING-LIGHT SIGNALS AS NECESSARY.
2. MAY USE A LATERAL OFFSET OF 2 FT TO THE CENTER OF THE SIGNAL POLE WHEN THE MOUNTING HEIGHT OF THE LOOK (R15-8) SIGN ADJACENT TO A PATHWAY IS 8 FT OR GREATER.
3. PLACE THE AUDIBLE DEVICE ON THE FRONT SIDE OF THE POLE WHERE IT DOES NOT CONFLICT WITH THE SIGNS OR FLASHING-LIGHT SIGNALS.
4. SEE STD DWG SN 7A FOR MOUNTING HEIGHT AND LATERAL OFFSET WHEN THE W10-7 BLANKOUT SIGN IS USED AT A LOCATION OTHER THAN A PATHWAY SUCH AS A SIDEWALK, A STATION PLATFORM OR A ROADWAY.

NO.	DATE	BY	CHKD	REVISIONS

UTAH DEPARTMENT OF TRANSPORTATION
STANDARD DRAWINGS FOR ROAD AND BRIDGE CONSTRUCTION
SALT LAKE CITY, UTAH

RECOMMENDED FOR APPROVAL
Randy S. Park
CHAIRMAN'S STANDARDS COMMITTEE
DATE: JAN. 01, 2017

APPROVED
[Signature]
DIRECTOR
DATE: JAN. 01, 2017

ACTIVE PEDESTRIAN
CONTROLS FOR
RAILROAD CROSSINGS
SHEET 1 OF 2

STANDARD DRAWING TITLE

STD. DWG. NO.
RR 3A1

THE CITY OF WEST JORDAN, UTAH

A Municipal Corporation

RESOLUTION NO. 18-22

A RESOLUTION AUTHORIZING THE MAYOR TO EXECUTE A STAKEHOLDER AGREEMENT AND SUPPLEMENT NO. 1 TO THE AGREEMENT BETWEEN THE CITY OF WEST JORDAN AND THE UTAH TRANSIT AUTHORITY

WHEREAS, the City Council of the City of West Jordan desires to approve the attached Stakeholder Agreement and Supplement No. 1 to the Agreement with the Utah Transit Authority (UTA) for the construction of curb, gutter and sidewalk, in an amount not to exceed, \$12,000.00; and

WHEREAS, the Mayor is authorized to execute the Stakeholder Agreement and Supplement No. 1 to the Agreement for the construction of curb, gutter and sidewalk, in an amount not to exceed, \$12,000.00.

NOW, THEREFORE, IT IS RESOLVED BY THE CITY COUNCIL OF WEST JORDAN, UTAH, THAT:

Section 1. The Mayor is hereby authorized and directed to execute the Stakeholder Agreement and Supplement No. 1 to the Agreement between the City of West Jordan and UTA for an amount not to exceed \$12,000.00.

Section 2. This Resolution shall take effect immediately upon passage.

Adopted by the City Council of West Jordan, Utah this 14th day of February 2018.



Jim Riding
Mayor

ATTEST:



CAROL HERMAN
City Recorder, DEPUTY



Voting by the City Council	"AYE"	"NAY"
Council Member Alan Anderson	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Council Member Dirk Burton	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Council Member Zach Jacob	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Council Member Chad R. Lamb	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Council Member Chris McConnehey	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Council Member Kayleen Whitelock	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Mayor Jim Riding	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Exhibit C

(Supplement Number 2 Interlocal Cooperation Agreement)

**SUPPLEMENT NO. 2 TO
STAKEHOLDER AGREEMENT
WEST JORDAN CITY**

TIGER GRANT

TIGER 2016 GRANT NO. 2018-02	UTA CONTRACT NO. 18-2658BM	STAKEHOLDER CONTRACT NO.
SUMMARY OF CITY PROJECTS INCLUDED IN THIS SUPPLEMENT: WEJ_RRX_2: SIDEWALK AND RR PED CROSSING; 4773 W OLD BINGHAM HWY WEJ_WAY_1: WAYFINDING SIGNAGE TO GARDNER VILLAGE & JORDAN RIVER PKWY TRAIL		PROJECT VALUE OF CITY PROJECTS \$ 241,967
		CITY REPRESENTATIVE: BILL BARANOWSKI

THIS SUPPLEMENT NO. 2 TO STAKEHOLDER AGREEMENT (“Supplement”), made and entered into this ____ day of _____, 2020, by and between **UTAH TRANSIT AUTHORITY**, a public transit district (“UTA”), and West Jordan City (“City”).

The parties hereto entered into a Stakeholder Agreement dated March 30, 2018, (the “Agreement”), which Agreement contemplated execution of a Supplement outlining specific details for the City Projects to be completed thereunder.

The parties hereto entered into a Supplement No. 1 to Stakeholder Agreement dated March 30, 2018 to outline specific details for City Projects WEJ_RRX_2: Sidewalk and RR Ped Crossing; 4773 W Old Bingham Hwy and WEJ_WAY_1: Wayfinding Signage to Gardner Village & Jordan River Pkwy Trail to be completed thereunder, including the scope, schedule, and estimated budget of the City Projects.

The parties hereto desire to enter into this Supplement No. 2 to increase the estimated budget of the City Projects. All definitions and terms of the Stakeholder Agreement and Supplement No. 1 remain in full force and effect unless otherwise specified herein.

1. Estimated Total Cost of Work: The parties hereto desire to increase the estimated budget for the City Projects by One Hundred Thirty Seven Thousand Seven Hundred Seventy Six Dollars (\$137,776), for an estimated budget of Two Hundred Forty One Thousand Nine Hundred Sixty Seven Dollars (\$241,967). The Estimated Total Cost of Work and funding sources is summarized below:

	SUPPLEMENT NO. 1	SUPPLEMENT NO. 2	TOTAL
ESTIMATED BUDGET:	\$104,191	\$137,776	\$241,967
ESTIMATED AMOUNT OF TIGER PARTICIPATION:	\$81,991		\$81,991
ESTIMATED AMOUNT OF CITY PARTICIPATION	\$12,000	\$82,776	\$94,776
ADDITIONAL FUNDING SOURCES (CATNIP SL County)	\$600		\$600
ADDITIONAL FUNDING SOURCES (UTA-Local)	\$9,600		\$9,600
ADDITIONAL FUNDING SOURCES (UDOT Section 130)	N/A	\$55,000	\$55,000

Upon full execution of this Supplement No. 2, UTA will be authorized to proceed with construction of the work covered herein. The estimated cost of the City Projects was determined using Contractor pricing from March 16, 2020 and includes construction contingency. City will be invoiced for Supplement No. 2 City participation funds based on actual construction costs incurred following Final Completion. Invoices shall be paid by the City within sixty (60) days of being invoiced for those costs by UTA.

IN WITNESS WHEREOF, the parties hereto have caused these presents to be executed by their duly authorized officers as of the day and year first written above.

UTAH TRANSIT AUTHORITY

By _____
Title _____
Date: _____

By _____
Title _____
Date: _____

Reviewed and Approved as to Form:

UTA Legal Counsel

WEST JORDAN CITY

By _____
Title _____
Date: _____

By _____
Title _____
Date: _____

MEMORANDUM TO THE BOARD



TO: Utah Transit Authority Board of Trustees
THROUGH: Carolyn Gonot, Executive Director
FROM: Eddy Cumins, Chief Operating Officer
PRESENTER(S): Eddy Cumins, Chief Operating Officer

BOARD MEETING DATE: July 22, 2020

SUBJECT:	Commuter Bus Replacement (Motor Coach Industries Inc.)	
AGENDA ITEM TYPE:	Expense Contract	
RECOMMENDATION:	Approve award and authorize Executive Director to execute contract and associated disbursements with Motor Coach Industries Inc. (MCI) for 27 commuter buses in the amount of \$18,617,525	
BACKGROUND:	In order to follow the outlined bus replacement schedule, the 2002 and 2004 MCI buses should be replaced. The 2002 and 2004 MCIs are currently the oldest buses in the UTA fleet. These buses will be between 17 and 19 years old and have 600,000 to 700,000 miles when replacements arrive.	
DISCUSSION:	UTA staff is requesting approval of a base contract with MCI to replace 27 buses in the amount of \$18,617,525. This best value contract with MCI provides 27 new revolutionary low floor commuter coaches. Additionally, the base order includes special tools and training for the new low floor coaches. This is a five-year contract with the option to purchase up to 65 additional vehicles. The estimated price of the 65 options is \$81,374,819 plus escalation of \$2,034,371 brings the potential total contract value to \$102,026,715. All options exercised in the future will come back to the board for approval.	
CONTRACT SUMMARY:	Contractor Name: Motor Coach Industries Inc.	
	Contract Number: 19-03122	Existing Contract Value:
	Base Contract Effective Dates: Upon approval – July 1, 2025	Extended Contract Dates:
	Amendment Amount:	New/Total Amount Contract Value: \$102,026,715 (total with options) \$18,617,525 (amount for approval now)
	Procurement Method: Best Value	Funding Sources: Lease/Financed

ALTERNATIVES:	UTA can continue to push commuter buses past their useful life of 17 years, but will experience more unscheduled maintenance and road calls, as well as corrosion and structural fatigue issues.
FISCAL IMPACT:	The requested amount for 2020-2021 would be covered by the bus replacement capital budget. All the buses except the pilot bus will be carried over into the 2021 budget.
ATTACHMENTS:	<ul style="list-style-type: none">• Contract

FORTY-FIVE (45') FOOT COMMUTER COACH CONTRACT 19-03122

THIS COMMUTER COACH CONTRACT ("Contract") is entered into effective as of the last signature below (the "Effective Date") by and between the **UTAH TRANSIT AUTHORITY**, a public transit district organized under the laws of the State of Utah (the "Agency"), and **MOTOR COACH INDUSTRIES, INC.**, a Corporation with a place of business at 200 East Oakton Street, Des Plaines, IL 60018 (the "Contractor")

RECITALS

WHEREAS, on January 8, 2020, the Agency issued a Request for Proposals (RFP No. 19-03122 and hereinafter the "RFP") for forty-five (45') Foot Commuter Coaches (the "Vehicles"), including configuration options, and all associated hardware, software, transportation, tools, training and documentation (together with the Vehicles, collectively the "Goods and Services"); and

WHEREAS, on March 18, 2020, the Agency received an initial proposal from Contractor; and;

WHEREAS, Contractor is willing to furnish the Goods and Services as set forth in the RFP (as modified by this Contract); and

WHEREAS, on May 19, 2020, the Agency issued to Contractor an award notification for the Goods and Services.

AGREEMENT

NOW, THEREFORE, on the stated premises, which are incorporated herein by reference, and for and in consideration of the mutual covenants and agreements hereafter set forth, the mutual benefits to the parties to be derived therefrom, and for other valuable consideration, the receipt and sufficiency of which the parties acknowledge, it is hereby agreed as follows:

1. TO BE PROVIDED BY CONTRACTOR

The Agency hereby retains Contractor to furnish the Goods and Services and Contractor will to the best of its ability and in a professional manner, provide the labor, equipment and materials necessary to furnish, deliver, and test the Goods and Services subject to the terms and conditions of: (i) RFP 19-03122; (ii) Contractor's proposal dated March 18, 2020 (the "Proposal"); (iii) and Contractor's Best and Final Offer dated May 13, 2020 (the "BAFO"). This Contract includes an initial order quantity of a pilot vehicle with a follow-on quantity of twenty-six (26) Vehicles in the Base Order, with the features and options described in an initial notice to proceed issued concurrently with this Contract.

2. TERM

Subject to the provisions for termination as hereinafter provided, this Contract shall be effective with respect to the purchase of any Goods and Services (up to the aggregate number of base and option Vehicle quantities set forth in the RFP) ordered prior to July 15, 2025 (the "Term"). All warranties, indemnities, and other obligations of either party with respect to the Goods and Services shall continue after the Term in accordance with the provisions of this Contract.

3. COMPENSATION AND FEES

For the initial order, the Agency agrees to pay Contractor a sum of \$18,617,525.01, determined in accordance with Attachment A. This sum includes all hardware, software, equipment, materials, labor, shipping costs, and other items necessary to supply the Goods and complete the Services in a satisfactory manner in compliance with this Contract.

The Agency (at its sole and exclusive election to be exercised in its sole discretion) may purchase up to sixty-five (65) additional Vehicles (in any combination of Vehicle powertrain configurations, and option packages) during the Term of this Contract, conditioned upon approval from the UTA Board of Trustees. The price for option Vehicles shall be based on the prices indicated in Attachment A (hereinafter the "Base Order Prices"). The Base Order Prices shall remain firm for any option Vehicles ordered within one hundred eighty (180) days of following the Effective Date. The price of any Vehicles ordered more than one hundred eighty (180) days following the Effective Date shall be the Base Order Price, subject to adjustment as provided in the following paragraph.

Adjustments to the Base Order Prices will be calculated based on the following formula which utilizes the U.S. Department of Labor/Bureau of Labor Statistics Producer Price Index ("PPI") Category 1413, "Truck and Bus Bodies". In no event will the price (s) for any order placed exceed by more than five percent (5%) the price(s) that would have been in effect twelve (12) months prior to the date of the release. The Base Order Price will be multiplied by the positive or negative percentage change in this index (subject to the five (5) percent cap on annual price increases to determine pricing for option Vehicles,

FORMULA:

<u>Index Point Change</u>	<u>Example</u>
PPI Index: Future Award Month	141.1
Less PPI Index: Base Award Month	<u>137.6</u>
Index Point Change	3.5
Index Percent Change	3.5
Index Point Change	<u>137.6</u>
Divided by PPI Index: Base Award Month	.0254
Results Multiplied by 100 = Percent Change	2.54%
Base Order Price	\$50,000.00
Plus Percent Change (2.54% x \$50,000)	<u>1,270.00</u>

Revised Price for Future Order

\$51,270.00

There is no guarantee that options with respect to any Vehicles will be exercised.

4. INCORPORATED DOCUMENTS

This Contract consists of the documents listed below. In case of any conflict among these documents, the order of precedence shall be:

1. This form of Contract.
2. "Section 4: Special Provisions" of the RFP.
3. "Section 3: General Conditions," and "Section 5: Federal Requirements" of the RFP.
4. "Section 6: Technical Specifications," "Section 7: Warranty Requirements," and "Section 8: Quality Assurance" of the RFP.
5. Contractor's Best and Final Offer
6. Contractor's Proposal

A modification or change to any document that is part of this Contract shall take its precedence from the term it amends. All other documents and terms and conditions shall remain unchanged.

As used herein, all referenced sections of RFP are deemed to include the modifications made pursuant to addenda issued by the Agency prior to the due date for proposals.

5. DELIVERY

Contractor hereby agrees to furnish, deliver, install, and test the Vehicles with associated spare parts and manuals within seventy-two (72) weeks after notice to proceed is issued by the Agency. Contractor shall, no later than ten (10) days after the execution of this Contract, provide the Agency with a proposed delivery schedule that satisfies the requirements of Special Provision 2.2 (Delivery Schedule). Once approved by the Agency's Project Manager, such delivery schedule (including agreed modifications thereto) shall constitute the "Delivery Schedule" against which Contractor's performance shall be monitored.

6. PAYMENT

Contractor shall submit to the Agency's Project Manager and Procurement & Contract Specialist for approval, invoices, after acceptance of the Vehicles, for which Contractor seeks payment from the Agency under this Contract. Within thirty (30) days after receipt of an invoice, the Agency shall: (i) approve and pay the invoice in accordance with Special Provision 5.1 (Payment Terms); or (ii) notify Contractor that it disapproves, in whole or in part, Contractor's invoice and the reasons for such disapproval. The Agency shall not be liable to Contractor for any expenses paid or incurred by Contractor unless listed herein or otherwise agreed to in advance, in writing, by the parties hereto.

7. WARRANTY OF TITLE

Contractor warrants that title to all Vehicles delivered as part of the Goods and Services and covered by an invoice for payment will pass to the Agency upon acceptance by the Agency. Contractor further warrants that upon payment, all equipment and/or work for which invoices for payment have been previously issued and payments received from the Agency shall be free and clear of liens, claims, security interests or encumbrances in favor of Contractor or any subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided equipment, materials, and labor related to the equipment and/or work for which payment is being requested. Contractor shall indemnify, defend, and hold the Agency harmless from and with respect to any claims, costs, fees (including attorneys' fees), liens, judgments or other losses sustained as a result of the breach of this warranty by Contractor.

8. USE OF SUBCONTRACTORS

Contractor shall not subcontract any services to be performed by it under this Contract other than those listed and identified in the Proposal without prior approval of the Agency. Contractor shall pay all subcontractors for satisfactory performance of their contracts no later than ten (10) days from receipt of each payment the Agency makes to Contractor, unless other arrangements are agreed to in writing by the parties involved. The Agency shall have no obligations to any subcontractors retained by Contractor.

9. CONTRACTOR SAFETY COMPLIANCE

The Agency is an ISO 14001 for Environmental Management Systems, ISO 9001 Quality and Performance Management, and OSHAS 18001 Safety Systems Management Company. Contractor, including its employees, subcontractors, authorized agents, and representatives, shall comply with all of the Agency's and industry safety standards, NATE, OSHA, EPA and all other State and Federal regulations, rules and guidelines pertaining to safety, environmental Management and will be solely responsible for any fines, citations or penalties it may receive or cause the Agency to receive while working on this project. Each employee, contractor and subcontractor must be trained in the Agency's EMS and Safety Management principles.

10. BUY AMERICA REQUIREMENTS

The phase increases in domestic content was included in the FAST Act, 49 U.S.C. Section 5323(j)/FAST Section 3011). The phase increases apply to this contract and are as follows:

- FY20 & beyond: more than 70% domestic content

11. AUDIT

The Agency and its authorized agents or representatives may, during the term of this Contract and for a period of six (6) years thereafter, upon giving reasonable notice and during usual business hours, audit and inspect all Contractor's files and records pertaining to the handling of the Agency's account and the products and services provided or performed under this Contract including, without limitation, all cost and profit data required to be provided to comply with General Condition 9.9 (Maintenance of Records; Access by Agency; Right to Audit Records).

12. AMENDMENTS TO GENERAL CONDITIONS AND SPECIAL PROVISIONS

This Contract includes the following changes to the General Conditions and Special Provisions:

- a. Special Provision 5.2 (Performance Guarantee (Optional) Alternatives Disputes is hereby deleted in its entirety.
- b. Special Provision 10 (Software Escrow Account) is hereby deleted in its entirety.

13. PROJECT MANAGER

The Agency's Project Manager for this Contract is Jesse Rogers, or designee. All questions and correspondence relating to the technical aspects of this Contract should be directed to Mr. Rogers, at Utah Transit Authority, office located at 669 West 200 South, Salt Lake City, Utah 84101, office phone (801) 237-4674.

14. CONTRACT ADMINISTRATOR

The Agency's Contract Administrator for this Contract is Pat Postell, Procurement & Contract Specialist, or designee. All questions and correspondence relating to the contractual aspects of this Contract should be directed to Ms. Postell, or designee, phone (801) 287-3060.

15. NOTICES OR DEMANDS

Any and all notices, demands or other communications required hereunder to be given by one party to the other shall be given in writing and will be personally delivered, mailed by US Mail, postage prepaid, or sent by overnight courier service and addressed to such party as follows:

If to the Agency:
Utah Transit Authority
ATTN: Procurement & Contract Specialist
669 West 200 South
Salt Lake City, UT 84101

If to Contractor:
Utah Transit Authority
Attn: General Counsel
669 West 200 South
Salt Lake City, UT 84101

If to Contractor:
Motor Coach Industries, Inc.
Attn: Bruce Wiebe
200 East Oakton Street
Des Plaines, IL 60018

Either party may change the address at which such party desires to receive written notice of such change to any other party. Any such notice shall be deemed to have been given, and shall be effective, on delivery to the notice address then applicable for the party to which the notice is directed; provided, however, that refusal to accept delivery of a notice or the inability to deliver a

notice because of an address change which was not properly communicated shall not defeat or delay the giving of a notice.

16. GOVERNING LAW

The validity, interpretation and performance of this Contract shall be governed by the laws of the State of Utah, without regard to its law on the conflict of laws. Any dispute arising out of this Contract that cannot be solved to the mutual agreement of the parties shall be brought in a court of competent jurisdiction in Salt Lake County, State of Utah.

17. SEVERABILITY

In the event any one or more of the provisions contained in this Contract are for any reason held to be invalid, illegal or unenforceable in any respect, such invalidity, illegality or unenforceability shall not affect any other provisions of this Contract. This Contract shall be construed as if such invalid, illegal or unenforceable provision had never been contained herein.

18. AMENDMENTS

This Contract sets forth the entire understanding between the parties. Any amendments must be in writing, signed by the party against whom enforcement of the amendment is sought.

19. INSURANCE

The Contractor shall maintain in effect during the term of this Contract, including any warranty period, at its own expense, at least the following coverage and limits of insurance:

- Statutory Workers Compensation and Employers Liability insurance and/or qualified self-insurance program covering Supplier's employees while on Agency property.
- Commercial General Liability Insurance:
 - Bodily Injury and Property Damage, including Contractual Liability covering the indemnification contained herein, \$10,000,000 combined single limits per occurrence, \$10,000,000 aggregate, where applicable.
 - Product liability: \$5,000,000 per occurrence, for a period of five (5) years after acceptance of the last bus delivered under this Contract (Products Liability coverage may be affected through one or more excess liability policies).
- Automobile Liability Insurance: Bodily Injury and Property Damage, \$1,000,000 combined single limits per occurrence.

a. Insurance is to be placed with insurers duly licensed or authorized to do business in the State of Utah and with an "A.M. Best" rating of not less than A-VII. UTA in no way warrants that the above-required minimum insurer rating is sufficient to protect the Contractor from potential insurer insolvency.

b. Contractor shall furnish UTA with certificates of insurance (ACORD form or equivalent approved by UTA) as required by the Contract. The certificates for each insurance policy are to be signed by a person authorized by that insurer to bind coverage on its behalf.

Contract 19-03122
Forty-five (45') Foot Commuter Coaches

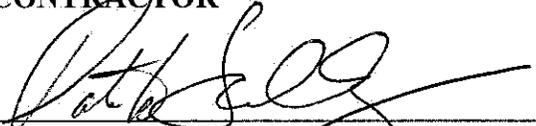
c. Contractors' certificate(s) shall include all subcontractors as additional insureds under its policies or Contractor shall furnish to UTA separate certificates and endorsements for each subcontractor. All coverage for subcontractors shall be subject to the minimum requirements identified above.

d. The insurance requirements herein are minimum requirements for this Contract and in no way limit the indemnity covenants contained in this Contract. UTA is no way warrants that the minimum limits contained herein are sufficient to protect the Contractor from liabilities that might arise out of the performance of the work under this contract by the Contractor, his agents, representatives, employees, or subcontractors and Contractor is free to purchase additional insurance as may be determined necessary.

Contractor shall deliver to the Agency, within ten (10) days after receiving Notice of Award of this Contract, evidence of the above. Prior to the expiration of any insurance during the time required, the Supplier shall furnish evidence of renewal to the Agency's Contract Administrator.

IN WITNESS WHEREOF, the parties hereto have caused this Contract to be executed by officers duly authorized to execute the same as of the day and year first above written.

CONTRACTOR



Printed Name: Patrick Scully
Title: Executive Vice-President,
Sales, Marketing, & Service

UTAH TRANSIT AUTHORITY

Carolyn M. Gonot
Executive Director

Eddy D. Cumins
Chief Operating Officer

David Hancock
Director of Asset Management

Approved As To Form and Content:

Michael Bell
Assistant Attorney General
UTA Counsel

ATTACHMENT A – BASE ORDER PRICING

CER 6. Pricing Schedule

D45 CRT (high floor diesel)

All prices are to be in United States dollars		
	– Unit Price	– Extension
Forty-Five (45') Foot High Floor Commuter Coach Clean Diesel – Quantity One (1)	\$636,563.00	\$636,563.00
Forty-Five (45') Foot High Floor Commuter Coaches Clean Diesel - Quantity Twenty-Six (26)	\$636,563.00	\$16,550,683.00
BUS OPTIONS:		
a. Purchase Forty-Five (45') Foot Low Floor Clean Diesel in place of above high floor .	n/a	n/a
b. Purchase Forty-Five (45') Foot Electric Propulsion System – Identify pricing with different battery sizes.	n/a	n/a
(1) Battery Size -	n/a	n/a
(2) Battery Size -	n/a	n/a
Training in the Maintenance and Operation of the Contracted Buses and Training Materials as follows		
a. Operations Department	\$2,250.00	\$2,250.00
b. Maintenance Department	\$107,000.00	\$107,000.00
c. Updated training and training materials when in-scope of contract, changes or modifications results.	MCI Trainer - \$1500 per day 3 rd Party Trainer - \$3000 per day	MCI Trainer - \$1500 per day 3 rd Party Trainer - \$3000 per day
d. Training provided as part of BAFO – Two (2) weeks MCI on-site training at no cost to include: air system and brakes; multiplex system and maintenance and operator familiarization.		(\$15,750.00)
Special Tools (provide itemized list with tool manufacturer's name and price for all specialty tools) No charge per BAFO	\$32,500.00 – \$0.00	\$32,500.00 \$0.00
Deliverables in accordance with Section 6 Technical Requirements (provide itemized list)	Not Separately Priced	Not Separately Priced
Keys – Any compartment that is lockable – Quantity Two (2)/Bus	Included in price	Included in price
Extended Warranty – Operator's Seat – Two (2) Years or 100,000 miles, 100% parts and labor except foam and fabric	\$50.00	\$1,350.00 (extension = 27 units)
Extended Warranty – Exterior Paint and Finish – Two (2) Years, unlimited miles, 100% parts and labor	No additional charge	No additional charge
OPTION QUANTITIES – Quantities up to Sixty-Five (65) for forty-five (45') foot Commuter Coaches. These could be high-floor, low floor, diesel or electric. The price stated above will be used and adjusted in accordance with the Special Provision SP 3. Options and Option Pricing.	\$636,563.00 plus PPI	\$636,563.00 plus PPI X quantity of option units ordered
– Sales tax (if applicable)	0.00	0.00
– Delivery charges	\$2900	\$78,300.00 (extension = 27 units)
– TOTAL PROPOSED PRICE		
– ADA equipment (included in above unit prices)	\$19,000.00	\$19,000.00 X quantity of option units ordered

CER 6. Pricing Schedule

D45 CRT LE (low floor diesel)

All prices are to be in United States dollars		
	– Unit Price	– Extension
Forty-Five (45') Foot High Floor Commuter Coach Clean Diesel – Quantity One (1)	n/a	n/a
Forty-Five (45') Foot High Floor Commuter Coaches Clean Diesel - Quantity Twenty-Six (26)	n/a	n/a
BUS OPTIONS:		
a. Purchase Forty-Five (45') Foot Low Floor Clean Diesel in place of above high floor .	\$683,125.00	\$18,444,375.00 (extension = 27 units)
b. Purchase Forty-Five (45') Foot Electric Propulsion System – Identify pricing with different battery sizes.		
(1) Battery Size – 389KWh	n/a	n/a
(2) Battery Size -	n/a	n/a
Training in the Maintenance and Operation of the Contracted Buses and Training Materials as follows		
a. Operations Department	\$2,250.00	\$2,250.00
b. Maintenance Department	\$107,000.00	\$107,000.00
c. Updated training and training materials when in-scope of contract, changes or modifications results.	MCI Trainer - \$1500 per day 3 rd Party Trainer - \$3000 per day	MCI Trainer - \$1500 per day 3 rd Party Trainer - \$3000 per day
d. Training provided as part of BAFO – Two (2) weeks MCI on-site training at no cost to include: air system and brakes; multiplex system and maintenance and operator familiarization.		(\$15,750.00)
Special Tools (provide itemized list with tool manufacturer's name and price for all specialty tools) No charge per BAFO	\$32,500.00 –\$0.00	\$32,500.00 \$0.00
Special Tools (provide itemized list with tool manufacturer's name and price for all specialty tools)	\$32,500.00	\$32,500.00
Deliverables in accordance with Section 6 Technical Requirements (provide itemized list)	Not Separately Priced	Not Separately Priced
Keys – Any compartment that is lockable – Quantity Two (2)/Bus	Included in price	Included in price
Extended Warranty – Operator's Seat – Two (2) Years or 100,000 miles, 100% parts and labor except foam and fabric	\$50.00	\$1,350.00 (extension = 27 units)
Extended Warranty – Exterior Paint and Finish – Two (2) Years, unlimited miles, 100% parts and labor	No additional charge	No additional charge
OPTION QUANTITIES – Quantities up to Sixty-Five (65) for forty-five (45') foot Commuter Coaches. These could be high-floor, low floor, diesel or electric. The price stated above will be used and adjusted in accordance with the Special Provision SP 3. Options and Option Pricing.	\$683,125.00 plus PPI	\$683,125.00 plus PPI x number of units ordered
– Sales tax (if applicable)	0.00	0.00
– Delivery charges	\$2900.00	\$78,300.00 (extension = 27 units)
– TOTAL PROPOSED PRICE		
– ADA equipment (included in above unit prices)	\$35,000.00	\$35,000.00 x quantity of option units ordered

CER 6. Pricing Schedule

D45 CRTe (high floor electric)

	All prices are to be in United States dollars	
	– Unit Price	– Extension
Forty-Five (45') Foot High Floor Commuter Coach Clean Diesel – Quantity One (1)	n/a	n/a
Forty-Five (45') Foot High Floor Commuter Coaches Clean Diesel - Quantity Twenty-Six (26)	n/a	n/a
BUS OPTIONS:		
a. Purchase Forty-Five (45') Foot Low Floor Clean Diesel in place of above high floor .	n/a	n/a
b. Purchase Forty-Five (45') Foot Electric Propulsion System – Identify pricing with different battery sizes.	n/a	n/a
(1) Battery Size – 544 KWh	\$1,244,924.00	\$33,612,948.00 (extension = 27 units)
(2) Battery Size -	n/a	n/a
Training in the Maintenance and Operation of the Contracted Buses and Training Materials as follows		
a. Operations Department	\$2,250.00	\$2,250.00
b. Maintenance Department	\$107,000.00	\$107,000.00
c. Updated training and training materials when in-scope of contract, changes or modifications results.	MCI Trainer - \$1500 per day 3 rd Party Trainer - \$3000 per day	MCI Trainer - \$1500 per day 3 rd Party Trainer - \$3000 per day
Special Tools (provide itemized list with tool manufacturer's name and price for all specialty tools)	\$51,971.85	\$51,971.85
Deliverables in accordance with Section 6 Technical Requirements (provide itemized list)	Not Separately Priced	Not Separately Priced
Keys – Any compartment that is lockable – Quantity Two (2)/Bus	Included in price	Included in price
Extended Warranty – Operator's Seat – Two (2) Years or 100,000 miles, 100% parts and labor except foam and fabric	\$50.00	\$1,350.00 (extension = 27 units)
Extended Warranty – Exterior Paint and Finish – Two (2) Years, unlimited miles, 100% parts and labor	No additional charge	No additional charge
OPTION QUANTITIES – Quantities up to Sixty-Five (65) for forty-five (45') foot Commuter Coaches. These could be high-floor, low floor, diesel or electric. The price stated above will be used and adjusted in accordance with the Special Provision SP 3. Options and Option Pricing.	\$1,244,924.00 plus PPI	\$1,244,924.00 plus PPI x number of option units ordered
– Sales tax (if applicable)	0.00	0.00
– Delivery charges	\$13,000.00	\$351,000.00 (extension = 27 units)
– TOTAL PROPOSED PRICE		
– ADA equipment (included in above unit prices)	\$19,000.00	\$19,000.00 x number of option units ordered

CER 6. Pricing Schedule

D45 CRTe LE (low floor electric)

All prices are to be in United States dollars		
	– Unit Price	– Extension
Forty-Five (45') Foot High Floor Commuter Coach Clean Diesel – Quantity One (1)	n/a	n/a
Forty-Five (45') Foot High Floor Commuter Coaches Clean Diesel - Quantity Twenty-Six (26)	n/a	n/a
BUS OPTIONS:		
a. Purchase Forty-Five (45') Foot Low Floor Clean Diesel in place of above high floor .	n/a	n/a
b. Purchase Forty-Five (45') Foot Electric Propulsion System – Identify pricing with different battery sizes.	n/a	n/a
(1) Battery Size – 388 KWh	\$1,172,095.00	\$31,646,565.00 (extension = 27 units)
(2) Battery Size -	n/a	n/a
Training in the Maintenance and Operation of the Contracted Buses and Training Materials as follows		
a. Operations Department	\$2,250.00	\$2,250.00
b. Maintenance Department	\$107,000.00	\$107,000.00
c. Updated training and training materials when in-scope of contract, changes or modifications results.	MCI Trainer - \$1500 per day 3 rd Party Trainer - \$3000 per day	MCI Trainer - \$1500 per day 3 rd Party Trainer - \$3000 per day
Special Tools (provide itemized list with tool manufacturer's name and price for all specialty tools)	\$51,971.85	\$51,971.85
Deliverables in accordance with Section 6 Technical Requirements (provide itemized list)	Not Separately Priced	Not Separately Priced
Keys – Any compartment that is lockable – Quantity Two (2)/Bus	Included in price	Included in price
Extended Warranty – Operator's Seat – Two (2) Years or 100,000 miles, 100% parts and labor except foam and fabric	\$50.00	\$1,350.00 (extension = 27 units)
Extended Warranty – Exterior Paint and Finish – Two (2) Years, unlimited miles, 100% parts and labor	No additional charge	No additional charge
OPTION QUANTITIES – Quantities up to Sixty-Five (65) for forty-five (45') foot Commuter Coaches. These could be high-floor, low floor, diesel or electric. The price stated above will be used and adjusted in accordance with the Special Provision SP 3. Options and Option Pricing.	\$1,172,095.00 plus PPI	\$1,172,095.00 plus PPI x number of option units ordered
– Sales tax (if applicable)	0.00	0.00
– Delivery charges	\$13,000.00	\$351,000.00 (extension = 27 units)

– TOTAL PROPOSED PRICE		
– ADA equipment (included in above unit prices)	\$35,000.00	\$35,000.00 x number of option units ordered

	High Floor Diesel	Low Floor Diesel	Electric -544 kWh
Base Price	\$636,563.00	\$683,125.00	\$1,244,924.00
Operations Training	\$83.33	\$83.33	\$83.33
Maintenance Training	\$3,962.96	\$3,962.96	\$3,962.96
MCI On-Site Training	(\$583.33)	(\$583.33)	\$0.00
Extended Warranty	\$50	\$50	\$50
Delivery Costs	\$2,900.00	\$2,900.00	\$2,900.00
Final Price	\$642,975.96	\$689,537.96	\$1,251,920.30
QUANTITY OPTIONS - 65			
High Floor-65	\$41,793,437.61		
Low Floor-65		\$44,819,967.61	
Electric-65			\$81,374,819.27

W/Base Order Amount	\$18,617,525.01	\$18,617,525.01	\$18,617,525.01
Quantity Options Amount	\$41,793,437.61	\$44,819,967.61	\$81,374,819.27
W/Estimated Escalation (2.5% charged)	\$1,044,835.94	\$1,120,499.19	\$2,034,370.48
Total Estimated Contract Amounts with Options and Escalation	\$61,455,798.56	\$64,557,991.81	\$102,026,714.76

ATTACHMENT B

SECTION 6: FINAL RED-LINED TECHNICAL SPECIFICATIONS

GENERAL

TS 1. Scope

Bus specifications will be for 45' Commuter Coach Buses. The base buses should be **high Low** floor Clean Diesel powered but the Agency would like pricing for the following variants included;

- Low **or High** Floor variant of commuter bus
- All electric propulsion system. (battery sizes options TBD at time of proposals)

The Bus body shall have the newer look of a "BRT" styling package which includes a more rounded and curved appearance on the top, front and rear of the bus, frameless passenger windows and an extra-large two-piece windshield. (If applicable for a Commuter Bus)

The Technical Specifications (TS) have been expanded slightly (added to) for the main reason of improving the operator's workstation. Other reasons include the safety and comfort of the riding customer and for more efficient maintenance activities. The expanded specifications are easy to recognize because they are underlined, dark red and italicize. This paragraph is a good example of added specifications.

The original specifications from the APTA SBPG will be left intact to a large extent to keep order and context wherever needed. The only exception will be removing unapproved/unselected options from each TS section.

Whenever a brand name of a component is mentioned, the words "or approved equal" follows the brand name even though the words "or approved equal" are not printed in the specification.

Technical specifications define requirements for heavy-duty transit buses and commuter coaches, which, by the selection of specifically identified alternative configurations, may be used for both suburban express service and general service on urban arterial streets. Buses shall have a minimum expected life of twelve (12) years or 500,000 miles, whichever comes first, and are intended for the widest possible spectrum of passengers, including children, adults, the elderly and people with disabilities.

TS 2. Definitions

Alternative: An alternative specification condition to the default bus configuration. The Agency may define alternatives to the default configuration to satisfy local operating requirements. Alternatives for the default configuration will be clearly identified.

Ambient Temperature: The temperature of the surrounding air. For testing purposes, ambient temperature must be between 16°C (50°F) and 38°C (100°F).

Analog Signals: A continuously variable signal that is solely dependent upon magnitude to express information content.

NOTE: Analog signals are used to represent the state of variable devices such as rheostats, potentiometers, temperature probes, etc.

Audible Discrete Frequency: An audible discrete frequency is determined to exist if the sound power level in any 1/3-octave band exceeds the average of the sound power levels of the two adjacent 1/3-octave bands by 4 decibels (dB) or more.

Battery Compartment: Low-voltage energy storage, i.e. 12/24 VDC batteries.

Battery Management System (BMS): Monitors energy, as well as temperature, cell or module voltages, and total pack voltage. The BMS adjusts the control strategy algorithms to maintain the batteries at uniform state of charge and optimal temperatures.

Braking Resistor: Device that converts electrical energy into heat, typically used as a retarder to supplement or replace the regenerative braking.

Burst Pressure: The highest pressure reached in a container during a burst test.

Capacity (fuel container): The water volume of a container in gallons (liters).

Cells: Individual components (i.e., battery or capacitor cells).

Code: A legal requirement.

Combination Gas Relief Device: A relief device that is activated by a combination of high pressures or high temperatures, acting either independently or together.

Composite Container for CNG: A container fabricated of two or more materials that interact to facilitate the container design criteria.

Compressed Natural Gas (CNG): Mixtures of hydrocarbon gases and vapors consisting principally of methane in gaseous form that has been compressed for use as a vehicular fuel.

Container: A pressure vessel, cylinder or cylinders permanently manifolded together, used to store CNG.

Container Appurtenances: Devices connected to container openings for safety, control or operating purposes.

Container Valve: A valve connected directly to a container outlet.

Curb Weight: Weight of vehicle, including maximum fuel, oil and coolant; and all equipment required for operation and required by this Specification, but without passengers or driver.

dBA: Decibels with reference to 0.0002 microbar as measured on the "A" scale.

DC to DC Converter: A module that converts a source of direct current from one voltage level to another.

Default Configuration Bus: The bus described if no alternatives are selected. Signing, colors, the destination sign reading list and other information must be provided by the Agency.

Defueling: The process of removing fuel from a tank.

Defueling Port. Device that allows for vehicle defueling, or the point at which this occurs.

Destroyed: Physically made permanently unusable.

Discrete Signal: A signal that can take only pre-defined values, usually of a binary 0 or 1 nature, where 0 is battery ground potential and 1 is a defined battery positive potential.

DPF: Diesel particulate filter.

Driver's Eye Range: The 95th-percentile ellipse defined in SAE Recommended Practice J941, except that the height of the ellipse shall be determined from the seat at its reference height.

Energy Density: The relationship between the weight of an energy storage device and its power output in units of watt-hours per kilogram (Wh/kg).

Energy Storage System (ESS): A component or system of components that stores energy and for which its supply of energy is rechargeable by the on-vehicle system(engine/regenerative braking/generator)or an off-vehicle energy source.

Fill Pressure for CNG: The pressure attained at the actual time of filling. Fill pressure varies according to the gas temperatures in the container, which are dependent on the charging parameters and the ambient conditions. The maximum dispensed pressure shall not exceed 125 percent of service pressure.

Flow Capacity: For natural gas flow, this is the capacity in volume per unit time (normal cubic meters/minute or standard cubic feet per minute) discharged at the required flow rating pressure.

Fuel Line: The pipe, tubing or hose on a vehicle, including all related fittings, through which natural gas passes.

Fusible Material: A metal, alloy or other material capable of being melted by heat.

Fire Resistant: Materials that have a flame spread index less than 150 as measured in a radiant panel flame test per ASTM-E 162-90.

Fireproof: Materials that will not burn or melt at temperatures less than 2000°F.

Free Floor Space: Floor area available to standees, excluding the area under seats, area occupied by feet of seated passengers, the vestibule area forward of the standee line, and any floor space indicated by manufacturer as non-standee areas, such as the floor space "swept" by passenger doors during operation. Floor area of 1.5 sq. ft. shall be allocated for the feet of each seated passenger protruding into the standee area.

Fuel Management System: Natural gas fuel system components that control or contribute to engine air fuel mixing and metering, and the ignition and combustion of a given air-fuel mixture. The fuel management system would include, but is not limited to, reducer/regulator valves, fuel metering equipment (e.g. carburetor, injectors), sensors (e.g., main throttle, waste gate).

GAWR (Gross Axle Weight Rated): The maximum total weight as determined by the axle manufacturer, at which the axle can be safely and reliably operated for its intended purpose.

Gross Load: 150lbs for every designed passenger seating position, for the driver, and for each 1.5 sq. ft. of free floor space.

GVW (Gross Vehicle Weight): Curb weight plus gross load.

GVWR (Gross Vehicle Weight Rated): The maximum total weight as determined by the vehicle manufacturer, at which the vehicle can be safely and reliably operated for its intended purpose.

High Pressure: Those portions of the CNG fuel system that see full container or cylinder pressure.

High Voltage (HV): Greater than 50 V(AC and DC).

Hose: Flexible line.

Hybrid: A vehicle that uses two or more distinct power sources to propel the vehicle.

Hybrid System Controller (HSC): Regulates energy flow throughout hybrid system components in order to provide motive performance and accessory loads, as applicable, while maintaining critical system parameters (voltages, currents, temperatures, etc.) within specified operating ranges.

Hybrid Drive System (HDS): The mechanical and/or electromechanical components, including the engine, traction motors and energy storage system, which comprise the traction drive portion of the hybrid propulsion system.

Intermediate Pressure: The portion of a CNG system after the first pressure regulator, but before the engine pressure regulator. Intermediate pressure on a CNG vehicle is generally from 3.5 to 0.5 MPa (510 to 70 psi).

Inverter: A module that converts DC to and from AC.

Labeled: Equipment or materials to which has been attached a label, symbol or other identifying mark of an organization, which is acceptable to the authority having jurisdiction and concerned with product evaluation, which maintains periodic inspection of production labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

Leakage: Release of contents through a Defect or a crack. See *Rupture*.

Line: All tubes, flexible and hard, that carry fluids.

Liner: Inner gas-tight container or gas container to which the overwrap is applied.

Local Regulations: Regulations below the state level.

Low-Floor Bus: A bus that, between at least the front (entrance) and rear (exit) doors, has a floor sufficiently low and level so as to remove the need for steps in the aisle between the doors and in the vicinity of these doors.

Low Voltage (LV): 50 V or less (AC and DC).

Lower Explosive Limit: The lowest concentration of gas where, given an ignition source, combustion is possible.

Maximum Service Temperature: The maximum temperature to which a container/cylinder will be subjected in normal service.

Metallic Hose: A hose whose strength depends primarily on the strength of its metallic parts; it can have metallic liners or covers, or both.

Metering Valve: A valve intended to control the rate of flow of natural gas.

Module: An assembly of individual components

Motor (Electric): A device that converts electrical energy into mechanical energy.

Motor (Traction): An electric motor used to power the driving wheels of the bus.

Operating Pressure: The varying pressure developed in a container during service.

Physical Layer: The first layer of the seven-layer International Standards Organization (ISO) Open Systems Interconnect (OSI) reference model. This provides the mechanical, electrical, functional and procedural characteristics required to gain access to the transmission medium (e.g., cable) and is responsible for transporting binary information between computerized systems.

Pipe: Nonflexible line.

Pressure Relief Device (PRD): A pressure and/or temperature activated device used to vent the container/cylinder contents and thereby prevent rupture of an NGV fuel container/cylinder, when subjected to a standard fire test as required by fuel container/cylinder standards.

NOTE: Since this is a pressure-activated device, it may not protect against rupture of the container when the application of heat weakens the container to the point where its rupture pressure is less than the rated burst pressure of the relief device, particularly if the container is partially full.

Power: Work or energy divided by time

Power Density: Power divided by mass, volume or area.

Propulsion System: System that provides propulsion for the vehicle proportional to operator commands. Includes, as applicable, engine, transmission, traction motors, the hybrid drive system, (HDS), energy storage system (ESS), and system controllers including all wiring and converter/inverter.

Real-Time Clock (RTC): Computer clock that keeps track of the current time.

Regenerative Braking: Deceleration of the bus by switching motors to act as generators, which return vehicle kinetic energy to the energy storage system.

Rejectable Damage: In terms of NGV fuel containers/cylinders, this is damage as outlined in CGA C-6.4, "Methods for External Visual Inspection of Natural Gas Vehicle Fuel Containers and Their Installations," and in agreement with the manufacturer's recommendations.

Retarder: Device used to augment or replace some of the functions of primary friction based braking systems of the bus.

Rupture: Sudden and unstable damage propagation in the structural components of the container resulting in a loss of contents. See *Leakage*.

Seated Load: 150lbs for every designed passenger seating position and for the driver.

SLW (Seated Load Weight): Curb weight plus seated load.

Serial Data Signals. A current loop-based representation of ASCII or alphanumeric data used for transferring information between devices by transmitting a sequence of individual bits in a prearranged order of significance.

NOTE: An example is the communication that takes place between two or more electronic components with the ability to process and store information.

Service Pressure: The settled pressure at a uniform gas temperature of 21°C (70°F) and full gas content. It is the pressure for which the equipment has been constructed, under normal conditions. Also referred to as the nominal service pressure or working pressure.

Settled Pressure: The gas pressure when a given settled temperature, usually 21°C (70°F), is reached.

Settled Temperature: The uniform gas temperature after any change in temperature caused by filling has dissipated.

Solid State Alternator: A module that converts high-voltage DC to low-voltage DC (typically 12/24 Vsystems).

Sources of Ignition: Devices or equipment that because of their modes of use or operation, are capable of providing sufficient thermal energy to ignite flammable compressed natural gas-air mixtures when introduced into such a mixture, or when such a mixture comes into contact with them.

Special Tools: Tools not normally stocked by the Agency.

Specification: A particular or detailed statement, account or listing of the various elements, materials, dimensions, etc. involved in the manufacturing and construction of a product.

Standard: A firm guideline from a consensus group. Standards referenced in “Section 6: Technical Specifications” are the latest revisions unless otherwise stated.

Standee Line: A line marked across the bus aisle to designate the forward area that passengers may not occupy when the bus is moving.

State of Charge (SOC): Quantity of electric energy remaining in the battery relative to the maximum rated amp-hour (Ah) capacity of the battery expressed in a percentage. This is a dynamic measurement used for the energy storage system. A full SOC indicates that the energy storage system cannot accept further charging from the engine-driven generator or the regenerative braking system.

Stress Loops: The “pigtailed” commonly used to absorb flexing in piping.

Structure: The basic body, including floor deck material and installation, load-bearing external panels, structural components, axle mounting provisions and suspension beams and attachment points.

Thermally Activated Gas Relief Device: A relief device that is activated by high temperatures and generally contains a fusible material.

NOTE: Since this is a thermally activated device, it does not protect against over-pressure from improper charging practices.

Wheelchair: A mobility aid belonging to any class of three- or four-wheeled devices, usable indoors, designed for and used by individuals with mobility impairments, whether operated manually or powered. A “common wheelchair” is such a device that does not exceed 30 in. in width and 48 in. in length measured 2 in. above the ground and does not weigh more than 600 lbs. when occupied.

TS 3. Referenced Publications

The documents or portions thereof referenced within this specification shall be considered part of the requirements of the specification. The edition indicated for each referenced document is the current edition, as of the date of the APTA issuance of this specification.

TS 4. Legal Requirements

The Contractor shall comply with all applicable federal, state and local regulations. These shall include but not be limited to ADA, as well as state and local accessibility, safety and security requirements. Local regulations are defined as those below the state level.

Buses shall meet all applicable FMVSS regulations and shall accommodate all applicable FMCSR regulations in effect at the location of the Agency and the date of manufacture.

In the event of any conflict between the requirements of these specifications and any applicable legal requirement, the legal requirement shall prevail. Technical requirements that exceed the legal requirements are not considered to conflict.

TS 5. Overall Requirements

The Contractor shall ensure that the application and installation of major bus subcomponents and systems are compliant with all such subcomponent vendors' requirements and recommendations. Contractor and Agency shall identify subcomponent vendors that shall submit installation/application approval documents with the completion of a pilot or lead bus. Components used in the vehicle shall be of heavy-duty design and proven in transit service.

TS 5.1 Weight

It shall be a design goal to construct each bus as light in weight as possible without degradation of safety, appearance, comfort, traction or performance.

Buses at a capacity load shall not exceed the tire factor limits, brake test criteria or structural design criteria.

TS 5.2 Capacity

The vehicle shall be designed to carry the gross vehicle weight, which shall not exceed the bus GVWR.

TS 5.3 Service Life

The minimum useful design life of the bus in transit service shall be at least twelve (12) years or 500,000 miles. It shall be capable of operating at least 40,000 miles per year, including the 12th year.

TS 5.4 Maintenance and Inspection

Scheduled maintenance tasks shall be related and shall be in accordance with the manufacturer's recommended preventative maintenance schedule (along with routine daily service performed during the fueling operations).

Test ports, as required, shall be provided for commonly checked functions on the bus, such as air intake, exhaust, hydraulic, pneumatic, charge-air and engine cooling systems.

The coach manufacturer shall give prime consideration to the routine problems of maintaining the vehicle. All coach components and systems, both mechanical and electrical, which will require periodic physical Work or inspection processes shall be installed so that a minimum of time is consumed in gaining access to the critical repair areas. It shall not be necessary to disassemble portions of the coach structure and/or equipment such as seats and flooring under seats in order to gain access to these areas. Each coach shall be designed to facilitate the disassembly, reassembly, servicing or maintenance, using tools and equipment that are normally available as standard commercial items.

Requirements for the use of unique specialized tools will be minimized. The body and structure of the coach shall be designed for ease of maintenance and repair. Individual panels or other equipment that may be damaged in normal service shall be repairable or replaceable. Ease of repair shall be related to the vulnerability of the item to damage in service.

Contractor shall provide a list of all special tools and pricing required for maintaining this equipment. Said list shall be submitted as a supplement to the Pricing Schedule.

NOTE: Tools such as compartment door keys, bellows gauges and other tools that are required for daily maintenance and inspections shall not be included in the special tool list and shall be furnished for each coach.

TS 5.5 Interchangeability

Unless otherwise agreed, all units and components procured under this Contract, whether provided by Suppliers or manufactured by the Contractor, shall be duplicates in design, manufacture and installation to ensure interchangeability among buses in each order group in this procurement. This interchangeability shall extend to the individual components as well as to their locations in the buses. These components shall include, but are not limited to, passenger window hardware, interior trim, lamps, lamp lenses and seat assemblies. Components with non-identical functions shall not be, or appear to be, interchangeable.

Any one component or unit used in the construction of these buses shall be an exact duplicate in design, manufacture and assembly for each bus in each order group in this Contract. Contractor shall identify and secure approval for any changes in components or unit construction provided within a Contract.

In the event that the Contractor is unable to comply with the interchangeability requirement, the Contractor must notify the Agency and obtain the Agency's prior written approval, including any changes in pricing.

Agency shall review proposed product changes on a case-by-case basis and shall have the right to require extended warranties to ensure that product changes perform at least as well as the originally supplied products.

TS 5.6 Training

NOTE: The following is illustrative; the Agency should carefully specify its training requirements.

The Contractor shall have at least one qualified instructor who shall be available at the Agency's property for [insert number] calendar days between the hours of [insert starting time] and [insert closing time] per month for [insert number] months prior to, and [insert number] months after, acceptance of the first bus. Instructor(s) shall conduct schools and advise the personnel of the Agency on the proper operation and maintenance of the equipment. The Contractor also shall provide visual and other teaching aids (such as manuals, slide presentations and literature) for use by the Agency's own training staff, which become the property of the Agency.

NOTE: The Agency should insert language that specifies the hours when it wants the training to occur, the total number of hours of instruction it wants to be provided, what items it expects the curriculum to cover and the format in which it expects the training and teaching aids to be provided (print, DVD, etc.).

Training Introduction

Training Costs shall be part of the bus evaluation but priced separately.

Contractor shall be responsible for providing the following training:

1. Training in the maintenance and operation of the contracted buses. Training materials sufficient to support continued in-house Agency's training.
2. Update training and training materials when, in the scope of the contract, changes or modifications are made that affect the operation or maintenance of the buses that are contracted through final delivery of the initial base order of buses. All subsequent training which may be requested for optional bus orders will be negotiated and priced accordingly. This deliverable section specifies the nature of the training activities and training materials that are required from the Contractor.

Scope of Work for the Maintenance and Operation's Departments

Operation's Department:

The Contractor shall have at least one qualified instructor who will be available at UTA for three continuous days between the hours of 8:00 am – 5:00 pm sometime after the acceptance of the first bus. The instructor shall conduct classes to teach UTA training staff on the proper operation of the buses as well as useful trouble shooting techniques associated with operating the bus. The Contractor shall provide sufficient operating manuals for the training staff to be used during the 2 days of training sessions. Provide an electronic copy of the operating manual to UTA for future training needs.

Maintenance Department:

Up to five (5) Maintenance Training Specialists and Maintenance Instructors, and five (5) Maintenance Supervisors shall be provided "Train the Trainer" instructions for Maintenance Procedures, as outlined below in Salt Lake City, Utah. Up to forty (40) mechanics shall be trained on the proper and recommended procedures to perform Maintenance procedures as outlined below at a UTA location to be determined by Maintenance Training and, at the discretion of UTA, be provided on more than one (1) shift (i.e. days, swing).

1. Maintenance Training will be tailored specifically to the Agency's buses, including all new technology equipment, and be designed to develop the knowledge and skills of the Maintenance Employees and Maintenance Training Specialists required to maintain the buses delivered under the contract. Maintenance Training will be provided in the following major areas:
 - a. Propulsion system (Vendor Specific)

- b. Transmission (Vendor Specific if applicable)
- c. Battery system
- d. HVAC (Vendor Specific)
- e. Passenger Door
- f. Wheelchair ramp (R & R and Overhaul) (Vendor Specific)
- g. Air & Brake System
- h. Electrical System (emphasis on new technologies)
- i. Steering/Suspension
- j. Familiarization and Orientation
- k. Preventive Maintenance (Contractor shall provide Inspection Sheets)
- l. Body and Panel Repair
- m. Tow, Service Truck procedures, and proper lifting of vehicle (specific to UTA equipment & facility).
- n. Fire Suppression Systems (Vendor Specific)
- o. Any new technology equipment not covered in section 2 a-m.

2. System Level Maintenance Training, covering:

- a. Theory of Operation
- b. Mechanical System Configuration
- c. Preventive Maintenance
- d. Written and Validated Inspection
- e. Use of any and all special tools and equipment necessary to diagnose, troubleshoot, and repair the bus.

3. Shop Level Maintenance Training, covering:

- a. Detailed Theory of operation to module, board, and/or device level.
- b. Component level Troubleshoot and Replacement.
- c. Testing and Alignment of repaired units.
- d. Use of any and all special tools and equipment necessary to diagnose, troubleshoot, and repair the bus.

Deliverables

Within sixty (60) days after Notice to Proceed, the Contractor will provide the Agency's Maintenance Training Department an outline of the proposed training programs for approval.

The Contractor shall submit two (2) draft copies of each deliverable for approval ninety (90) days prior to the first scheduled class. The Agency's Maintenance Training Department will coordinate and schedule all classes.

Thirty (30) days prior to the beginning of the first scheduled class, the Agency's Training Department requires the following approved course materials to be delivered by the Contractor according to the following specifications:

- 1. Instructor's Guide to contain all the information and directions necessary for the Agency's instructors to make an effective presentation and practical demonstration. It shall include adequate guidelines to conduct a comprehensive training program. Individual lessons within the course will be organized as separate units or modules which may be taught as a unit. In some instances, the same unit could be used more than once. For example, the unit on standard operating procedures could be used to train operators, mechanics and service personnel.

The Instructors Guide should contain, at a minimum:

- a. A list of learner prerequisites (if any);
- b. Program Overview;
- c. A statement of overall program goals;

3. A complete set of all written materials, drawings, pictures, etc. shall be in electronic format (stored on DVD). The electronic format shall be written in Word or Excel. If the Contractor uses a software other than that specified, the Contractor's software shall be included.
4. All written and audio-visual training and software materials shall become the property of the Agency. The Agency reserves the right to copy any and all materials to be used in training the Agency's personnel.

Instructional Delivery

Contractor shall meet the following specifications in instructional delivery:

1. Instructor Qualifications. A description of instructor qualifications, a resume, curriculum vita, or other description of instructor qualifications must be submitted during the RFP's Approved Equals stage of the procurement. The description should document a thorough knowledge of the equipment being taught, an understanding of the adult learning process, and demonstrated experience in vocational instruction.
2. Class Size. Classes shall be limited to a maximum of ten (10) mechanics per class for Maintenance personnel.
3. Testing. Instructor must give written and practical tests as a measuring device to determine knowledge and skills transference. Tests must be pre-approved by the Agency. A practical hands-on test is required (if applicable) to measure the skills transfer of Technicians. The practical test, if provided, shall be administered by the use of a check list of each job and/or task.

TS 5.6.1 Technical/Service Representatives

The Contractor shall, at its own expense, have one or more competent technical service representatives available on request to assist the Agency in the solution of engineering or design problems within the scope of the specifications that may arise during the warranty period. This does not relieve the Contractor of responsibilities under the provisions of "Section 7: Warranty Requirements."

TS 5.7 Operating Environment

ALTERNATIVE-----APPROVED

Agency will provide temperature range.

The bus shall achieve normal operation in ambient temperature ranges of 0 °F to 110 °F, at relative humidity between 5 percent and 100 percent, and at altitudes ~~up to 4,200 ft thru 5,200 ft~~ above sea level in urban service areas. Degradation of performance due to atmospheric conditions shall be minimized at temperatures below 10 °F, above 115 °F or at altitudes ~~above~~ from 5,200 ft. thru 8,300 feet in canyon service areas. Altitude requirements above 5,200 ft to 8,300 ft will need separate discussions with the engine manufacturer to ensure that performance requirements are not compromised. Speed, gradability and acceleration performance requirements shall be met at, or corrected to, 77 °F, 29.31 in. Hg, dry air per SAE J1995.

TS 5.8 Noise

TS 5.8.1 Interior Noise

The combination of inner and outer panels and any material used between them shall provide sufficient sound insulation so that a sound source with a level of 80 dBA measured at the outside skin of the bus shall have a sound level of 65 dBA or less at any point inside the bus. These conditions shall prevail with all openings, including doors and windows, closed and with the engine and accessories switched off.

The bus-generated noise level experienced by a passenger at any seat location in the bus shall not exceed 80 dBA. The driver area shall not experience a noise level of more than 75 dBA. Measurements of interior noise levels shall be taken in accordance with SAEJ2805. An exception shall be made for the turntable area, which shall be considered a separate environment.

ALTERNATIVE.....APPROVED

Interior noise: required no more than 65 DBA, 49.3 DBA (with engine off).

No more than 70.1 DBA (at passenger when engine operating), Driver's area: 79.4 DBA

Exterior noise: 75.4 DBA max

When bus accelerating, 76.8 DBA max

Low idle nose 63.4 DBA (with A/C off), and 66.7 DBA with A/C on).

TS 5.8.2 Exterior Noise

Airborne noise generated by the bus and measured from either side shall not exceed 80dBA under full power acceleration when operated at 0 to 35 mph at curb weight. The maximum noise level generated by the bus pulling away from a stop at full power shall not exceed 83 dBA. The bus-generated noise at curb idle shall not exceed 65dBA. If the noise contains an audible discrete frequency, a penalty of 5 dBA shall be added to the sound level measured. The Contractor shall comply with the exterior noise requirements defined in local laws and ordinances identified by the Agency and SAEJ366.

DEFAULT-----APPROVED

Noise level should be as stated.

TS 5.9 Fire Safety

The bus shall be designed and manufactured in accordance with all applicable fire safety and smoke emission regulations. These provisions shall include the use of fire-retardant/low-smoke materials, fire detection systems, bulkheads and facilitation of passenger evacuation.

TS 5.9.1 Materials

DEFAULT-----APPROVED

All materials used in the construction of the passenger compartment of the bus shall be in accordance with the Recommended Fire Safety Practices defined in FMVSS 302.

TS 5.10 Fire Suppression

DEFAULT-----APPROVED

The bus shall have a fire suppression system installed per manufacturer's recommendations. *Supply and install a Fire Suppression System for bus protection. The system shall be a dry chemical pre-engineered fire suppression system with automatic detection and actuation.*

- 1. System must comply with NFPA 17.*
- 2. System shall provide 24-hour fire detection of the engine compartment.*
- 3. The system shall be designed to operate at 12 or 24 VDC and shall not exceed 0.1-amp current draw.*

4. *The entire Fire Suppression System shall be Factory Mutual Research Corporation approved.*
5. *A minimum of four ambient, temperature-sensitive sensors shall be provided.*

APPROVED: Three temperature sensors in engine compartment.

6. *Sensors shall be located in the engine compartment under all horizontal bulkheads, above and downwind of the major heat sources, and in areas likely to be exposed to leaking flammable fluids.*
7. *Additional sensors shall be located in other potentially critical areas.*
8. *The sensors shall detect over-temperature in the critical areas and shall activate the fire alarm bell and warning light in the driver's compartment.*
9. *The sensors shall return to normal setting and deactivate alarms when the temperature returns to normal.*
10. *The fire suppression system shall shut down the engine when activated.*
11. *Install the fire extinguisher Control Panel and Manual Switch in the Operator's compartment.*
12. *System must have self-check and manual test functions to ensure the system is operational.*
13. *The dry chemical bottle must be located so the gauge can be easily seen and for ease of maintenance.*

The Amerex model VH-25 ABC Agent Modular Vehicle Fire Suppression System has been APPROVED FOR CLEAN DIESEL ONLY. Pricing for All electric bus variant shall have a fire suppression system ONLY if there is one specifically designed for an All electric bus. Any fire suppression system designed for a diesel bus is NOT approved for an all-electric bus.

TS 5.11 Respect for the Environment

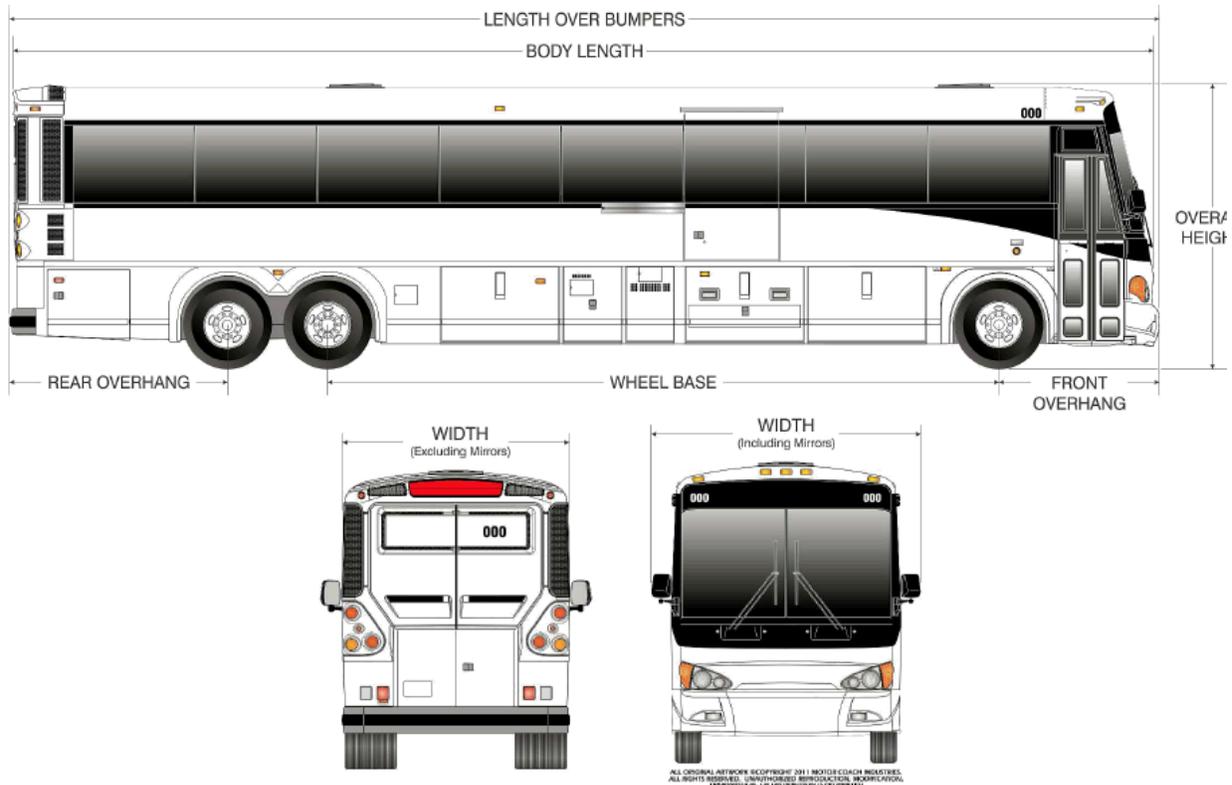
In the design and manufacture of the bus, the Contractor shall make every effort to reduce the amount of potentially hazardous waste. In accordance with Section 6002 of the Resource Conservation and Recovery Act, the Contractor shall use, whenever possible and allowed by the specifications, recycled materials in the manufacture of the bus.

DIMENSIONS

TS 6. Physical Size

With exceptions such as exterior mirrors, marker and signal lights, bumpers, fender skirts, washers, wipers, ad frames, cameras, object detection systems, bicycle racks, feelers and rubrails, the bus shall have the following overall dimensions as shown in **Figure 1** at static conditions and design height.

FIGURE 1
Transit Bus Exterior Dimensions



TS 6.1 Bus Length

For ease of use, the following tolerances will be allowable for each given bus length. Bus length is determined as the measurement from bumper to bumper.

- **30ft bus:** 29 ft, 11 in. to 34ft, 11 in.
- **35ft bus:** 35ft to 39ft, 11 in.
- **40ft bus:** 40ft to 44ft, 11 in.
- **45ft bus:** 45 to 47ft
- **60ft (articulated) bus:** 59 to 65ft

TS 6.2 Bus Width

~~TS 6.2.1 Transit Coach~~

TS 6.2.2 Commuter Coach

~~DEFAULT~~-----**APPROVED**

102 in. Width Bus

Body width shall be 102 in. (+0, -1 in.).

TS 6.3 Bus Height

~~DEFAULT~~ -----**APPROVED**

Maximum Overall Height

Maximum overall height shall be 140 in., including all rigid, roof-mounted items such as A/C, exhaust, fuel system and cover, etc.

TS 6.4 Step Height

~~TS 6.4.1 Transit Coach~~

TS 6.4.2 Commuter Coach

The step height shall not exceed 16.5 in. at doorway without kneeling and shall not exceed 15.5 in. at the step.

~~TS 6.4.3 Articulated Coach~~

TS 6.5 Underbody Clearance

The bus shall maintain the minimum clearance dimensions as defined and shown in Figure 2 of SAE Standard J689, regardless of load up to the gross vehicle weight rating.

TS 6.6 Ramp Clearances

The approach angle is the angle measured between a line tangent to the front tire static loaded radius arc and the initial point of structural interference forward of the front tire to the ground.

The departure angle is the angle measured between a line tangent to the rear tire static loaded radius arc and the initial point of structural interference rearward of the rear tire to the ground.

The breakover angle is the angle measured between two lines tangent to the front and rear tire static loaded radius and intersecting at a point on the underside of the vehicle that defines the largest ramp over which the vehicle can roll.

A minimum of two steel rear skid plates shall be welded to the underside of the engine rails. Skid design shall be durable construction to adequately protect mechanical or other body components from damage due to the bus bottoming out.

~~DEFAULT~~-----**APPROVED WITH THE EXCEPTION OF REAR SKID PLATES**

Refer to **Table 2a**. **APPROVED: Approach angle of 8.2 deg and departure angle of 6.8 deg.**

TABLE 2a
 Default Breakover Angle

Angle	30 to 45ft Bus	60ft Bus
Approach	8.6 deg (min.)	8.6 deg (min.)

Front breakover	8 deg (min.)	10.2 deg (min.)
Rear breakover (articulated only)	n/a	8.7 deg (min.)
Departure	8.6 deg (min.)	8.6 deg (min.)

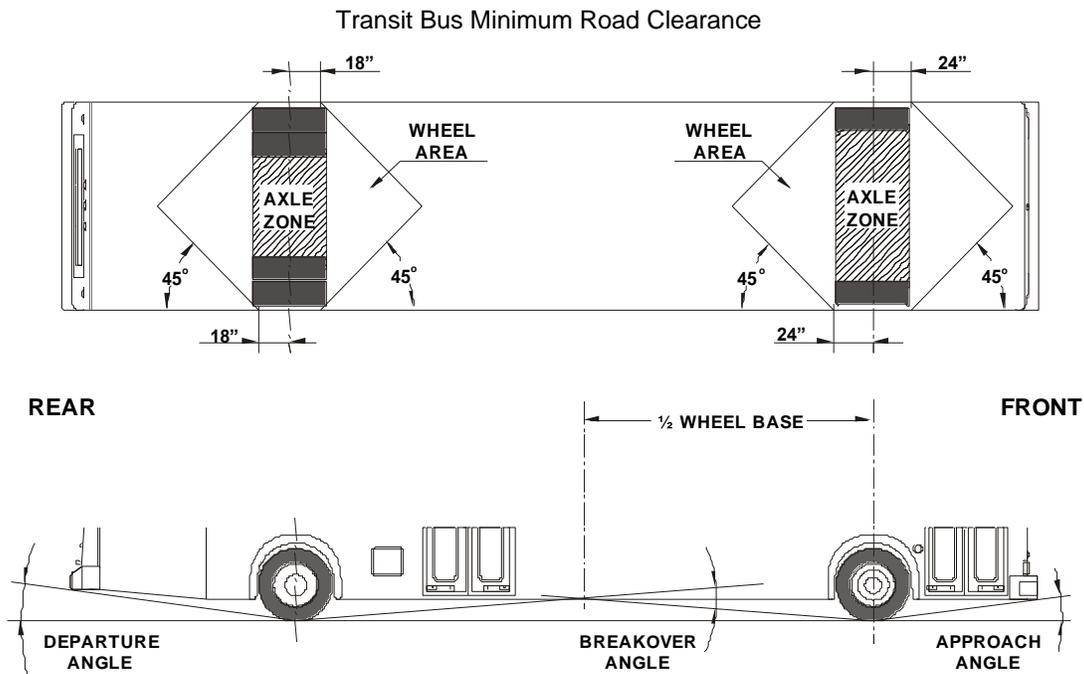
TS 6.7 Ground Clearance

Ground clearance shall be no less than 9 in., (8 in. at jacking pad) except within the axle zone and wheel area.

Axle zone clearance, which is the projected area between tires and wheels on the same axial centerline, shall be no less than 5.4 in.

Wheel area clearance shall be no less than 8 in. for parts fixed to the bus body and 6 in. for parts that move vertically with the axles.

– FIGURE 2



TS 6.8 Floor Height

TS 6.8.1 Transit Coach

TS 6.8.2 Commuter Coach

Height of the step above the street shall be no more than ~~16 in.~~ 15.5 in measured at the centerline of the doorway. All floor measurements shall be with the bus at the design running height and on a level surface and with the standard installed tires.

TS 6.9 Interior Headroom

Headroom above the aisle and at the centerline of the aisle seats shall be no less than 78 in. in the forward half of the bus tapering to no less than 74 in. forward of the rear settee. At the centerline of the window seats, headroom shall be no lower than 65 in., except for parcel racks and reading lights, if specified. Headroom at the back of the rear bench seat may be reduced to a minimum of 56 in., but it shall increase to the ceiling height at the front of the seat cushion. In any area of the bus directly over the head of a seated passenger and positioned where a passenger entering or leaving the seat is prone to strike his or her head, padding shall be provided on the overhead paneling.

APPROVED: Centerline of aisle seat of approximately 75.50 inch headroom.

VEHICLE PERFORMANCE

TS 7. Power Requirements

The propulsion system shall be sized to provide sufficient power to enable the bus to meet the defined acceleration, top speed and gradability requirements, and operate all propulsion-driven accessories using actual road test results and computerized vehicle performance data.

TS 7.1 Top Speed

ALTERNATIVE -----APPROVED

Agency to specify top speed limit. The bus shall be capable of safely maintaining the vehicle speed according to the recommendations by the tire manufacturer. *The bus shall be governed at 70 mph road speed, for emergency and passing maneuvers, on a straight, level road at SLW.*

NOTE: Values are assumed to be sustained. Manufacturer shall supply Agency with data if there is a variance between peak performance and sustained vehicle performance.

TS 7.2 Gradability

Gradability requirements shall be met on grades with a dry commercial asphalt or concrete pavement at GVWR with all accessories operating.

ALTERNATIVE-----APPROVED

Agency will provide operating profile information to the Contractor. *Gradability requirements shall be met on grades with a surface friction coefficient of 0.3 and above at SLW with all accessories operating. The standard configuration power plant shall enable the bus to maintain a speed of 65 mph on a 2-percent grade and 25 mph on a 16-percent grade.*

NOTE: Values are assumed to be sustained. Manufacturer shall supply Agency with data if there is a variance between peak performance and sustained vehicle performance.

TS 7.3 Acceleration

TS 7.3.1 Non-Hybrid

TS 7.3.2 Acceleration Hybrid

TS 7.3.3 Acceleration (Commuter Coach)

The Contractor shall provide performance scans to the Agency based on the Agency's specific drivetrain configuration. Vehicle shall accelerate from 0 to 15 mph in five seconds, with the bus at S.L.W.

TS 7.4 Operating Range

The operating range of the coach shall be designed to meet the operating profile as stated in the "Design Operating Profile" section.

TS 7.4.1 Diesel (Transit Coach)

TS 7.4.2 Diesel (Commuter Coach)

ALTERNATIVE

Agency to designate operating range. The operating range of the bus run on the design operating profile shall be at least 450 miles on a single fill-up of diesel fuel.

TS 7.4.3 CNG

TS 7.4.4 Hybrid

TS 8. Fuel Economy (Design Operating Profile)

Test results from the FTA ABD Cycle economy tests or other applicable test procedures shall be provided to the Agency. Results shall include vehicle configuration and test environment information. Fuel economy data shall be provided for each design operating profile. The design operating profile is assumed to be defined by the FTA ABD Cycle.

Fuel economy tests shall be run on these four duty cycles:

- Manhattan: 6.8 mph
- Orange County: 12.7 mph
- UDDS: 19 mph
- Idle time

The Agency will provide a percentage of each duty cycle that is representative of its service.

POWERPLANT

TS 9. Engine

The engine shall comply with applicable local, state and/or federal emissions and useful life requirements. The engine shall have a design life of not less than 300,000 miles without replacement or major service. The lifetime estimate is based on the design operating profile.

The engine shall provide 445 gross horsepower and 1450-pound feet of torque at 1200 revolutions per minute and zero governor droop.

~~**NOTE:** For commuter coaches, minimum rating horsepower of 400 and minimum torque rating of 1400 ft-lbs shall be installed.~~

The engine shall be equipped with an electronically controlled management system, compatible with either 12 or 24 V power distribution. The engine control system shall be capable of transmitting and receiving electronic inputs and data from other drivetrain components and broadcasting that data to other vehicle systems. Communication between electronic drivetrain components and other vehicle systems shall be made using the communications networks. The engine's electronic management system shall monitor operating conditions and provide instantaneous adjustments to optimize both engine and bus performance. The system shall be programmable to allow optimization of programmable features.

The engine starting system shall be protected by an interlock that prevents its engagement when the engine is running. Special equipment or procedures may be employed to start the bus when exposed to temperatures less than 30 °F for a minimum of four hours without the engine in operation. All cold weather starting aids, engine heating devices and procedures shall be of the type recommended by the engine manufacturer and approved by the Agency. The integration of all systems on the vehicle relative to engine idle speed shall be the responsibility of the vehicle manufacturer to meet the requirements of the transit property.

The engine control system shall protect the engine against progressive damage. The system shall monitor conditions critical for safe operation and automatically derate power and/or speed and initiate engine shutdown as needed.

DEFAULT-----APPROVED

Automatic Engine Protection/Shutdown Override Feature

A control shall be available to the operator/driver that when constantly depressed and released will delay the engine shutdown or allow the bus to be moved. Override action shall be recorded. This data shall be retrievable by the Agency.

~~TS 9.1 Engine (CNG)~~

~~TS 9.2 Propulsion System (Hybrid)~~

~~TS 9.2.1 Propulsion System Description~~

TS 9.2.2 Propulsion System Service

The propulsion system shall be arranged so that accessibility for all routine maintenance is ensured. No special tools, other than dollies and hoists, shall be required to remove the propulsion system or any subsystems. However, the Agency shall recognize that properly rated test equipment and safe electrical work practices are essential when servicing high-voltage hybrid components. The exhaust system, air cleaner, air compressor, starter (if used), alternator, radiator, all engine accessories, and any other component requiring service or replacement shall be easily removable. The Contractor shall provide all specialty tools and diagnostic equipment required for maintaining the propulsion system in accordance with the Special Tools List.

Provide an APPROVED Fumoto or similar, engine oil pan Drain Plug. May be ship loose with the bus. Provide an engine oil sampling valve on a pressurized flow-through oil line. Care should be taken to

minimize the length of the line that feeds the sampling valve. Location TBD. The "Checkfluid KP18NV" sampling valve has been APPROVED

~~TS 9.2.3 Primary Propulsion Unit and Traction Motor~~

~~TS 9.2.4 Energy Storage and Controller~~

~~TS 9.2.5 Hybrid System Controller (HSC)~~

TS 9.2.6 Engine

The engine and related emission systems shall meet all applicable emissions and design/durability guidelines and standards.

The Contractor shall provide the Agency with expected durability of the engine and related emission systems.

NOTE: The Agency will provide desired fuel type.

ALTERNATIVE-----APPROVED

Agency shall define required power plant. A Cummins X12 Diesel engine has been APPROVED.

The engine shall be equipped with an electronically controlled management system, compatible with multiplex wiring systems and either 12 or 24 V electrical systems.

The engine shall have on-board diagnostic capabilities, be able to monitor vital functions, store out-of-parameter conditions in memory and communicate faults and vital conditions to service personnel. Diagnostic reader device connector ports, suitably protected against dirt and moisture, shall be provided in the operator's area and near or inside the engine compartment. The on-board diagnostic system shall inform the operator via visual and/or audible alarms when out-of-parameter conditions exist for vital engine functions.

The engine starting system shall be protected by an interlock that prevents its engagement when the engine is running. Special equipment or procedures may be employed to start the engine when exposed to temperatures less than 30°F for a minimum of four hours without the engine in operation. All cold weather starting aids, engine heating devices and procedures shall be of the type recommended by the engine manufacturer and approved by the Agency. An engine block heater, 240-volt, Block heater plug in shall be mounted on the left rear side of the bus with an external access cover so that it can be plugged in without have to open a door. Plug shall also be 5 feet above the ground. The external access cover shall be positioned so the bus washer brushes do not open the access cover as the bus goes through the bus wash.

ALTERNATIVE-----APPROVED

Automatically Activated Fast Idle as Required

The fast idle device shall be activated and controlled automatically by the control system. The Fast Idle shall turn "On" (even when the Fast-Idle switch is turned "Off") whenever the A/C is operating, the transmission is in neutral and the parking brake applied.

TS 10. Cooling Systems

The cooling systems shall be of sufficient size to maintain all engine and transmission fluids and engine intake air at safe, continuous operating temperatures during the most severe operations possible and in accordance with engine and transmission manufacturers' cooling system requirements. The cooling system fan controls should sense the temperatures of the operating fluids and the intake air, and if either is above safe operating conditions, the cooling fan should be engaged. The fan control system shall be designed with a fail-safe mode of "fan on." The cooling system shall meet the requirements stated in the operating environment.

TS 10.1 Engine Cooling

A means of determining satisfactory engine coolant level shall be provided. A spring-loaded, push-button type valve or lever shall be provided to safely release pressure or vacuum in the cooling system with both it and the water filler no more than ± 60 in. above the ground. Both shall be accessible through the same access door. Provide a minimum of two sight-glasses in the metal surge tank. The upper sight-glass is to check the coolant level when hot, the lower sight-glass is for checking the coolant level when cold.

The cooling fan shall be temperature controlled, allowing the engine to reach operating temperature quickly. Provide Electric cooling fans for radiator/CAC. A Modine (hinge out style) electric fan system is APPROVED

Hose clamps are to be constant torque type. Breeze CONSTANT-TORQUE® clamps are approved

APPROVED: The one sight glass in the Surge Tank (in radiator compartment on top of the radiator). A signed glass should also be provided in the Coolant Recovery Tank (in engine compartment). Both of the tanks shall have one sight glass with a cold fill level mark.

APPROVED: The use of constant torque type clamps form "Oiteker" and "Ideal" on coolant lines.

APPROVED: Radiator/charge air cooling module with fins density of 20 FPI for radiator, and 12 RFP for CAD. Module is E-coated for extra corrosion protection.

ALTERNATIVE-----APPROVED

The radiator and charge air cooler shall be of durable, corrosion-resistant construction with non-removable radiator headers. Include Corrosion Resistant Epoxy (E-Coat) to the entire exterior of the radiator and charge air cooler by the dipping process. Provide a strong, cross braced, if necessary, radiator core made totally of aluminum; lead free solder inside and out, with reinforced tubes and core corners. Provide solid fins made out of aluminum with the leading and trailing edges folded and crimped with a maximum of 10 fins per inch. Hump hoses are to be installed on the radiator inlet and outlet.

TS 10.1.1 Radiator Screen

ALTERNATIVE-----APPROVED

Screen in Front of Radiator

The radiator input shall be protected by an easily cleanable screen designed to collect large debris. Radiators with a fin density greater than ~~12~~ 10 fins per inch or a louvered slit design shall not be used. No heat-producing components or climate-control system components shall be mounted between the engine cooling air intake aperture and the radiator. The radiator and charge air cooler shall be designed to withstand thermal fatigue and vibration associated with the installed configuration. The radiator and charge air cooler cores shall be easily cleaned (to include engine side core surface) with standard pressure-washing equipment.

TS 10.1.2 Coolant

ALTERNATIVE-----APPROVED

Coolant Filtration without Supplemental Additives

The engine cooling system shall be equipped with a properly sized water filter with a spin-on element. The filter shall not release or contain supplemental coolant additives. Coolant to be an OAT formula heavy-duty extended life coolant that provides total cooling system protection for 1,000,000 miles of on-road use. Coolant shall meet the minimum Cummins Engineering Standard 14603.

Install a heavy-duty push-button valve from the engine coolant outlet to take engine coolant samples.

Location TBD.

The "Checkfluid KP18NV" sample valve has been APPROVED.

Old World Industries FINAL CHARGE® coolant has been APPROVED

APPROVED: Coolant that is an OAT technology ethylene glycol-based coolant and is a fully formulated lifetime. 50/50 mixture that requires no additional SCAs or chemically charged filters for use. The coolant shall be nitrite free, phosphate free, borate free, silicate free, non 2-EH type, and must meet or exceed the ASTM D3306, ASTM D6210, and Cummins CES 14603 requirements. The DD Power Plus OAT must meet all the requirements.

TS 10.1.3 Drive Design

ALTERNATIVE-----APPROVED

Electric Fans

The bus shall be equipped with an electric fan drive bus cooling system. A screen guard must be installed on electric motor fans per SAE J1308. Modine electric fans are Approved

TS 10.1.4 Mounting

ALTERNATIVE-----APPROVED

Higher Mounting Design

The lower edge of the radiator and charge air cooler core(s) shall be mounted at a height no less than ~~3-ft~~ 60 in above street level to minimize core fouling caused by dirt, debris, leaves, etc. ***APPROVED: The cooling module location at LH rear lower corner. Height from the ground cannot be 60 inch, due to new coach model engine compartment configuration. Cooling module is E-coated for extra corrosion protection, and also located behind screened radiator door.***

TS 10.2 Charge Air Cooling

DEFAULT-----APPROVED

The charge air cooling system, also referred to as after-coolers or inter-coolers, shall provide maximum air intake temperature reduction with minimal pressure loss. The charge air radiator shall be sized and positioned to meet engine manufacturer's requirements. The charge air radiator shall not be stacked ahead of or behind the engine radiator and shall be positioned as close to the engine as possible unless integrated with the radiator. Air ducting and fittings shall be protected against heat sources and shall be configured to minimize restrictions and maintain sealing integrity.

TS 10.3 Transmission Cooling

The transmission shall be cooled by a dedicated heat exchanger sized to maintain operating fluid within the transmission manufacturer's recommended parameters of flow, pressure and temperature. The transmission cooling system shall be matched to the retarder and engine cooling systems to ensure that all operating fluids remain within recommended temperature limits established by each component manufacturer. The engine cooling system should provide coolant bypass flow to the transmission cooling system with the engine thermostats closed. Unless otherwise noted, the transmission cooler is to be the first component to see cold water from the radiator outlet. In addition, all return water piping, aside from the thermostat bypass line, is to be plumbed in after the transmission cooler.

~~TS 10.4 Hybrid Drive System Cooling~~

TS 11. Transmission (Conventional Powertrain)

The transmission shall be multiple speed, automatic shift with torque converter, retarder and electronic controls. Gross input power, gross input torque and rated input speed shall be compatible with the engine. The transmission shall be designed to operate for not less than 300,000 miles on the design operating profile without replacement or major service. The transmission should be easily removable without disturbing the engine and accessible for service.

The electronic controls shall be capable of transmitting and receiving electronic inputs and data from other drivetrain components and of broadcasting that data to other vehicle systems. Communication between electronic drivetrain components and other vehicle systems shall be made using the communications networks. Electronic controls shall be compatible with either 12 or 24 Vpower distribution, provide consistent shift quality, and compensate for changing conditions, such as variations in vehicle weight and engine power. At a minimum, drivetrain components consisting of the engine, transmission, retarder, ASR, and anti-lock braking systems shall be powered by a dedicated and isolated ignition supply voltage to ensure data communication among components exists when the vehicle ignition is switched to the "on" position.

DEFAULT-----APPROVED

A nominal brake pedal application of 6 to 10 psi shall be required by the driver to engage forward or reverse range from the neutral position to prevent sudden acceleration of the bus from a parked position.

The electronically controlled transmission shall have on-board diagnostic capabilities, be able to monitor functions, store and timestamp out-of-parameter conditions in memory, and communicate faults and vital conditions to service personnel. The transmission shall contain built-in protection software to guard against severe damage. The on-board diagnostic system shall trigger a visual alarm to the driver when the electronic control unit detects a malfunction.

An electronic transmission fluid level monitoring and protection system shall be provided. An ALLISON B500 six speed transmission is APPROVED.

ALTERNATIVE-----APPROVED

Automatic Neutral Function with Automatic Re-Engagement

The transmission, when in forward direction, shall automatically shift the transmission to neutral when the vehicle registers zero road speed, engine is idle and service brakes are applied. If the status of any one or more of the three signals changes, the transmission immediately and automatically resumes forward mode operation.

ALTERNATIVE-----APPROVED FOR ELECTRIC BUS OPTION ONLY

Hill Holder

A vehicle hill holder function shall be integrated with an automatic or reduced engine load state function to prevent inadvertent vehicle movement while the transmission is not in forward range.

TS 12. Retarder (Transit Coach)

TS 13. Engine Brake (Commuter Coach)

The powertrain shall be equipped with an engine brake designed to extend brake lining service life. The application of the engine brake shall cause a smooth blending of both engine brake and service brake function and shall not activate the brake lights. The Jacobs brake toggle switch shall be an on/off switch located underneath the dash. The Jake brake shall operate on medium setting (4 cylinders) when the throttle is released. The Jake brake will operate at the maximum setting (6 cylinders) in conjunction with the activation of the service brakes. The 6-cylinder brake operates with the service brake application of 8 PSI. Any ABS event will cancel the Jake brake.

APPROVED: The Jacob brake on/off switch as a rocker type and located on the LH dash panel.

DEFAULT

Brake lights shall not illuminate when the retarder is activated.

ALTERNATIVE

Brake lights shall illuminate when the retarder is activated.

DEFAULT

Standard Requirement for Retarder Activation

The retarder shall be adjustable within the limits of the powertrain and activated when the brake pedal is depressed. The Agency will work with the OEM/drive system manufacturer to determine retarder performance settings.

ALTERNATIVE

Throttle Pedal Activation of the Retarder

The retarder shall become partially engaged (approximately one third of its total application, with a resulting deceleration of no greater than 0.077g) when the throttle pedal is completely released. Maximum retarder shall be achieved when brake pedal is depressed prior to engagement of service brakes, with a maximum resulting deceleration of approximately 0.20g in an empty bus. The resulting decelerations specified include the effects of engine braking, wind resistance and rolling resistance.

The thermostatically controlled cooling fan shall be activated when the retarder is engaged and the coolant temperature reaches the maximum operating temperature established by the engine and transmission manufacturers.

DEFAULT

Accessible Retarder Disable Switch

The retarder disable switch shall be accessible to the seated driver.

ALTERNATIVE

Retarder Disable Switch Not Accessible

The retarder disable switch is not required to be accessible to the seated driver.

ALTERNATIVE

Disabling retarder shall be recorded for Agency data collection.

ALTERNATIVE

Unless specified by the transmission manufacturer, a retarder disable switch will not be supplied.

TS 14. Mounting

All power plant mounting shall be mechanically isolated to minimize transfer of vibration to the body structure and provide a minimum clearance of 0.75 in. Mounts shall control the movement of the power plant so as not to affect performance of belt-driven accessories or cause strain in piping and wiring connections to the power plant.

TS 14.1 Service

The propulsion system shall be arranged for ease of access and maintenance. The Contractor shall list all special tools, fixtures or facility requirements recommended for servicing. The muffler, exhaust system, air cleaner, air compressor, starter, alternator, radiator, all accessories and any other component requiring service or replacement shall be easily removable and independent of the engine and transmission removal. An engine oil pressure gauge and coolant temperature gauge shall be provided in the engine compartment.

These gauges shall be easily read during service and mounted in an area where they shall not be damaged during minor or major repairs.

An air cleaner with a dry filter element and a graduated air filter restriction indicator shall be provided. The location of the air intake system shall be designed to minimize the entry of dust and debris and to maximize the life of the air filter. The engine air duct shall be designed to minimize the entry of water into the air intake system. Drainage provisions shall be included to allow any water/moisture to drain prior to entry into the air filter.

DEFAULT-----APPROVED

Engine oil and the radiator filler caps shall be hinged to the filler neck and closed with spring pressure or positive locks to prevent leakage. All fluid fill locations shall be properly labeled to help ensure that correct fluid is added. All fillers shall be easily accessible with standard funnels, pour spouts and automatic dispensing equipment. All lubricant sumps shall be fitted with magnetic-type drain plugs or magnets in pan.

ALTERNATIVE-----APPROVED

Centrifugal, ~~non-disposable~~ engine bypass oil filter. A Spinner II 576HE with a FC300 high temperature hose has been APPROVED

DEFAULT-----APPROVED

Engine Oil Pressure and Coolant Temperature Display

Engine oil pressure and coolant temperature gauges required in engine compartment. A single LCD gauge shall be mounted in the engine compartment that picks up Engine oil pressure.

Engine coolant temperature, Transmission oil temperature and Engine RPM from the J1939.

TS 15. Hydraulic Systems

Hydraulic system service tasks shall be minimized and scheduled no more frequently than those of other major coach systems. All elements of the hydraulic system shall be easily accessible for service or unit replacement. Critical points in the hydraulic system shall be fitted with service ports so that portable diagnostic equipment may be connected or sensors for an off-board diagnostic system permanently attached to monitor system operation when applicable. A tamper-proof priority system shall prevent the loss of power steering during operation of the bus if other devices are also powered by the hydraulic system.

The hydraulic system shall operate within the allowable temperature range as specified by the lubricant manufacturer. ~~Provide a service port on the steering gear for testing hydraulic pressure and flow.~~ **DELETED.**

APPROVED: Hydraulic System: Deletion of requirement of conduit to all lines per CER 2 Request #14.

~~ALTERNATIVE~~-----APPROVED

Hydraulic System Sensors

Sensors in the main hydraulic system, excluding those in the power steering system, shall indicate on the driver's on-board diagnostic panel conditions of low hydraulic fluid level.

TS 15.1 Fluid Lines

All lines shall be rigidly supported to prevent chafing damage, Fatigue Failures, degradation and tension strain. Lines should be sufficiently flexible to minimize mechanical loads on the components. Lines passing through a panel, frame or bulkhead shall be protected by grommets (or similar devices) that fit snugly to both the line and the perimeter of the hole that the line passes through to prevent chafing and wear. Pipes and fluid hoses shall not be bundled with or used to support electrical wire harnesses.

Lines shall be as short as practicable and shall be routed or shielded so that failure of a line shall not allow the contents to spray or drain onto any component operable above the auto-ignition temperature of the fluid.

All hoses, pipes, lines and fittings shall be specified and installed per the manufacturer's recommendations. Add split plastic conduit over all flexible hoses that carry fluids and air located in the engine compartment, a/c compartment and under the bus to protect the lines from any possible chafing wear.

TS 15.2 Fittings and Clamps

All clamps shall maintain a constant tension at all times, expanding and contracting with the line in response to temperature changes and aging of the line material. The lines shall be designed for use in the environment where they are installed (for example, high-temperature resistant in the engine compartment, resistant to road salts near the road surface, and so on).

Compression fittings shall be standardized to prevent the intermixing of components. Compression fitting components from more than one manufacturer shall not be mixed, even if the components are known to be interchangeable.

Oetiker and Breeze clamps have been APPROVED.

Ideal constant torque clamps have been APPROVED

TS 15.3 Charge Air Piping

Charge air piping and fittings shall be designed to minimize air restrictions and leaks. Piping shall be as short as possible, and the number of bends shall be minimized. Bend radii shall be maximized to meet the pressure drop and temperature rise requirements of the engine manufacturer. The cross section of all charge air piping shall not be less than the cross section of the intake manifold inlet. Any changes in pipe diameter shall be gradual to ensure a smooth passage of air and to minimize restrictions. Piping shall be routed away from heat sources as practicable and shielded as required to meet the temperature rise requirements of the engine manufacturer.

Charge air piping shall be constructed of stainless steel, aluminized steel, anodized aluminum or painted steel rated at minimum 1000 hours of salt spray according to ASTM B117, except between the air filter

and turbocharger inlet, where piping may be constructed of flexible heat-resistant material. Connections between all charge air piping sections shall be sealed with a short section of reinforced hose and secured with stainless steel constant tension clamps that provide a complete 360deg seal.

TS 16. Radiator

Radiator piping shall be stainless steel, brass tubing or painted steel rated at 1000 hours of salt spray according to ASTM B117 and where practicable, hoses shall be eliminated, including biodiesel. Necessary hoses shall be impervious to all bus fluids. All hoses shall be secured with stainless steel clamps that provide a complete 360deg seal. The clamps shall maintain a constant tension at all times, expanding and contracting with the hose in response to temperature changes and aging of the hose material.

TS 17. Oil and Hydraulic Lines

Oil and hydraulic lines shall be compatible with the substances they carry. The lines shall be designed and intended for use in the environment where they are installed (for example, high-temperature resistant in the engine compartment, resistant to road salts near the road surface and so on). Lines within the engine compartment shall be composed of steel tubing where practicable, except in locations where flexible lines are required.

Hydraulic lines of the same size and with the same fittings as those on other piping systems of the bus, but not interchangeable, shall be tagged or marked for use on the hydraulic system only.

Add split plastic conduit over all flexible hoses that carry fluids and air located in the engine compartment, a/c compartment and under the bus to protect the lines from any possible chafing wear.

APPROVED: Oil and Hydraulic Lines: Deletion of requirement of conduit to all lines per CER 2 Request #15.

TS 18. Fuel

TS 18.1 Fuel Lines

Fuel lines shall be securely mounted, braced and supported as designed by the bus manufacturer to minimize vibration and chafing and shall be protected against damage, corrosion or breakage due to strain or wear.

Manifolds connecting fuel containers shall be designed and fabricated to minimize vibration and shall be installed in protected locations to prevent line or manifold damage from unsecured objects or road debris.

Fuel hose and hose connections, where permitted, shall be made from materials resistant to corrosion and fuel and protected from fretting and high heat. Fuel hoses shall be accessible for ease of serviceability.

Add split plastic conduit over all flexible hoses that carry fluids and air located in the engine compartment, a/c compartment and under the bus to protect the lines from any possible chafing wear.

APPROVED: Fuel Lines: Deletion of requirement of conduit to all lines per CER 2 Request #16.

DEFAULT -----APPROVED

Agency to specify fuel type. *Fuel type is to be diesel fuel. Provide pricing for an All-electric commuter coach variant if available.*

TS 18.1.1 Fuel Lines, Diesel

Fuel lines shall be capable of carrying the type of fuel specified by the Agency (i.e., up to B20 type fuel). *Provide a FP382 (or Approved Equal) Heated Primary filter as well as a Cummins supplied secondary fuel filter.*

TS 18.1.2 Fuel Lines, CNG

TS 18.2 Design and Construction

TS 18.2.1 Design and Construction, Diesel

Fuel Tank(s)

ALTERNATIVE-----APPROVED

The fuel tank(s) shall be made of corrosion-resistant stainless steel. The fuel tank shall be made of sufficiently heavy gauge 300 series or ASTM A240 stainless steel.

ALTERNATIVE-----APPROVED

The fuel tank(s) shall be made of high-density cross-linked polyethylene plastic material with or without baffles.

ALTERNATIVE-----APPROVED

The fuel tank(s) shall be made of high strength aluminum (191 US Gal usable capacity.)

Installation

The fuel tank(s) shall be securely mounted to the bus to prevent movement during bus maneuvers.

The fuel tank(s) shall be equipped with an external, hex head, drain plug. It shall be at least a 3/8in. size and shall be located at the lowest point of the tank(s). The fuel tank(s) shall have an inspection plate or easily removable filler neck to permit cleaning and inspection of the tank(s) without removal from the bus. The tank(s) shall be baffled internally to prevent fuel-sloshing regardless of fill level. The baffles or fuel pickup location shall assure continuous full power operation on a 6 percent upgrade for 15 minutes starting with no more than 25 gal of fuel over the unusable amount in the tank(s). The bus shall operate at idle on a 6 percent downgrade for 30 minutes starting with no more than 10 gal of fuel over the unusable amount in the tank(s).

The materials used in mounting shall withstand the adverse effects of road salts, fuel oils and accumulation of ice and snow for the life of the bus.

Labeling

The capacity, date of manufacture, manufacturer name, location of manufacture, and certification of compliance to federal motor carrier safety regulations shall be permanently marked on the fuel tank(s). The markings shall be readily visible and shall not be covered with an undercoating material.

Fuel Filler

The fuel filler shall be located 7 to 32ft behind the centerline of the front door on the curbside of the bus. The filler cap shall be retained to prevent loss and shall be recessed into the body so that spilled fuel will not run onto the outside surface of the bus.

The fuel lines forward of the engine bulkhead shall be in conformance to SAE Standards. Provide an AIM 2.4 Fuel Master module to be installed in the bus for the Agency's fuel management system.

DEFAULT-----APPROVED

OEM to designate height of fuel filler.

DEFAULT-----APPROVED

Dry-Break Fuel Filler

The fuel filler shall accommodate a nozzle that forms a locked and sealed connection during the refueling process to eliminate spills. Fuel shall not be allowed to flow into the tank unless the nozzle has been properly coupled, locked and sealed to the filler. With the nozzle open, fuel shall enter the tank at a fill rate of not less than 40 gal per minute of foam-free fuel without causing the nozzle to shut off before the tank is full. The nozzle shall automatically shut off when the tank is essentially full. Once disconnected, fuel shall not be allowed to flow through the nozzle at any time. Any pressure over 3 psi shall be relieved from the fuel tank automatically. An audible signal shall indicate when the tank is essentially full. The dry break system shall be compatible with the Agency's system. The fuel filler cap shall be hinged.

ALTERNATIVE-----APPROVED

The fuel filler cap shall be hinged.

TS 18.2.2 Design and Construction, CNG

Fuel Containers/Cylinders

TS 19. Emissions and Exhaust

TS 19.1 Exhaust Emissions

The engine and related systems shall meet all applicable emission and engine design guidelines and standards.

TS 19.2 Exhaust System

The exhaust pipe shall be of sufficient height to prevent exhaust gases and waste heat from discoloring or causing heat deformation to the bus. The entire exhaust system shall be adequately shielded to prevent heat damage to any bus component, including the exhaust after treatment compartment area. The exhaust outlet shall be designed to minimize rain, snow or water generated from high-pressure washing systems from entering into the exhaust pipe and causing damage to the after treatment.

ALTERNATIVE-----APPROVED

Exhaust gases and waste heat shall be discharged from the street-side under-rear bumper. Exhaust gases and waste heat from the radiator shall not be discharged on the curbside and shall be directed generally left of centerline of the bus

TS 19.3 Exhaust After treatment

An exhaust after treatment system will be provided to ensure compliance to all applicable EPA regulations in effect.

Diesel Exhaust Fluid Injection

If required by the engine manufacturer to meet NOx level requirements specified by EPA, a DEF injection system will be provided. The DEF system will minimally include a tank, an injector, a pump, an ECM and a selective catalytic converter. The tanks shall be designed to store DEF in the operating environment described in the "Operating Environment" section. . Provide a minimum 15-gallon storage tank with a tethered twist-cap.

DEFAULT-----APPROVED

The DEF filler shall accommodate a standard nozzle. The nozzle shall automatically shut off when the tank is essentially full. The DEF filler cap shall be a screw-on cap and located curbside.

ALTERNATIVE-----APPROVED

The DEF fluid lines shall be designed with heated lines for temperatures up to -20 °F.

TS 19.4 Particulate After treatment

If required by the engine manufacturer to meet particulate level requirements specified by EPA, a particulate trap will be provided. The particulate trap shall regenerate itself automatically if it senses clogging. Regeneration cycles and conditions will be defined by the engine manufacturer.

STRUCTURE

TS 20. General

TS 20.1 Design

The structure of the bus shall be designed to withstand the transit service conditions typical of an urban or intercity duty cycle throughout its service life. The vehicle structural frame shall be designed to operate with minimal maintenance throughout the 12-year design operating profile. The design operating profile specified by the Agency shall be considered for this purpose.

TS 21. Altoona Testing

Prior to acceptance of first bus, the vehicle must have completed any FTA-required Altoona testing. Any items that required repeated repairs or replacement must undergo the corrective action with supporting test and analysis. A report clearly describing and explaining the failures and corrective actions taken to ensure that any and all such failures will not occur shall be submitted to the Agency.

DEFAULT-----APPROVED

~~If available, the Altoona Test Report shall be provided to the Agency with the Proposal submittal. If not available, then the report shall be provided prior to first acceptance of bus.~~ The agency cannot award any proposed vehicle configuration that has not passed Altoona.

DEFAULT-----APPROVED

Electric models, the D45 CRTe and D45 CRTe LE are in the final stages of development and product. As such, Altoona testing has not yet been completed. No electric coaches will be delivered prior to the Altoona testing being completed, which is anticipated in year 20201.

TS 21.1 Structural Validation

~~DEFAULT~~-----**APPROVED**

Baseline Structural Analysis

The structure of the bus shall have undergone appropriate structural testing and/or analysis. At minimum, appropriate structural testing and analysis shall include Altoona testing or finite element analysis (FEA).

TS 22. Distortion

The bus, loaded to GVWR and under static conditions, shall not exhibit deflection or deformation that impairs the operation of the steering mechanism, doors, windows, passenger escape mechanisms or service doors. Static conditions shall include the vehicle at rest with any one wheel or dual set of wheels on a 6 in. curb or in a 6 in. deep hole.

TS 23. Resonance and Vibration

All structure, body and panel-bending mode frequencies, including vertical, lateral and torsional modes, shall be sufficiently removed from all primary excitation frequencies to minimize audible, visible or sensible resonant vibrations during normal service.

TS 23.1 Engine Compartment Bulkheads

The passenger and engine compartment shall be separated by fire-resistant bulkheads. The engine compartment shall include areas where the engine and exhaust system are housed. ~~This bulkhead shall preclude or retard propagation of an engine compartment fire into the passenger compartment and shall be in accordance with the Recommended Fire Safety Practices defined in FTA Docket 90A, dated October 20, 1993.~~ Only necessary openings shall be allowed in the bulkhead, and these shall be fire-resistant. Any passageways for the climate control system air shall be separated from the engine compartment by fire-resistant material. Piping through the bulkhead shall have fire-resistant fittings sealed at the bulkhead. Wiring may pass through the bulkhead only if connectors or other means are provided to prevent or retard fire propagation through the bulkhead. Engine access panels in the bulkhead shall be fabricated of fire-resistant material and secured with fire-resistant fasteners. These panels, their fasteners and the bulkhead shall be constructed and reinforced to minimize warping of the panels during a fire that will compromise the integrity of the bulkhead.

TS 23.2 Crashworthiness (Transit Coach)

TS 24. Corrosion

The bus flooring, sides, roof, understructure and axle suspension components shall be designed to resist corrosion or deterioration from atmospheric conditions and de-icing materials for a period of 12 years or 500,000 miles, whichever comes first. It shall maintain structural integrity and nearly maintain original appearance throughout its service life, with the Agency's use of proper cleaning and neutralizing agents.

All materials that are not inherently corrosion resistant shall be protected with corrosion-resistant coatings. All joints and connections of dissimilar metals shall be corrosion resistant and shall be protected from galvanic corrosion. Representative samples of all materials and connections shall withstand a two-week (336-hour) salt spray test in accordance with ASTM Procedure B-117 with no structural detrimental effects to normally visible surfaces and no weight loss of over 1 percent. *The chassis and structure to be made out of low-corrosion stainless steel (minimum 403).*

ALTERNATIVE-----APPROVED

Corrosion Resistance Requirements

All exposed surfaces and the interior surfaces of tubing and other enclosed members shall be corrosion resistant through application of a corrosion protection system.

APPROVED CLARIFICATION - Chassis structures made of low corrosion stainless steel, with exception of front and rear bogey areas, made of high Strength steel. These areas are protected with paint and undercoating.

APPROVED – Tubes using non-stainless steel, which are protected with paint and undercoating are acceptable. Tubes designed with end caps for application of corrosion inhibitor to interior do not require corrosion.

TS 25. Towing

Each towing device shall withstand, without permanent deformation, tension loads up to 1.2 times the curb weight of the bus within 20 deg. of the longitudinal axis of the bus. If applicable, the rear towing device(s) shall not provide a toehold for unauthorized riders. The method of attaching the towing device shall not require the removal, or disconnection, of front suspension or steering components. Removal of the bike rack is permitted for attachment of towing devices.

DEFAULT-----APPROVED

Shop air connectors shall be provided at the front and rear of the bus and shall be capable of supplying all pneumatic systems of the bus with externally sourced compressed air. The location of these shop air connectors shall facilitate towing operations.

A shop air connector, Foster 10-3 and tethered dust cap have been APPROVED.

ALTERNATIVE:

A plug connector permanently mounted at the front of the bus shall provide for bus tail lamp, marker, stop and turn signal lamp operation as controlled from the towing vehicle. The connector shall include a spring-loaded dust- and water-resistant cap.

DEFAULT-----APPROVED

No Provision of Glad-Hand Type Connectors for Towing

No glad-hand type connector shall be provided.

DEFAULT-----APPROVED

Lifted (Supported) Front Axle and Flat Towing Capability

The front towing devices shall allow attachment of adapters for a rigid tow bar and shall permit the lifting of the bus until the front wheels are clear off the ground in order to position the bus on the towing equipment by the front wheels. These devices shall also permit common flat towing.

Two rear recovery devices/tie downs shall permit lifting and towing of the bus for a short distance, such as in cases of an emergency, to allow access to provisions for front towing of bus. The method of attaching the tow bar or adapter shall require the specific approval of the Agency. Any tow bar or adapter

exceeding 50 lbs should have means to maneuver or allow for ease of use and application. Each towing device shall accommodate a crane hook with a 1 in. throat.

TS 26. Jacking

It shall be possible to safely jack up the bus, at curb weight, with a common 10-ton floor jack with or without special adapter, when a tire or dual set is completely flat and the bus is on a level, hard surface, without crawling under any portion of the bus. Jacking from a single point shall permit raising the bus sufficiently high to remove and reinstall a wheel and tire assembly. Jacking pads located on the axle or suspension near the wheels shall permit easy and safe jacking with the flat tire or dual set on a 6 in. high run-up block not wider than a single tire. The bus shall withstand such jacking at any one or any combination of wheel locations without permanent deformation or damage.

DEFAULT-----APPROVED

Yellow Pads

Jacking pads shall be painted safety yellow.

TS 27. Hoisting

The bus axles or jacking plates shall accommodate the lifting pads of a two-post (or three-post if 60 ft. articulated bus) hoist system. Jacking plates, if used as hoisting pads, shall be designed to prevent the bus from falling off the hoist. Other pads or the bus structure shall support the bus on jack stands independent of the hoist.

The vehicle shall be capable of lifting by the wheels, and, as necessary to meet tire load requirements, the proper number for wheel lifts and/or adapters must be used.

TS 28. Floor

~~TS 28.1 Design (Transit Coach)~~

TS 28.2 Design (Commuter Coach)

The floor shall be essentially a continuous plane, except at the wheel housings and platforms. Where the floor meets the walls of the bus, as well as other vertical surfaces such as platform risers, the surface edges shall be blended with a circular section of radius not less than ¼ in. or installed in a fully sealed butt joint. Similarly, a molding or cover shall prevent debris accumulation between the floor and wheel housings. The vehicle floor in the area of the entrance and exit doors shall have a lateral slope not exceeding 2 deg. to allow for drainage.

The aisle of the bus shall be a sloped floor design and shall not exceed 5.5 deg. off the horizontal or include one step not to exceed entrance doorstep heights. The floor shall be a continuous plane over the wheel housings. Where the floor meets the walls of the bus, as well as other vertical surfaces such as platform risers, the surface edges shall be blended with a circular section of radius not less than ¼ in. or installed in a fully sealed butt joint.

TS 28.3 Design (Articulated Transit Coach)

TS 28.4 Strength

The floor deck may be integral with the basic structure or mounted on the structure securely to prevent chafing or horizontal movement and designed to last the life of the bus. Sheet metal screws shall not be used to retain the floor, and all floor fasteners shall be serviceable from one side only. Any adhesives, bolts or screws used to secure the floor to the structure shall last and remain effective throughout the life of the coach. Tapping plates, if used for the floor fasteners, shall be no less than the same thickness as a standard nut, and all floor fasteners shall be secured and protected from corrosion for the service life of the bus.

The floor deck shall be reinforced as needed to support passenger loads. At GVWR, the floor shall have an elastic deflection of no more than 0.60 in. from the normal plane. The floor shall withstand the application of 2.5 times gross load weight without permanent detrimental deformation. The floor, with coverings applied, shall withstand a static load of at least 150 lbs applied through the flat end of a ½ in. diameter rod, with 1/32 in. radius, without permanent visible deformation.

TS 28.5 Construction

The floor shall consist of the subfloor and the floor covering that will last the life of the bus. The floor as assembled, including the sealer, attachments and covering, shall be waterproof, non-hygroscopic and resistant to mold growth. The subfloor shall be resistant to the effects of moisture, including decay (dry rot). It shall be impervious to wood-destroying insects such as termites.

DEFAULT-----APPROVED

Pressure-Preserved Plywood Panel

Plywood shall be certified at the time of manufacturing by an industry-approved third-party inspection agency such as APA – The Engineered Wood Association (formerly the American Plywood Association). Plywood shall be of a thickness adequate to support design loads, manufactured with exterior glue, satisfy the requirements of a Group I Western panel as defined in PS 1-95 (Voluntary Product Standard PS 1-95, “Construction and Industrial Plywood”) and be of a grade that is manufactured with a solid face and back. Plywood shall be installed with the highest-grade, veneer side up. Plywood shall be pressure-treated with a preservative chemical and process such as alkaline copper quaternary (ACQ) that prevents decay and damage by insects. Preservative treatments shall utilize no EPA-listed hazardous chemicals. The concentration of preservative chemicals shall be equal to or greater than required for an above ground level application. Treated plywood will be certified for preservative penetration and retention by a third-party inspection agency. Pressure-preservative treated plywood shall have a moisture content at or below 15 percent.

TS 28.6 Construction (Commuter Coach)

The floor shall consist of the subfloor and the floor covering that will last the life of the bus. The floor as assembled, including the sealer, attachments and covering, shall be waterproof, non-hygroscopic and resistant to mold growth. The subfloor shall be resistant to the effects of moisture, including decay (dry rot). It shall be impervious to wood-destroying insects such as termites.

The floor deck may not be integral with the basic structure but shall be mounted on the structure securely to prevent chafing or horizontal movement. Sheet metal screws shall not be used to retain the floor. All floor fasteners shall be secured and protected from corrosion for the service life of the coach. The floor deck shall be reinforced as needed to support passenger loads. At GVWR, the floor shall have an elastic

defection of no more than 0.375 in. (10 mm) from the normal plane. The floor shall withstand the application of 3.0 times gross load weight without permanent detrimental deformation.

TS 29. Platforms

TS 29.1 Driver's Area

The covering of platform surfaces and risers, except where otherwise indicated, shall be the same material as specified for floor covering. Trim shall be provided along top edges of platforms unless integral nosing is provided.

DEFAULT-----APPROVED

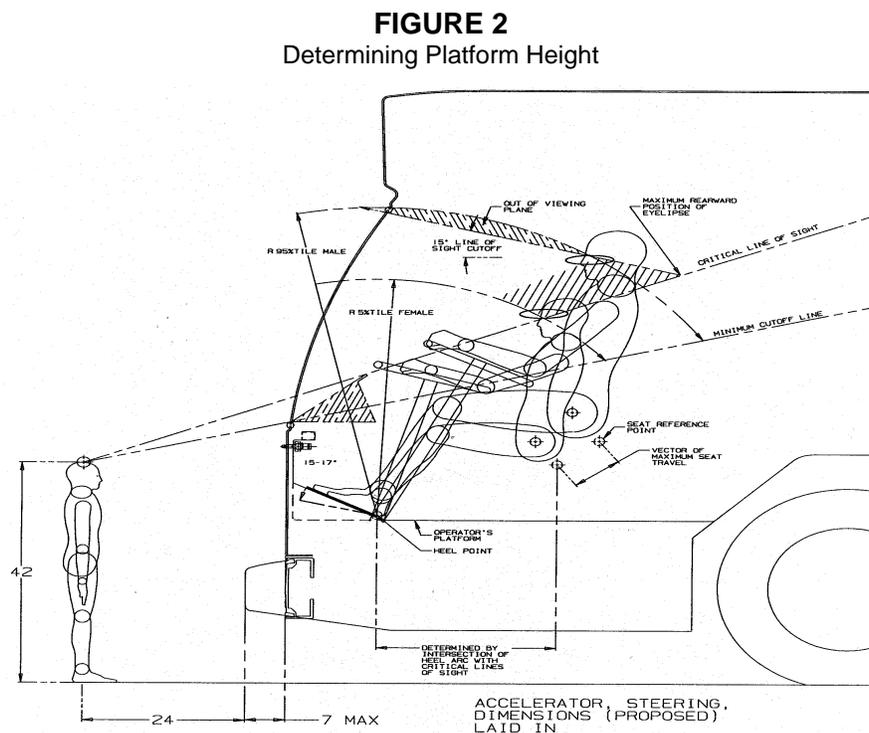
No specific trim material specified.

TS 29.2 Driver's Platform

The driver's platform shall be of a height such that, in a seated position, the driver can see an object located at an elevation of 42 in. above the road surface, 24 in. from the leading edge of the bumper. Notwithstanding this requirement, the platform height shall not position the driver such that the driver's vertical upward view is less than 15 deg. A warning decal or sign shall be provided to alert the driver to the change in floor level. **Figure 2** illustrates a means by which the platform height can be determined, using the critical line of sight.

ALTERNATIVE....APPROVED

Front object detection is provided with a help of round convex mirror mounted under arm of RH exterior rearview mirror..



TS 29.3 Farebox

Farebox placement should minimize impact to passenger access and minimize interference with the driver's line of sight.

ALTERNATIVE-----APPROVED

No interface, no platform.

~~TS 29.4 Rear Step Area to Rear Area (Transit Coach)~~

TS 30. Wheel Housing

TS 30.1 Design and Construction

Sufficient clearance and air circulation shall be provided around the tires, wheels and brakes to preclude overheating when the bus is operating on the design operating profile. Wheel housings shall be constructed of corrosion-resistant and fire-resistant material.

Wheel housings, as installed and trimmed, shall withstand impacts of a 2in. steel ball with at least 200 ft-lbs of energy without penetration.

~~TS 30.2 Design and Construction (Transit Coach)~~

ALTERNATIVE-----APPROVED

The wheel housing shall be designed to have the ability to chain buses.

~~TS 30.3 Articulated Joint (Articulated Transit Coach)~~

~~TS 30.4 Raceway (Articulated Transit Coach)~~

~~TS 30.5 Bellows~~

CHASSIS

TS 31. Suspension

TS 31.1 General Requirements

The front, rear and mid (if articulated) suspensions shall be pneumatic type. The basic suspension system shall last the service life of the bus without major overhaul or replacement. Adjustment points shall be minimized and shall not be subject to a loss of adjustment in service. Routine adjustments shall be easily accomplished by limiting the removal or disconnecting the components.

TS 31.2 Alignment

All axles should be properly aligned so the vehicle tracks accurately within the size and geometry of the vehicle.

TS 31.3 Springs and Shock Absorbers

TS 31.3.1 Suspension Travel

The suspension system shall permit a minimum wheel travel of ~~2.75~~ 3.5 in. jounce-upward travel of a wheel when the bus hits a bump (higher than street surface), and ~~2.75~~ 3 in. rebound-downward travel when the bus comes off a bump and the wheels fall relative to the body. Elastomeric bumpers shall be provided at the limit of jounce travel. Rebound travel may be limited by elastomeric bumpers or hydraulically within the shock absorbers. Suspensions shall incorporate appropriate devices for automatic height control so that regardless of load the bus height relative to the centerline of the wheels does not change more than ½ in. at any point from the height required. The safe operation of a bus cannot be impacted by ride height up to 1 in. from design normal ride height.

TS 31.3.2 Damping

Vertical damping of the suspension system shall be accomplished by hydraulic shock absorbers mounted to the suspension arms or axles and attached to an appropriate location on the chassis. Damping shall be sufficient to control coach motion to three cycles or less after hitting road perturbations. The shock absorber bushing shall be made of elastomeric material that will last the life of the shock absorber. The damper shall incorporate a secondary hydraulic rebound stop. Provide hydraulic shock absorbers that can be manually adjusted for stiffness.

“Koni” shock absorbers have been APPROVED

TS 31.3.3 Lubrication

DEFAULT-----APPROVED

Standard Grease Fittings

All elements of steering, suspension and drive systems requiring scheduled lubrication shall be provided with grease fittings conforming to SAE Standard J534. These fittings shall be located for ease of inspection and shall be accessible with a standard grease gun from a pit or with the bus on a hoist. Each element requiring lubrication shall have its own grease fitting with a relief path. The lubricant specified shall be standard for all elements on the bus serviced by standard fittings and shall be required no less than every 6000 miles.

TS 31.3.4 Kneeling

DEFAULT-----APPROVED

A kneeling system shall lower the ~~bus floor entrance(s) of the bus~~ a minimum of 2 in. 3" to 6" during loading or unloading operations regardless of load up to GVWR, measured at the longitudinal centerline of the entrance door(s) by the driver. The kneeling control shall provide the following functions:

- Downward control must be held to allow downward kneeling movement.
- Release of the control during downward movement must completely stop the lowering motion and hold the height of the bus at that position.
- Upward control actuation must allow the bus to return to normal floor height without the driver having to hold the control.

The brake and throttle interlock shall prevent movement when the bus is kneeled. The kneeling control shall be disabled when the bus is in motion. The bus shall kneel at a maximum rate of 1.25 in. per second at essentially a constant rate. After kneeling, the bus shall rise within 4 seconds to a height permitting the bus to resume service and shall rise to the correct operating height within 7 seconds regardless of load up to GVWR. During the lowering and raising operation, the maximum vertical acceleration shall not exceed 0.2g, and the jerk shall not exceed 0.3g/second.

An indicator visible to the driver shall be illuminated until the bus is raised to a height adequate for safe street travel. An audible warning alarm will sound simultaneously with the operation of the kneeler to alert passengers and bystanders. A warning light mounted near the curbside of the front door, a minimum 2.5 in. diameter amber lens, shall be provided that will blink when the kneel feature is activated. Kneeling shall not be operational while the wheelchair ramp *or lift* is deployed or in operation.

TS 32. Wheels and Tires

TS 32.1 Wheels

All wheels shall be interchangeable except for the middle axle of an artic where a super single tire size is used and shall be removable without a puller. Wheels shall be compatible with tires in size and load-carrying capacity. Front wheels and tires shall be balanced as an assembly per SAE J1986.

ALTERNATIVE-----APPROVED

Two-sided polished aluminum rims. *with cryogenic hardened surfaces and flanges to prevent premature wear.*

Provide a total of thirteen (13) wheels per bus. Mount 1 wheel for the spare tire. The other (4) spare wheels are for the Agency to mount snow tires on for winter use. Provide 6 plastic wheel separators per bus for installation by the Agency between all wheels and hubs. Provide double seal, Flow-Through Valve Stem Caps that do not stick so air will not slowly exhaust from the tire. Provide Valve Stems that are the right length for use with long double seal flow-through stem caps. Provide lug nut covers with a chrome appearance for all lug nuts on the bus.

Alcoa Dura Bright and Dura Flange wheels have been APPROVED.

Myers V2B Flow through Valve Stem Caps (21534) for all mounted wheels have been APPROVED.

Dill (VS-554-D) Valve Stems for all mounted wheels have been APPROVED.

Alcoa #000185 Lug Nut Covers have been APPROVED.

Meyers Through Valve P/N #22610 for all mounted and spare wheels.

SmartTire system From Bendix, showing tire pressure and temperature status shown on a dash display is Approved.

ALTERNATIVE-----APPROVED

Tire ~~pressure~~ temperature monitoring system. The agency has experienced problems with tire fires in the past. Provide pricing/info for available tire/hub temperature monitoring or brake specific fire suppression systems.

DEFAULT-----APPROVED

Standard non-locking lug nut.

TS 32.2 Tires

Tires shall be suitable for the conditions of transit service and sustained operation at the maximum speed capability of the bus. Load on any tire at GVWR shall not exceed the tire supplier's rating.

Sufficient space shall be provided to allow the Agency to carry a spare tire, if required.

DEFAULT-----APPROVED

The tires shall be provided under a lease agreement between the Agency and the tire supplier and shall be the appropriate size and load range for the vehicle.

TS 33. Steering

DEFAULT -----APPROVED

Hydraulically assisted steering shall be provided. The steering gear shall be an integral type with the number and length of flexible lines minimized or eliminated. Engine-driven hydraulic pump shall be provided for power steering. ~~Provide a pressure fitting off of the steering gear to test hydraulic pressure.~~

ALTERNATIVE....APPROVED

ZF Hydraulic assist mechanical power steering system is approved.

ALTERNATIVE-----APPROVED

Electrically assisted steering shall be provided to reduce steering effort. The TRW Electric Steering Assist has been APPROVED.

TS 33.1 Steering Axle (Transit Coach)

TS 33.2 Steering and Tag Axles (Commuter Coach)

The front and tag axles shall be solid beam, non-driving with a load rating sufficient for the bus loaded to GVWR and shall be equipped with unitized grease type wheel bearings and seals.

All friction points on the front axle shall be equipped with replaceable bushings or inserts and, if needed, lubrication fittings easily accessible from a pit or hoist.

The steering geometry of the outside (front lock) wheel shall be within 2 deg. of true Ackerman up to 50 percent lock measured at the inside (back lock) wheel. The steering geometry shall be within 3 degrees of true Ackerman for the remaining 100 percent lock measured at the inside (back lock) wheel.

ALTERNATIVE.....APPROVED
ZF'S independent front and tag axles, wish bone type axles.

TS 33.3 Steering Wheel

TS 33.3.1 Turning Effort

Steering effort shall be measured with the bus at GVWR, stopped with the brakes released and the engine at normal idling speed on clean, dry, level, commercial asphalt pavement and the tires inflated to recommended pressure.

Under these conditions, the torque required to turn the steering wheel 10 deg. shall be no less than 5 ft.-lbs. and no more than 10 ft.-lbs. Steering torque may increase to 70 ft.-lbs. when the wheels are approaching the steering stops, as the relief valve activates.

Power steering failure shall not result in loss of steering control. With the bus in operation, the steering effort shall not exceed 55 lbs at the steering wheel rim, and perceived free play in the steering system shall not materially increase as a result of power assist failure. Gearing shall require no more than seven turns of the steering wheel lock-to-lock.

Caster angle shall be selected to provide a tendency for the return of the front wheels to the straight position with minimal assistance from the driver.

TS 33.3.2 Steering Wheel, General

The steering wheel diameter shall be approximately ~~16~~ 18 to 20 in.; the rim diameter shall be 7/8 to 1 1/4 in. and shaped for firm grip with comfort for long periods of time.

Steering wheel spokes and wheel thickness shall ensure visibility of the dashboard so that vital instrumentation is clearly visible at center neutral position (within the range of a 95th-percentile male, as described in SAE 1050a, Sections 4.2.2 and 4.2.3). Placement of steering column must be as far forward as possible, but either in-line with or behind the instrument cluster.

A 16" steering wheel is standard with the Electric Assist Steering Column.

The VIP 16-inch, Soft Touch, 2 Spoke Steering Wheel has been APPROVED.

The VIP 18-inch steering wheel, 4-spoke, leather wrapped is APPROVED.

TS 33.3.3 Steering Column Tilt

The steering column shall have full tilt capability with an adjustment range of no less than 40 deg. from the vertical and easily adjustable by the driver and shall be accessible by a 5th percentile female and 95th percentile male.

The 4 tilt positions steering column, with 21 degrees from horizontal for steering column is approved.

TS 33.3.4 Steering Wheel Telescopic Adjustment

The steering wheel shall have full telescoping capability and have a minimum telescopic range of 2 in. and a minimum low-end adjustment of 29 in., measured from the top of the steering wheel rim in the horizontal position to the cab floor at the heel point.

TABLE 4
 Steering Wheel Height¹ Relative to Angle of Slope

At Minimum Telescopic Height Adjustment (29 in.)		At Maximum Telescopic Height Adjustment (5 in.)	
Angle of Slope	Height	Angle of Slope	Height
0 deg.	29 in.	0 deg.	34 in.
15 deg.	26.2 in.	15 deg.	31.2 in.
25 deg.	24.6 in.	25 deg.	29.6 in.
35 deg.	22.5 in.	35 deg.	27.5 in.

– 1. Measured from bottom portion closest to driver.

The telescopic steering column from Douglas Autotech with max height adjustment of 2 inch is Approved.

TS 34. Drive Axle

The bus shall be driven by a heavy-duty axle with a load rating sufficient for the bus loaded to GVWR. The drive axle shall have a design life to operate for not less than 300,000 miles on the design operating profile without replacement or major repairs. The lubricant drain plug shall be magnetic type. If a planetary gear design is employed, the oil level in the planetary gears shall be easily checked through the plug or sight gauge. The axle and driveshaft components shall be rated for both propulsion and retardation modes with respect to duty cycle.

NOTE: The retardation duty cycle can be more aggressive than propulsion.

The drive shaft shall be guarded to prevent hitting any critical systems, including brake lines, coach floor or the ground, in the event of a tube or universal joint failure.

TS 34.1 Non-Drive Axle

The non-drive axle is the drive axle without the drive gear with a load rating sufficient for the load to GVWR.

TS 35. Tag Axles (Commuter Coach)

A tag axle shall be located behind the drive axle. The tag axle shall be a solid beam type with fixed steering. The tag axle shall have single tires the same size as the tires on the front and drive axles. Tag axle weight shall not exceed 14,000 lbs. With full passenger seating capacity, load on any axle shall not exceed 22,400 lbs. Combined load capacity weight on the drive and tag axles shall not exceed 36,500 lbs. A tag axle unloading feature will allow full or partial unloading or dumping of air from the tag axle air spring bellows. This feature enables weight to shift to the drive axle for more traction. Manual unloading valves are located inside the RH rear curbside service door.

Approved: The tag axle will be an independent suspension type with passive steering. Tag axle weight shall not exceed 16,500 lbs. With full passenger seat capacity, load on any axles shall not exceed 23,000 lbs. combined load capacity weight on the drive and tag axles shall not exceed 39,500. Manual unloading values located in wheelwell ares (accessible using pull rod tool).

ALTERNATIVE-----APPROVED

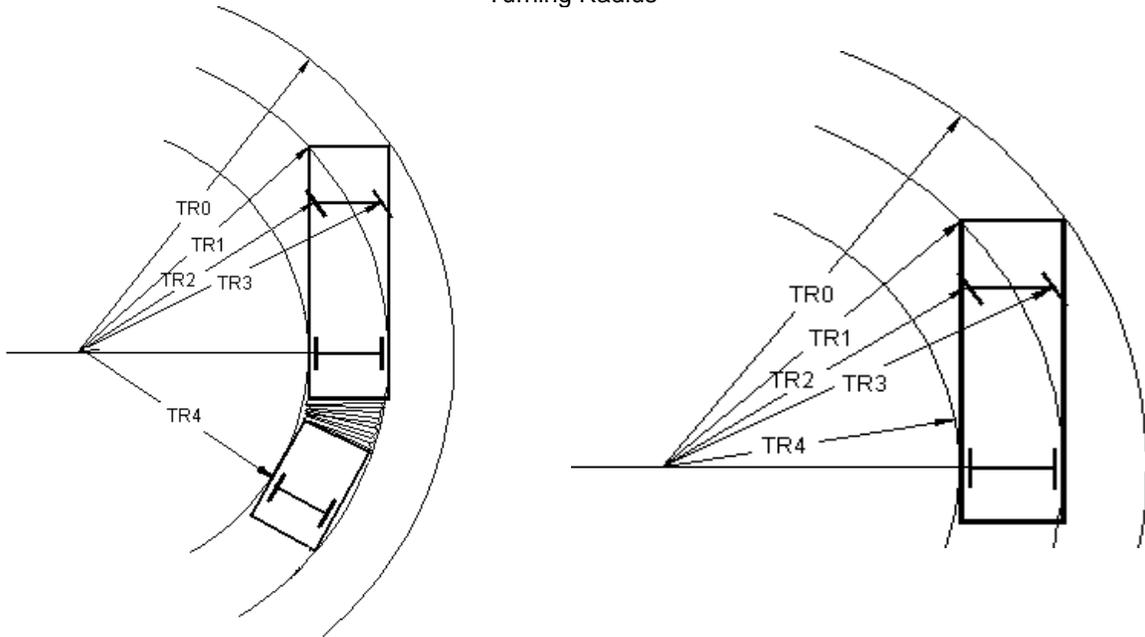
Steerable tag axle will be provided.

TS 36. Turning Radius

TABLE 5
 Maximum Turning Radius

Bus Length (approximate)	Maximum Turning Radius (see Figure 3)	Agency Requirement
30 ft.	31 ft. (TR0)	
35 ft.	39 ft. (TR0)	
40 ft.	44 ft. (TR0)	
45 ft.	49 ft. (TR0)	
60 ft.	44.5ft (outside front axle, TR0) 17 ft. (inside rearmost axle, TR4)	

FIGURE 3
 Turning Radius



TS 37. Brakes

TS 37.1 Service Brake

DEFAULT-----APPROVED

Brakes shall be self-adjusting. Brake wear indicators (visible brake sensors) shall be provided on exposed push rods.

CLARIFICATION: Standard brake wear indicators can be provided (mechanical type, visual detection) is Approved.

ALTERNATIVE-----APPROVED

Visible stroke indicators may be combined with electronic brake monitoring system and vehicle brake warning system to notify driver and maintenance of unsafe brake conditions. *Vehicles provided under this RFP are to include Electronic Brake Monitoring (specifically brake stroke) as part of the vehicle air disc braking on-board diagnostic system. The Electronic Brake Monitoring System (EBMS) shall include both parking brake and service brake electronic monitoring utilizing a computer module with appropriate software, brake application pressure sensing via pressure transducer(s), associated cabling communicating the required electronic signals, and optical as well as mechanical sensing at the brake actuator / air disc caliper. The EBMS system shall be designed to detect over-stroke, non-functioning, brake drag and low pad-to-rotor clearance conditions at each vehicle wheel end. The Agency requests this be a part of the base bus price.*

Any wheel-end brake fault condition detected by the EBMS shall be communicated via SAE brake fault codes over the vehicle J-1939 network in real-time. These predefined fault codes shall provide instant warnings to operations and maintenance of critical brake system problems which may affect the safe operation of vehicle.

The system shall specifically employ embedded optical and mechanical sensing at each wheel end which monitors operational conditions for air brake delivery and release, (as well as mechanical conditions inside the caliper that effect lining and pad clearance), and the proper mechanical functionality of air disc calipers at each wheel end position

The on-board EBMS shall be designed to augment safety and aid maintenance in determining when to perform necessary unscheduled maintenance to mitigate vehicle performance and safety concerns. The EBMS shall additionally provide a log of stored fault codes for later retrieval by maintenance personnel to additionally be utilized by maintenance personnel for vehicle troubleshooting. The system shall also provide additional capability for conducting electronic pre-trip and/or post trip inspection on air disc brake vehicles.

The MGM E-stroke Brake Monitoring System has been APPROVED.

TS 37.2 Actuation

DEFAULT-----APPROVED

Service brakes shall be controlled and actuated by a compressed air system. Force to activate the brake pedal control shall be an essentially linear function of the bus deceleration rate and shall not exceed 75 lbs at a point 7 in. above the heel point of the pedal to achieve maximum braking. The heel point is the location of the driver's heel when his or her foot is rested flat on the pedal and the heel is touching the floor or heel pad of the pedal. The ECU for the ABS system shall be protected, yet in an accessible location to allow for ease of service.

The total braking effort shall be distributed among all wheels in such a ratio as to ensure equal friction material wear rate at all wheel locations. Manufacturer shall demonstrate compliance by providing a copy of a thermodynamic brake balance test upon request.

ALTERNATIVE-----APPROVED

Microprocessor controlled automatic traction control (ATC) shall be provided.

Provide a momentary type Mud and Snow switch on the dash. This switch is to be used temporarily by the bus operator when the ATC is activated to the point the engine rpm has been decreased almost back to idle. The Mud and Snow switch temporarily over-rides the ATC and allows for maximum throttle if necessary, regardless of wheel slip.

ALTERNATIVE-----APPROVED

The ABS/EBC controller must support EBC1 (PGN 61441) "Brake Pedal Position" (SPN 521) to support and enhance fuel savings technologies.

TS 37.3 Friction Material

The brake linings shall be made of non-asbestos material. In order to aid maintenance personnel in determining extent of wear, a provision such as a scribe line or a chamfer indicating the thickness at which replacement becomes necessary shall be provided on each brake lining. The complete brake lining wear indicator shall be clearly visible from the hoist or pit without removing backing plates.

CLARIFICATION: Standard brake wear indicators can be provided (mechanical type, visual detection) is Approved.

ALTERNATIVE-----APPROVED

Remote brake wear indicator shall be provided.

TS 37.4 Hubs and Drums/Discs

Replaceable wheel bearing seals shall run on replaceable wear surfaces or be of an integral wear surface sealed design. Wheel bearing and hub seals and unitized hub assemblies shall not leak or weep lubricant when operating on the design operating profile for the duration of the initial manufacturer's warranty.

ALTERNATIVE-----APPROVED

Disc Brakes on All Axles

The bus shall be equipped with disc brakes on all axles, and the brake discs shall allow machining of each side of the disc to obtain smooth surfaces per manufacturer's specifications.

The brake system material and design shall be selected to absorb and dissipate heat quickly so that the heat generated during braking operation does not glaze the brake linings.

TS 37.5 Hubs and Drums (Commuter Coach)

Replaceable wheel bearing seals shall run on replaceable wear surfaces or be of an integral wear surface sealed design. Wheel bearing and hub seals and unitized hub assemblies shall not leak or weep lubricant when operating on the design operating profile for the duration of the initial manufacturer's warranty.

The bus shall be equipped with disc brakes on all axles, and the brake discs shall allow machining of each side of the disc to obtain smooth surfaces per manufacturer's specifications.

TS 37.6 Parking/Emergency Brake

DEFAULT-----APPROVED

Air Brakes

The parking brake shall be a spring-operated system, actuated by a valve/*electronics* that exhausts compressed air to apply the brakes. The parking brake may be manually enabled when the air pressure is at the operating level per FMVSS 121. Provide an electronic Parking Brake capable of using a series of interlocks – door switch, seat belt and vehicle speed – which automatically sets the parking brake, while sounding an alarm, should the driver forget to do so. This system allows the brakes to intervene when a driver exits the vehicle without setting the parking brake. Bendix Intellipark™ is approved. Park brake knob is to be metal.

ALTERNATIVE

Emergency Brake

An emergency brake release shall be provided to release the brakes in the event of automatic emergency brake application. The driver shall be able to manually depress and hold down the emergency brake release valve to release the brakes and maneuver the bus to safety. Once the driver releases the emergency brake release valve, the brakes shall engage to hold the bus in place. Air to the emergency brake release system shall be provided by a dedicated emergency air tank.

TS 38. Interlocks (Transit Coach)

TS 38.1 Passenger Door Interlocks

To prevent opening mid and rear passenger doors while the bus is in motion, a speed sensor shall be integrated with the door controls to prevent the mid/rear doors from being enabled or opened unless the bus speed is less than 2 mph.

To preclude movement of the bus, an accelerator interlock shall lock the accelerator in the closed position, and a brake interlock shall engage the service brake system to stop movement of the bus when

the driver's door control is moved to a mid/rear door enable or open position, or a mid or rear door panel is opened more than 3 in. from the fully closed position (as measured at the leading edge of the door panel). The interlock engagement shall bring the bus to a smooth stop and shall be capable of holding a fully loaded bus on a 6 percent grade, with the engine at idle and the transmission in gear, until the interlocks are released. These interlock functions shall be active whenever the vehicle master run switch is in any run position.

All door systems employing brake and accelerator interlocks shall be supplied with supporting failure mode effects analysis (FEMA) documentation, which demonstrates that failure modes are of a failsafe type, thereby never allowing the possibility of release of interlock while an interlocked door is in an unsecured condition, unless the door master switch has been actuated to intentionally release the interlocks.

DEFAULT-----APPROVED

Non-adjustable brake interlock regulator.

DEFAULT-----APPROVED

No requirements for accelerator and brake interlocks whenever front doors are open.

TS 39. Pneumatic System

TS 39.1 General

The bus air system shall operate the air-powered accessories and the braking system with reserve capacity. New buses shall not leak down more than 5psi over a 15-minute period of time as indicated on the dash gauge.

Provision shall be made to apply shop air to the bus air systems. A quick disconnect fitting shall be easily accessible and located in the engine compartment and near the front bumper area for towing. Retained caps shall be installed to protect fitting against dirt and moisture when not in use. Air for the compressor shall be filtered. The air system shall be protected per FMVSS 121.

TS 39.2 Air Compressor

DEFAULT-----APPROVED

The engine-driven air compressor shall be sized to charge the air system from 40psi to the governor cut-off pressure in less than 3 minutes while not exceeding the fast idle speed setting of the engine. *The Bendix BA-922 is APPROVED*

TS 39.3 Air Lines and Fittings

Air lines, except necessary flexible lines, shall conform to the installation and material requirements of SAE Standard J1149 for copper tubing with standard, brass, flared or ball sleeve fittings, or SAE Standard J844 for nylon tubing if not subject to temperatures over 200 °F. The air on the delivery side of the

compressor where it enters nylon housing shall not be above the maximum limits as stated in SAE J844. Nylon tubing shall be installed in accordance with the following color-coding standards:

DEFAULT-----APPROVED

- **Green:** Indicates primary brakes and supply.
- **Red:** Indicates secondary brakes.
- **Brown:** Indicates parking brake.
- **Yellow:** Indicates compressor governor signal.
- **Black:** Indicates accessories.
- **An additional air line- Blue for suspension - APPROVED**

Line supports shall prevent movement, flexing, tension, strain and vibration. Copper lines shall be supported to prevent the lines from touching one another or any component of the bus. To the extent practicable and before installation, the lines shall be pre-bent on a fixture that prevents tube flattening or excessive local strain. Copper lines shall be bent only once at any point, including pre-bending and installation. Rigid lines shall be supported at no more than 5ft intervals. Nylon lines may be grouped and shall be supported at 30 in. intervals or less.

The compressor discharge line between power plant and body-mounted equipment shall be flexible convoluted copper or stainless-steel line or may be flexible Teflon hose with a braided stainless steel jacket. Other lines necessary to maintain system reliability shall be flexible Teflon hose with a braided stainless-steel jacket. End fittings shall be standard SAE or JIC brass or steel, flanged, swivel-type fittings. Flexible hoses shall be as short as practicable and individually supported. They shall not touch one another or any part of the bus except for the supporting grommets. Flexible lines shall be supported at 2ft intervals or less.

Air lines shall be clean before installation and shall be installed to minimize air leaks. All air lines shall be routed to prevent water traps to the extent possible. Grommets or insulated clamps shall protect the air lines at all points where they pass through understructure components.

TS 39.4 Air Reservoirs

All air reservoirs shall meet the requirements of FMVSS Standard 121 and SAE Standard J10 and shall be equipped with drain plugs and guarded or flush type drain valves. Major structural members shall protect these valves and any automatic moisture ejector valves from road hazards. Reservoirs shall be sloped toward the drain valve. All air reservoirs shall have drain valves that discharge below floor level with lines routed to eliminate the possibility of water traps and/or freezing in the drain line.

TS 39.5 Air System Dryer

An air dryer shall prevent accumulation of moisture and oil in the air system. The air dryer system shall include one or more replaceable desiccant cartridges.

ALTERNATIVE-----APPROVED

Requirement for Additional Oil Separator Provision

A provision shall be included to collect/remove oil from the air system to prevent affecting function and/or damaging pneumatic system components.

ALTERNATIVE-----APPROVED

The air system shall be equipped with an air dryer located before the no. 1 air tank and as far from the compressor as possible to allow air to cool prior to entering the air dryer. An SKF Dual Turbo 2000 with double oil and water filtration and heated is APPROVED

ELECTRICAL, ELECTRONIC AND DATACOMMUNICATION SYSTEMS

TS 40. Overview

The electrical system will consist of vehicle battery systems and components that generate, distribute and store power throughout the vehicle. (e.g., generator, voltage regulator, wiring, relays and connectors).

Electronic devices are individual systems and components that process and store data, integrate electronic information or perform other specific functions.

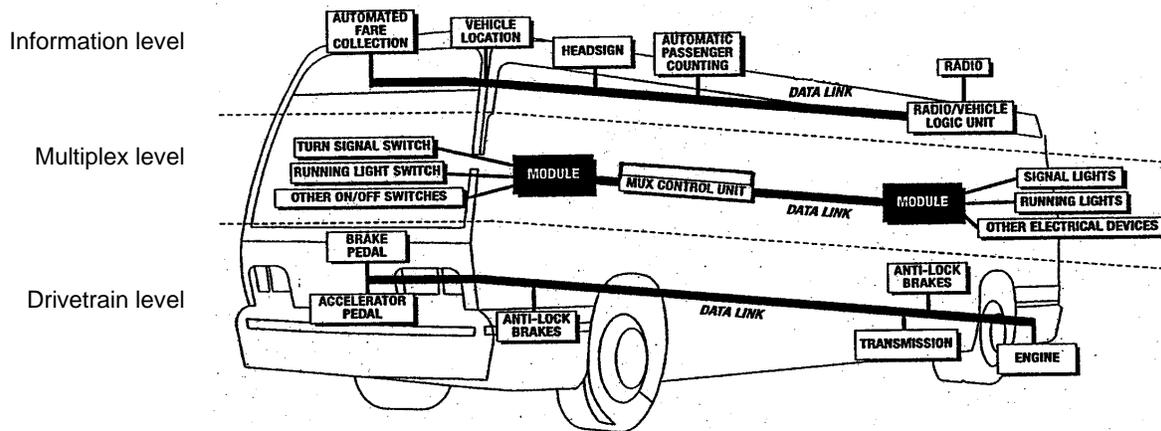
The data communication system consists of the bi-directional communications networks that electronic devices use to share data with other electronic devices and systems. Communication networks are essential to integrating electronic functions, both onboard the vehicle and off.

Information level systems that require vehicle information for their operations or provide information shall adhere to J1939 data standard.

Data communications systems are divided into three level store the use of multiple datanet works:

- **Powertrain level:** Components related to the powertrain, including the propulsion system components (engine, transmission and hybrid units) and anti-lock braking system (ABS), which may include traction control. At a minimum, powertrain components consisting of the engine, transmission, retarder, ASR and anti-lock braking systems shall be powered by a dedicated and isolated ignition supply voltage to ensure data communication between components exists when the vehicle ignition is switched to the “on” position.
- **Information level:** Components whose primary function is the collection, control or display of data that is not necessary to the safe drivability of the vehicle (i.e., the vehicle will continue to operate when those functions are inoperable). These components typically consist of those required for automatic vehicle location (AVL) systems, destination signs, fareboxes, passenger counters, radio systems, automated voice and signage systems, video surveillance and similar components.
- **Multiplex level:** Electrical or electronic devices controlled through input/output signals such as discrete, analog and serial data information (i.e., on/off switch inputs, relay or relay control outputs). Multiplexing is used to control components not typically found on the drivetrain or information levels, such as lights; wheelchair lifts; doors; heating, ventilation and air conditioning (HVAC) systems (if applicable); and gateway devices.

FIGURE 4
Data Communications Systems Levels



TS 40.1 Modular Design

Design of the electrical, electronic and data communication systems shall be modular so that each electronic device, apparatus panel, or wiring bundle is easily separable from its interconnect by means of connectors.

Power plant wiring shall be an independent wiring harness. Replacement of the engine compartment wiring harness(es) shall not require pulling wires through any bulkhead or removing any terminals from the wires.

TS 41. Environmental and Mounting Requirements

The electrical system and its electronic components shall be capable of operating in the area of the vehicle in which they will be installed, as recommended in SAE J1455.

Electrical and electronic equipment shall not be located in an environment that will reduce the performance or shorten the life of the component or electrical system when operating within the design operating profile. As a recommendation, no vehicle component shall generate, or be affected by, electromagnetic interference or radio-frequency interference (EMI/RFI) that can disturb the performance of electrical/electronic equipment as defined in SAE J1113 and UNECE Council Directive 95/54(R10).

The Agency shall follow recommendations from bus manufacturers and subsystem suppliers regarding methods to prevent damage from voltage spikes generated from welding, jumpstarts, shorts, etc.

TS 41.1 Hardware Mounting

The mounting of the hardware shall not be used to provide the sole source ground, and all hardware shall be isolated from potential EMI/RFI, as referenced in SAE J1113.

All electrical/electronic hardware mounted in the interior of the vehicle shall be accessible to passengers and hidden from view unless intended to be viewed. The hardware shall be mounted in such a manner as to protect it from splash or spray.

All electrical/electronic hardware mounted on the exterior of the vehicle that is not designed to be installed in an exposed environment shall be mounted in a sealed enclosure.

All electrical/electronic hardware and its mounting shall comply with the shock and vibration requirements of SAEJ1455.

TS 42. General Electrical Requirements

TS 42.1 Batteries

TS 42.1.1 Low-Voltage Batteries (24V)

DEFAULT

~~Four Group 31 Maintenance-Free Batteries~~

~~Four Group 31 Series deep-cycling maintenance-free battery units shall be provided. Each battery shall have a minimum of 700 cold cranking amps. Each battery shall have a purchase date no more than one year from the date of release. For shipment to the Agency.~~

ALTERNATIVE

~~Two 8D Battery Units~~

~~Two 8D battery units conforming to SAE Standard J537 shall be provided. Each battery shall have a minimum of 1150 cold cranking amps. Each battery shall have a purchase date no more than 120 days from the date of release, and shall be fully maintained prior to shipment to the Agency. The battery compartment must be well-ventilated to prevent hydrogen buildup while protecting the compartment from road spray, water intrusion and de-icing chemicals.~~

ALTERNATIVE

~~Two 8D Maintenance-Free Batteries~~

~~Each battery shall have a purchase date no more than 120 days from date of release, and shall be fully maintained prior to shipment to the Agency. Battery compartment must be well-ventilated to prevent hydrogen build-up while protecting the compartment from road spray, water intrusion and de-icing chemicals.~~

DEFAULT

~~Same Size Terminal Ends~~

~~Positive and negative terminal ends shall be the same size.~~

ALTERNATIVE

~~Different Size Terminal Ends~~

~~Positive and negative terminal ends shall be different sizes.~~

ALTERNATIVE

~~Capacitor Start System~~

~~A capacitor start system will be provided to assist with starting the bus. This system will be isolated from the regular starting system to prevent the capacitors from draining during regular operation or long periods of downtime.~~

NOTE: Agency to specify post size if different sized terminal ends are utilized.

ALTERNATIVE

Four Group 31 AGM Batteries

Four Group 31 Series deep-cycling sealed non spill able maintenance free absorbed glass mat (AGM) batteries shall be provided. Each battery shall have a minimum of 1000 cold cranking amps (CCA) at 0 °F. The batteries shall be designed and installed to withstand the operating environment. Each battery shall have a purchase date no more than one year from the date of release for shipment to the Agency.

ALTERNATIVE-----APPROVED

Two FOUR Group 31 AGM Batteries with Ultracapacitors

Two FOUR Group 31 Series deep-cycling sealed non spill able maintenance-free absorbed glass mat (AGM) batteries shall be provided. Each battery shall have a minimum of 1000 cold cranking amps (CCA) at 0 °F. Ultracapacitors (supercapacitors) shall be used in conjunction with the AGM batteries to provide effective power storage and to ensure successful engine starting. Ultracapacitor technology is to be used for cranking applications and then employing AGM battery technology to manage auxiliary loads. Ultracapacitors shall deliver their storage electrical energy at a high crank rate in a variety of extreme temperatures to provide reliable and consistent starting. The ultracapacitors shall be rated at a minimum of 120 kJ for cold climates and 75 kJ for warmer climates. The batteries and ultracapacitors shall be designed and installed to withstand the operating environment. Each battery shall have a purchased at no more than one year from the date of release for shipment to the Agency. The Agency will accept an ultra-capacitor system with four (4) batteries. Odyssey group 31 are -APPROVED.

Additional specifications for AGM Batteries

- Requires a built-in handle
- Reserve Capacity: 200 minutes minimum at a 25-amp discharge at 0° F.
- Must meet or exceed SAE J2185, minimum cycle rating for “Commercial Starting is 200 cycles” and “Deep cycle is 300 cycles”. Bidders must provide proof that batteries meet or exceed this requirement with their offer.
- Positive and negative plate construction: Pure lead or pure lead/tin.
- Battery terminals: Top mounted 3/8-inch coarse thread, stainless steel terminals with lead or brass pads, aligned on the longitudinal centerline of the battery.
- Warranty: 4-year full replacement warranty.
- Must be available for delivery locally.

An Odyssey AGM Battery 31-PC2150S-H has been APPROVED.

Additional Specifications for Ultracapacitors

- Operating Voltage, 8-29 Volts
- Maximum Voltage, 32 Volts
- Capacitance, 500 F
- Energy stored within operating Voltage Window, 190 KJ
- Energy stored within a specified Voltage window of 13-26 Volts, 120 KJ
- Maximum Power at 24 KW
- Leakage at 28 Volts, 15 mA
- Cycle Life, ~1,000,000
- Nickel Carbon

A 24 Volt KBI KAPower Starting Module, KSM050024 has been APPROVED.

KAPower Starting Module, KSM102408, 120 KJ rated is APPROVED.

TS 42.1.2 Battery Cables

The battery terminal ends, and cable ends shall be color-coded with red for the primary positive, black for negative and another color for any intermediate voltage cables. Positive and negative battery cables shall not cross each other if at all possible, shall be flexible and shall be sufficiently long to reach the batteries with the tray in the extended position without stretching or pulling on any connection and shall not lie directly onto top of the batteries. Except as interrupted by the master battery switch, battery and starter wiring shall be continuous cables with connections secured by bolted terminals and shall conform to specification requirements of SAE Standard J1127—Type SGR, SGT, SGX or GXL and SAE Recommended Practice J541, with 2100 strand 4/0 cable or greater recommended.

ALTERNATIVE-----APPROVED

Color code each voltage.

TS 42.1.3 JumpStart

ALTERNATIVE-----APPROVED

Jump-Start Connector

A jump-start connector, red for 24V and blue for 12V, shall be provided in the engine compartment, equipped with dust cap and adequately protected from moisture, dirt and debris. *The Whitaker RWT-551512120 connector with dust cap has been APPROVED.*

CLARIFICATION: A secondary jump start connector is not required and location in the engine compartment (behind side service door) is Approved.

ALTERNATIVE-----A SECOND 24 V JUMP-START CONNECTOR IS APPROVED

Jump-Start Connector

A jump-start connector shall be located next to the battery disconnect switch.

TS 42.1.4 Battery Compartment

The battery compartment shall prevent accumulation of snow, ice and debris on top of the batteries and shall be vented and self-draining. It shall be accessible only from the outside of the vehicle. All components within the battery compartment, and the compartment itself, shall be protected from damage or corrosion from the electrolyte. The inside surface of the battery compartment's access doors shall be electrically insulated, as required, to prevent the battery terminals from shorting on the door if the door is damaged in an accident or if a battery comes loose. The battery compartment temperature should not exceed manufacturer's specification.

The vehicle shall be equipped with a 12VDC and 24VDC quick disconnect switch(es). The battery compartment door shall conveniently accommodate operation of the 12VDC and 24VDC quick disconnect switch(es).

The battery quick disconnect access door shall be identified with a decal. The decal size shall not be less than 3.5 × 5 in. (8.89 × 12.7 cm).

~~The battery hold-down bracket shall be constructed of a nonconductive and corrosion resistant material (plastic or fiberglass).~~ A standard battery hold-down bracket made of metal is APPROVED on the condition that the bracket is adequately protected against corrosion.

This access door shall not require any special locking devices to gain access to the switch, and it shall be accessible without removing or lifting the panel. The door shall be flush-fitting and incorporate a spring tensioner or equal to retain the door in a closed position when not in use.

The batteries shall be securely mounted on a stainless steel or equivalent tray that can accommodate the size and weight of the batteries. The battery tray, if applicable, shall pull out easily and properly support the batteries while they are being serviced. The tray shall allow each battery cell to be easily serviced. A locking device shall retain the battery tray to the stowed position.

If not located in the engine compartment, the same fire-resistant properties must apply to the battery compartment. No sparking devices should be located within the battery box.

TS 42.1.5 Auxiliary Electronic Power Supply

If required, gel-pack, or any form of sealed (non-venting) batteries used for auxiliary power are allowed to be mounted on the interior of the vehicle if they are contained in an enclosed, non-airtight compartment and accessible only to maintenance personnel. This compartment shall contain a warning label prohibiting the use of lead-acid batteries.

TS 42.1.6 Master Battery Switch

The location of the master battery switch shall be clearly identified on the exterior access panel, be accessible in less than 10 seconds for deactivation and prevent corrosion from fumes and battery acid when the batteries are washed or are in normal service.

Turning the master switch off with the power plant operating, during an emergency, shall shut off the engine and shall not damage any component of the electrical system. The master switch shall be capable of carrying and interrupting the total circuit load.

DEFAULT-----APPROVED

Single Switch

The batteries shall be equipped with a single switch for disconnecting both 12V and 24V power.

TS 42.1.7 Low-Voltage Generation and Distribution

The low-voltage generating systems shall maintain the charge on fully charged batteries, except when the vehicle is at standard idle with at to allow-voltage generator load exceeding 70 percent of the low-voltage generator name plate rating.

Voltage monitoring and over-voltage output protection (recommended at 32V) shall be provided.

Dedicated power and ground shall be provided as specified by the component or system manufacturer. Cabling to the equipment must be sized to supply the current requirements with no greater than a 5 percent volt drop across the length of the cable. A Niehoff Alternator/Generator is APPROVED. Niehoff Alternator is to have a Niehoff smart regulator. A2-368 is APPROVED.

TS 42.1.8 Circuit Protection

All branch circuits, except battery-to-starting motor and battery-to-generator/alternator circuits, shall be protected by current-limiting devices such as circuit breakers, fuses or solid-state devices sized to the requirements of the circuit. Electronic circuit protection for the cranking motor shall be provided to prevent engaging of the motor for more than 30 seconds at a time to prevent overheating. The circuit breaker fuses shall be easily accessible for authorized personnel. Fuses shall be used only where it can be

demonstrated that circuit breakers are not practicable. This requirement applies to in-line fuses supplied by either the Contractor or a supplier. Fuse holders shall be constructed to be rugged and waterproof. All manual reset circuit breakers critical to the operation of the bus shall be mounted in a location convenient to the Agency mechanic with visible indication of open circuits. The Agency shall consider the application of automatic reset circuit breakers on a case-by-case basis. The Contractor shall show all in-line fuses in the final harness drawings. Any manually resettable circuit breakers shall provide a visible indication of open circuits. Any manually resettable circuit breakers shall provide a visible indication of open circuits.

Circuit breakers or fuses shall be sized to a minimum of 15 percent larger than the total circuit load. The current rating for the wire used for each circuit must exceed the size of the circuit protection being used.

TS 42.2 Grounds

The battery shall be grounded to the vehicle chassis/frame at one location only, as close to the batteries as possible. When using a chassis ground system, the chassis shall be grounded to the frame in multiple locations, evenly distributed throughout the vehicle to eliminate ground loops. No more than 1 spade terminal connections shall be made per ground stud with spacing between studs ensuring conductivity and serviceability. Electronic equipment requiring an isolated ground of the battery (i.e., electronic ground) shall not be grounded through the chassis.

TS 42.3 Low Voltage/Low Current Wiring and Terminals

All power and ground wiring shall conform to specification requirements of SAE Recommended Practice J1127, J1128 and J1292. Double insulations shall be maintained as close to the junction box, electrical compartment or terminals as possible. The requirement for double insulations shall be met by wrapping the harness with plastic electrical tape or by sheathing all wires and harnesses with non-conductive, rigid or flexible conduit.

Wiring shall be grouped, numbered and/or color-coded. Wiring harnesses shall not contain wires of different voltage classes unless all wires within the harness are insulated for the highest voltage presenting the harness. Kinking, grounding at multiple points, stretching, and exceeding minimum bend radius shall be prevented.

Strain-relief fittings shall be provided at all points where wiring enters electrical compartments. Grommets or other protective material shall be installed at points where wiring penetrates metal structures outside of electrical enclosures. Wiring supports shall be protective and non-conductive at areas of wire contact and shall not be damaged by heat, water, solvents or chafing.

To the extent practicable, wiring shall not be located in environmentally exposed locations under the vehicle. Wiring and electrical equipment necessarily located under the vehicle shall be insulated from water, heat, corrosion and mechanical damage. Where feasible, front-to-rear electrical harnesses should be installed above the window line of the vehicle.

All wiring harnesses over 5 ft. long and containing at least five wires shall include 10 percent (minimum one wire) excess wires for spares. This requirement for spare wires does not apply to datalinks and communication cables. Wiring harness length shall allow end terminals to be replaced twice without pulling, stretching or replacing the wire. Terminals shall be crimped to the wiring according to the connector manufacturer's recommendations for techniques and tools. All cable connectors shall be locking type, keyed and sealed, unless enclosed in watertight cabinets or vehicle interior. Pins shall be removable, crimp contact type, of the correct size and rating for the wire being terminated. Unused pin

positions shall be sealed with sealing plugs. Adjacent connectors shall use either different inserts or different insert orientations to prevent incorrect connections.

Terminals shall be crimped, corrosion-resistant and full ring type or interlocking lugs with insulating ferrules. When using pressure type screw terminal strips, only stranded wire shall be used. Insulation clearance shall ensure that wires have a minimum of "visible clearance" and a maximum of two times the conductor diameter or 1/16 in., whichever is less. When using shielded or coaxial cable, upon stripping of the insulation, the metallic braid shall be free from frayed strands that can penetrate the insulation of the inner wires.

Ultra-sonic and T-splices may be used with 8AWG or smaller wire. When a T-splice is used, it shall meet these additional requirements:

- It shall include a mechanical clamp in addition to solder on the splice.
- The wire shall support no mechanical load in the area of the splice.
- The wire shall be supported to prevent flexing.

All splicing shall be staggered in the harness so that no two splices are positioned in the same location within the harness.

Wiring located in the engine compartment shall be routed away from high-heat sources or shielded and/or insulated from temperatures exceeding the wiring and connector operating requirements.

The instrument panel and wiring shall be easily accessible for service from the driver's seat or top of the panel. The instrument panel shall be separately removable and replaceable without damaging the instrument panel or gauges. Wiring shall have sufficient length and be routed to permit service without stretching or chafing the wires.

TS 42.4 Electrical Components

All electrical components, including switches, relays, flashers and circuit breakers, shall be heavy-duty designs with either a successful history of application in heavy-duty vehicles or design specifications for an equivalent environment.

All electric motors shall be heavy-duty brushless type where practical and have a continuous duty rating of no less than 40,000 hours (except cranking motors, washer pumps, auxiliary heater pumps, defroster and wiper motors). All electric motors shall be easily accessible for servicing.

TS 42.5 Electrical Compartments

All relays, controllers, flashers, circuit breakers and other electrical components shall be mounted in easily accessible electrical compartments. All compartments exposed to the outside environment shall be corrosion-resistant and sealed. The components and their functions in each electrical compartment shall be identified and their location permanently recorded on a drawing attached to the inside of the access panel or door. The drawing shall be protected from oil, grease, fuel and abrasion.

The front compartment shall be completely service able from the driver's seat, vestibule or from the outside. "Rear start and run" controls shall be mounted in an accessible location in the engine compartment and shall be protected from the environment.

TS 43. General Electronic Requirements

If an electronic component has an internal real-time clock, it shall provide its own battery backup to monitor time when battery power is disconnected, and/or it may be updated by a network component. If

an electronic component has an hour meter, it shall record accumulated service time without relying on battery backup.

All electronic component suppliers shall ensure that their equipment is self-protecting in the event of shorts in the cabling, and also in over-voltage (over 32V DC on a 24V DC nominal voltage rating with a maximum of 50V DC) and reverse polarity conditions. If an electronic component is required to interface with other components, it shall not require external pull-up and/or pull-down resistors. Where this is not possible, the use of a pull-up or pull-down resistor shall be limited as much as possible and easily accessible and labeled.

TS 43.1 Wiring and Terminals

Kinking, grounding at multiple points, stretching and reducing the bend radius below the manufacturer's recommended minimum shall not be permitted.

TS 43.1.1 Discrete I/O(Inputs/Outputs)

All wiring to I/O devices, either at the harness level or individual wires, shall be labeled, stamped or color-coded in a fashion that allows unique identification at a spacing not exceeding 4 in. Wiring for each I/O device shall be bundled together. If the I/O terminals are the same voltages, then jumpers may be used to connect the common nodes of each I/O terminal.

TS 43.1.2 Shielding

All wiring that requires shielding shall meet the following minimum requirements. A shield shall be generated by connecting to a ground, which is sourced from a power distribution bus bar or chassis. A shield shall be connected at one location only, typically a tone end of the cable. However, certain standards or special requirements, such as SAE J1939 or RF applications, have separate shielding techniques that also shall be used as applicable.

NOTE: A shield grounded at both ends forms a ground loop, which can cause intermittent control or faults.

When using shielded or coaxial cable, upon stripping of the insulation, the metallic braid shall be free from frayed strands, which can penetrate the insulation of the inner wires. To prevent the introduction of noise, the shield shall not be connected to the common side of a logic circuit.

TS 43.1.3 Communications

The data network cabling shall be selected and installed according to the selected protocol requirements. The physical layer of all network communication systems shall not be used for any purpose other than communication between the system components, unless provided for in the network specifications.

Communications networks that use power line carriers (e.g., data modulated on a 24V power line) shall meet the most stringent applicable wiring and terminal specifications.

TS 43.1.4 Radio Frequency (RF)

RF components, such as radios, video devices, cameras, global positioning systems (GPS),etc., shall use coaxial cable to carry the signal. All RF systems require special design consideration for losses along the cable. Connectors shall be minimized, since each connector and crimp has a loss that will at tribute to attenuation of the signal. Cabling should allow for the removal of antennas or attached electronics without removing the installed cable between them. If this cannot be done, then a conduit of sufficient size shall be provided for ease of attachment of antenna and cable assembly. The corresponding component vendors shall be consulted for proper application of equipment, including installation of cables.

TS 43.1.5 Audio

Cabling used for microphone level and line level signals shall be 22AWG minimum with shielded twisted pair. Cabling used for amplifier level signals shall be 18AWG minimum.

TS 44. Multiplexing

TS 44.1 General

The primary purpose of the multiplexing system is control of components necessary to operate the vehicle. This is accomplished by processing information from input devices and controlling output devices through the use of an internal logic program.

Versatility and future expansion shall be provided for by expandable system architecture. The multiplex system shall be capable of accepting new inputs and outputs through addition of new modules and/or the utilization of existing spare inputs and outputs. All like components in the multiplex system shall be modular and interchangeable with self-diagnostic capabilities. The modules shall be easily accessible for troubleshooting electrical failures and performing system maintenance. Multiplex input/output modules shall use solid-state devices to provide extended service life and individual circuit protection.

APPROVED: The multiplex system from Parker-Vansco.

DEFAULT-----APPROVED

Ten percent of the total number of inputs and outputs, or at least one each for each voltage type utilized (0V, 12V, 24V) at each module location shall be designated as spares.

TS 44.2 System Configuration

Multiplexing may either be distributed or centralized. A distributed system shall process information on multiple control modules within the network. A centralized system shall process the information on a single control module. Either system shall consist of several modules connected to form a control network.

TS 44.2.1 I/O Signals

The input/output for the multiplex system may contain four types of electrical signals: discrete, modulating, analogue, serial data.

Discrete signals shall reflect the on/off status of switches, levers, limit switches, lights, etc. Analog signals shall reflect numerical data as represented by a voltage signal (0–12V, 10–24V, etc.) or current signal (4–20 mA). Both types of analog signals shall represent the status of variable devices such as rheostats, potentiometers, temperature probes, etc. Serial data signals shall reflect ASCII or alphanumeric data used in the communication between other on-board components.

TS 45. Data Communications

TS 45.1 General

All data communication networks shall be either in accordance with a nationally recognized interface standard, such as those published by SAE, IEEE or ISO, or shall be published to the Agency with the following minimum information:

- Protocol requirements for all timing issues (bit, byte, packet, inter-packet timing, idle line timing, etc.) packet sizes, error checking and transport (bulk transfer of data to/from the device).

- Data definition requirements that ensure access to diagnostic information and performance characteristics.
- The capability and procedures for uploading new application or configuration data.
- Access to revision level of data, application software and firmware.
- The capability and procedures for uploading new firmware or application software.
- Evidence that applicable data shall be broadcast to the network in an efficient manner such that the overall network integrity is not compromised.

Any electronic vehicle components used on a network shall be conformance tested to the corresponding network standard.

Provide a conduit minimum 1 1/2" size between the overhead luggage rack behind the driver, to the destination sign compartment.

Provide a conduit minimum size 3/4" from the the overhead luggage rack behind the driver, to the typical antenna mounting location (TBD).

Bus shall be equipped with patron Wifi system.

TS 45.2 Drivetrain Level

Drivetrain components, consisting of the engine, transmission, retarder, anti-lock braking system and all other related components, shall be integrated and communicate fully with respect to vehicle operation with data using SAE Recommended Communications Protocols such as J1939 and/or J1708/J1587 with forward and backward compatibilities or other open protocols. At a minimum, drivetrain components consisting of the engine, transmission, retarder ASR, and anti-lock braking systems shall be powered by a dedicated and isolated ignition supply voltage to ensure data communication among components exists when the vehicle ignition is switched to the "on" position.

TS 45.2.1 Diagnostics, Fault Detection and Data Access

Drive train performance, maintenance and diagnostic data, and other electronic messages shall be formatted and transmitted on the communications networks.

The drivetrain level shall have the ability to record abnormal events in memory and provide diagnostic codes and other information to service personnel. At a minimum, this network level shall provide live/fail status, current hardware serial number, software/data revisions and uninterrupted timing functions.

Provide an onboard telematics system (including all hardware and monitoring charges in the bus price) allowing the agency to monitor the vehicle in real-time.

The system shall include tools to assess vehicle health, driver monitoring information, location, conditions and diagnostics.

New Flyer Connect™ has been APPROVED.

APPROVED: MCI Connect for use on coaches.

TS 45.2.2 Programmability (Software)

The drivetrain level components shall be programmable by the Agency with limitations as specified by the subsystem Supplier.

CLARIFICATION: Drivetrain components programming not available to the Customer and programming of the drivetrain components including the multiplex system can be arranged by the OEM or suppliers is APPROVED.

TS 45.3 Multiplex Level

TS 45.3.1 Data Access

At a minimum, information shall be made available via a communication port on the multiplex system. The location of the communication port shall be easily accessible. A hardware gateway and/or wireless communications system are options If requested by the Agency. The communication port(s) shall be located as specified by the Agency.

Provide type II 9 pin connectors in the following locations:

- *Inside the driver's side front overhead luggage rack*
- *Below the curbside front luggage rack*
- *Under the dash*
- *Rear luggage compartment (under bus curbside) (location TBD for Low Floor variant)*
- *Rear runbox*

TS 45.3.2 Diagnostics and Fault Detection

The multiplex system shall have a proven method of determining its status (system health and input/output status) and detecting either active (online) or inactive (offline) faults through the use of on-board visual/audible indicators.

In addition to the indicators, the system shall employ an advanced diagnostic and fault detection system, which shall be accessible via either a personal computer or a handheld unit. Either unit shall have the ability to check logic function. The diagnostic data can be incorporated into the information level network or the central data access system.

DEFAULT-----APPROVED

No requirement for mock-up board.

TS 45.3.3 Programmability (Software)

The multiplex system shall have security provisions to protect its software from unwanted changes. This shall be achieved through any or all of the following procedures:

- Password protection
- Limited distribution of the configuration software
- Limited access to the programming tools required to change the software
- Hardware protection that prevents undesired changes to the software

Provisions for programming the multiplex system shall be possible through a PC or laptop. The multiplex system shall have proper revision control to ensure that the hardware and software are identical on each vehicle equipped with the system. Revision control shall be provided by all of the following:

- Hardware component identification where labels are included on all multiplex hardware to identify components
- Hardware series identification where all multiplex hardware displays the current hardware serial number and firmware revision employed by the module
- Software revision identification where all copies of the software in service display their ostrecentre vision number
- A method of determining which version of these of tware is currently in use in the multiplex system

The Agency must be made aware in writing or by phone call of any software/firmware updates/changes made to the bus at any time after the bus is accepted. This is to avoid confusion in diagnosing problems and any potential programming related bugs/glitches.

DEFAULT-----APPROVED

Revision control labels shall be electronic.

TS 45.4 Electronic Noise Control

Electrical and electronic subsystems and components on all buses shall not emit electromagnetic radiation that will interfere with on-board systems, components or equipment, telephone service, radio or TV reception, or violate regulations of the Federal Communications Commission.

Electrical and electronic subsystems on the coaches shall not be affected by external sources of RFI/EMI. This includes, but is not limited to, radio and TV transmission, portable electronic devices including computers in the vicinity of or onboard the buses, AC or DC power lines and RFI/EMI emissions from other vehicles.

DRIVER PROVISIONS, CONTROLS AND INSTRUMENTATION

TS 46. Driver's Area Controls

TS 46.1 General

In general, when designing the driver's area, it is recommended that SAE J833, "Human Physical Dimensions," be used.

Switches and controls shall be divided into basic groups and assigned to specific areas, in conformance with SAE Recommended Practice J680, Revised 1988, "Location and Operation of Instruments and Controls in Motor Truck Cabs," and be essentially within the hand reach envelope described in SAE Recommended Practice J287, "Driver Hand Control Reach."

TS 46.2 Glare

The driver's work area shall be designed to minimize glare to the extent possible. Objects within and adjacent to this area shall be matte black or dark gray in color wherever possible to reduce the reflection of light onto the windshield. The use of polished metal and light-colored surfaces within and adjacent to the driver's area shall be avoided.

TS 46.3 Visors/Sun Shades

DEFAULT

Front and Side Sun Shade/Visor

~~Adjustable sun visor(s) shall be provided for the driver's windshield and the driver's side window. Visors shall be shaped to minimize light leakage between the visor and windshield pillars. Visors shall store out of the way and shall not obstruct airflow from the climate control system or interfere with other equipment, such as the radio handset or the destination control. Deployment of the visors shall not restrict vision of the rearview mirrors. Visor adjustments shall be made easily by hand with positive locking and releasing devices and shall not be subject to damage by over tightening. Sun visor construction and materials shall be strong enough to resist breakage during adjustments. Visors may be transparent but shall not allow a visible light transmittance in excess of 10 percent. Visors, when deployed, shall be effective in the driver's field of view at angles more than 5 deg. above the horizontal.~~

ALTERNATIVE-----APPROVED

Driver's Window Sunscreens

An adjustable roller type sunscreen shall be provided over the driver's windshield (*right and left side*) and/or the driver's side window. The sunscreen shall be capable of being lowered to the midpoint of the driver's window. When deployed, the screen shall be secure, stable, and shall not rattle, sway or intrude into the driver's field of view due to the motion of the coach or as a result of air movement. Once lowered, the screen shall remain in the lowered position until returned to the stowed position by the driver. Sunscreen shall be shaped to minimize light leakage between the visor and windshield pillars to the extent possible.

TS 46.4 Driver's Controls

Frequently used controls must be in easily accessible locations. These include the door control, kneel control, windshield wiper/washer controls, ramp, and lift and run switch. Any switches and controls necessary for the safe operation of the bus shall be conveniently located and shall provide for ease of operation. They shall be identifiable by shape, touch and permanent markings. Controls also shall be located so that passengers may not easily tamper with control settings.

All panel-mounted switches and controls shall be marked with easily read identifiers. Graphic symbols shall conform to SAE Recommended Practice J2402, "Road Vehicles – Symbols For Controls, Indicators, and Tell Tales," where available and applicable. Color of switches and controls shall be dark with contrasting typography or symbols.

Mechanical switches and controls shall be replaceable, and the wiring at these controls shall be serviceable from a convenient location. Switches, controls and instruments shall be dust- and water-resistant.

DEFAULT-----APPROVED

All switches/controls in the driver's controls area shall be mounted in an angled panel steep enough to discourage drivers from using it as a personal storage area for items like food, drinks, cell phones, etc.

ALTERNATIVE-----APPROVED

The transmission shift selector shall be mounted in an angled panel steep enough to discourage drivers from using it as a personal storage area for electronic devices such as cell phones, music players, navigation systems, etc.

TS 46.5 Normal Bus Operation Instrumentation and Controls

The following list identifies bus controls used to operate the bus. These controls are either frequently used or critical to the operation of the bus. They shall be located within easy reach of the operator. The operator shall not be required to stand or turn to view or actuate these controls unless specified otherwise.

Systems or components monitored by onboard diagnostics system shall be displayed in clear view of the operator and provide visual and/or audible indicators. The intensity of indicators shall permit easy determination of on/off status in bright sunlight but shall not cause a distraction or visibility problem at night. *by using a dimmer switch*. All indicators *and dash lighting* shall be illuminated using *fiber optics for backlighting*.

The indicator panel shall be located in Area 1 or Area 5, within easy view of the operator instrument panel. All indicators shall have a method of momentarily testing their operation. The audible alarm shall be tamper-resistant and shall have an outlet level between 80 and 83 dBA when measured at the location of the operator's ear.

On-board displays visible to the operator shall be limited to indicating the status of those functions described herein that are necessary for the operation of the bus. All other indicators needed for diagnostics and their related interface hardware shall be concealed and protected from unauthorized access. **Table 6** represents instruments and alarms. The intent of the overall physical layout of the indicators shall be in a logical grouping of systems and severity nature of the fault.

Consideration shall be provided for future additions of spare indicators as the capability of onboard diagnostic systems improves. Blank spaces shall contain LEDs. *A dash mounted multifunction display with minimum 7" screen size or the largest MFD available shall be provided. The display will incorporate all electronic gauges, all warning light indicators and rear-view camera image.*

Provide a sweeper/coach cleaner switch that wakes up the PLC and turns on the interior lights for the time the PLC is awake (typically 15 min)

TABLE 6

~~Transit~~-Bus Instruments and Alarms

Final instrument panel layout to be approved by the Agency pre-production. Indicators and gauges that work well in the MFD are permitted upon approval. Final Locations TBD.

Device	Description	Location	Function	Visual/ Audible
Master run switch	Rotary, four-position detent	Side console	Master control for bus, off, day run, night run and clearance ID lights	
Engine start, front	Approved momentary switch	Side console	Activates engine starter motor	

Engine start, rear	Approved momentary switch	Engine compartment	Activates engine starter motor	
Engine run, rear	Three-position toggle switch	Engine compartment	Permits running engine from rear start, normal front run position and off	Amber light
Drive selector	Touch panel switch	Side console	Provides selection of propulsion: forward, reverse and neutral	Gear selection
HVAC	Switch or switches to control HVAC	Side console	Permits selection of passenger ventilation: off, cool, heat, low fan, high fan or full auto with on/off only	
Driver's ventilation	Rotary, three-position detent	Side console or dash left wing	Permits supplemental ventilation: fan off, low or high	
Defroster fan	Rotary, three-position detent	Side console or dash left wing	Permits defroster: fan off, low, medium or high	
Defroster temperature	Variable position	Side console or dash left wing	Adjusts defroster water flow and temperature	
Windshield wiper	One-variable rotary position operating both wipers	Dash left wing	Variable speed control of left and right windshield wipers	
Windshield washer	Push button	Dash left wing	Activates windshield washers	
Dash panel lights	Rotary rheostat or stepping switch	Side console or dash left wing	Provides adjustment for light intensity in night run position	
Interior <i>Dome</i> light <i>switch</i>	Three-position switch	Side console or front dash	<i>Reduces interior light reflection from the windshield at night.</i> Selects mode of passenger compartment lighting: off, on, normal <i>All, Off, Street-side</i>	<i>"All" = all Dome lights "on" when doors are open or closed.</i> <i>"Off" = all Dome lights "off".</i> <i>"Street-side" = only street-side Dome lights "on" when all doors are closed.</i> <i>When either door is opened, all Dome lights are "on".</i>

<u>Dimmer Knob for all Dome lights</u>	<u>Rotary analog knob</u>	<u>Next to the "Interior Dome Light" three-position switch.</u>	<u>Select mode: "Bright", "Dim"</u>	<u>"Bright" = All Dome lights are 100% "bright".</u> <u>"Dim" = All Dome lights dimmed to knob setting when both front and rear doors are closed. When one or both doors are open, dome lights are 100% bright.</u>
Fast idle	Two-position switch	Side console	Selects high idle speed of engine	
WC ramp/ kneel enable	Two-position switch ¹	Side console or dash right wing	Permits operation of ramp and kneel operations at each door remote panel	Amber light
Front door ramp/kneel enable	Two-position keyed switch ¹	Front door remote or dash right wing	Permits ramp and kneel activation from front door area, key required ¹	Amber light
rear door ramp (LF model only)	Three-position momentary switch	Right side of steering wheel	Permits deploy and stow of rear rear door ramp	Red light
Front kneel	Three-position momentary switch	Front door remote <u>Right side of steering wheel</u>	Permits kneeling activation and raise and normal at front door remote location	Amber or red dash indicator; exterior alarm (<u>only when raising or lowering</u>) and amber flashing
Rear door ramp/kneel enable	Two-position keyed switch ¹	Rear door remote	Permits ramp and kneel activation from rear door area; key required ¹	Red light
Rear door ramp	Three-position momentary switch	Rear door remote	Permits deploy and stow of rear ramp	
Rear kneel	Three-position momentary switch	Rear door remote	Permits kneeling activation and raise and normal at rear door remote location	
Silent alarm	Recessed push button, NO and NC contacts momentary <u>Heel switch</u>	Side console <u>On floor in front of Operator's seat</u>	Activates emergency radio alarm at dispatch and permits covert microphone and/or enables destination sign emergency message	<u>Harness and switch provided by the Agency and installed by the Contractor</u>
Video system event switch	on/off momentary switch with plastic guard	Side console	Triggers event equipment, triggers event light on dash	Amber light
Left remote <u>Flat & Convex</u> mirrors	<u>Single control</u> -Four-position toggle type	Side console	<u>Individually</u> Permits two-axis adjustment of <u>both flat and convex</u> left exterior mirrors	

Right remote <u>Flat & Convex</u> mirrors	<u>Single control</u> -Four-position toggle type	Side console	<u>Individually</u> Permits two-axis adjustment of <u>both flat and convex</u> right exterior mirrors	
Mirror heater	<u>Momentary 15 minute</u> Switch or temperature	Side console	Permits heating of <u>ALL</u> outside mirrors when required	
Passenger door control	<u>Non-removable</u> Five-position handle type detent or two momentary push buttons (LF model only) (use switch for high floor bus)	Side console, forward	Permits open/close control of front and rear passenger doors	Red light
Rear door override	Two-position switch in approved location	Side console, forward	Allows driver to override activation of rear door passenger tape switches	
Engine shutdown override	Momentary switch with operation protection	Side console	Permits driver to override auto engine shutdown	
Hazard flashers	Two-position, <u>long handle steel</u> switch	Side console or dash right wing	Activates emergency flashers. <u>Not audible with parking brake activated. Medium audible clicking when "in gear" and parking brake released.</u>	Two green lights
Fire suppression	Red push button with protective cover	Dash left wing or dash center	Permits driver to override and manually discharge fire suppression system	Red light
	<u>Fire suppression manual actuator and fire suppression control module</u>	<u>Above the driver on the saw tooth panel</u>		
Mobile data terminal	Mobile data terminal coach operator interface panel	<u>Above To the right of the right dash wing or TBD</u>	Facilitates driver interaction with communication system and master log-on	LCD display with visual status and text messages
Farebox interface	Farebox coach operator interface panel	Near farebox	Facilitates driver interaction with farebox system	LCD display
Destination sign interface	Destination sign interface panel	In approved location	Facilitates driver interaction with destination sign system, manual entry	LCD display

Turn signals	Momentary push button (two required) raised from other switches	Left foot <u>on 30% raised panel</u>	Activates left and right turn signals	Two green lights and optional <u>low</u> audible <u>clicking</u> indicator
PA manual	<u>Vendor provided.</u> Momentary push button	In approved location <u>on floor next to steering column</u>	Permits driver to manually activate public address microphone	
<u>Low-profile microphone</u> <u>Microphone-less</u>	<u>Low-profile discrete mounting</u> <u>Microphone provided as part of the PA amplifier</u>	<u>Steering column</u> <u>In approved location</u>	Permits driver to make announcements with both hands on the wheel and focusing on road conditions	
High beam	Detented push button <u>located above and between the two turn signal switches</u>	<u>In approved location</u> <u>Left foot on 30% raised panel</u>	Permits driver to toggle between low and high beam	Blue light
Parking brake	Pneumatic PPV (Bendix intelbepark approved)	Side console or dash left wing	Permits driver to apply and release parking brake	Red light
Park brake release <u>Park brake release valve</u>	Pneumatic PPV	Vertical side of the side console or dash center. <u>Horizontal surface of the side console</u>	Permits driver to push and hold to release brakes	
Hill holder	Two-position momentary switch	Side console	Applies brakes to prevent bus from rolling	
Remote engine speed	Rotary rheostat <u>3 position momentary toggle switch (Increase-off-Decrease)</u>	Engine compartment	Permits technician to raise and lower engine RPM from engine compartment <u>in 250 rpm increments</u>	
Master door/interlock	Multi-pole toggle, detented	Out of operator's reach <u>in approved location</u>	Permits driver override to disable door and brake/throttle interlock	Red light

Warning interlocks deactivated	Red indicator light	Dash panel center	Illuminates to warn driver that interlocks have been deactivated	Red light
Retarder disable Jake Brake	Multi-pole switch detented <u>2 position with red guard</u>	Within reach of operator or approved location-Under dash	Permits driver override to disable Jake brake retardation/regeneration	Red light
Alarm acknowledge	Push button momentary	Approved location	Permits driver to acknowledge alarm condition	
Rear door passenger sensor disable	Multi-pole toggle, detented	In sign compartment or driver's barrier compartment	Permits driver to override rear door passenger sensing system	
Indicator/ alarm test button	Momentary switch or programming ¹	Dash center panel	Permits driver to activate test of sentry, indicators and audible alarms	All visuals and audibles
Auxiliary power	120 V power receptacle/USB ports	Approved locations	Property to specify what function to supply	
Speedometer	Speedometer, odometer, and diagnostic capability, 5- mile increments	Dash center panel/MFD	Visual indication of speed and distance traveled, accumulated vehicle mileage, fault condition display	Visual
Air pressure gauge	Primary and secondary, 5 psi increments	Dash center panel	Visual indication of primary and secondary air systems	Red light and buzzer
Fire detection	Coach operator display	Property specific or dash center	Indication of fire detection activation by zone/location	Buzzer and red light
Door obstruction	Sensing of door	Dash center	Indication of rear door sensitive edge activation	Red light and buzzer
Door ajar	Door not properly closed	Property specific or dash center	Indication of rear door not properly closed	Buzzer or alarm and red light
Low system air pressure	Sensing low primary and secondary air tank pressure	Dash center	Indication of low air system pressure	Buzzer and red light
Engine coolant indicator	Low coolant indicator may be supplied as audible alert and visual and/or text message	Within driver's sight	Detects low coolant condition	Amber light
Hot engine	Coolant temperature indicator may be supplied as audible alert and visual and/or text message	Within driver's sight	Detects hot engine condition and initiates time delay shutdown	Red light
Low engine oil	Engine oil pressure indicator may be supplied as audible alert and visual and/or text message	Within driver's sight	Detects low engine oil pressure condition and initiates time-	Red light
ABS indicator	Detects system status	Dash center	Displays system failure	Amber light

HVAC indicator	Detects system status	Dash center	Displays system failure	Amber or red light
Charging system indicator (12/24 V)	Detect charging system status	Dash center	Detects no charge condition and optionally detects battery high, low, imbalance, no charge condition, and initiates time-delayed shutdown	Red light flashing or solid based on condition
Bike rack deployed indicator	Detects bike rack position	Dash center	Indication of bike rack not being in fully stowed position	Amber or red light
Fuel tank level	Analog gauge, graduated based on fuel type	Dash center	Indication of fuel tank level/pressure	
DEF gauge	Level Indicator	Center dash	Displays level of DEF tank and indicates with warning light when low	Red light <u>Amber light</u>
<i>Mud and Snow</i>	<i>Push On/Push Off switch</i>	<i>Front dash or side</i>	<i>Temporary overrides engine idle derate</i>	<i>Blinking ATC Tell-Tale light</i>
<i>Switch</i>	<i>On/Off toggle switch</i>	<i>Side console</i>	<i>Turns off the "Stop Request" chime</i>	
<i>Switch</i>	<i>Volume switch</i>	<i>Side console</i>	<i>Controls the volume of the "Stop Request" chime</i>	
<u>New Flyer Connect System (Approved)</u>			<u>Remote diagnostics. Reduces road calls.</u>	
<u>No Adjustable</u>		<u>Mounted behind driver on forward side of the SDS</u>	<u>Outputs 83DBA when measured at a distance of 18"</u>	

TS 46.6 Driver Foot Controls

Accelerator and brake pedals shall be designed for ankle motion. Foot surfaces of the pedals shall be faced with wear-resistant, nonskid, replaceable material.

TS 46.6.1 Pedal Angle

The vertical angle of the accelerator and brake pedals shall be determined from a horizontal plane regardless of the slope of the cab floor. The accelerator and brake pedals shall be positioned at an angle of 37 to 50deg at the point of initiation of contact and extend downward to an angle of 10 to 18deg at full throttle.

The location of the brake and accelerator pedals shall be determined by the manufacturer, based on space needs, visibility, lower edge of windshield and vertical H-point.

TS 46.6.2 Pedal Dimensions and Position

The floor-mounted accelerator pedal shall be 10 to 12 in. long and 3 to 4 in. wide. Clearance around the pedal must allow for no interference precluding operation.

The accelerator and brake pedals shall be positioned such that the spacing between them, measured at the heel of the pedals, is between 1 and 2 in. Both pedals should be located approximately on the same plane coincident to the surface of the pedals.

TS 46.7 Brake and Accelerator Pedals

ALTERNATIVE-----APPROVED

Adjustable Brake and Accelerator Pedals

~~Both pedals shall be adjustable forward and rearward a minimum of 3 in. The adjustment shall be made by use of a dash-mounted toggle or rocker switch. The switch shall be clearly labeled to identify it as pedal adjustment and shall be within easy reach of the driver. Pedal adjustment shall be enabled only when the bus is stationary, and the parking brake engaged. The Kongsberg Pedals have been APPROVED.~~

TS 46.8 Driver Foot Switches

Floor-Mounted Foot Control Platform

The angle of the turn signal platform shall be determined from a horizontal plane, regardless of the slope of the cab floor. The turn signal platform shall be angled at a minimum of 10 deg and a maximum of 37 deg. It shall be located no closer to the seat front than the heel point of the accelerator pedal.

CLARIFICATION: The distance between centerlines of the foot switched will be 5 inch is APPROVED.

DEFAULT

Turn Signal Controls

~~Turn signal controls shall be floor-mounted, foot-controlled, water-resistant, heavy-duty, momentary contact switches.~~

ALTERNATIVE

Turn Signal Controls

~~Adjustable turn signal platform.~~

DEFAULT-----APPROVED

Foot Switch Control

The control switches for the turn signals shall be mounted on an inclined, floor-mounted stainless-steel enclosure or metal plate mounted to an incline integrated into the driver's platform, located to the left of the steering column. The location and design of this enclosure shall be such that foot room for the operator is not impeded. The inclined mounting surface shall be skid-resistant. All other signals, including high beam and public address system, shall be in approved locations.

The foot switches shall be UL-listed, heavy-duty type, of a rugged, corrosion-resistant metal construction. The foot switches for the directionals shall be momentary type, while those for the PA system and the high beam shall be latching type. The spacing of the switches (*minimum 5" between Turn Signal Switches*) shall be such that inadvertent simultaneous deflection of switches is prevented.

ALTERNATIVE-----APPROVED

Other Floor-Mounted Controls

The following may be floor mounted, momentary or latching, as identified by the Agency:

- *Hazard mounted on operator's side panel.*
- *Silent Alarm harness and heel operated switch shall be provided by the Agency, installed by the Contractor on the floor in front of the operator's seat.*
- *PA System Clam-Shell Switch shall be a vendor supplied momentary switch, mounted to the floor next*
- *to the rear left-side of the steering column. Exact location TBD.*
- *High Beam Switch to be mounted between and slightly above the two Turn Signal Switches.*

TS 47. Driver's Amenities

TS 47.1 Coat Hanger

ALTERNATIVE-----APPROVED

Coat Hook

A hook and loop shall be provided to secure the driver's coat. *Location TBD. Coat hooks must have backing/adequate support behind fasteners to prevent fasteners from pulling through.*

TS 47.2 Drink Holder

ALTERNATIVE-----APPROVED

Drink Holder

A device shall be provided to securely hold the driver's drink container, which may vary widely in diameter. It must be mounted within easy reach of the driver and must have sufficient vertical clearance for easy removal of the container. When the container is in the device, the driver's view of the road must not be obstructed, and leakage from the container must not fall on any switches, gauges or controls. *Requires approval by the Agency.*

TS 47.3 Storage Box

~~DEFAULT~~-----APPROVED

Storage Box

An enclosed driver storage area shall be provided with a positive latching door and/or lock. The minimum size is 2750 in.³

TS 48. Windshield Wipers and Washers

TS 48.1 Windshield Wipers

The bus shall be equipped with a windshield wiper for each half of the windshield. At 60 mph, no more than 10 percent of the wiped area shall be lost due to windshield wiper lift. For two-piece windshields, both wipers shall park along the center edges of the windshield glass. For single-piece windshields, wipers shall park along the bottom edge of the windshield. Windshield wiper motors and mechanisms shall be easily accessible for repairs or service. The fastener that secures the wiper arm to the drive mechanism shall be corrosion resistant.

~~DEFAULT~~-----APPROVED

~~Single control, electric two-speed intermittent wiper.~~

~~ALTERNATIVE~~-----APPROVED

Intermittent Wiper with Variable Control

A variable-speed feature shall be provided to allow adjustment of wiper speed for each side of the windshield between approximately five (5) and twenty-five (25) cycles per minute.

~~ALTERNATIVE~~-----APPROVED

Non-Synchronized Wipers

For non-synchronized wipers, separate controls for each side shall be supplied.

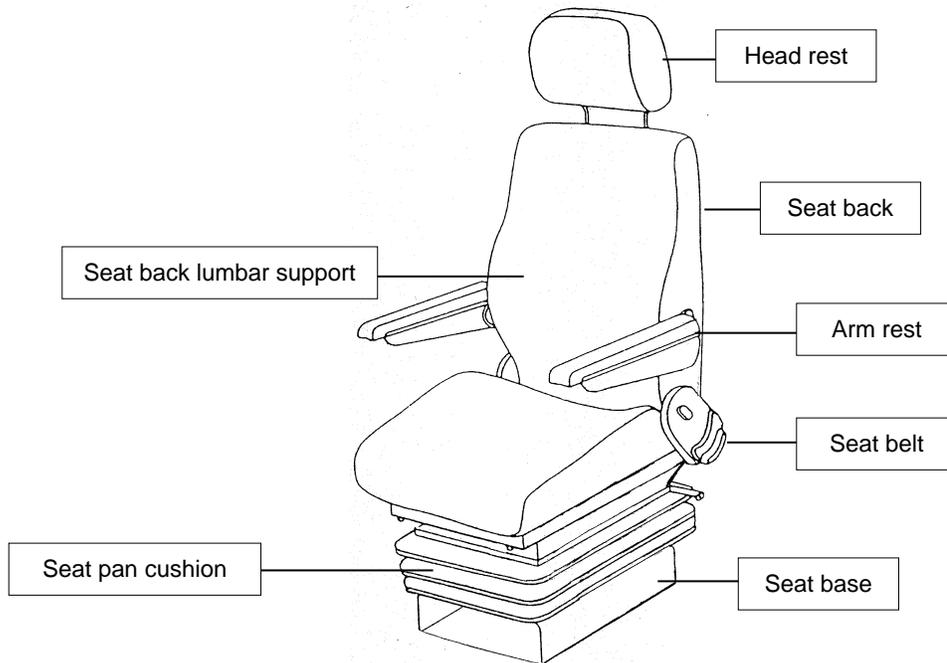
TS 48.2 Windshield Washers

The windshield washer system, when used with the wipers, shall deposit washing fluid evenly and completely wet the entire wiped area.

The windshield washer system shall have a minimum 3-gallon reservoir, located for easy refilling from outside the bus. Reservoir pumps, lines and fittings shall be corrosion-resistant and must include a means to determine fluid level.

TS 49. Driver's Seat

FIGURE 5
Driver's Seat



TS 49.1 Dimensions

The driver's seat shall be comfortable and adjustable so that people ranging in size from a 95th-percentile male to a 5th-percentile female may operate the bus.

TS 49.1.1 Seat Pan Cushion Length

Measurement shall be from the front edge of the seat pan to the rear at its intersection with the seat back. The adjustment of the seat pan length shall be no less than 16.5 in. at its minimum length and no more than 20.5 in. at its maximum length.

i. Seat Pan Cushion Height

~~DEFAULT~~ ----- APPROVED

Dimensions

Measurement shall be from the cab floor to the top of the level seat at its center midpoint. The seat shall adjust in height from a minimum of 14 in., with a minimum 6 in. vertical range of adjustment.

TS 49.1.2 Seat Pan Cushion Slope

Measurement is the slope of the plane created by connecting the two high points of the seat, one at the rear of the seat at its intersection with the seat back and the other at the front of the seat just before it waterfalls downward at the edge. The slope can be measured using an inclinometer and shall be stated in degrees of incline relative to the horizontal plane (0 deg). The seat pan shall adjust in its slope from no less than plus 12 deg (rearward "bucket seat" incline) to no less than minus 5 deg (forward slope).

TS 49.1.3 Seat Base Fore/Aft Adjustment

Measurement is the horizontal distance from the heel point to the front edge of the seat. The minimum and maximum distances shall be measured from the front edge of the seat when it is adjusted to its minimum seat pan depth (approximately 15 in.). On all low-floor buses, the seat base shall travel horizontally a minimum of 9 in. It shall adjust no closer to the heel point than 6 in. On all high-floor buses, the seat base shall travel a minimum of 9 in. and adjust no closer to the heel point than 6 in.

TS 49.1.4 Seat Pan Cushion Width

Measurement is the horizontal distance across the seat cushion. The seat pan cushion shall be 17 to 21 in. across at the front edge of the seat cushion and 20 to 23 in. across at the side bolsters.

TS 49.1.5 Seat Suspension

The driver's seat shall be appropriately dampened to support a minimum weight of 380 lbs. The suspension shall be capable of dampening adjustment in both directions.

Rubber bumpers shall be provided to prevent metal-to-metal contact.

TS 49.1.6 Seat Back

Width

Measurement is the distance between the outermost points of the front of the seat back, at or near its midpoint in height. The seat back width shall be no less than 19 in. Seat back will include dual recliner gears on both sides of the seat.

Height

Standard height seat back.

TS 49.1.7 Headrests

~~DEFAULT~~-----APPROVED

Adjustable headrest.

TS 49.1.8 Seat Back Lumbar Support

Measurement is from the bottom of the seat back at its intersection with the seat pan to the top of the lumbar cushioning. The seat back shall provide adjustable-depth lumbar back support with three individual operating lumbar cells within a minimum range of 7 to 11 in.

TS 49.1.9 Seat Back Angle Adjustment

The seat back angle shall be measured relative to a level seat pan, where 90 deg is the upright position and 90 deg-plus represents the amount of recline.

The seat back shall adjust in angle from a minimum of no more than 90 deg (upright) to at least 105 deg (reclined), with infinite adjustment in between.

TS 49.2 Seat Belt

The belt assembly should be an auto-locking retractor (ALR). All seat belts should be stored in automatic retractors. The belts shall be mounted to the seat frame so that the driver may adjust the seat without resetting the seat belt.

The seat and seatbelt assemblies as installed in the bus shall withstand static horizontal forces as required in FMVSS 207 and 210.

DEFAULT-----APPROVED

Seatbelt webbing shall be black in color.

ALTERNATIVE-----APPROVED

Lap and Shoulder (Three-Point) Seat Belt

Seat belts shall be provided across the driver's lap and diagonally across the driver's chest. The driver shall be able to use both belts by connecting a single buckle on the right side of the seat cushion. Three-point seatbelts must be emergency locking retractor (ELR) in design.

ALTERNATIVE-----APPROVED

All seatbelt assemblies shall come equipped with a warning switch device to remind operators to buckle up.

Lap Belt Length

ALTERNATIVE-----APPROVED

72 in. with Extension

The lap belt assembly shall be 72 in. in length with an 8in. extension

TS 49.3 Adjustable Armrest

ALTERNATIVE-----APPROVED

One armrest, right side.

TS 49.4 Seat Control Locations

While seated, the driver shall be able to make seat adjustments by hand without complexity, excessive effort or being pinched. Adjustment mechanisms shall hold the adjustments and shall not be subject to inadvertent changes.

TS 49.5 Seat Structure and Materials

Cushions

Cushions shall be fully padded with at least 3 in. of materials in the seating areas at the bottom and back.

Cushion Materials

DEFAULT-----APPROVED WITH LIQUICELL OPTION

Open-cell polyurethane (FMVSS 302).

TS 49.6 Pedestal

DEFAULT

~~Powder coated steel.~~

ALTERNATIVE

~~Stainless steel.~~

TS 49.7 Seat Options

Choose among the following:

- heated seat
- seat alarm
- fabric options-----APPROVED, Transit grade black nylon fabric
- seat air vent
- side bolsters adjustments-----APPROVED with Transit grade black vinyl Bolsters
- silicone seat cushion
- LiquiCell-----APPROVED
- Adjustable Thigh Cushion-----APPROVED

The Ergo Metro AM80 with LiquiCell option has been APPROVED.

TS 49.8 Mirrors

TS 49.8.1 Exterior Mirrors

The bus shall be equipped with corrosion-resistant, outside rearview mirrors mounted with stable supports to minimize vibration. Mirrors shall be firmly attached to the bus to minimize vibration and to prevent loss of adjustment with a breakaway mounting system. Mirrors shall permit the driver to view the roadway along the sides of the bus, including the rear wheels. Mirrors should be positioned to prevent blind spots.

Mirrors shall retract or fold sufficiently to allow bus washing operations but avoid contact with windshield.

ALTERNATIVE-----APPROVED

Spring-loaded mirror heads auto return.

ALTERNATIVE-----APPROVED

Combination of flat and convex mirrors referred to as transit-specific.

Curbside Mirrors

The curbside rearview mirror shall be mounted so that its lower edge is no less than 76in. above the street surface. A lower mount may be required due to mirror configuration requests.

ALTERNATIVE-----APPROVED

Heated and Remote Mirrors

The heaters shall be energized whenever the driver's heater and/or defroster is activated or activated independently.

Street-Side Mirrors

ALTERNATIVE-----APPROVED

Remote Adjustment of ~~Curbside~~ Streetside Mirror

The driver shall be able to adjust the street-side mirror remotely while seated in the driving position. The control for remote positioning of the mirror shall be a single switch or device.

ALTERNATIVE-----APPROVED

Heated Street-Side Mirrors

The street-side mirrors shall have heaters that energize whenever the driver's heater and/or defroster is activated or can be activated independently.

ALTERNATIVE-----APPROVED

Mirrors with external mounted turn signal, both sides.

TS 49.8.2 Interior Mirrors

Mirrors shall be provided for the driver to observe passengers throughout the bus without leaving the seat and without shoulder movement. The driver shall be able to observe passengers in the front/entrance and rear/exit areas (if applicable), anywhere in the aisle, and in the rear seats.

WINDOWS

TS 50. General

Use with 30ft length: A minimum of 6000 sq in. of window area, including operator and door windows, shall be required on each side of the standard configuration bus.

Use with 35ft length: A minimum of 8000 sq in. of window area, including operator and door windows, shall be required on each side of the standard configuration bus.

Use with 40ft length: A minimum of 10,000 sq in. of window area, including operator and door windows, shall be required on each side of the standard configuration bus.

Use with 45ft length: A minimum of 12,000 sq in. of window area, including operator and door windows, shall be required on each side of the standard configuration bus.

Use with 60ft length: A minimum of 16,000 sq in. of window area, including operator and door windows, shall be required on each side of the standard configuration bus.

TS 51. Windshield

The windshield shall permit an operator's field of view as referenced in SAE Recommended Practice J1050. The vertically upward view shall be a minimum of 14deg, measured above the horizontal and excluding any shaded band. The vertically downward view shall permit detection of an object 3½ft high no more than 2 ft in front of the bus. The horizontal view shall be a minimum of 90 deg above the line of sight. Any binocular obscuration due to a center divider may be ignored when determining the 90deg requirement, provided that the divider does not exceed a 3deg angle in the operator's field of view. Windshield pillars shall not exceed 10 deg of binocular obscuration. The windshield shall be designed and installed to minimize external glare as well as reflections from inside the bus.

The windshield shall be easily replaceable by removing zip-locks from the windshield retaining moldings. Bonded-in-place windshields shall not be used. Winglets may be bonded.

TS 51.1 Glazing

The windshield glazing material shall have a ¼ in. nominal thickness laminated safety glass conforming to the requirements of ANSI Z26.1 Test Grouping AS-1 and the recommended practices defined in SAE J673.

DEFAULT-----APPROVED

Shaded Band

The upper portion of the windshield above the driver's field of view shall have a dark, shaded band and marked AS-3, with a minimum luminous transmittance of 5 percent when tested in accordance to ASTM D-1003.

ALTERNATIVE

Partial band required to allow view for camera and mirror viewing.

DEFAULT-----APPROVED

Two-piece windshield.

TS 52. Driver's Side Window

The driver's side window shall be the sliding type, requiring only the rear half of the sash to latch upon closing, and shall open sufficiently to permit the seated operator to easily adjust the street-side outside rearview mirror. When in an open position, the window shall not rattle or close during braking. This window section shall slide in tracks or channels designed to last the service life of the bus. The operator's side window shall not be bonded in place and shall be easily replaceable. The glazing material shall have a single-density tint.

CLARIFICATION: The driver's window being bonded in place and replaceable using standard shop tools in approximately six hours is APPROVED.

~~The driver's view, perpendicular through operator's side window glazing, should extend a minimum of 33 in. (840 mm) to the rear of the heel point on the accelerator, and in any case must accommodate a 95th percentile male operator.~~ The view through the glazing at the front of the assembly should begin not more than 26 in. (560 mm) above the operator's floor to ensure visibility of an under-mounted convex mirror. Driver's window construction shall maximize ability for full opening of the window.

ALTERNATIVE-----APPROVED

The driver's side window glazing material shall have a ¼ in. nominal thickness tempered safety glass conforming to the requirements of ANSI Z26.1-1996 Test Grouping AS-2 and the recommended practices defined in SAE J673.

The design shall prevent sections from freezing closed in the winter. Light transmittance shall be 75 percent on the glass area below 53 in. from the operator platform floor. On the top-fixed-over-bottom-slider configuration, the top fixed area above 53 in. may have a maximum 5 percent light transmittance.

DEFAULT

Standard Driver's Side Window, Traditional Frame

Agency to choose from the following options:

- ~~• full slider~~
- ~~• egress~~
- ~~• non-egress~~
- ~~• top fixed over bottom slider~~
- ~~• egress~~
- ~~• non-egress~~

ALTERNATIVE-----APPROVED

Hidden Frame (Flush "Euro-Look") Driver's Side Window

Agency to choose from the following options:

- full slider-----APPROVED
 - egress
 - non-egress-----APPROVED
- top fixed over bottom slider
 - egress
 - non-egress

ALTERNATIVE-----APPROVED

Quick Change Operator's Side Window

Glazing in the window assembly shall be replaced without removing the window from its installed position on the bus or manipulation of the rubber molding surrounding the glazing. The glazing shall be held in place mechanically by a formed metal extruded ring constructed to last the life of the vehicle.

ALTERNATIVE

~~Standard Driver's Side Window, Traditional Frame~~

Agency to choose from the following options:

- ~~• full slider~~
- ~~• egress~~
- ~~• non egress~~
- ~~• top fixed over bottom slider~~
- ~~• egress~~
- ~~• non egress~~

TS 53. Side Windows

TS 53.1 Configuration

Side windows shall not be bonded in place but shall be easily replaceable without disturbing adjacent windows and shall be mounted so that flexing or vibration from engine operation or normal road excitation is not apparent. All aluminum and steel material will be treated to prevent corrosion.

TS 53.2 Emergency Exit (Egress) Configuration

DEFAULT

Minimum Egress

All side windows shall be fixed in position, except as necessary to meet the emergency escape requirements.

ALTERNATIVE-----APPROVED

Maximum Egress

Every window shall be capable of being made an egress window.

APPROVED: Standard window configuration of 3 per side on the CET LE and 4 per side on the CRT.

DEFAULT

Standard Passenger Side Window Configurations

Agency to choose from the following options:

- traditional frame
 - full fixed
 - openable windows with inward-opening transom panels
 - openable windows with sliding transom panels
 - openable windows with a fixed transom panel and sliding lower panels
 - openable windows with full-height sliding panels
- hidden frame (flush "Euro-look") -----APPROVED
 - full fixed-----APPROVED
 - openable windows with inward-opening transom panels.

ALTERNATIVE

Quick Change Passenger Side Windows

Glazing in the window assembly shall be replaced without removing the window from its installed position on the bus or manipulation of the rubber molding surrounding the glazing. The glazing shall be held in place mechanically by a formed metal extruded ring constructed to last the life of the vehicle.

DEFAULT

Traditional Frame

Agency to choose from the following options:

- full fixed
- openable windows with inward-opening transom panels
- openable windows with sliding transom panels
- openable windows with a fixed transom panel and sliding lower panels
- openable windows with full-height sliding panels

ALTERNATIVE-----APPROVED

Hidden Frame (Seamless)

Agency to choose from the following options:

- full fixed-----APPROVED
- openable windows with inward-opening transom panels

TS 53.3 Configuration

DEFAULT-----APPROVED

Fixed Side Windows

All side windows shall be fixed in position, except as necessary to meet the emergency escape requirements.

TS 53.4 Materials

DEFAULT-----APPROVED

Safety Glass Glazing Panels

Side windows glazing material shall have a minimum 3/16 in. nominal thickness tempered safety glass. The material shall conform to the requirements of ANSI Z26.1-1996 Test Grouping 2 and the recommended practices defined in SAE J673.

ALTERNATIVE

Polycarbonate Glazing Panels

Side window glazing material shall have a minimum 3/16 in. nominal thickness. The material shall conform with the requirements of ANSI Z26.1-1996, "Standard for Type AS-5 Safety Glazing Materials," except for Test Number 17, which shall subject the specimens to 100 cycles with less than 4 percent hazing and 500 cycles with less than 12 percent hazing. Windows shall be polycarbonate sheet with an abrasion-resistant coating on both sides of the window.

ALTERNATIVE

Acrylic Glazing Panels

Side window glazing material shall have a minimum of 3/16 in. nominal thickness. The material shall conform with the requirements of ANSI Z26.1-1996, "Standard for Type AS-5 Safety Glazing Materials," except for Test Number 17, which shall subject the specimens to 100 cycles with less than 4 percent hazing and 500 cycles with less than 12 percent hazing. Windows shall be cell cast acrylic sheet with an abrasion-resistant coating on both sides of the window.

ALTERNATIVE

Laminated Glazing Panels; Not Available on Hidden Frame (Seamless) Windows

Side windows glazing material shall have a minimum of 3/16 in. nominal thickness laminated safety glass. The material shall conform to applicable requirements of ANSI Z26.1-1996 and the recommended practices defined in SAE J673.

ALTERNATIVE

Laminated and Tempered Safety Glazing with Anti-Vandalism Polyester Sacrificial Film

All glazing material that is aft of the standee line shall be equipped with 6 mm laminated polyester film. Material shall be easily installed and removed without the use of specialized tools. Polyester film shall adhere to the window and be resistant to peeling, curling and discoloration by ultraviolet rays. The film shall withstand normal cleaning operations.

ALTERNATIVE

Anti-Vandalism Sacrificial Liner ("Quick Change")

All glazing material aft of the standee line shall be equipped with necessary bracketry, fasteners and clear acrylic liner that shall be easily removable in the event of vandalism. The acrylic liner shall be clear and shall have minimal effect on the transmittance of the underlying glazing. This material shall not be adversely affected by ultraviolet rays and shall withstand normal cleaning practices. The installation of the liner shall prevent clouding or fogging. This acrylic sacrificial liner must be replaced without removing the window from its installed position on the bus, without removing the tempered glazing from the sash, and without the removal or manipulation of the window assembly's rubber molding.

DEFAULT

Windows on the bus sides and in the rear door shall be tinted a neutral color, complementary to the bus exterior. The maximum solar energy transmittance shall not exceed 37 percent, as measured by ASTM E-424. Luminous transmittance shall be measured by ASTM D-1003. Windows over the destination signs shall not be tinted.

ALTERNATIVE

All side and door windows shall be heat-rejecting glass with a solar heat gain coefficient (SHGC) of no greater than 40 percent and a visible light transmission of no less than 75 percent. Lower light transmission may be considered if SHGC values of less than 40 percent can be attained.

DEFAULT (LIGHT)

55 percent luminous transmittance.

ALTERNATIVE (LIGHT)

75 percent luminous transmittance.

DEFAULT (DARK) -----APPROVED

27 percent luminous transmittance.

ALTERNATIVE

Property to specify, but no less than 12 percent.

DEFAULT

Safety Glass Glazing Panels

Side windows glazing material shall have a minimum of 3/16 in. nominal thickness tempered safety glass. The material shall conform to the requirements of ANSI Z26.1 Test Grouping 2 and the recommended practices defined in SAE J673.

ALTERNATIVE

Polycarbonate Glazing Panels

Side window glazing material shall have a minimum of 3/16 in. nominal thickness. The material shall conform to the requirements of ANSI Z26.1-1977, "Standard for Type AS-5 Safety Glazing Materials," except for Test Number 17, which shall subject the specimens to 1000 cycles, and the arithmetic mean of the percentages of light scattered shall not exceed 5 percent. Windows shall be polycarbonate sheet with an abrasion-resistant coating on both sides of the window.

ALTERNATIVE

Acrylic Glazing Panels

Side window glazing material shall have a minimum of 3/16 in. nominal thickness. The material shall conform to the requirements of ANSI Z26.1-1977, "Standard for Type AS-5 Safety Glazing Materials," except for Test Number 17, which shall subject the specimens to 1000 cycles and the arithmetic mean of the percentages of light scattered shall not exceed 5 percent. Windows shall be cell cast acrylic sheet with an abrasion-resistant coating on both sides of the window.

ALTERNATIVE

Laminated Glazing Panels

Side windows glazing material shall have a minimum of 3/16 in. nominal thickness laminated safety glass. The material shall conform to applicable requirements of ANSI Z26.1 and the recommended practices defined in SAE J673.

ALTERNATIVE-----APPROVED

Anti-Vandalism Polyester Sacrificial Film

All glazing material that is aft of the standee line shall be equipped with 6 ~~mm~~ mil laminated polyester film. This material shall be easily installed and removed without the use of specialized tools. Polyester film shall adhere to the window and be resistant to peeling, curling and discoloration by ultraviolet rays. The film shall withstand normal cleaning operations.

ALTERNATIVE

Anti-Vandalism Sacrificial Liner (“Storm Window Type”)

All glazing material aft of the standee line shall be equipped with necessary bracketry, fasteners and clear acrylic liner that shall be easily removable in the event of vandalism. The acrylic material shall be clear and shall have minimal effect on the transmittance of the underlying glazing. This material shall not be adversely affected by ultraviolet rays and shall withstand normal cleaning practices. The installation of the liner shall prevent clouding or fogging. A mechanic shall be able to easily remove and replace the acrylic liner without the use of any specialized tools in 5 minutes or less.

NOTE: All glass treatments must be permanent, within the glass and/or in the center membrane. Surface films are not permitted.

SHGC and light transmission performance shall be defined by the National Fenestration Rating Council.

TS 53.5 Rear Window

DEFAULT-----APPROVED

No requirement for rear window.

ALTERNATIVE

Rear Window Requirement

~~[Note that requirement for a rear mounted HVAC unit will preclude a rear window.] A rear window shall be provided. The rear window shall be glazed with the same material (including anti-vandalism provision if required) and tint as side windows. The glazing shall be set in rubber channels or be push-out type to meet FMVSS 217. If push-out type, it shall be one-piece, rugged sash design, meeting specifications for side windows.~~

HEATING, VENTILATING AND AIR CONDITIONING

TS 54. Capacity and Performance

The HVAC climate control system shall be capable of controlling the temperature and maintaining the humidity levels of the interior of the bus as defined in the following paragraphs.

DEFAULT-----APPROVED

HVAC equipped. See below for configuration.

DEFAULT-----APPROVED

Allow Either Roof- or Rear-Mounted HVAC Unit

The HVAC unit may either be roof or rear-mounted. Note that a rear-mounted unit will preclude a rear window and that the term “roof-mounted unit” includes units mounted on top of or beneath the roof surface.

ALTERNATIVE (TC)

Require Roof-Mounted HVAC Unit

The HVAC unit shall be roof-mounted. [Note that this includes units mounted on top of or beneath the roof surface.]

ALTERNATIVEAPPROVED

The MCC/Carrier 05G 41 CFM Compressor. If the 05G is not offered the Agency will accept the Bitzer.

With the bus running at the design operating profile with corresponding door opening cycle, and carrying a number of passengers equal to 150 percent of the seated load, the HVAC system shall control the average passenger compartment temperature within arrange between 65 and 80 °F, while maintaining the relative humidity to a value of 50 percent or less. The system shall maintain these conditions while subjected to any outside ambient temperatures within arrange of 10 to 95 °F and at any ambient relative humidity levels between 5 and 50 percent.

When the bus is operated in outside ambient temperatures of 95 to 115 °F, the interior temperature of the bus shall be permitted to rise 0.5°F for each degree of exterior temperature in excess of 95 °F.

When the bus is operated in outside ambient temperatures in the range of -10 to 10 °F, the interior temperature of the bus shall not fall below 55 °F while the bus is running on the design operating profile.

System capacity testing, including pull-down/warm-up, stabilization and profile, shall be conducted in accordance to APTA's *Recommended Practice* "Transit Bus HVAC System Instrumentation and Performance Testing."

NOTE: The recommended locations of temperature probes are only guidelines and may require slight modifications to address actual bus design. Care must be taken to avoid placement of sensing devices in the immediate path of an air duct outlet. In general, the locations are intended to accurately represent the interior passenger area.

Additional testing shall be performed as necessary to ensure compliance to performance requirements stated herein.

ALTERNATIVE-----APPROVED

Hotter Ambient Conditions

The air conditioning portion of the HVAC system shall be capable of reducing the passenger compartment temperature from 110 to 70°F ±3°F in less than 30 minutes after system engagement for 30, 35 and 40ft buses. Engine temperature shall be within the normal operating range at the time of start-up of the cool-down test, and the engine speed shall be limited to fast idle at three-quarters max governed speed that may be activated by a driver-controlled device. During the cool-down period, the refrigerant pressure shall not exceed safe high-side pressures, and the condenser discharge air temperature, measured 6 in. from the surface of the coil, shall be less than 45 °F above the condenser inlet air temperature. No simulated solar load shall be used. There shall be no passengers on board, and the doors and windows shall be closed.

ALTERNATIVE-----APPROVED

Colder Ambient Conditions

The pull-up requirements for the heating system shall be in accordance with Section 11.1 of APTA's *Recommended Practice* "Transit Bus HVAC System Instrumentation and Performance Testing." With ambient temperature at -20 °F, and vehicle cold soaked at that temperature, the bus heating system shall warm the interior passenger compartment to an average temperature of 70 °F ±2 °F within 70 minutes.

ALTERNATIVE-----APPROVED

R134a

The air conditioning system shall meet these performance requirements using R134a. [Note that selection of this refrigerant may impact pull-down performance.]

ALTERNATIVE

R407C

The air conditioning system shall meet these performance requirements using R407C.

ALTERNATIVE-----APPROVED

Other

Agency to specify how the air conditioning system shall meet these performance requirements Provide an A/C Screw Compressor for smooth operation and smaller size and weight as compared to a piston compressor. This compressor shall also have a projected life of 100,000 hours.

Provide an a/c compressor oil sample port (Shrader Valve) on the compressor for taking oil samples.

The compressor shall have suction and discharge convoluted SSTL refrigerant hoses covered with a stainless-steel braid and with welded fittings.

Provide a "reheat" option instead of the "cycling clutch" option.

Provide two (2) electronic pressure gauges in the air-return compartment. An Electronic Pressure Display module in place of the Electronic Pressure Gauges is Approved.

Use copper Type "K" hard copper lines with brazed or silver soldered connections.

TS 55. Controls and Temperature Uniformity

The HVAC system excluding the driver's heater/defroster shall be centrally controlled with an advanced electronic/diagnostic control system with provisions for extracting/reading data. The system shall be compliant with J1939 Communication Protocol for receiving and broadcasting of data.

Hot engine coolant water shall be delivered to the HVAC system driver's defroster/heater and other heater cores by means of an auxiliary coolant pump, sized for the required flow, which is brushless and sealless having a minimum maintenance-free service life for both the brushless motor and the pump of at least 40,000 hours at full power.

ALTERNATIVE-----APPROVED

Fully Automatic Climate Control System

The climate control system shall be fully automatic and control the interior average temperature to within ± 2 °F of specified temperature control setpoint.

ALTERNATIVE

Dual-Temperature Control Set Point

The temperature control setpoint for the system shall be [insert temperature]°F in the cooling mode and [insert temperature] °F in the heating mode.

ALTERNATIVE-----APPROVED

Manually Adjustable Temperature Control Set Point

The climate control system shall have the provision to allow the driver to adjust the temperature control setpoint at a minimum of between 68 and 72 °F. From then on, all interior climate control system requirements shall be attained automatically, unless re-adjusted by the driver.

The driver shall have full control over the defroster and driver's heater. The driver shall be able to adjust the temperature in the driver's area through air distribution and fans. The interior climate control system shall switch automatically to the ventilating mode if the refrigerant compressor or condenser fan fails.

Interior temperature distribution shall be uniform to the extent practicable to prevent hot and/or cold spots. After stabilization with doors closed, the temperatures between any two points in the passenger compartment in the same vertical plane, and 6 to 72 in. above the floor, shall not vary by more than 5 °F with doors closed. The interior temperatures, measured at the same height above the floor, shall not vary more than ± 5 °F from the front to the rear from the average temperature determined in accordance with APTA's "Recommended Instrumentation and Performance Testing for Transit Bus Air Conditioning System." Variations of greater than ± 5 °F will be allowed for limited, localized areas provided that the majority of the measured temperatures fall within the specified requirement.

TS 55.1 Auxiliary Heater

ALTERNATIVE-----APPROVED

Auxiliary Heater

An auxiliary heater fired by diesel fuel shall be provided to supplement the heat supplied by the engine and shall have an output necessary to meet the performance criteria. The heater shall be equipped with safety devices to prevent overfueling, overheating due to loss of coolant or water pump failure, and operation during conditions of low battery voltage. The auxiliary heater shall have capability of functioning in the supplemental mode and preheat mode. The supplemental mode shall automatically cycle the auxiliary heater “on” and “off” according to the coolant temperature. No driver input shall be required when the engine is running. The preheat mode shall be enabled through a single-pole double-throw momentary switch. With the master run switch in the “off” position, toggling the switch to its momentary upward (“on”) position shall enable the auxiliary heater to operate in preheat. Once in preheat, the unit shall continue to operate and cycle until either the preheat switch is toggled to its momentary downward (“off”) position, or the master run switch is turned “on,” or the time elapsed exceeds 60 minutes, at which time the preheat mode will automatically be disabled. The supplement mode will always override the preheat mode.

The auxiliary heater coolant pump shall shut down when the coolant is up to temperature during the supplemental mode. With the engine running, there shall be coolant flow through the heater all the time. The temperature sensor shall constantly measure the coolant temperature and cycle “on” if required, at which time the coolant pump turns on.

The auxiliary heater shall be equipped with a self-priming fuel pump. The unit shall be electronically controlled with appropriate diagnostics for troubleshooting. Operation, as well as diagnostic data, shall be stored and shall be retrievable through an IBM compatible PC. The auxiliary heater maintenance/diagnostic information shall be communicated through the appropriate protocol, SAE J1708 or J1939.

A ProHeat X series variable BTU auxiliary heater is approved. Auxiliary heater exhaust pipe must terminate past the exterior of the vehicle.

CLARIFICATION: If the x30 31,000 btu variable BTU hear is available it is APPROVED, if not available the Agency will accept the X45.

TS 56. Air Flow

TS 56.1 Passenger Area

The cooling mode of the interior climate control system shall introduce air into the bus at or near the ceiling height at a minimum rate of 25 cubic ft per minute (cfm) per passenger based on the standard configuration bus carrying a number of passengers equal to 150 percent of the seated load. Airflow shall be evenly distributed throughout the bus, with air velocity not exceeding 100 ft per minute on any passenger. The ventilating mode shall provide air at a minimum flow rate of 20 cfm per passenger.

Airflow may be reduced to 15 cfm per passenger (150 percent of seated load) when operating in the heating mode. The fans shall not activate until the heating element has warmed sufficiently to ensure at least 70 °F air outlet temperature. The heating air outlet temperature shall not exceed 120 °F under any normal operating conditions.

The climate control blower motors and fan shall be designed such that their operation complies with the interior noise level requirements.

DEFAULT

No "Fresh Air" Requirements

To be used by agencies that have an operating profile where the door opening cycle results in effectively providing an adequate "fresh air" mixture.

ALTERNATIVE-----APPROVED

Requirement for 10 Percent "Fresh Air" Mixture

The air shall be composed of no less than 10 percent outside air.

TS 56.2 Driver's Area

The bus interior climate control system shall deliver at least 100 cfm of air to the driver's area when operating in the ventilating and cooling modes. Adjustable nozzles shall permit variable distribution or shutdown of the airflow. Airflow in the heating mode shall be reduced proportionally to the reduction of airflow into the passenger area. The windshield defroster unit shall meet the requirements of SAE Recommended Practice J382, "Windshield Defrosting Systems Performance Requirements," and shall have the capability of diverting heated air to the driver's feet and legs. The defroster or interior climate control system shall maintain visibility through the driver's side window.

TS 56.3 Controls for the Climate Control System (CCS)

The controls for the driver's compartment for heating, ventilation and cooling systems shall be integrated and shall meet the following requirements:

- The heat/defrost system fan shall be controlled by a separate switch that has an "off" position and at least two positions for speed control. All switches and controls shall preclude the possibility of clothing becoming entangled, and shields shall be provided, if required. If the fans are approved by the Agency, an "on/off" switch shall be located to the right of or near the main defroster switch.
- A manually operated control valve shall control the coolant flow through the heater core.
- If a cable-operated manual control valve is used, then the cable length shall be kept to a minimum to reduce cable seizing. Heater water control valves shall be "positive" type, closed or open. The method of operating remote valves shall require the concurrence of the Agency project manager.

TS 56.4 Driver's Compartment Requirements

A separate heating, ventilation and defroster system for the driver's area shall be provided and shall be controlled by the driver. The system shall meet the following requirements:

- The heater and defroster system shall provide heating for the driver and heated air to completely defrost and defog the windshield, driver's side window, and the front door glasses in all operating conditions. Fan(s) shall be able to draw air from the bus body interior and/or exterior through a control device and pass it through the heater core to the defroster system and over the driver's feet. A minimum capacity of 100 cfm shall be provided. The driver shall have complete control of the heat and fresh airflow for the driver's area.
- The defroster supply outlets shall be located at the lower edge of the windshield. These outlets shall be durable and shall be free of sharp edges that can catch clothes during normal daily cleaning. The system shall be such that foreign objects such as coins or tickets cannot fall into the defroster air outlets. Adjustable ball vents or louvers shall be provided at the left of the driver's position to allow direction of air onto the side windows.

A ventilation system shall be provided to ensure driver comfort and shall be capable of providing fresh air in both the foot and head areas. Vents shall be controllable by the driver from the normal driving position. Decals shall be provided, indicating “operating instructions” and “open” and “closed” positions. When closed, vents shall be sealed to prevent the migration of water or air into the bus.

TS 56.5 Driver’s Cooling

DEFAULT

No dedicated evaporator.

ALTERNATIVE-----APPROVED

Separate Dedicated Evaporator

Using a separate, dedicated evaporator, the climate control system shall be designed to maintain the driver’s compartment temperatures within the range specified for the passenger compartment. The unit shall operate when the climate control switch is in the “Cool” position. It shall have a separate thermostatic control.

ALTERNATIVE

A separate fan unit shall provide 100 cfm of air to the driver’s area through directionally adjustable nozzles and an infinitely variable fan control, both of which shall be located above and ahead of the driver.

ALTERNATIVE

Air from the evaporator shall be provided to the driver’s area through vents located on the dash in front of the driver.

ALTERNATIVE

Driver’s booster blower.

TS 57. Air Filtration

Air shall be filtered before entering the AC system and being discharged into the passenger compartment. The filter shall meet the ANSI/ASHRAE 52.1 requirement for 5 percent or better atmospheric dust spot efficiency, 50 percent weight resistance, and a minimum dust holding capacity of 120 g per 1000 cfm cell. Air filters shall be easily removable for service.

DEFAULT-----APPROVED

Cleanable Filters

Air filters shall be cleanable.

ALTERNATIVE

Disposable Type Filters

Air filters shall be of disposable type.

ALTERNATIVE

Other Type Filters

Air filters shall be [insert type of air filters].

TS 58. Roof Ventilators

Each ventilator shall be easily opened and closed manually. When open with the bus in motion, this ventilator shall provide fresh air inside the bus. The ventilator shall cover an opening area no less than 425 sq in. and shall be capable of being positioned as a scoop with either the leading or trailing edge open no less than 4 in., or with all four edges raised simultaneously to a height of no less than 3½ in. An escape hatch shall be incorporated into the roof ventilator. Roof ventilator(s) shall be sealed to prevent entry of water when closed.

ALTERNATIVE-----APPROVED

Two Roof Ventilators

Two roof ventilators shall be provided in the roof of the bus, one approximately over or just forward of the front axle and the other approximately over the rear axle. *Both ventilators shall open from the rear to prevent wind drag from damaging the ventilator at high speed. Provide a cable to physically attach the escape hatch lid to the roof of the bus.*

ALTERNATIVEAPPROVED

Transpec hatches that can be opened in 5 positions (front, rear, LH and RH sides, all sides raised.

ALTERNATIVE-----APPROVED

A tool shall be provided to manually open and close the hatch.

TS 59. Maintainability

Manually controlled shut-off valves in the refrigerant lines shall allow isolation of the compressor and dehydrator filter for service. To the extent practicable, self-sealing couplings utilizing O-ring seals shall be used to break and seal the refrigerant lines during removal of major components, such as the refrigerant compressor. Shut-off valves may be provided in lieu of self-sealing couplings. The condenser shall be located to efficiently transfer heat to the atmosphere and shall not ingest air warmed above the ambient temperature by the bus mechanical equipment, or to discharge air into any other system of the bus. The location of the condenser shall preclude its obstruction by wheel splash, road dirt or debris. HVAC components located within 6 in. of floor level shall be constructed to resist damage and corrosion.

DEFAULT-----APPROVED

High and low refrigerant pressure electronic gauges to be located in the return air area.

CLARIFICATION: High and low pressure readings retried through diagnostic reader, or drivers HVAC display is APPROVED.

NOTE: The Agency may include the following sections if an alternative for colder ambient performance is specified above.

TS 60. Entrance/Exit Area Heating

~~ALTERNATIVE~~-----APPROVED

Entrance/Exit Area Heating

Heat shall be supplied to the entrance and exit areas to maintain a tread surface temperature no less than 35 °F in an ambient of -10 °F to prevent accumulation of snow, ice or slush with the bus operating under design operating profile and corresponding door opening cycle.

TS 61. Floor-Level Heating

TS 61.1 Transit Coach

DEFAULT

No requirements for floor level heating.

ALTERNATIVE

~~Floor-Level Heating~~

~~Sufficient floor level heaters shall be provided to evenly supply heated forced air. Control of the floor-level heating shall be through the main heating system electronic control.~~

ALTERNATIVE

~~Forced Air Floor-Level Heating~~

~~Sufficient floor level heaters shall be provided to evenly supply heated forced air through floor ducts across the length of the bus. Floor ducts may be discontinued at the upper level, but additional provisions to prevent cold floors and ensure temperature uniformity shall be included. Control of the floor level heating shall be through the main heating system electronic control.~~

ALTERNATIVE

~~Convactor Air Floor-Level Heating~~

~~Sufficient floor level heaters shall be provided that evenly supply convactor air across the length of the bus. Control of the floor level heating shall be through the main heating system's electronic control.~~

ALTERNATIVE

~~Warm Wall Heating~~

~~Sufficient heaters shall be provided with ducting to blow warm air upward through a cavity in the wall and discharge the warm air at the base of the windows. Control of the warm wall heating shall be through the main heating system electronic control.~~

TS 61.2 Commuter Coach

Sufficient heaters shall be provided with ducting to blow warm air upward through a cavity in the wall and discharge the warm air at the base of the windows. Control of the warm wall heating shall be through the main heating system electronic control.

EXTERIOR PANELS, FINISHES AND EXTERIOR LIGHTING

TS 62. Design

The bus shall have a clean, smooth, simple design, primarily derived from bus performance requirements and passenger service criteria. The exterior and body features, including grilles and louvers, shall be shaped to facilitate cleaning by automatic bus washers without snagging washer brushes. Water and dirt shall not be retained in or on anybody feature to freeze or bleed out onto the bus after leaving the washer. The body and windows shall be sealed to prevent leaking of air, dust or water under normal operating conditions and during cleaning in automatic bus washers for the service life of the bus.

Exterior panels shall be sufficiently stiff to minimize vibration, drumming or flexing while the bus is in service. When panels are lapped, the upper and forward panels shall act as a watershed. However, if entry of moisture into the interior of the vehicle is prevented by other means, then rear cap panels may be lapped otherwise. The windows, hatches and doors shall be able to be sealed. Accumulation of spray and splash generated by the bus's wheels shall be minimized on windows and mirrors.

TS 62.1 Materials

Body materials shall be selected, and the body fabricated to reduce maintenance, extend durability and provide consistency of appearance throughout the service life of the bus. Detailing shall be kept simple, and add-on devices and trim shall be minimized and integrated into the basic design.

DEFAULT-----<u>APPROVED</u>

No requirement for protection against graffiti/vandalism for body material surfaces.
--

TS 62.2 Roof-Mounted Equipment (Transit Coach)

TS 63. Pedestrian Safety

Exterior protrusions along the side and front of the bus greater than ½ in. and within 80 in. of the ground shall have a radius no less than the amount of the protrusion. The exterior rearview mirrors, cameras and required lights and reflectors are exempt from the protrusion requirement. Advertising frames shall protrude no more than 7/8 in. from the body surface. Grilles, doors, bumpers and other features on the sides and rear of the bus shall be designed to minimize toeholds or handholds.

Exterior protrusions shall not cause a line-of-sight blockage for the driver.

TS 64. Repair and Replacement

TS 64.1 Side Body Panels (Transit Coach)

Structural elements supporting exterior body panels shall allow side body panels below the windows to be repaired in lengths not greater than 12.5 ft.

TS 64.2 Side Body Panels (Commuter Coach)

Structural elements supporting exterior body panels shall allow side body panels below the windows to be repaired.

TS 65. Rain Gutters

Rain gutters shall be provided to prevent water flowing from the roof onto the passenger doors and driver's side window. When the bus is decelerated, the gutters shall not drain onto the windshield,

driver's side window or door boarding area. Cross sections of the gutters shall be adequate for proper operation.

TS 66. License Plate Provisions

Provisions shall be made to mount standard-size U.S./Canada license plates per SAE J686 on the front and rear of the bus. These provisions shall direct-mount or recess the license plates so that they can be cleaned by automatic bus-washing equipment without being caught by the brushes. The rear license plate provision shall be illuminated per SAE J587.

ALTERNATIVE-----APPROVED

Front Plate or Holder is Required

Location to be provided to OEM.

TS 66.1 Rub rails

ALTERNATIVE-----APPROVED

Requirement for Rub Rails

Rub rails composed of flexible, resilient material shall be provided to protect both sides of the bus body from damage caused by minor sideswipe accidents with automobiles. Rub rails shall have vertical dimensions of no less than 2 in. (50 mm) with the centerline no higher than 35 in. above the ground between the wheelwells. The rubrails shall withstand impacts of 200 ft-lbs of energy from a steel-faced spherical missile no less than 9 in. in diameter and of a 500lb load applied anywhere along their length by a rigid plate 1 ft in length, wider than the rubrail, and with a ¼ in. end radii, with no visible damage to the rubrail, retainer or supporting structure.

The rub rail may be discontinued at doorways, wheel wells and articulated joints if applicable. A damaged portion of the rub rail shall be replaceable without requiring removal or replacement of the entire rub rail.

NOTE: Installation of rub rails may preclude the installation and/or size of exterior advertising signs or racks.

TS 67. Fender Skirts

DEFAULT-----APPROVED

Features to minimize water spray from the bus in wet conditions shall be included in wheel housing design. Any fender skirts shall be easily replaceable. They shall be flexible if they extend beyond the allowable body width. Wheels and tires shall be removable with the fender skirts in place.

~~TS 68. Wheel Covers (Transit Coach)~~

TS 68.1 Splash Aprons

DEFAULT-----APPROVED

Standard Splash Aprons

Splash aprons, composed of ¼ in. minimum composition or rubberized fabric, shall be installed behind and/or in front of wheels as needed to reduce road splash and to protect underfloor components. The splash aprons shall extend downward to within 6 in. off the road surface at static conditions. Apron widths shall be no less than tire widths. Splash aprons shall be bolted to the bus understructure. Splash aprons and their attachments shall be inherently weaker than the structure to which they are attached. The flexible portions of the splash aprons shall not be included in the road clearance measurements. Splash apron shall be installed as necessary to protect the wheelchair loading device from road splash. Other splash aprons shall be installed where necessary to protect bus equipment. *Splash Aprons shall be installed behind each front wheel, the rearmost wheels, and between the drive and tag axles and shall extend downward within 4 inches of the road surface.*

TS 69. Service Compartments and Access Doors

~~TS 69.1 Access Doors (Transit Coach)~~

TS 69.2 Access Doors (Commuter Coach)

Conventional doors shall be used for the engine compartment and for all auxiliary equipment compartments including doors for checking the quantity and adding to the engine coolant, engine lubricant and transmission fluid. Access openings shall be sized for easy performance of tasks within the compartment, including tool operating space. Access doors shall be of rugged construction and shall maintain mechanical integrity and function under normal operations throughout the service life of the bus. They shall close flush with the body surface. All doors shall be hinged at the top or on the forward edge and shall be prevented from coming loose or opening during transit service or in bus washing operations. All access doors shall be retained in the open position. Latch handles shall be flush with, or recessed behind, the body contour and shall be sized to provide an adequate grip for opening. Access doors, when opened, shall not restrict access for servicing other components or systems.

If precluded by design, the manufacturer shall provide door design information specifying how the requirements are met.

TS 69.3 Access Door Latch/Locks

DEFAULT-----APPROVED

Requirement for Latches on Access Doors

Access doors larger than 100 sq in. in area shall be equipped with corrosion-resistant flush-mounted latches or locks except for coolant and fuel fill access doors. All such access doors that require a tool to open shall be standardized throughout the vehicle and will require a nominal 5/16 in. square male tool to open or lock.

ALTERNATIVE-----APPROVED

Other Locks and Latches

Agency may define any required locks or latches for access doors.

TS 70. Bumpers

TS 70.1 Location

Bumpers shall provide impact protection for the front and rear of the bus with the top of the bumper being 27 in., ± 2 in., above the ground. Bumper height shall be such that when one bus is parked behind another, a portion of the bumper faces will contact each other.

TS 70.2 Front Bumper

No part of the bus, including the bumper, shall be damaged as a result of a 5mph impact of the bus at curb weight with a fixed, flat barrier perpendicular to the bus's longitudinal centerline. The bumper shall return to its pre-impact shape within 10 minutes of the impact. The bumper shall protect the bus from damage as a result of 6.5 mph impacts at any point by the common carriage with contoured impact surface defined in Figure 2 of FMVSS 301 loaded to 4000lbs parallel to the longitudinal centerline of the bus. It shall protect the bus from damage as a result of 5.5mph impacts into the corners at a 30deg angle to the longitudinal centerline of the bus. The energy absorption system of the bumper shall be independent of every power system of the bus and shall not require service or maintenance in normal operation during the service life of the bus. The bumper may increase the overall bus length specified by no more than 7 in.

CLARIFICATION: The bus should be priced with brackets for a 3 position bike rack on the front.

ALTERNATIVE-----<u>APPROVED</u>
--

Mounting provisions for integrated bike rack.

DEFAULT

Standard bumper.

ALTERNATIVE

Integrated Design with Recessed Middle Portion

The bumper shall be an integrated design with the coach styling and be recessed in the middle portion to provide for mounting of a bike rack if necessary.
--

TS 70.3 Rear Bumper

No part of the bus, including the bumper, shall be damaged as a result of a 2mph impact with a fixed, flat barrier perpendicular to the longitudinal centerline of the bus. The bumper shall return to its pre-impact shape within 10 minutes of the impact. When using a yard tug with a smooth, flat plate bumper 2 ft wide contacting the horizontal centerline of the rear bumper, the bumper shall provide protection at speeds up to 5 mph, over pavement discontinuities up to 1 in. high, and at accelerations up to 2 mph/sec. The rear bumper shall protect the bus when impacted anywhere along its width by the common carriage with contoured impact surface defined in Figure 2 of FMVSS 301 loaded to 4000 lbs, at 4 mph parallel to or up to a 30degangle to the longitudinal centerline of the bus. The rear bumper shall be shaped to preclude unauthorized riders standing on the bumper. The bumper shall not require service or maintenance in normal operation during the service life of the bus. The bumper may increase the overall bus length specified by no more than 7 in.

TS 70.4 Bumper Material

Bumper material shall be corrosion-resistant and withstand repeated impacts of the specified loads without sustaining damage. These bumper qualities shall be sustained throughout the service life of the bus.

TS 71. Finish and Color

TS 71.1 Appearance

All exterior surfaces shall be smooth and free of wrinkles and dents. Exterior surfaces to be painted shall be properly prepared as required by the paint system Supplier prior to application of paint to ensure a proper bond between the basic surface and successive coats of original paint for the service life of the bus. Drilled holes and cutouts in exterior surfaces shall be made prior to cleaning, priming and painting, where possible, to prevent corrosion. The bus shall be painted prior to installation of exterior lights, windows, mirrors and other items that are applied to the exterior of the bus. Body filler materials may be used for surface dressing, but not for repair of damaged or improperly fitted panels.

Paint shall be applied smoothly and evenly with the finished surface free of visible dirt and the following other imperfections:

- blisters or bubbles appearing in the topcoat film
- chips, scratches or gouges of the surface finish
- cracks in the paint film
- craters where paint failed to cover due to surface contamination
- overspray
- peeling
- runs or sags from excessive flow and failure to adhere uniformly to the surface
- chemical stains and water spots
- dry patches due to incorrect mixing of paint activators
- buffing swirls

All exterior finished surfaces shall be impervious to diesel fuel, gasoline and commercial cleaning agents. Finished surfaces shall resist damage by controlled applications of commonly used graffiti-removing chemicals.

Proper adhesion between the basic surface and successive coats of the original paint shall be measured using an Elcometer adhesion tester as outlined in ASTM D4541-85. Adhesion shall be a minimum 300 ft-lbs. The bus manufacturer shall supply test samples of the exterior surface for each step of the painting process that may be subject to adhesion testing per ASTM G4541-87 and ASTM D4145-85. ASTM D4541-93 may be used for inspection testing during assembly of the vehicle.

ALTERNATIVE-----<u>APPROVED</u>
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Standard OEM exterior paint system.

The following brand of material has been APPROVED for color, color durability, and material durability.

1. UTA's Logos

3M White Scotchlite = #280-10

3M Ruby Red Scotchlite = #280-82

3M Blue Scotchlite = #280-75

2. The Authority's logo shall be located in the front, both sides, and rear of the bus. A copy of UTA's logo will be sent to the successful proposer.

3. Four exterior bus numbers, four-inch high, white or black reflective decals, are to be installed. Exact location TBD.

On the front of the bus

On the rear of the bus

On the street-side of the bus above the driver's window

On the curbside of bus above the front entrance door

Use 3M White Scotchlite #280-10,

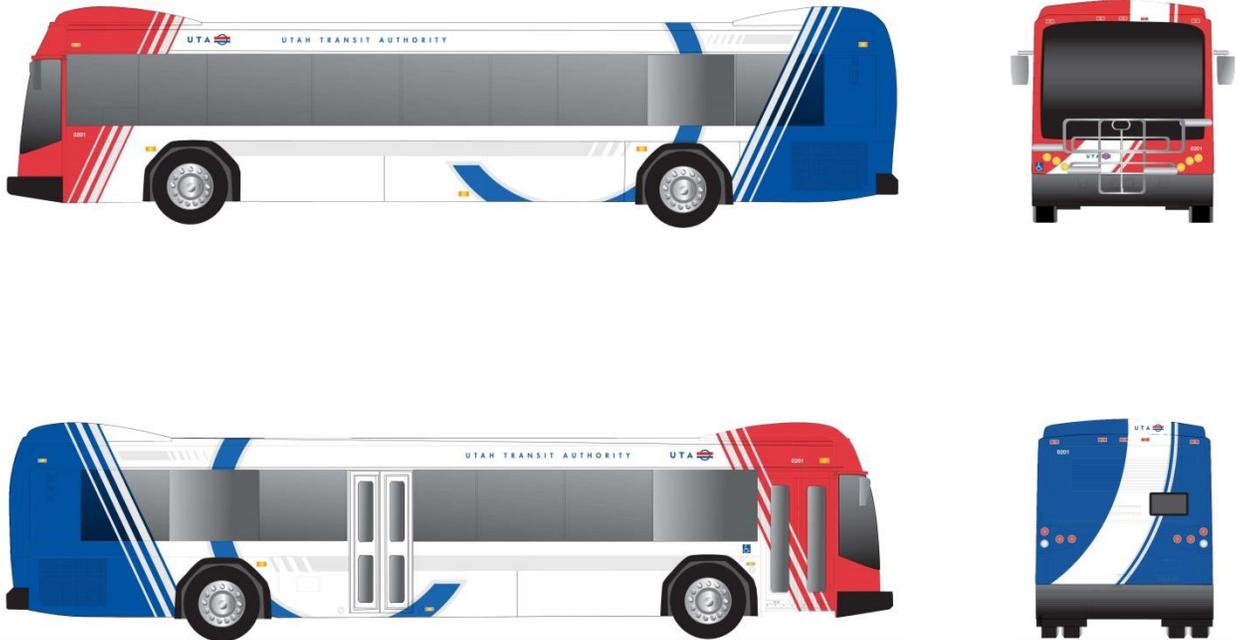
Use 3M Black Scotchlite #285-85.

4. Install one interior bus number – four (4) inches high – white or black, located on the center of the front destination sign door.

5. The style of both the interior and exterior numbers shall be Helvetica Medium.

The bus numbers shall be numbered consecutively from #XXXXX through #XXXXX ...TBD

The paint scheme shown below is for illustration only. Details will be provided to the successful vendor.



Dupont Imron 5000 Paint Colors: White Base 735085-EX

Blue 777407-EX

Red 777406-EX

Black N0001-EX

Color for axle hubs: Silver

TS 72. Decals, Numbering and Signing

Monograms, numbers and other special signing shall be applied to the inside and outside of the bus as required. Signs shall be durable and fade-, chip- and peel-resistant. They may be painted signs, decals or pressure-sensitive appliques. All decals shall be installed per the decal Supplier recommendations. Signs shall be provided in compliance with the ADA requirements defined in 49 CFR Part 38, Subpart B, 38.27.

Utah Transit requests the following interior decal package at a minimum: electrical terminal compartment decal indicating correct voltage for all terminals, 4" interior fleet numbers, "REMAIN SEATED AND DO NOT TALK TO DRIVER" header decal, "DON'T CROSS IN FRONT OF BUS" decal installed on back of the Card Holder box, "NO STANDING FORWARD OF STANDEE LINE" and "NO SMOKING, EATING, DRINKING, RADIO," decals installed on destination sign door and one installed on "Radio with Earphones" symbol on rear enclosure panel, "Front seats must be vacated for seniors and persons with disabilities – Thank You, Mobility aids have priority in this area; Emergency window exit-pull handle to unlatch-Push out to open; Watch your step, the priority seating decals to be in English and Spanish, and no seat reservation markers are required on the parcel racks. Emergency window placards need to be a

permanent type that cannot be peeled off like a vinyl decal. International symbols for some of these signs may be used. All written signs must have a Spanish translation either on the same sign or on a separate sign. Signs will be finalized in the pre-production engineering meeting. Signs must meet all ADA letter requirements.

Utah Transit requests the following exterior decal package at a minimum: “BATTERY DISCONNECT SWITCH INSIDE” decal installed on exterior of the battery door, “NO ACCESS” decal below the baggage door handles on the three roadside and two rear curbside doors, “FIRE EXTINGUISHER INSIDE” and “BIKE RACK INSIDE” decals on the #1 right hand baggage door below the lower rub rail, and a wheelchair lift decal shall be provided on the outside of the bus.

TS 72.1 Passenger Information

ADA priority seating signs as required and defined by 49 CFR shall be provided to identify the seats designated for passengers with disabilities.

Requirements for a public information system in accordance with 49 CFR shall be provided.

TS 73. Exterior Lighting

All exterior lights shall be designed to prevent entry and accumulation of moisture or dust. Lamps, lenses and fixtures shall be interchangeable to the extent practicable. Two hazard lamps at the rear of the bus shall be visible from behind when the engine service doors are opened. Light lenses shall be designed and located to prevent damage when running the vehicle through an automatic bus washer.

DEFAULT-----APPROVED

Commercially available LED-type lamps shall be utilized at all exterior lamp locations.

ALTERNATIVE-----APPROVED

Potted Lamps

LED lamps shall be potted type and designed to last the life of the bus.

DEFAULT-----APPROVED

Standard Size

Size of LED lamps used for tail, brake and turn signal lamps shall be standard installation of OEM.

ALTERNATIVE-----APPROVED

Front marker (clearance) lights along with lights located on the roof and sides of the bus shall have protective shields or be of the flush mount type to protect the lens against minor impacts.

ALTERNATIVE.....APPROVED

Grote, LED style, p/n 63611 Curb Lamp.

TS 73.1 Backup Light/Alarm

Visible and audible warnings shall inform following vehicles or pedestrians of reverse operation. Visible reverse operation warning shall conform to SAE Standard J593. Audible reverse operation warning shall conform to SAE Recommended Practice J994 Type C or D.

TS 73.2 Doorway Lighting

Lamps at the front and rear passenger doorways (if applicable) shall comply with ADA requirements and shall activate only when the doors open. These lamps shall illuminate the street surface to a level of no less than 1 foot-candle for a distance of 3 ft outward from the outboard edge of the door threshold. The lights may be positioned above or below the lower daylight opening of the windows and shall be shielded to protect passengers' eyes from glare.

TS 73.3 Turn Signals

ALTERNATIVE-----APPROVED

Wraparound Front Turn Signals

Front turn signals shall be of wraparound design or shall be designed to be visible from the front and the near side of the bus.

Curbside Corner Lamp

A Dialight PN 47121CB804 grommet mounted lamp (or submitted deviation) shall be low mounted forward of the curbside rear wheels facing rearward. Light to be activated with right turn signal in Night Run at or below 25 mph.

Rear Yield

A Triangle pattern LED yield lamp with amber colored light shall be provided on the streetside of the rear HVAC door. Programming for operation of this lamp shall be finalized at the preconstruction meeting.

TS 73.4 Headlights

Headlamps shall be designed for ease of replacement.

ALTERNATIVE-----APPROVED

Daytime Running Lights

Headlamps shall incorporate a daytime running light feature.

ALTERNATIVE-----APPROVED

LED

Headlamps shall be LED/halogen, sealed beam lights with extra LED lights pointed to the right and left. The extra lights are to be programmable through the bus multiplex system. Program the extra lights to be 100% bright when when turn signal is activated left or right and 30% bright all other times.

High and Low Beam Dinex Star LED Adaptive Headlights with Turning Alert have been APPROVED.

TS 73.5 Brake Lights

TS 73.5.1 Transit Coach (and commuter)

Brake lights shall be provided in accordance with federal regulations.

ALTERNATIVE-----APPROVED

High and Center Mount Red Brake Lamp

Bus shall include red, high and center mount brake lamp(s) along the backside of the bus in addition to the lower brake lamps required under FMVSS. The high and center mount brake lamp(s) shall illuminate steadily with brake application. Agency to specify the size of the high and center mount brake lamp(s).

ALTERNATIVE-----APPROVED

High and Center Mount Amber Lamp

Bus shall include amber high and center mount lamp(s) along the backside of the bus *that activate in conjunction with the standard turn signal ambers.* ~~illuminate steadily when the transmission is in forward mode and when the throttle is completely released (0 percent engagement). The amber lamps shall automatically extinguish, regardless of transmission and throttle condition, with brake application.~~ Operation of the amber lamps shall be programmable with the multiplex system. Agency to specify the size of the high and center mount, amber lamp(s).

TS 73.5.2 Commuter Coach

Brake lights shall be provided in accordance with federal regulations.

Bus shall include red, high and center mount brake lamp(s) along the backside of the bus in addition to the lower brake lamps required under FMVSS. The high and center mount brake lamp(s) shall illuminate steadily with brake application.

TS 73.6 Service Area Lighting (Interior and Exterior)

LED lamps shall be provided in the engine and all other compartments where service may be required to generally illuminate the area for night emergency repairs or adjustments. These service areas shall include, but not be limited to, the engine compartment, the communication box, junction/apparatus panels and passenger door operator compartments. Lighting shall be adequate to light the space of the service areas to levels needed to complete typical emergency repairs and adjustments. The service area lamps shall be suitable for the environment in which they are mounted.

Engine compartment lamps shall be controlled by a switch mounted near the rear start controls. All other service area lamps shall be controlled by switches mounted on or convenient to the lamp assemblies. Power to the service area lighting shall be programmable. Power shall latch on with activation of the switch and shall be automatically discontinued (timed out) after 30 minutes to prevent damage caused by inadvertently leaving the service area lighting switch in the “on” position after repairs are made.

INTERIOR PANELS AND FINISHES

TS 74. General Requirements

Materials shall be selected on the basis of maintenance, durability, appearance, safety, flammability and tactile qualities. Materials shall be strong enough to resist everyday abuse and be vandalism and corrosion resistant. Trim and attachment details shall be kept simple and unobtrusive. Interior trim shall be secured to avoid resonant vibrations under normal operational conditions.

Interior surfaces more than 10 in. below the lower edge of the side windows or windshield shall be shaped so that objects placed on them fall to the floor when the coach is parked on a level surface. Any components and other electrical components within close proximity to these surfaces shall also be resistant to this cleaning method.

ALTERNATIVE-----APPROVED

Requirements for additional anti-graffiti/vandalism treatments for interior surfaces.

TS 75. Interior Panels

Panels shall be easily replaceable and tamper resistant. They shall be reinforced, as necessary, to resist vandalism and other rigors of transit bus service. Individual trim panels and parts shall be interchangeable to the extent practicable.

ALTERNATIVE-----APPROVED

Textured stainless steel.

ALTERNATIVE-----APPROVED

Anodized or powder-coated aluminum.

ALTERNATIVE-----APPROVED

Scratch-resistant plastic.

ALTERNATIVE-----APPROVED

Melamine-type material.

TS 75.1 Driver Area Barrier

TS 75.1.1 Transit Coach

TS 75.1.2 Commuter Coach

A barrier or bulkhead between the driver and the street-side front passenger seat shall be provided. The barrier shall minimize glare and reflections in the windshield directly in front of the barrier from interior lighting during night operation. Location and shape must permit full seat travel and reclining possibilities that can accommodate the shoulders of a 95th-percentile male. The partition shall have a side return and stanchion to prevent passengers from reaching the driver by standing behind the driver's seat. The lower

area between the seat and panel must be accessible to the driver. The partition must be strong enough in conjunction with the entire partition assembly for mounting of such equipment as flare kits, fire extinguishers (1.2 kg), microcomputer, public address amplifier, etc. The panel should be properly attached to minimize noise and rattles.

The driver's barrier shall extend from the floor area to the ceiling and from the bus wall to the first stanchion immediately behind the driver to provide security to the driver and to limit passenger conversation.

Schedule Racks, Driver's Defect Booklet Holder, Registration Card Holder

Provide 3 Schedule Holders mounted to the rear but near the operator and accessible to customers. Dimensions: 3.88" wide x 5" high x 1.62" deep.

Provide 1 Driver's Defect Booklet Holder mounted behind the operator. Dimensions: 6" wide x 6.13" high x 2.16" deep.

Provide 1 Registration/Permit Holder mounted above the operator. Dimensions: 9" wide x 6" high x .090" deep with clear plastic cover.

TS 75.2 Modesty Panels

Sturdy divider panels constructed of durable, unpainted, corrosion-resistant material complementing the interior shall be provided to act as both a physical and visual barrier for seated passengers.

Design and installation of modesty panels located in front of forward-facing seats shall include a handhold or grab handle along its top edge. These dividers shall be mounted on the sidewall and shall project toward the aisle no farther than passenger knee projection in longitudinal seats or the aisle side of the transverse seats. Modesty panels shall extend from at least the window opening of the side windows, and those forward of transverse seats shall extend downward to 1 and 1½ in. above the floor. Panels forward of longitudinal seats shall extend to below the level of the seat cushion. Dividers positioned at the doorways, where applicable, shall provide no less than a 2½ in. clearance between the modesty panel and a fully open, inward opening door, or the path of a deploying flip-out ramp to protect passengers from being pinched. Modesty panels installed at doorways shall be equipped with grab rails if passenger assists are not provided by other means.

The modesty panel and its mounting shall withstand a static force of 250 lbs applied to a 4 × 4 in. area in the center of the panel without permanent visible deformation.

DEFAULT-----APPROVED

Modesty panels shall be installed as stated.

TS 75.3 Front End

The entire front end of the bus shall be sealed to prevent debris accumulation behind the dash and to prevent the driver's feet from kicking or fouling wiring and other equipment. The front end shall be free of protrusions that are hazardous to passengers standing at the front of the standee line area of the bus during rapid decelerations. Paneling across the front of the bus and any trim around the driver's compartment shall be formed metal or composite material. Composite dash panels shall be reinforced as

necessary, vandal-resistant and replaceable. All colored, painted and plated parts forward of the driver's barrier shall be finished with a surface that reduces glare. Any mounted equipment must have provision to support the weight of equipment.

TS 75.4 Rear Bulkhead

The rear bulkhead and rear interior surfaces shall be material suitable for exterior skin; painted and finished to exterior quality; or paneled with melamine-type material, composite, scratch-resistant plastic or carpeting and trimmed with stainless steel, aluminum or composite.

The rear bulkhead paneling shall be contoured to fit the ceiling, side walls and seat backs so that any litter or trash will tend to fall to the floor or seating surface when the bus is on a level surface. Any air vents in this area shall be louvered to reduce airflow noise and to reduce the probability of trash or liter being thrown or drawn through the grille. If it is necessary to remove the panel to service components located on the rear bulkhead, then the panel shall be hinged or shall be able to be easily removed and replaced. Grilles where access to or adjustment of equipment is required shall be heavy duty and designed to minimize damage and limit unauthorized access.

TS 75.5 Headlining

Ceiling panels shall be made of durable, corrosion resistant, easily cleanable material. Headlining shall be supported to prevent buckling, drumming or flexing and shall be secured without loose edges. Headlining materials shall be treated or insulated to prevent marks due to condensation where panels are in contact with metal members. Moldings and trim strips, as required to make the edges tamperproof, shall be stainless steel, aluminum or plastic, colored to complement the ceiling material. Headlining panels covering operational equipment that is mounted above the ceiling shall be on hinges for ease of service but retained to prevent inadvertent opening.

TS 75.6 Fastening

Interior panels shall be attached so that there are no exposed unfinished or rough edges or rough surfaces. Fasteners should be corrosion resistant. Panels and fasteners shall not be easily removable by passengers. Exposed interior fasteners should be minimized, and where required shall be tamper resistant.

TS 75.7 Insulation

Any insulation material used between the inner and outer panels shall minimize the entry and/or retention of moisture. Insulation properties shall be unimpaired during the service life of the bus. Any insulation material used inside the engine compartment shall not absorb or retain oils or water and shall be designed to prevent casual damage that may occur during maintenance operations.

The combination of inner and outer panels on the sides, roof, wheel wells and ends of the bus, and any material used between these panels, shall provide a thermal insulation sufficient to meet the interior temperature requirements. The bus body shall be thoroughly sealed so that the driver or passengers cannot feel drafts during normal operations with the passenger doors closed.

ALTERNATIVE-----APPROVED

FMVSS 302

Insulation shall meet the requirements of FMVSS 302.

TS 75.8 Floor Covering

The floor covering shall have a non-skid walking surface that remains effective in all weather conditions. The floor covering, as well as transitions of flooring material to the main floor and to the entrance and exit area, shall be smooth and present no tripping hazards. Seams shall be sealed/welded per manufacturer's specifications. The standee line shall be approximately 2 in. wide and shall extend across the bus aisle. The color and pattern shall be consistent throughout the floor covering.

Any areas on the floor that are not intended for standees, such as areas "swept" during passenger door operation, shall be clearly and permanently marked.

The floor shall be easily cleaned and shall be arranged to minimize debris accumulation.

A one-piece center strip shall extend from the vertical wall of the rear settee between the aisle sides of transverse seats to the standee line. If the floor is of a bi-level construction, then the center strip shall be one piece at each level. The covering between the center strip and the wheel housings may be separate pieces. At the rear door, however, a separate strip as wide as the door shall extend from the center strip to the outboard edge of the rear/exit area.

The floor under the seats shall be covered with smooth surface flooring material. The floor covering shall closely fit the sidewall in a fully sealed butt joint or extend to the top of the cove.

TS 75.9 Interior Lighting

The light source shall be located to minimize windshield glare, with distribution of the light focused primarily on the passengers' reading plane while casting sufficient light onto the advertising display. The lighting system may be designed to form part of or the entire air distribution duct.

The lens material shall be translucent polycarbonate. Lenses shall be designed to effectively "mask" the light source. Lenses shall be sealed to inhibit incursion of dust and insects yet be easily removable for service. Access panels shall be provided to allow servicing of components located behind light panels. If necessary, the entire light fixture shall be hinged.

TS 75.10 Passenger

DEFAULT

First Row Lights

The first light on each side (behind the driver and the front door) is normally turned on only when the front door is opened, in "night run" and "night park." As soon as the door closes, these lights shall go out. These lights shall be turned on at any time if the switch is in the "on" position.

ALTERNATIVE

Dimming Second Row Lights

To help eliminate windshield reflection on suburban roads where street lighting is at a low level, the second light on each side, when "night run" or "night park" is selected, shall be controlled by the switch; off in "off" and on in "normal." These lights shall be turned on at any time if the switch is in the "on" position.

All interior lighting shall be turned off whenever the transmission selector is in reverse and the engine run switch is in the "on" position.

The interior lighting design shall require the approval of the Agency.

DEFAULT-----APPROVED

LED lights. Provide Dimmable LEDs, final lighting control strategy and color/temperature TBD by the agency.

ALTERNATIVE

Fluorescent Lights

Fluorescent tubes shall be a maximum 6ft in length, single-pin, T-12 type (with exceptions granted for extinguishing or dimming fixtures, as noted below).

Individual ballast units shall be provided for each light fixture. Ballast shall have a fire-resistant housing, minimum operating frequency of above audible range, reverse polarity protection and integrated circuit breaker/automatic thermal protection.

ALTERNATIVE

Enhanced design ballast that minimize arcing and carries a type and CC UL935 certification.

DEFAULT-----APPROVED

First Light Modules Dim/Extinguish When Front Door is Closed

When the master switch is in the “run” or “night/run” mode, the first light module on each side of the coach shall automatically extinguish or dim when the front door is in the closed position and illuminate when the door is opened. Dimming strategy for “night/run” modes to be appropriate for a commuter bus. Final strategy to be approved by the agency.

ALTERNATIVE

No Dimming/Extinguishing of First Light Modules When Front Door is Closed

No dimming/extinguishing feature of first light modules shall be provided.

TS 75.11 Driver’s Area

The driver’s area shall have a light to provide general illumination, and it shall illuminate the half of the steering wheel nearest the driver to a level of 5 to 10 foot-candles.

TS 75.12 Seating Areas (Transit Coach)

TS 75.13 Seating Areas (Commuter Coach)

A minimum 10-module parcel rack without dividers and compartment doors shall be furnished over all two-passenger seating positions except in the wheelchair door area. Retention cords shall run the length of the rack housing. The parcel rack edge, running along the full length of the aisle, shall incorporate a handhold for use by standees. Passenger headroom, measured from the rack end to the top of the seat headrest, shall be a minimum 17 in. (432 mm). Interior window post caps shall be ABS, thermo formed plastic, off-white in color to provide a clean finished appearance. The interior of the rack shall be vinyl covered aluminum to complement the interior. Parcel racks shall be supported by polycarbonate glass filled hangers spaced approximately 40 in. (1016 mm) apart. Total capacity shall be a minimum 109 ft³(3 m³) to allow for ample storage space for carry-on items.

Passenger service modules mounted on the underside of the parcel rack shall include individually controlled and adjustable LED passenger reading lights; an exit signal push button, red in color; and individual air distribution outlets. These outlets shall be adjustable from fully closed to fully open position. A minimum of 26 speakers shall also be provided in the cluster panels for the driver-controlled public address system. Speakers shall broadcast, in a clear tone, announcements that are clearly perceived from all seat positions at approximately the same volume level. Passengers utilizing the securement systems shall be provided identical amenities as provided for all other passengers, except that the parcel rack shall be deleted in the area of the wheelchair lift door. Separate and independent notification will be provided on the dashboard indicator panel for stop request notification from securement positions.

ALTERNATIVE-----APPROVED

Parcel rack air conditioning will be provided.

~~TS 75.14 Vestibules/Doors (Transit Coach)~~

TS 75.15 Vestibules/Doors (Commuter Coach)

Floor surface in the aisles shall be a minimum of 2 foot-candles, and the vestibule area in accordance with ADA requirements.

TS 75.16 Step Lighting

Step lighting for the intermediate steps between lower and upper floor levels shall be a minimum of 4 foot-candles and shall illuminate in all engine run positions. The step lighting shall be low profile to minimize tripping and snagging hazards for passengers and shall be shielded as necessary to protect passengers' eyes from glare.

TS 75.17 Ramp Lighting (Transit Coach)

Exterior and interior ramp lighting shall comply with federal regulations.

~~TS 75.18 Turntable Lighting (Articulated Coach)~~

TS 75.19 Farebox Lighting

~~TS 75.19.1 Transit Coach~~

TS 75.19.2 Commuter Coach

ALTERNATIVE (CC) -----APPROVED

Farebox Light

A light fixture shall be mounted in the ceiling above the farebox location. The fixture shall be capable of projecting a concentrated beam of light on the farebox. This light will automatically come on whenever the front doors are opened, and the run switch is in the "night run" or "night park" position.

TS 76. Fare Collection

Space and structural provisions shall be made for installation of currently available fare collection devices, which shall be as far forward as practicable. Location of the fare collection device shall not restrict traffic in the vestibule, including wheelchairs if a front door loading device is used, and shall allow the driver to easily reach the farebox controls and to view the fare register. The farebox shall not restrict access to the driver area, shall not restrict operation of driver controls and shall not—either by

itself or in combination with stanchions, transfer mounting, cutting and punching equipment, or route destination signs—restrict the driver’s field of view per SAE Recommended Practice J1050. The location and mounting of the fare collection device shall allow use, without restriction, by passengers. The farebox location shall permit accessibility to the vault for easy manual removal or attachment of suction devices. Meters and counters on the farebox shall be readable on a daily basis. The floor under the farebox shall be reinforced as necessary to provide a sturdy mounting platform and to prevent shaking of the farebox.

Contractor shall provide fare collection installation layout to the Agency for approval.

Transfer mounting, cutting and punching equipment shall be located in a position convenient to the driver.

DEFAULT

Agency will install its own farebox.

ALTERNATIVE-----APPROVED

Agency will specify a farebox for Contractor to install. A 41” high, GFI Transview 100 farebox with 12” cashbox is APPROVED.

CLARIFICATION: The bus should be shipped with provisions for a “smart farebox” as they are moving away from the Transview 100. No farebox needs to be supplied with the bus.

TS 77. Interior Access Panels and Doors (Transit Coach) or commuter

Access for maintenance and replacement of equipment shall be provided by panels and doors that appear to be an integral part of the interior. Access doors shall be hinged with gas props or over-center springs, where practical, to hold the doors out of the mechanic’s way. Panels shall prevent entry of mechanism lubricant into the bus interior. All fasteners that retain access panels shall be captive in the cover.

DEFAULT

Access Doors that Do Not Require Tools or Keys to Open

Access doors shall be secured with hand screws or latches. All fasteners that retain access panels shall be captive in the cover.

ALTERNATIVE-----APPROVED

Access Doors with Locks

Access doors shall be secured with locks. ~~The locks shall be standardized so that only one tool is required to open access doors on the bus.~~ Final location and types TBD by the Agency

TS 77.1 Floor Panels

Access openings in the floor shall be sealed to prevent entry of fumes and water into the bus interior. Flooring material at or around access openings shall be flush with the floor and shall be edge-bound with stainless steel or another material that is acceptable to the Agency to prevent the edges from coming loose. Access openings shall be asymmetrical so that reinstalled flooring shall be properly aligned. Fasteners shall tighten flush with the floor.

The number of special fastener tools required for panel and access door fasteners shall be minimized.

PASSENGER ACCOMMODATIONS

TS 78. Passenger Seating

~~TS 78.1 Arrangements and Seat Style (Transit Coach)~~

The passenger seating arrangement in the bus shall be such that seating capacity is maximized and in compliance to the following requirements.

~~TS 78.2 Rearward Facing Seats (Transit Coach)~~

~~TS 78.3 Turntable Seating (Articulated Coach)~~

~~TS 78.4 Padded Inserts/Cushioned Seats (Transit Coach)~~

TS 78.5 Seat back fitness

ALTERNATIVE-----APPROVED

Cushioned Seat Configuration

Seating and interior trim shall have features to maximize passenger comfort. The seat cushion shall be supported by springs. The seat cushion and back shall be padded with a cellular foam product and be no less than 2 in. thick in areas contacted and loaded by passengers in the normal seated position and shall be upholstered with vinyl and/or fabric materials.

Seats, back cushions and other pads shall be securely attached and shall be detachable by means of a simple release mechanism so that they are easily removable by maintenance personnel but not by passengers. To the extent practicable, seat cushions and pads shall be interchangeable throughout the bus. Materials shall have high resistance to tearing, flexing and wetting.

~~TS 78.6 Drain Hole in Seats~~

TS 78.7 Arrangements and Seat Style (Commuter Coach)

DEFAULT -----APPROVED

Forward-Facing Seat Configuration

Passenger seats shall be arranged in forward-facing configuration with a minimum of 55 reclining and cushioned passenger seats. Contractor to provide seat layout to the Agency once the Agency has provided the seat manufacturer and model number. *American Seating model 2096 reclining seats are APPROVED*

TS 78.8 Hip-to-Knee Room

Hip-to-knee room measured from the center of the seating position, from the front of one seat back horizontally across the highest part of the seat to a vertical surface immediately in front, shall be a minimum of 26 in. At all seating positions in paired transverse seats immediately behind other seating positions, hip-to-knee room shall be no less than 27 in.

TS 78.9 Foot Room

Foot room, measured at the floor forward from a point vertically below the front of the seat cushion, shall be no less than 14 in. Seats immediately behind the wheel housings and modesty panels may have foot room reduced.

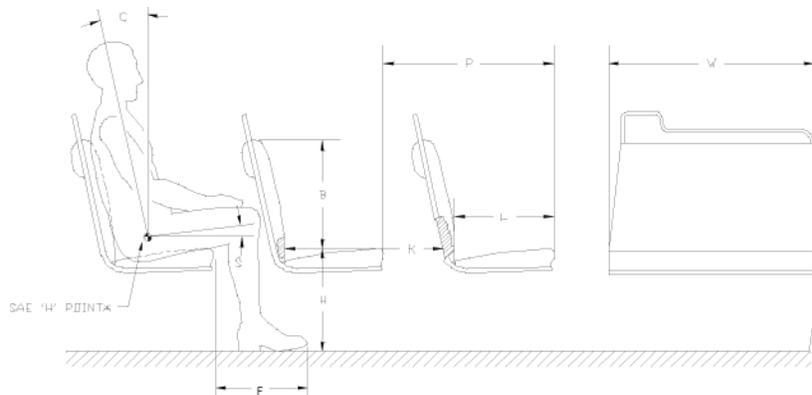
TS 78.10 Aisles (Transit Coach)

TS 78.11 Aisles (Commuter Coach)

The aisle between the seats shall be no less than 14 in. wide at seated passenger hip height.

TS 78.12 Dimensions (Transit Coach)

FIGURE 6
Seating Dimensions and Standard Configuration



DEFAULT

Seat dimensions for the various seating arrangements shall have the dimensions as follows (refer to **Figure 6**):

- The width, W, of the two-passenger transverse seat shall be a minimum 35 in.
- The length, L, shall be 17 in., ± 1 in.
- The seat back height, B, shall be a minimum of 15 in.
- The seat height, H, shall be 17 in., ± 1 in. For the rear lounge (or settee) and longitudinal seats, and seats located above raised areas for storage of under-floor components, a cushion height of up to 18 in., ± 2 in., will be allowed. This shall also be allowed for limited transverse seats, but only with the expressed approval of the Agency.
- Foot room = F.
- The seat cushion slope, S, shall be between 5 and 11 deg.
- The seat back slope, C, shall be between 8 and 17 deg.
- Hip to knee room = K.
- The pitch, P, is shown as reference only.

~~ALTERNATIVE~~-----**APPROVED**

Agency to specify seat dimensions. Seat width shall be nominal 40.5 inches. Aisle shall not be less than 14 inches wide.

~~TS 78.13 Structure and Design (Transit Coach)~~

TS 78.14 Structure and Design (Commuter Coach)

Passenger seats shall be arranged in a transverse, forward-facing configuration.

No more than 10 seated positions shall be lost on any bus configuration to accommodate two wheelchair passengers occupying the securement positions.

Each transverse, forward-facing seat, except the rear seats, shall accommodate two adult passengers. Floor seat tracks shall be stainless steel and shall be welded to the coach frame and be nearly flush with the finished floor. The wall tracks shall be stainless steel or aluminum and shall be bolted or riveted to the sidewall.

Seats shall be commuter coach reclining seats. Seat frames shall be constructed of high-strength, fatigue-resistant, welded steel with a durable powder-coated, corrosion-resistant colored finish that complements the coach interior. The seat frame shall be wall mounted with heavy gauge steel brackets and shall be attached to the coach floor with a heavy-duty stainless-steel T pedestal. The seat back shall recline a minimum of 1 inch to a maximum of 5 inches (127 mm) maximum with an infinite number of stops. The reclining seat backs shall be provided with a dress-up feature to facilitate coach cleaning. Seat width shall be a minimum of 36 inches and a maximum of 40.50 in. (1029 mm). Aisle shall not be less than 14 in. (356 mm) wide.

~~TS 78.15 Construction and Materials (Transit Coach)~~

TS 78.16 Construction and Materials (Commuter Coach)

Seat cushions shall be supported by steel serpentine springs. Seat covering shall be high-quality wool fabric or vinyl. Wool fabric shall be tested to a minimum of 60,000 rubs per the Wyzendeek test method.

Seat foam padding shall be polyurethane. Seat upholstery shall be able to be removed with ease to aid for cleaning/replacement purposes.

DEFAULT-----APPROVED

Agency to select seat fabric. Seat fabric to be Camira Aura CAF322

ALTERNATIVE

Contractor will select seat fabric on the basis of durability, ease of maintenance and pleasing texture and appearance.

~~TS 79. Passenger Assists (Transit Coach)~~

~~Passenger assists in the form of full grip, vertical stanchions or handholds shall be provided for the safety of standees and for ingress/egress. Passenger assists shall be convenient in location, shape and size for both the 95th percentile male and the 5th percentile female standee. Starting from the entrance door and moving anywhere in the bus and out the exit door, a vertical assist shall be provided either as the vertical portion of the seat back assist or as a separate item so that a 5th percentile female passenger may easily move from one assist to another using one hand and the other without losing support. All handholds and stanchions at the front doorway, around the farebox, and at interior steps for bi-level designs shall be powder-coated in a high-contrast yellow color.~~

ALTERNATIVE

The forward most vertical stanchions on either side of the aisle immediately behind the driver's area shall be powder coated black.

ALTERNATIVE

The forward most vertical stanchions on either side of the aisle immediately behind the driver's area shall be powder coated yellow.

ALTERNATIVE

The forward most vertical stanchions on either side of the aisle immediately behind the driver's area shall be a stainless steel finish.

TS 79.1 Assists (Transit Coach)

Excluding those mounted on the seats and doors, the assists shall have a cross-sectional diameter between 1/4 and 1/2 in. or shall provide an equivalent gripping surface with no corner radii less than 1/4 in. All passenger assists shall permit a full hand grip with no less than 1 1/2 in. of knuckle clearance around the assist. Passenger assists shall be designed to minimize catching or snagging of clothes or personal items and shall be capable of passing the NHTSA Drawstring Test.

Any joints in the assist structure shall be underneath supporting brackets and securely clamped to prevent passengers from moving or twisting the assists. Seat handholds may be of the same construction and finish as the seat frame. Door mounted passenger assists shall be of anodized aluminum, stainless steel or powder coated metal. Connecting tees and angles may be powder coated metal castings. Assists shall withstand a force of 300 lbs applied over a 12in. lineal dimension in any direction normal to the assist without permanent visible deformation. All passenger assist components, including brackets, clamps, screw heads and other fasteners used on the passenger assists shall be designed to eliminate pinching, snagging and cutting hazards and shall be free from burrs or rough edges.

TS 79.2 Front Doorway

Front doors, or the entry area, shall be fitted with ADA-compliant assists. Assists shall be as far outward as practicable but shall be located no farther inboard than 6 in. from the outside edge of the entrance step and shall be easily grasped by a 5th-percentile female boarding from street level. Door assists shall be functionally continuous with the horizontal front passenger assist and the vertical assist and the assists on the wheel housing or on the front modesty panel.

TS 79.3 Vestibule (Transit Coach)

The aisle side of the driver's barrier, the wheel housings and when applicable the modesty panels shall be fitted with vertical passenger assists that are functionally continuous with the overhead assist and that extend to within 36 in. of the floor. These assists shall have sufficient clearance from the barrier to prevent inadvertent wedging of a passenger's arm.

A horizontal passenger assist shall be located across the front of the bus and shall prevent passengers from sustaining injuries on the fare collection device or windshield in the event of a sudden deceleration. Without restricting the vestibule space, the assist shall provide support for a boarding passenger from the front door through the fare collection procedure. The assist shall be no less than 36 in. above the floor. The assists at the front of the bus shall be arranged to permit a 5th-percentile female passenger to easily

reach from the door assist, to the front assist, to vertical assists on the driver's barrier, wheel housings or front modesty panel.

TS 79.4 Rear Doorway(s) (Transit Coach) (Low Floor Commuter option only)

Vertical assists that are functionally continuous with the overhead assist shall be provided at the aisle side of the transverse seat immediately forward of the rear door and on the aisle side of the rear door modesty panel(s). Passenger assists shall be provided on modesty panels that are functionally continuous with the rear door assists. Rear doors, or the exit area, shall be fitted with assists having a cross-sectional diameter between 1¼ and 1½ in. or providing an equivalent gripping surface with no corner radii less than ¼ in., and shall provide at least 1½ in. of knuckle clearance between the assists and their mounting. The assists shall be designed to permit a 5th-percentile female to easily move from one assist to another during the entire exiting process. The assists shall be located no farther inboard than 6 in. from the outside edge of the rear doorway step.

NOTE: For an articulated bus, passenger assists will be provided to aid in the transition between the front and rear sections of the bus.

TS 79.5 Overhead (Transit Coach)

~~Except forward of the standee line and at the rear door, a continuous, full-grip, overhead assist shall be provided. This assist shall be located over the center of the aisle seating position of the transverse seats. The assist shall be no less than 70 in. above the floor.~~

DEFAULT

~~No requirements for overhead grab straps/extensions.~~

ALTERNATIVE

~~Grab straps or other extensions as necessary shall be provided for sections where vertical assists are not available and for use by passengers that cannot reach to 70 in.~~

DEFAULT

~~Grip straps shall be stainless steel.~~

ALTERNATIVE

~~Grip straps shall be fabric.~~

ALTERNATIVE

~~Grip straps shall be flip-up/non-flip.~~

ALTERNATIVE

~~Grip straps shall be leather.~~

ALTERNATIVE

~~Grip straps shall be plastic.~~

Overhead assists shall simultaneously support 150 lbs on any 12in. length. No more than 5 percent of the full grip feature shall be lost due to assist supports.

TS 79.6 Longitudinal Seat Assists (Transit Coach)

Longitudinal seats shall have vertical assists located between every other designated seating position, except for seats that fold/flip up to accommodate wheelchair securement. Assists shall extend from near the leading edge of the seat and shall be functionally continuous with the overhead assist. Assists shall be staggered across the aisle from each other where practicable and shall be no more than 52 in. apart or functionally continuous for a 5th percentile female passenger.

TS 79.7 Wheel Housing Barriers/Assists (Transit Coach)

Unless passenger seating is provided on top of wheel housings, passenger assists shall be mounted around the exposed sides of the wheel housings (and propulsion compartments if applicable), which shall also be designed to prevent passengers from sitting on wheel housings. Such passenger assists shall also effectively retain items, such as bags and luggage, placed on top of wheel housings.

TS 80. Passenger Doors

TS 80.1 Transit Coach

Doorways will be provided in the locations and styles as follows. Passenger doors and doorways shall comply with ADA requirements.

TS 80.1.1 Front door

DEFAULT

Door shall be forward of the front wheels and under direct observation of the driver.

TS 80.1.2 Rear Door(s)

ALTERNATIVE

Curbside doorway centerline located rearward of the point midway between the front door centerline and the rearmost seat back.

ALTERNATIVE

Curbside doorway located behind the rear axle.

ALTERNATIVE

Street side rearward of the point midway between the front door centerline and the rearmost seat back.

ALTERNATIVE

Street side located behind the rear axle.

Articulated buses

ALTERNATIVE

Curbside located forward of the rear axle of the trailer section.

ALTERNATIVE

Street side located forward of the rear axle of the trailer section.

ALTERNATIVE

Curbside, located forward of the center axle.

In cases where street side and curbside doors are chosen, provisions shall be made for operating the front door, curbside rear door(s) and street side rear door(s) independently or in the combinations shown in **Table 7** while providing positive tactile feedback to the operator identifying the door control selection.

TABLE 7
 Door Operating Combinations

Front	Curbside Rear	Street-Side Rear
Closed	Closed	Closed
Open	Closed	Closed
Open	Open	Closed
Open	Closed	Open
Open	Open	Open
Closed	Open	Closed
Closed	Closed	Open
Closed	Open	Open

DEFAULT

If air powered, the door system shall operate per specification at air pressures between 90 and 130 psi.

ALTERNATIVE

Electric powered doors.

TS 80.2 Commuter Coach

TS 80.2.1 Front door

DEFAULT-----APPROVED

Forward of the front wheels and under direct observation of the driver. *Provide a Vapor electric-powered door(s) (or submitted deviation)*

Masats entrance door, standard design bi-part style, electrically controlled and operated is APPROVED.

CLARIFICATION: Masat entrance door glazing is replaceable but it is bonded with adhesive is APPROVED.

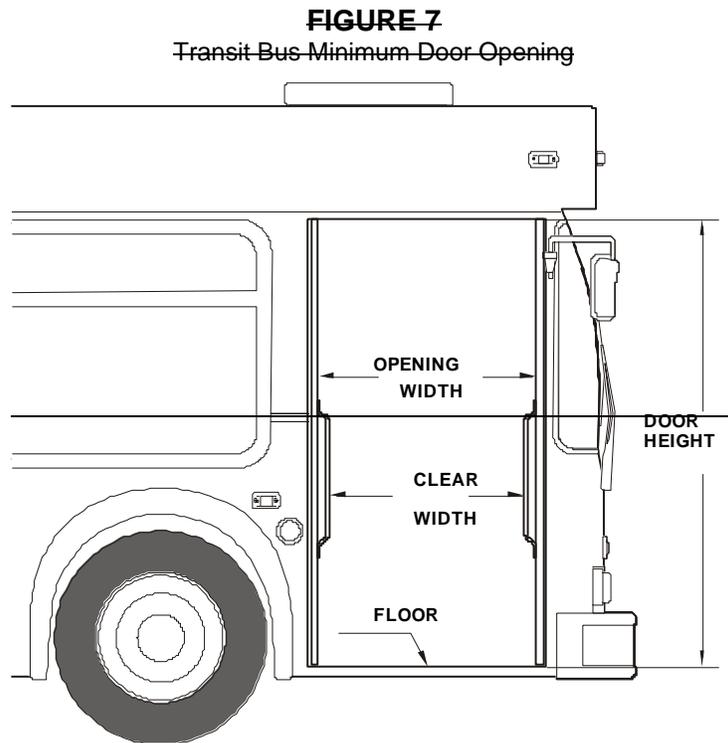
TS 80.3 Materials and Construction

Structure of the doors, their attachments, inside and outside trim panels and any mechanism exposed to the elements shall be corrosion resistant. Door panel construction shall be of corrosion-resistant metal or reinforced non-metallic composite materials. When fully opened, the doors shall provide a firm support and shall not be damaged if used as an assist by passengers during ingress or egress. Door edges shall be sealed to prevent infiltration of exterior moisture, noise, dirt and air elements from entering the passenger compartment, to the maximum extent possible based on door types.

The closing edge of each door panel shall have no less than 2 in. of soft weather stripping. The doors, when closed, shall be effectively sealed, and the hard surfaces of the doors shall be at least 4 in. apart (not applicable to single doors). The combined weather seal and window glazing elements of the front door shall not exceed 10 deg of binocular obstruction of the driver's view through the closed door.

TS 80.4 Dimensions

TS 80.4.1 Transit Coach



~~When open, the doors shall leave an opening no less than 75 in. in height.~~

DEFAULT

31¾ in. Minimum Doorway Clear Width

~~Front door clear width shall be a minimum of 31¾ in. with the doors fully opened. Rear door opening clear width shall be a minimum of 24 in. with the doors fully opened. If a rear door ramp or lift is provided, then the clear door opening width shall be a minimum of 31¾ in. with door fully opened.~~

ALTERNATIVE

~~Doorway Clear Width Greater than 31¾ in.~~

~~The front door clear width shall be a minimum of [insert number] in. with the doors fully opened. The rear door clear width shall be a minimum of [insert number] in. with the doors fully opened.~~

~~If the Agency requires a minimum rear door clear width of 31¾ in. or greater and an outward opening (swing) door is specified, then the maximum outboard excursion of 13 in. may be exceeded.~~

TS 80.4.2 Commuter Coach

Minimum doorway width per ADA requirements.

TS 80.5 Door Glazing

The upper section of both front and rear doors shall be glazed for no less than 45 percent of the respective door opening area of each section. The lower section of the front door shall be glazed for no less than 25 percent of the door opening area of the section.

Door glazing shall be easily replaceable.

DEFAULT-----APPROVED

Zip type glazing rubber.

ALTERNATIVE

Quick change glazing exterior frame.

ALTERNATIVE

Full exterior glass quick change glazing hidden frame (tempered glass only).

ALTERNATIVE

Bonded or adhesive.

DEFAULT-----APPROVED

The front door panel glazing material shall have a nominal ¼ in. thick laminated safety glass conforming with the requirements of ANSI Z26.1 Test Grouping 2 and the recommended practices defined in SAE J673.

ALTERNATIVE

The front door panel glazing material shall have a nominal ¼ in. thick tempered glass conforming with the requirements of ANSI Z26.1 Test Grouping 2 and the recommended practices defined in SAE J673.

Glazing material in the rear doorway door panels shall be defined by the Agency.

TS 80.6 Door Projection (Transit Coach)

TS 80.6.1 Exterior

~~The exterior projection of the front doors beyond the side of the bus shall be minimized and shall not block the line of sight of the rear exit door via the curb side mirror when the doors are fully open. The exterior projection of both doors shall be minimized and shall not exceed 14 in. during the opening or closing cycles or when doors are fully opened.~~

TS 80.6.2 Interior

~~Projection inside the bus shall not cause an obstruction of the rear door mirror or cause a hazard for standees.~~

TS 80.7 Door Height Above Pavement

It shall be possible to open and close either passenger door when the bus loaded to gross vehicle weight rating is not knelt and parked with the tires touching an 8in. high curb on a street sloping toward the curb so that the street-side wheels are 5 in. higher than the right-side wheels.

TS 80.8 Closing Force

Closing door edge speed shall not exceed 12 in. per second, and opening door speed shall not exceed 19 in. per second. Power doors shall not slam closed under any circumstance, even if the door is obstructed during the closing cycle. If a door is obstructed during the closing cycle, the pressure exerted on the obstruction shall not increase once initial contact has been made.

Doors closed by a return spring or counterweight-type device shall be equipped with an obstruction-sensing device that, at a minimum, alerts the driver if an obstruction is detected between the closing doors. Doors closed by a return spring or counterweight type device, when unlocked, shall be capable of being pushed to the point where the door starts to open with a force not to exceed 25 lbs applied to the center edge of the forward door panel.

Whether or not the obstruction-sensing system is present or functional, it shall be possible to withdraw a 1½ in. diameter cylinder from between the center edges of a closed and locked door with an outward force not greater than 35 lbs.

TS 80.8.1 Rear Door Closing Force (Transit Coach)

~~Power close rear doors shall be equipped with an obstruction sensing system such that if an obstruction is within the path of the closing doors, the doors will stop and/or reverse direction prior to imparting a 10-lb force on 1 sq in. of that obstruction. If a contactless obstruction sensing system is employed, it shall be capable of discriminating between the normal doorway environment and passengers or other obstructions within the doorway, and of altering the zones of detection based upon the operating state of the door system.~~

TS 80.9 Actuators

Doors shall open or close completely in not more than 3.5 seconds from the time of control actuation and shall be subject to the closing force requirements.

Door actuators shall be adjustable so that the door opening and closing speeds can be independently adjustable to satisfy the above requirements. Actuators and the complex door mechanism shall be concealed from passengers but shall be easily accessible for servicing. The door actuators shall be

rebuildable. If powered by compressed air, exhaust from the door system shall be routed below the floor of the bus to prevent accumulation of any oil that may be present in the air system and to muffle sound.

Door actuators and associated linkages shall maximize door holding forces in the fully open and fully closed positions to provide firm, non-rattling, non-fluttering door panels while minimizing the force exerted by the doors on an obstruction midway between the fully open and closed positions.

DEFAULT-----APPROVED

The rear door actuator(s) shall be under the complete control of the vehicle operator and shall open and close in response to the position of the driver's door control.

ALTERNATIVE

The rear doors shall be passenger-controlled. The vehicle operator shall unlock and enable the opening mechanism, which shall be annunciated by illumination of a green light near the door. After enabling and unlocking, the doors shall be opened by either the passenger manually pushing the door open, or by a powered mechanism actuated by passenger activation of a touch bar or touch switch, or by passenger activation of a contactless sensing system. A switch located within reach of the seated operator shall, when actuated, restore rear door function to complete operator control, as described in the Default.

Doors that employ a "swing" or pantograph geometry and/or are closed by a return spring or counterweight-type device shall be equipped with a positive mechanical holding device that automatically engages and prevents the actuation mechanism from being back-driven from the fully closed position. The holding device shall be overcome only when the driver's door control is moved to an "Exit Door Enable" position and the vehicle is moving at a speed of less than 2 mph, or in the event of actuation of the emergency door release.

Locked doors shall require a force of more than 300 lbs to open manually. When the locked doors are manually forced to open, damage shall be limited to the bending of minor door linkage with no resulting damage to the doors, actuators or complex mechanism.

TS 80.9.1 Actuator (Commuter Coach)

The nominal door opening and closing speed shall be in the 3–5 second range. The maximum door opening and closing speeds will be regulated using fixed, maintenance free orifices and airline sizes. If required, door speeds can be decreased with the addition of a flow-restricting device. Actuators and the complete door mechanism shall be concealed from passengers but shall be easily accessible for servicing.

~~TS 80.9.2 Rear Door Interlocks (Transit Coach)~~

~~See "Hardware Mounting" for door system interlock requirements.~~

TS 80.10 Emergency Operation

In the event of an emergency, it shall be possible to manually open doors designated as emergency exits from inside the bus using a force of no more than 25 lbs after actuating an unlocking device. The unlocking device shall be clearly marked as an emergency-only device and shall require two distinct actions to actuate. The respective door emergency unlocking device shall be accessible from the doorway area. The unlocking device shall be easily reset by the operator without special tools or opening the door mechanism enclosure. Doors that are required to be classified as "emergency exits" shall meet the requirements of FMVSS 217.

TS 80.11 Door Control

The door control shall be located in the operator's area within the hand reach envelope described in SAE Recommended Practice J287, "Driver Hand Control Reach." The driver's door control shall provide tactile feedback to indicate commanded door position and resist inadvertent door actuation.

DEFAULT-----APPROVED

Door control located on street side.

ALTERNATIVE

Location as specified by Agency.

DEFAULT-----APPROVED

The front door shall remain in commanded state position even if power is removed or lost.

ALTERNATIVE

As specified by Agency.

TS 80.12 Door Controller

TS 80.12.1 Transit Coach (or Low Floor Commuter)

DEFAULT-----APPROVED for low floor commuter variant only

Five-Position Driver's Door Controller

The control device shall be protected from moisture. Mounting and location of the door control device handle shall be designed so that it is within comfortable, easy arm's reach of the seated driver. The door control device handle shall be free from interference by other equipment and have adequate clearance so as not to create a pinching hazard. Provide Vapor electronic handle or approved equal for low floor variant.

Position of the door control handle shall result in the following operation of the front and rear doors:

- **Center position:** Front door closed, rear door(s) closed or set to lock.
- **First position forward:** Front door open, rear door(s) closed or set to lock.
- **Second position forward:** Front door open, rear door(s) open or set to open.
- **First position back:** Front door closed, rear door(s) open or set to open.
- **Second position back:** Front door open, rear door(s) open or set to open.

ALTERNATIVE.....APPROVED

Rocker switch for the high floor variant only. Switches are labeled and located within driver's reach on lh console panel.

ALTERNATIVE

Push-Button Door Controls

Doors shall be operated by push button controls, conveniently located and operable within the driver's reach. The push buttons shall be labeled. There shall be a separate set of push button controls for the front and rear door(s), as needed.

ALTERNATIVE

Two position switch for front door only.

TS 80.12.2 Commuter Coach

Doors shall be operated by ~~push button~~ *toggle switch* controls, conveniently located and operable within the driver's reach. The push buttons shall be labeled.

TS 80.13 Door Open/Close

ALTERNATIVE-----APPROVED

Operator-Controlled Front and Rear Doors (If Applicable)

Operation of, and power to, the passenger doors shall be completely controlled by the operator.

ALTERNATIVE (TC)

Operator-Controlled Front and Passenger-Controlled Rear Doors

Operation of, and power to, the front passenger doors shall be completely controlled by the operator. Power to rear doors shall be controlled by the operator. After enabling, the rear doors shall be opened by the passenger.

ALTERNATIVE (TC)

Operator-Controlled Front and Passenger-Controlled Rear Doors with Provision for Driver Override

Operation of, and power to, the front passenger doors shall be completely controlled by the operator. Power to rear doors shall be controlled by the operator. After enabling, the rear doors shall be opened by the passenger. A switch shall be provided to enable the driver to obtain full control of the rear doors.

DEFAULT-----APPROVED

A control or valve in the operator's compartment shall shut off the power to, and/or dump the power from, the front door mechanism to permit manual operation of the front door with the bus shut down. A master door switch, which is not within reach of the seated operator, when set in the "off" position shall close the rear/center doors (if applicable), deactivate the door control system, release the interlocks and permit only manual operation of the rear/center doors.

ALTERNATIVE

An exterior door control switch shall be installed. An air dump valve shall be accessible from the exterior of the bus.

TS 81. Accessibility Provisions

Space and body structural provisions shall be provided at the front or rear door of the bus to accommodate a wheelchair loading system.

TS 81.1 Loading Systems

There are three options:

- high-floor lift
- low-floor ramp
- platform (boarding bridge plate) level boarding

TS 81.2 Lift

The wheelchair lift control system must be capable of receiving multiplex commands from vehicle interlocks.

An automatically controlled, power-operated wheelchair lift system compliant to requirements defined in 49 CFR 571.403(FMVSS 403) shall provide ingress and egress quickly, safely and comfortably, both in forward and rearward directions, for a passenger in a wheelchair from a level street or curb.

DEFAULT

Wheelchair lift mounted in front step well.

ALTERNATIVE

Wheelchair lift mounted in rear center door location.

ALTERNATIVE

Folding Lifts

When the system is not in use, the passageway shall appear normal. In the stored position of the ramp, no tripping hazards shall be present, and any resulting gaps shall be minimized. The controls shall be simple to operate with no complex phasing operations required, and the loading system operation shall be under the surveillance and complete control of the driver. If the loading system and controls are at the rear doors, then a keyed switch shall be provided in the driver's area to disable the loading system. The bus shall be prevented from moving during the loading or unloading cycle by a throttle and brake interlock system. The loading system shall be inhibited from stowing/deploying when a passenger is on the ramp/platform. A passenger departing or boarding via the ramp shall be able to easily obtain support by grasping the passenger assist located on the doors or other assists provided for this purpose. The platform shall be designed to protect the ramp from damage and people on the sidewalk from injury during the extension/retraction or lowering/raising phases of operation.

The loading platform shall be covered with a replaceable or renewable nonskid material and shall be fitted with devices to prevent the wheelchair from rolling off the sides during loading or unloading.

Deployment or storage of the ramp shall require no more than 15 seconds. The device shall function without failure or adjustment for 500 cycles or 5000 miles in all weather conditions on the design operating profile when activated once during the idle phase. A manual override system shall permit unloading a wheelchair and storing the device in the event of a primary power failure. The manual operation of the ramp shall not require more than 35 lbs of force.

ALTERNATIVE-----APPROVED FOR LOW FLOOR VARIANT

Heavy-Duty Ramp System

Power units must meet other spec requirements (hydraulic or electric).

TS 81.3 Loading System for 30 to 60ft Low-Floor Bus

An automatically controlled, power-operated ramp system compliant to requirements defined in 49 CFR Part 38, Subpart B, §38.23c shall provide ingress and egress quickly, safely and comfortably, both in forward and rearward directions, for a passenger in a wheelchair from a level street or curb.

DEFAULT

Front Door Location of Loading System, Flip-Out Design Ramp with 6:1 Slope

The wheelchair loading system shall be located at the front door, with the ramp being of a simple hinged, flip-out type design being capable of deploying to the ground at a maximum 6:1 slope.

ALTERNATIVE

Rear/Center Door Location of Loading System, Flip-Out Design Ramp with 4:1 Slope

The wheelchair loading system shall be located at the rear/center door, with the ramp being of a simple hinged, flip-out type design being capable of deploying to the ground at a maximum 4:1 slope.

ALTERNATIVE

Front Door Location of Loading System, Flip-Out Design Ramp with 6:1 Slope

The wheelchair loading system shall be located at the rear door, with the ramp being a flip-out type design being capable of deploying to the ground at a maximum 6:1 slope.

ALTERNATIVE

Rear/Center Door Location of Loading System, Flip-Out Design Ramp with 6:1 Slope

The wheelchair loading system shall be located at the rear/center door, with the ramp being a flip-out type design being capable of deploying to the ground at a maximum 6:1 slope.

TS 81.4 Loading System for Level Boarding on a 45 to 60ft Low-Floor BRT

For level entry boarding in applications such as BRT, where the vertical transition from the vehicle floor and the boarding and alighting surface is no more than 3 in., a bridge plate shall be used. Bridge plates 30 in. or longer shall support a load of 600 lbs, placed at the centroid of the ramp or bridge plate distributed over an area of 26 × 26 in., with a safety factor of at least 3, based on the ultimate strength of the material. Bridge plates shorter than 30 in. shall support a load of 300 lbs. When deployed to boarding and alighting surface, the slope of the bridge plate shall not exceed 6:1.

DEFAULT

Front Door Location of Bridge plate Loading System

The bridge plate loading system shall be located at the front door.

ALTERNATIVE

Rear Door Location of Bridge plate Loading System

The bridge plate loading system shall be located at the rear/center door.

TS 81.5 Wheelchair Accommodations

NOTE: Agency will approve acceptable securement system.

DEFAULT

Two Forward-Facing Wheelchair Securement Locations

Two forward-facing locations, as close to the wheelchair loading system as practical, shall provide parking space and securement system compliant with ADA requirements for a passenger in a wheelchair.

CLARIFICATION: For high floor variable, two forward facing WCL positions will be provided. For low floor variable, one WCL position, will be facing forward, and one WCL position will be facing rearwards is APPROVED.

ALTERNATIVE

Additional (Beyond Two) Number of Wheelchair Securement Locations

[insert number] forward-facing location(s), as close to the wheelchair loading system as practical, shall provide parking space and securement system compliant with ADA requirements for a passenger in a wheelchair.

ALTERNATIVE

Non-Forward Facing

All passenger securement devices must be stowed off the floor and out of the way when not in use.

TS 81.6 Interior Circulation

Maneuvering room inside the bus shall accommodate easy travel for a passenger in a wheelchair from the loading device and from the designated securement area. It shall be designed so that no portion of the wheelchair protrudes into the aisle of the bus when parked in the designated parking space(s). When the positions are fully utilized, an aisle space of no less than 20 in. shall be maintained. As a guide, no width dimension should be less than 34 in. Areas requiring 90deg turns of wheelchairs should have a clearance arc dimension no less than 45 in., and in the parking area where 180deg turns are expected, space should be clear in a full 60in.diameter circle. A vertical clearance of 12in. above the floor surface should be provided on the outside of turning areas for wheelchair footrests.

TS 82. Wheelchair Lifts (Commuter Coach)

TS 82.1 Lift

A travel lift and two forward-facing mobility device securement areas shall be provided. The lift assembly shall comply with all current ADA and FMVSS 403 and 404 requirements. The lift shall be installed below the floor line at the number 2 right-hand luggage bay on the curbside of the coach.

The lift shall be controlled by a dash-mounted toggle switch and a rear lift area toggle switch and operated by up/down switches on a pendant mounted to the lift support bracket inside the number 2 baggage bay. The lift restraint belt must be buckled before the lift can be raised or lowered. The safety

interlock circuit can be energized to operate the lift only if the transmission is in neutral, the park brake is applied, engine fast idle is on, the dash-mounted master switch is on, the lift secondary switch is on, and the lift restraint belt is buckled.

The wheelchair loading system shall provide safe, comfortable and rapid ingress and egress for applicable passengers from the street level or a curb. When not in use, the lift shall stow in the luggage bay. The lift mechanism shall include a threshold warning device to provide "passenger on platform" information and to prevent stowing the lift platform when a passenger is sensed. The outer barrier shall be automatically controlled and shall be such that it cannot be overridden by the loading system operator. A dash-mounted indicator light shall be provided and shall be illuminated when the loading system is activated. The interlock shall apply, the bus shall not move, and the engine throttle shall be disabled whenever the wheelchair loading system is activated. If the lift door is open or ajar, the interlock shall remain engaged. Brackets, clamps, screw heads and other fasteners used on the passenger assists shall be anodized aluminum or stainless steel and shall be flush with the surface and free of rough edges.

The lift control mounted on the lift structure shall have push button up/down switches. The toggle electrical supply switch shall be located in close proximity to the controller. This toggle switch must be turned on prior to the lift operation. All lift control switches shall be permanently labeled. Decals shall not be permitted. The stow guard switch shall be red in color, and the stow/deploy switch shall be black in color. These switches shall be incorporated in a handheld pendant.

The lift shall include a hinged platform to bridge the coach floor to the lift platform. The bridge shall be hinged and locked in an upward position to act as a barrier when the lift is in use. The bridge shall also allow lift passenger ingress/egress easily from the platform. Lift travel speeds and lift operation shall be adjusted to the lift manufacturer's specifications upon completion of the lift installation into each coach and before coach delivery. The individual handrails shall incorporate a visual aid to ensure that they are folded in the proper order.

The lift shall include an emergency system in case of driver operation malfunction. Should an emergency situation occur, the lift operator shall release the push-button switch on the controller to immediately stop the lift cycle. The emergency hand pump handles and pump shall be located in an enclosed box at the rear wall of the number 1 right-hand luggage bay door. The handle shall be stored adjacent to the pump to allow immediate usage.

TS 82.2 Lift Door

The lift door shall be a single leaf design that operates in a sliding track mounted both above and below the door leaf. The door shall open by sliding to the rear of the coach and shall remain on a horizontal plane throughout the opening and closing process. No pin-hinged doors shall be provided. The transmission must be in neutral and the parking brake activated for the lift to operate. The accelerator shall be automatically disabled and the fast-idle system activated when either the lift master switch is turned on or the lift door is open in order to provide maximum safety and security. These features shall be wired to the lift master switch to allow activation only when the transmission is in neutral. The coach directional (hazard) lights will also flash on/off. After the lift operation is completed, the lift shall be properly stored and secured, with the access door closed and the lift master switch at the dash in the "off" position in order to move the coach.

The lift door shall have a window in line with the other passenger windows and shall not detract from the appearance of the coach. The door latch mechanism shall be located in the lower section of the door so that operators in the 5th percentile female range can operate the lift door.

The lift storage door shall not block the visual observation to the lift assembly while utilizing the manual override mode of the lift. A lift door design consisting of a horizontally hinged lift platform egress door mounted within a vertical motion pantograph luggage door is a preferred design.

ALTERNATIVE.....APPROVED

The lift door (single leaf design) will be sliding forward for high floor variant only

TS 82.3 Lift Width

The installation of the lift to the coach structure as well as the installation of the lift door into the sidewall of the coach shall not affect the structural integrity of the coach.

The parcel rack module above the wheelchair lift platform area shall be permanently removed to provide additional headroom. The modified rack shall be professionally finished at all ends.

A threshold warning module with a red warning light and an acoustic sensor shall be mounted in the ceiling structure above the wheelchair lift entrance doorway.

The heating and air ducts shall be rerouted around the lift area to ensure proper interior air conditioning/heating airflow and distribution.

A passenger chime tape switch shall be mounted on the sidewall at the two wheelchair securement positions.

Each coach shall have adequate information decals installed that detail the proper lift operation in both the normal and manual modes of operation.

TS 82.4 Lighting Requirements

Lighting for the lift areas shall be designed to meet Title 13 and ADA and FMVSS 404 standards. Lighting shall be provided to effectively illuminate the lift area. Light shall be wired through the lift master toggle switch on the driver's dash and shall automatically illuminate when this switch is in the "on" position. The lighting design shall minimize the effect of glare on passengers entering the bus through the wheelchair lift door. During lift operation, the street surface shall be illuminated to a minimum of 6 candlepower a distance of 3 ft beyond the external dimensions of the lift platform once deployed and lowered. Additional lighting shall be provided to ensure illumination of the instruction placard and the manual override pump when it is in use.

TS 82.5 Securement System

The vehicle interior shall permit the securement of two forward-facing wheelchair passengers in which the primary position shall be on the street side of the coach directly across from the lift. Securement areas shall be a minimum 30 × 48 in. as required by the ADA.

A separate three-point belt securement shall be provided to effectively secure wheelchair passengers. To further secure the passenger during the lift operation, a retractable seat belt strap shall be provided at the ingress/egress area of the lift platform. A minimum 10.5 in. high barrier shall also be provided at the rear of the lift area for additional passenger protection. *A Q-strait Q pod is APPROVED*

Alternative.....APPROVED

***Q-Strait Quantum WCL restraint mechanism (1 position only) on the low floor coach variable
Other WCL position will be provided with floor mounted slide and click style restraints.***

For high floor variable Q-straint Delux seat frame mounted restraint system.

TS 82.6 Roof Ventilation/Escape Hatches

Two roof ventilators shall be provided and designed to perform as escape hatches. One ventilator/escape hatch shall be located in the roof at the front of the coach, another in the roof at the rear of the coach. Both shall open from the rear side.

SIGNAGE AND COMMUNICATION

TS 83. Destination Signs

DEFAULT-----APPROVED

A destination sign system shall be furnished on the front, on the right side near the front door.

ALTERNATIVE-----APPROVED

Route sign on the rear of the vehicle.

CLARIFICATION: Provide a front sign requiring 24 rows x 200 columns with LED's in full color, a curb side destination sign, requiring 8 row x 96 columns with amber LED's and a rear route sign requiring 16 rows x 48 columns with amber LED's. The destination sign shall be capable of being programmed with USD memory sticks.

ALTERNATIVE.....APPROVED

Luminator full Color Spectrum 24 row x 200 column Titan sign.

Route Card Holder

The Contractor shall make and install a Card Holder A card holder, approximately 18" long, 3/4" thick, and 7" high, shall be installed on the center of a reinforced front dash. The card holder shall be made out of .090" aluminum and powder coated black. A sample card holder will be given to the successful bidder. Exact mounting location will be determined later.

All signs shall be controlled via a single human-machine interface (HMI). In the absence of a single mobile data terminal (MDT), the HMI shall be conveniently located for the bus driver within reach of the seated driver.

DEFAULT-----APPROVED

The driver shall be able to access the sign while seated.

ALTERNATIVE

The sign shall not be located within reach of the seated driver.

DEFAULT-----APPROVED

The destination sign compartments shall meet the following minimum requirements:

- Compartments shall be designed to prevent condensation and entry of moisture and dirt.
- Compartments shall be designed to prevent fogging of both compartment window and glazing on the unit itself.
- Access shall be provided to allow cleaning of inside compartment window and unit glazing.
- The front window shall have an exterior display area of no less than 8.5 in. high by 56 in. wide.

ALTERNATIVE

No active defogging required.

ALTERNATIVE

Run number sign shall be installed.

TS 84. Passenger Information and Advertising (Transit Coach)

TS 84.1 Interior Displays

Provisions shall be made on the rear of the driver's barrier or equipment box located on the wheel well for a frame to retain information such as routes and schedules.

Advertising media 11 in. high and 0.09 in. thick shall be retained near the juncture of the bus ceiling and sidewall. The retainers may be concave and shall support the media without adhesives. The media shall be illuminated by the interior light system.

TS 84.2 Exterior Displays

Provisions shall be made to integrate advertising into the exterior design of the bus. Advertising media, frames or supporting structures shall not detract from the readability of destination signs and signal lights, and shall not compromise passenger visibility. Advertising provisions shall not cause pedestrian hazards or foul automatic bus washing equipment, and shall not cover or interfere with doors, air passages, vehicle fittings or in any other manner restrict the operation or serviceability of the bus.

TS 85. Passenger Stop Request/Exit Signal

TS 85.1 Transit Coach

DEFAULT

Use for Touch Tape Passenger Signal

~~A passenger "stop requested" signal system that complies with applicable ADA requirements defined in 49 CFR, Part 38.37, shall be provided. The system shall consist of a touch tape, chime and interior sign message. The touch tape shall be accessible to all seated passengers, with provisions for standees. It shall be easily accessible to all passengers, seated or standing. Vertical touch tape shall be provided at each window mullion and adjacent to each wheelchair parking position and priority seating positions.~~

ALTERNATIVE

Pull Cord Passenger Signal

A passenger “stop requested” signal system that complies with applicable ADA requirements defined in 49 CFR, Part 38.37, shall be provided. The system shall consist of a heavy duty pull cable, chime and interior sign message. The pull cable shall be located the full length of the bus on the sidewalls at the level where the transom is located. If no transom window is required, then the height of the pull cable shall approximate this transom level and shall be no greater than 63 in. as measured from the floor surface. It shall be easily accessible to all passengers, seated or standing. Pull cable(s) shall activate one or more solid state or magnetic proximity switches. At each wheelchair passenger position and at priority seating positions, additional provisions shall be included to allow a passenger in a mobility aid to easily activate the “stop requested” signal.

An auxiliary passenger “stop requested” signal shall be installed at the rear door to provide passengers standing in the rear door/exit area a convenient means of activating the signal system. The signal shall be a heavy duty push button type located in the rear door vicinity. Button shall be clearly identified as “passenger signal.”

DEFAULT

No requirements for additional “stop request” button on rear door stanchion.

ALTERNATIVE

Additional “Stop Request” Button on Rear Door Stanchion

A heavy duty “stop request” signal button shall be installed on the modesty panel stanchion immediately forward of the rear door and clearly identified as “STOP.”

ALTERNATIVE

“Stop request” signal buttons shall be available at intervals to be determined by the Agency.

TS 85.2 Commuter Coach

A heavy-duty “stop request” signal button shall be installed at every seat location except the rear cross seat. *Provide 2-line amber sign in the front of the bus capable of displaying programed text such as “stop requested” as well as displaying next stop information. The Hannover sunrise 2-line sign is approved.*

TS 85.3 Signal Chime

TS 85.3.1 Transit Coach

DEFAULT

A single “stop requested” chime shall sound when the system is first activated. A double chime shall sound anytime the system is activated from wheelchair passenger areas.

Exit signals located in the wheelchair passenger area shall be no higher than 4 ft above the floor. Instructions shall be provided to clearly indicate function and operation of these signals.

ALTERNATIVE

Passenger signal system shall be arranged with push button switches accessible by each seated passenger and on stanchions and at rear door locations for standees.

TS 85.3.2 Commuter Coach

DEFAULT

A single "stop requested" chime shall sound when the system is first activated. A double chime shall sound anytime the system is activated from wheelchair passenger areas.

Exit signals located in the wheelchair passenger area shall be no higher than 4 ft above the floor. Instructions shall be provided to clearly indicate the function and operation of these signals.

ALTERNATIVE

Agency to specify the stop request system for wheelchair seating area

TS 86. Communications

TS 86.1 Camera Surveillance System

DEFAULT

No surveillance system provisions required.

ALTERNATIVE

Provide all wiring and mounting locations for a multi-camera surveillance system for the later provision of and installation of cameras, recorder, microphone, etc. Agency to specify the camera system cable to be installed, the locations for pre-wiring and the quantity.

ALTERNATIVE

Provide all wiring and mounting locations for a multi-camera surveillance system, including the installation of cameras, recorder, microphone, etc.

TS 86.2 Public Address System

A public address system shall be provided on each bus for facilitating radio system and driver-originated announcements to passengers.

Provide a microphoneless (microphone imbedded in PA amplifier housing) PA system. Provide a clam-shell switch on the floor next to the steering column to activate the microphone. Mounting locations TBD. Provide a fully populated and labeled harness from the amplifier (mounted on the dash) to the Electronics/Radio Compartment located in the street-side overhead luggage rack Parcel Compartment. The Auxiliary Microphone Key and Input Harness is part of the fully populated harness. Provide approximately 36 extra inches of circular coiled harness in the Electronic/Radio Compartment.

The Clever Devices / SpeakEasy-II 360503-20C has been APPROVED.

Exterior PA Speaker

If exterior speaker is exposed to wheelspray from rain/snow off the front wheel, provide an access door with a removable speaker/assembly to allow for easy replacement of Exterior PA speaker.

Linemaster 971-SWN0210 Clam-Shell Switch has been APPROVED.

External P/A Speaker 8Ω Quam 4C3Z80T or equivalent mounted in a removable speaker assembly for ease of replacement is APPROVED.

TS 86.2.1 Speakers

DEFAULT-----APPROVED

27 interior loudspeakers shall be provided, semi-flush mounted, on alternate sides of the bus passenger compartment, installed with proper phasing. Total impedance seen at the input connecting end shall be 8 Ohms. Mounting shall be accomplished with riv-nuts and machine screws.

ALTERNATIVE.....APPROVED

14 interior speakers with 4 Ohm impedance as long as it is shown that the final impedance is compatible with the Agency's speakeasy II PA system.

ALTERNATIVE

The speaker cable shall terminate at the instrument panel area on the curb side with a minimum of 3 ft of extra speaker cable. An end connector shall be supplied so a lead can be connected from the radio control head in order to make announcements directly from the transit control center to passengers through the PA system.

TS 86.3 Automatic Passenger Counter (APC)

DEFAULT

No APC system shall be installed.

ALTERNATIVE-----APPROVED

~~An infrared APC system shall be installed.~~ **An APC system shall be installed.** Agency to provide details of APC system, including installation locations and number of buses to be equipped. The Urban Transportation Associates, one or two door installation (Integrated System RS232) including the Hella type overhead sensors has been Approved.

TS 86.4 Radio Handset and Control System

TS 86.4.1 Drivers Speaker

~~Each bus shall have a recessed speaker in the ceiling panel above the driver. This speaker shall be the same component used for the speakers in the passenger compartment. It shall have 8 Ohms of impedance.~~

Contractor will install the Agency's provided harness from the Electronic/Radio Compartment to the driver's speaker located on the dash unless there is a better location. Exact location TBD. The Agency will install the speaker once the bus is delivered.

The agency would like to clarify that all parts will be new and that the agency will provide an itemized list of harnesses/antennae. The agency will act as a 3rd party vendor from which the contractor will simply order the list of part numbers from the agency (at no cost) and install the same as any other 3rd party supplied component. Instructions will be provided for installation.

TS 86.4.2 Handset

~~Contractor will install a handset for driver use.~~ *Contractor will install the Agency's provided handset harness from Electronic/Radio Compartment to the dash. Exact location TBD. The Agency will install the handset once the Bus is delivered.*

TS 86.4.3 Driver Display Unit (DDU)

~~Contractor shall install a driver display unit as close to the driver's instrument panel as possible.~~

The Contractor will install the Agency provided MDC (DDU) harness from the dash to the Electronic/Radio Compartment. Exact location TBD. The Agency will install the MDC once the Bus is delivered. Contractor will install a reinforced mounting pad on the dash to mount these components. Location TBD.

TS 86.4.4 Emergency Alarm

~~Contractor shall install an emergency alarm that is accessible to the driver but hidden from view.~~

Contractor shall install an Agency provided emergency alarm wiring harness for the foot operated Emergency Alarm Switch from the Electronic/Radio Compartment down to the floor in front of the operator's seat. Exact Location TBD.

TS 87. Event Data Recorders (EDR)

DEFAULT-----APPROVED

No EDR shall be installed.

ALTERNATIVE

EDRs shall be installed on the bus, one at the front and the other at the rear. These units are to be installed as low as possible. The EDRs shall be able to communicate over the J1939 CAN line and shall each be equipped with three-axis accelerometers. Settings are to be finalized with the Agency during pre-production. EDRs shall broadcast via the J1939 data communication link severe impact events to the vehicle monitoring system and also trigger an event in the camera system. The EDR shall also tag an event from a signal received over the J1939 CAN line from the silent alarm switch signal and the camera event button and in turn broadcast these events to the vehicle monitoring system. The EDR shall also record the following operational data: headlights on or off, turn signals and hazard lights on or off, ignition on or off, low air pressure warning, whether moving in forward or reverse or idling, and whether parking brake is on or off.

TS 88. Approved Equals

Table 8 lists products that have been approved for the bus procurement. The list contains products that are of interest to the Agency and is not intended to be a comprehensive listing of every product required for the manufacture of the subject buses. Product categories not listed are left to the discretion of the Contractor so long as the product complies with the specifications. Product specification information is for reference only and may not reflect the latest or future improvements by manufacturers. Any change, revision or substitution of specified products requires approval of the agency. To add to or revise this list, Contractor must submit a written request per the Specification by the due date found in the RFP for approved equals.

NOTE: Transit agencies are encouraged to list as many suppliers as possible.

Product	Manufacturer	Product Specification
TS 9. Oil pan drain valve	Fumoto Engineering	Fumoto #F104, N-Series valve
TS 9. HD push button sample valve		Check Fluid #KP18NV
Diesel Engine	Cummins	TS 9. Cummins ISX
Block Heater	Phillips-Timor	TS 9. Phillips-Temro, 240 volts, 1,500 watts
Electric cooling fans for radiator/CAC	Modine	TS 10. Modine Frameless electric fan system
Transmission	Allison	TS 11. B500
Oil cleaner spinner	T.F. Huggins	TS 14. Spinner II 576 HE
Engine compartment instruments	Forester Instruments	TS 14. LCD display #7-743-028
Constant torque hose clamps	Oetiker and Breeze Clamps	TS 15. Oetiker and Breeze
Diesel fuel filling components	Emco Wheaton	TS 18. Posilock 105 Dry Break/Flip Cap
Shop air couplers	Foster	TS 25. Foster 10-3
Tire Chains	Insta-Chain	TS 30. Insta-Chain
Shock Absorbers	Koni	TS 31. Adjustable shock absorbers
Aluminum Bus wheels	Alcoa	TS 32. Cryogenic hardened surfaces and flanges
Flow thru valve stem Caps	Meyers Tire Supply	TS 32. V2B Flow thru Valve Stem Caps, #21534
Valve Stems	Meyers Tire Supply	TS 32. Dill Valve Stems , #VS-554-D
Lug Nut Covers	Alcoa	TS 32. Alcoa Lug Nut Covers, #000185
Electric Steering Assist	TRW	TS 33. Electric steering assistance with hydraulic power steering
Small diameter steering wheel		TS 33. VIP 16", Soft Touch, 2 spoke steering wheel
Air System Dryer for 100% air compressor duty cycle	SKF	TS 39. Dual Turbo 2000 with double oil and water filtration and heated
Bus AGM Batteries	Thermo King Odyssey	TS 42. AGM Odyssey 4yr warranty battery, #31-PC2150S-H

UltraCapacitor for bus starting	KBI	TS 42. KBI KAPower for Cummins ISX
Battery jump start connector	Whitaker	TS 42. Whitaker Jump Start Connector #15121
Electrical Corrosion Preventive Spray	NOCO Chemical in Cleveland	TS 42. Battery Corrosion Preventive Spray, NOCO, NCP-2, Part #A-202
Weatherproof low voltage electrical connectors	Packard Electric	TS 42. Packard Electric Weather Pack Connectors
Sun Shades (Windshield Visors)	Automation Sun Shade	TS 46. Push/Pull scissor action sun shades
Adjustable Throttle and Brake Pedals	Konsberg Pedals	TS 46. Push button adjustable, throttle and brake pedals
2 Garbage cans	Rubbermaid	TS 47. Rubbermaid Garbage Cans, #2952
Operator's Seat	Recaro	TS49. Recaro, Ergo-Metro AM80
Curb-side exterior rear mirrors, mirror housing, and arms	Hadley	TS 49. Part #20-55185V009
Street-side exterior rear mirrors, mirror housing, and arms	Hadley	TS 49. Part #20-55184V192
Rear view camera for backing up	Safety Vision	TS 49. Safety Vision rear view backing camera
Air Conditioning Compressor	Thermo King	TS 54. Thermo King Screw Compressor, #S391
<i>Rear Backing Camera</i>	<i>Brigade</i>	

TS 89. Radio Antennas

The Contractor shall install Agency supplied antennas with attached cables in the roof of the Bus just over the Electronic/Radio Compartment. Route the antenna cables into the Electronic/Radio Compartment with the extra cable in a round service loop. Do not tie the service loop into a dog-bon shape. Exact location and details TBD.

TS. 90 Electronic/Radio Compartment

Install a 12 volt power cable sized for a maximum of 40 amps directly from a 40 amp fuse located in the battern box to the Electronic/Radio Compartment. Install a ground cable from a battery ground lug in the battery box to the Electronic/Radio Compartment. Provide an Ignition Sense wire into the Electronic/Radio Compartment. Provide all cables and wires with at least 30 inch service loop. Wiring shall be approved by the Agency.



UTAH TRANSIT AUTHORITY



July 1, 2020

Motor Coach Industries, Inc.
Attn: Bruce Wiebe
200 Oakton Street
Des Plaines, IL 60018

*Sent by email only to:
Bruce.Wiebe@mcicoach.com*

RE: Contract 19-03122, Forty-Five (45') Foot Commuter Coach Buses

**BASE ORDER NOTICE TO PROCEED
AWARD OF CONTRACT**

**For One (1) Pilot 45' Low Floor Diesel Commuter Coach Bus and Twenty-Six (26)
45' Low Floor Diesel Commuter Buses**

Dear Mr. Wiebe,

This letter shall serve as the Base Order for Contract Award wherein the Authority places the base order from the Motor Coach Industries, Inc. (MCI) Contract Effective July 1, 2020.

These 45' Low Floor Diesel Commuter Coach Buses shall be manufactured as outlined in the Authority's Updated Red-Lined Technical Requirements, the above referenced contract and MCI's Exhibit A Pricing Schedule.

The cost of the twenty-seven (27) 45' Commuter Coach Low Floor Diesel Buses are as follows:

Quantity	Description	U/Price	Total Price
1	Forty-Five (45') Foot Low Floor Diesel Commuter Coach Pilot Bus	\$683,125.00	\$683,125.00
26	Forty-Five (45') Foot Low Floor Diesel Commuter Coach Buses	\$683,125.00	\$17,761,250.00
	Training in the Maintenance and Operation of the Contracted Buses and Training Materials as follows:		

27	Operations Training	\$83.33	\$2,250.00
27	Maintenance Training	\$3,962.96	\$107,000.00
27	Training provided as part of BAFO – Two (2) weeks MCI on-site training at no cost to include: air system and brakes; multiplex system and maintenance and operator familiarization.	(\$583.33)	(\$15,750.00)
27	Special Tools (provide itemized list with tool manufacturer's name and price for all specialty tools) No charge per BAFO	\$0.00	\$0.00
1	Deliverables in accordance with Section 6 Technical Requirements (provide itemized list)	\$0.00	\$0.00
27	Keys – Any compartment that is lockable – Quantity Two (2)/Bus	Included in price	Included in price
27	Extended Warranty – Operator's Seat – Two (2) Years or 100,000 miles, 100% parts and labor except foam and fabric	\$50.00	\$1,350.00
27	Extended Warranty – Exterior Paint and Finish – Two (2) Years, unlimited miles, 100% parts and labor	No additional charge	No additional charge
27	ADA equipment included in above unit prices)	included in above unit prices	included in above unit prices
27	Delivery Costs	\$2,900.00	\$78,300.00
	GRAND TOTAL	\$689,537.96	\$18,617,525.01

The total amount of this Notice to Proceed is \$18,617,525.01. Delivery of the Forty-Five (45') Foot Low Floor Diesel Commuter Coach Buses is no later than November 10, 2021.



If you are in agreement to the above, please sign on the line indicated below and return a copy to Ms. Pat Postell at ppostell@rideuta.com. A fully executed copy will be provided after all signatures are obtained.

MOTOR COACH INDUSTRIES, INC.



Printed Name: Patrick Scully
Title: Executive Vice-President, Sales,
Marketing, & Service

UTAH TRANSIT AUTHORITY

Carolyn M. Gonot
Executive Director

D. Eddy Cumins
Chief Operating Officer

David Hancock
Director of Asset Management

Approved As To Form and Content:

Michael Bell
Assistant Attorney General
UTA Legal Counsel





MEMORANDUM TO THE BOARD

TO: Utah Transit Authority Board of Trustees
THROUGH: Carolyn Gonot, Executive Director
FROM: Mary DeLoretto, Chief Service Development Officer
PRESENTER(S): Paul Drake, Director of Real Estate & TOD

BOARD MEETING DATE: July 22, 2020

SUBJECT:		Real Property Acquisition for Box Elder County Right of Way - Parcel 1071:T (Box Elder Federal Credit Union)
AGENDA ITEM TYPE:	Real Estate Contract	
RECOMMENDATION:	Approve and authorize the Executive Director to execute the real estate contract and associated disbursements with Box Elder Federal Credit Union (“Seller”) to purchase Parcel 1071:T for the amount of \$376,600 (plus approximately \$4,000 in standard closing costs).	
BACKGROUND:	In 2007, Box Elder County passed the second-quarter sales tax to support the development of the extension of commuter rail to Brigham City. UTA has received Box Elder County tax funds to purchase and preserve critical right of way.	
DISCUSSION:	<p>Project Parcel 1071:T has been identified as necessary for corridor preservation as well as a prime location for a potential station. The subject parcel includes approximately 3.766 acres of raw land located on the north side of 750 North Street in Willard adjacent east of the existing UPRR corridor. The property has been listed for sale since June 2019 with an asking price of \$380,000. UTA’s appraisal has valued the parcel at \$376,600 which the sellers have agreed to accept as the purchase price.</p> <p>Purchasing the Subject Property meets Box Elder County objectives to preserve right of way for future transit expansion, avoiding future acquisition and potential relocation costs.</p>	
CONTRACT SUMMARY:	Contractor Name: Box Elder Federal Credit Union	
	Contract Number: 20-03319	Existing Contract Value: NA
	Amendment Amount: NA	New/Total Amount Contract Value: \$376,600 (plus approximately \$4,000 in standard closing costs).

ALTERNATIVES:	Deny approval. Waiting to purchase the property could result in increased future costs or loss of opportunity. Non-action could also strain relations with Box Elder County and Brigham City, who have appropriated funding and prioritized the corridor preservation.
FISCAL IMPACT:	The cost to acquire the property is \$376,600 plus approximately \$4,000 in standard title closing costs. This amount is within the Box Elder County Right of Way budget to acquire future transportation right-of-way. Purchasing the property now will save the agency acquisition costs in the future.
ATTACHMENTS:	<ol style="list-style-type: none">1) Real Estate Purchase Contract2) Warranty Deed3) Project Map4) County GIS Map

REAL ESTATE PURCHASE CONTRACT

Project No.: MSP-140	Parcel No(s): 1071:T
Job/Proj/Auth. No.: FrontRunner North Extension	Pin No.: 880051
Project Location: Weber-Box Elder Counties	
County of Property: Box Elder	Tax Id./Sidwell Nos.: 02-043-0025
Property Address: Approximately 500 West 750 North, Willard, UT 84340	
Seller(s): Box Elder County Federal Credit Union	
Seller's Address: 1023 Medical Drive, Brigham City, UT 84302	

IN CONSIDERATION of the mutual promises herein Box Elder County Federal Credit Union ("Seller") agrees to sell to the Utah Transit Authority ("UTA"), the Sale Property for transportation-related purposes. UTA and Seller agree as follows:

1. **SALE PROPERTY.** The Sale Property referred to in this Contract is Box Elder County Tax ID numbers 02-043-0025 identified as UTA project parcel 1071:T, more particularly described in Exhibit "A", which is attached hereto and incorporated herein, together with all structures and appurtenances.
 - 1.1. This is a voluntary sale to UTA and is not subject to condemnation. As this is a voluntary sale, the Seller waives any "right of first refusal" to repurchase any surplus property not used for transportation-related purposes.
2. **PURCHASE PRICE.** The Purchase Price for the Sale Property is \$376,600.00.
3. **SETTLEMENT AND CLOSING.**
 - 3.1. **Settlement.** "Settlement" shall mean that Seller and UTA have signed and delivered to each other or to the escrow/closing office all documents required by this Contract or by the escrow/closing office, and that all monies required to be paid by Seller or UTA under this Contract have been delivered to the escrow/closing office, in the form of cash, wire transfer, cashier's check, or other form acceptable to the escrow/closing office.
 - 3.2. **Closing.** "Closing" shall mean that: (a) Settlement has been completed; (b) the amounts owing to Seller for the sale of the Sale Property have been paid to Seller, and (c) the applicable Closing documents have been recorded in the office of the county recorder ("Recording"). Settlement and Closing shall be completed at the earliest time convenient to the parties and the closing office.
 - 3.3. **Possession.** Upon signing of this Contract by Seller and UTA, Seller grants UTA, its employees and contractors, including utility service providers and their contractors, the right to immediately occupy the Sale Property. Any contracted rental of the Sale Property prior to or after Closing, between Seller and UTA, shall be by separate written agreement. Seller agrees to deliver the Property to UTA free of any debris and personal belongings, except as outlined under separate agreement. The provisions of this Section 3.3 shall survive Closing.
 - 3.4. **Scrivener's Errors.** Parties agree that it is their intent that the Sale Property boundaries and easement boundaries close. In the event of any scrivener's errors in the deeds or survey, the parties shall cooperate in promptly executing a corrected instrument.
4. **PRORATIONS / ASSESSMENTS / OTHER PAYMENT OBLIGATIONS.**

Prorations. All prorations, including, but not limited to, homeowner's association dues, property taxes for the current year and rents shall be made as of the time of Settlement by Seller. Greenbelt rollback taxes owing on Sale Property, if any, shall be the responsibility of Seller.

4.1. **Fees/Costs.**

4.1.1. **Escrow Fees.** UTA agrees to pay the fees charged by the escrow/closing office for its services in the settlement/closing process.

4.1.2. **Title Insurance.** If UTA elects to purchase title insurance, UTA will pay the cost thereof.

5. **TITLE TO SALE PROPERTY.** Seller represents and warrants that Seller has fee title to the Sale Property. Seller shall indemnify and hold UTA harmless from all claims, demands and actions from lien holders, lessees, or other third parties claiming an interest in the Sale Property or the Purchase Price paid hereunder. Seller will convey marketable title to the Sale Property to UTA at Closing by warranty deed. The provisions of this Section 5 shall survive Closing.
6. **SELLER DISCLOSURES CONCERNING ENVIRONMENTAL HAZARDS.** Seller represents and warrants that there are no claims and/or conditions known to Seller relating to environmental hazards, contamination or related problems affecting the Sale Property. Seller agrees to transfer the Sale Property free of all hazardous materials including paint, oil and chemicals. The provisions of this Section 6 shall survive Closing.
7. **CONDITION OF SALE PROPERTY AND CHANGES DURING TRANSACTION.** Seller agrees to deliver the Sale Property to UTA in substantially the same general condition as it was on the date that Seller signed this Contract.
8. **AUTHORITY OF SIGNERS.** If Seller is a corporation, partnership, trust, estate, limited liability company or other entity, the person signing this Contract on its behalf warrants his or her authority to do so and to bind Seller.
9. **COMPLETE CONTRACT.** This Contract, together with any attached addenda and exhibits, (collectively referred to as the "Contract"), constitutes the entire contract between the parties and supersedes and replaces any and all prior negotiations, representations, warranties, understandings or contracts between the parties whether verbal or otherwise. The Contract cannot be changed except by written agreement of the parties. This Contract may be executed in counterparts.
10. **ELECTRONIC TRANSMISSION AND COUNTERPARTS.** This Contract may be executed in counterparts. Signatures on any of the documents, executed physically, shall be deemed original signatures and shall have the same legal effect as original signatures.

SELLER:

BOX ELDER COUNTY FEDERAL CREDIT UNION

Scott Wehre
By: Scott Wehre
Its: Pres. / CEO

May 19, 2020
Date

SELLER:

By: _____
Its: _____

Date

UTAH TRANSIT AUTHORITY:

By: Spencer Burgoyne
Manager of Property Administration

Date

By: Hal Johnson
Project Manager

Date

By: Mary Deloretto
Chief Service Development Officer

Date

By: Carolyn Gonot
Executive Director

Date

APPROVED AS TO FORM:

Tim Merrill
Assistant Attorney General

SW
Seller's Initials

Exhibit "A"

Page 1 of 3

WHEN RECORDED, MAIL TO
Utah Transit Authority
C/O Property Management
669 West 200 South
Salt Lake City, Utah 84101

Warranty Deed

(Corporation)

Box Elder County	Tax ID No.	02-043-0025
	UTA Project No.	MSP-140
	UDOT PIN No.	880051
	Parcel No.	1071:T

Box Elder County Federal Credit Union, Grantor(s), a Corporation of the State of Utah, hereby CONVEYS AND WARRANTS to the Utah Transit Authority, a large public transit district organized and existing pursuant to Utah law, Grantee, at 669 West 200 South, Salt Lake City, Utah 84101, for the sum of TEN (\$10.00) Dollars, and other good and valuable considerations, the following described parcel of land in Box Elder County, State of Utah, to-wit:

An entire tract of land in fee, situate in Lot 1 of Section 22, T.8N., R.2W., and Lot 4 and the SE 1/4 SE 1/4 of Section 15, T.8N., R.2W., S.L.B. & M. The boundaries of said parcel of land are described as follows:

Part of the South half of the Southeast Quarter of Section 15 and part of the North half of the Northeast Quarter of Section 22, Township 8 North, Range 2 West, Salt Lake Base and Meridian: Beginning at the intersection of the Easterly right-of-way line of U.P.R.R. right-of-way and the Northerly right-of-way line of existing approach road to 1-15, said point being approximately 1526.0 feet West and 85.0 feet South from the Northeast corner of said Section 22, and running thence North 85°03'58" East 441.58 feet, along the North line of said road to a point of tangency with a 5779.58 foot radius curve to the right, thence Easterly 709.05 feet along the arc of said curve and right-of-way, thence South 87°54'17" East 77.28 feet along said right-of-way to an existing highway right-of-way marker, thence North 78°26'30" West 741.52 feet along an old fence line, thence North 81°22'00" West 528.12 feet along an old fence line to the Easterly line of U.P.R.R. right-of-way, thence South 04°41'47" East 281.50 feet along said right-of-way to the point of beginning.

The above described entire tract of land contains 164,025 square feet in area or 3.766 acres, more or less.

Continued on Page 2
COMPANY RW-01C (11-01-03)


Seller's Initials

Exhibit "A"

Page 2 of 3

PAGE 2

UTA Project No.	MSP-140
UDOT PIN No.	880051
Parcel No.	1071:T

IN WITNESS WHEREOF, said Grantor has caused this instrument to be executed by its proper office thereunto duly authorized, this ____ day of _____, A.D. 20 ____.

STATE OF _____)
) ss. _____
)
 COUNTY OF _____) By _____
 Manager

On the date first above written personally appeared before me, _____, who, being by me duly sworn, they are the _____ of Box Elder County Federal Credit Union, a Corporation of the State of Utah, and that the within and foregoing instrument was signed in behalf of said corporation by authority of _____ and said _____ acknowledged to me that said corporation executed the same.

WITNESS my hand and official stamp the date in this certificate first above written:

Notary Public

Prepared by: (AJC) Meridian Engineering, Inc.

10P - 2/5/2020

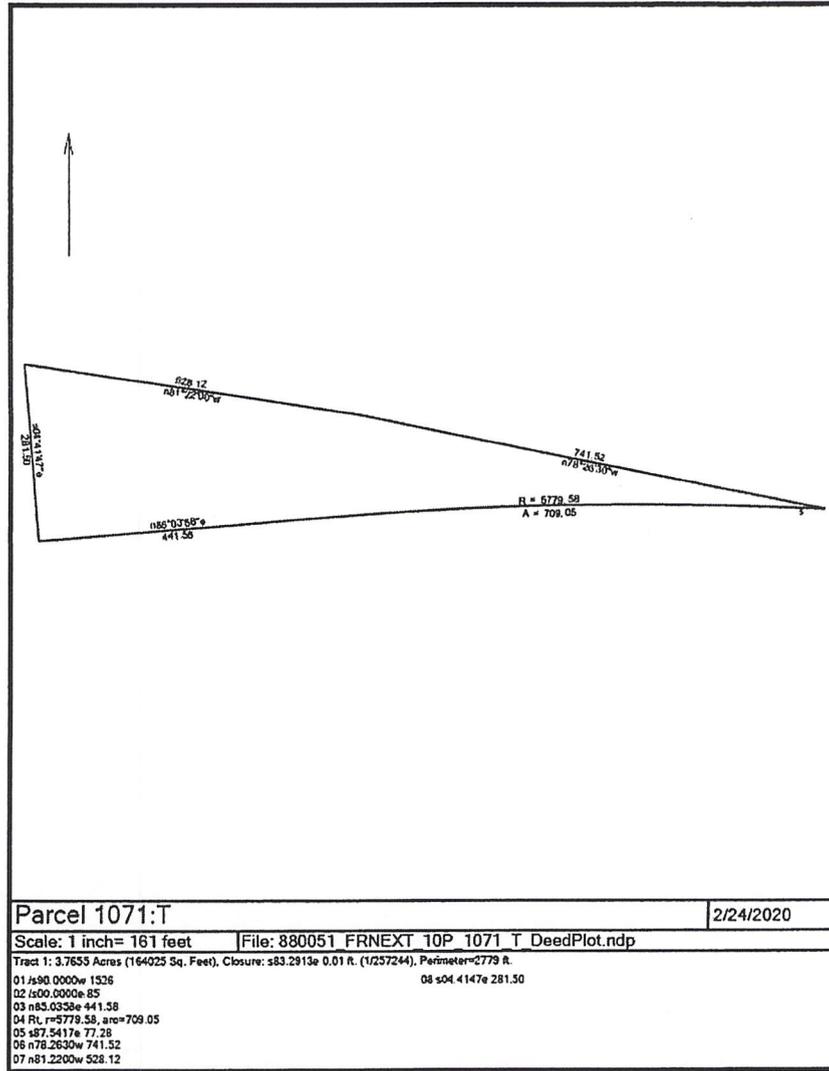
COMPANY RW 81C (11-01-03)

Page 5

SW
Seller's Initials

Exhibit "A"

Page 3 of 3



SW
 Seller's Initials

WHEN RECORDED, MAIL TO:
Utah Transit Authority
C/O Property Management
669 West 200 South
Salt Lake City, Utah 84101

Warranty Deed (Corporation)

Box Elder County

Tax ID No.	02-043-0025
UTA Project No.	MSP-140
UDOT PIN No.	880051
Parcel No.	1071:T

Box Elder County Federal Credit Union, Grantor(s), a Corporation of the State of Utah, hereby CONVEYS AND WARRANTS to the Utah Transit Authority, a large public transit district organized and existing pursuant to Utah law, Grantee, at 669 West 200 South, Salt Lake City, Utah 84101, for the sum of TEN (\$10.00), Dollars, and other good and valuable considerations, the following described parcel of land in Box Elder County, State of Utah, to-wit:

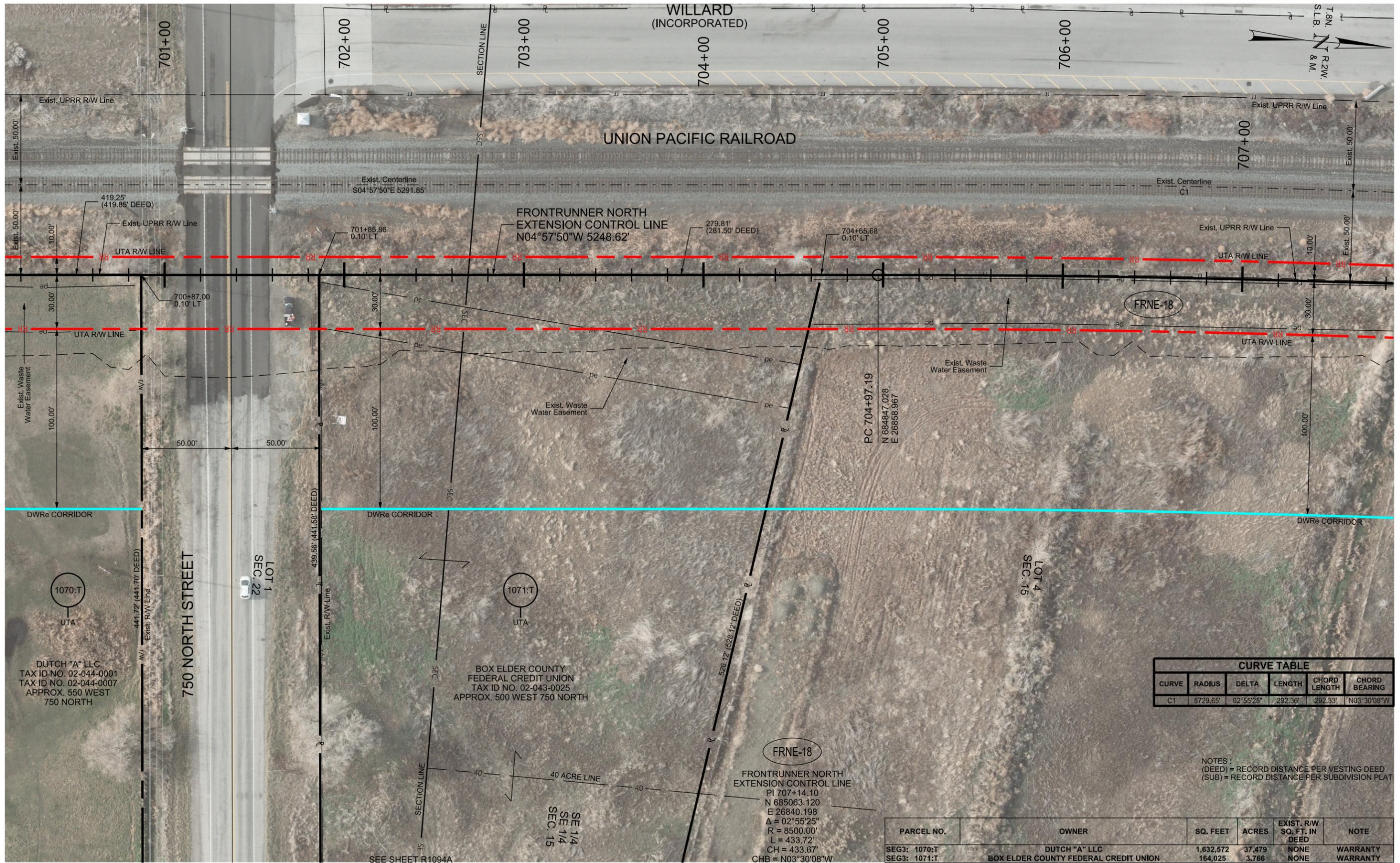
An entire tract of land in fee, situate in Lot 1 of Section 22, T.8N., R.2W., and Lot 4 and the SE1/4 SE1/4 of Section 15, T.8N., R.2W., S.L.B. & M. The boundaries of said parcel of land are described as follows:

Part of the South half of the Southeast Quarter of Section 15 and part of the North half of the Northeast Quarter of Section 22, Township 8 North, Range 2 West, Salt Lake Base and Meridian: Beginning at the intersection of the Easterly right-of-way line of U.P.R.R. right-of-way and the Northerly right-of-way line of existing approach road to 1-15, said point being approximately 1526.0 feet West and 85.0 feet South from the Northeast corner of said Section 22, and running thence North 85°03'58" East 441.58 feet, along the North line of said road to a point of tangency with a 5779.58 foot radius curve to the right, thence Easterly 709.05 feet along the arc of said curve and right-of-way, thence South 87°54'17" East 77.28 feet along said right-of-way to an existing highway right-of-way marker, thence North 78°26'30" West 741.52 feet along an old fence line, thence North 81°22'00" West 528.12 feet along an old fence line to the Easterly line of U.P.R.R. right-of-way, thence South 04°41'47" East 281.50 feet along said right-of-way to the point of beginning.

The above described entire tract of land contains 164,025 square feet in area or 3.766 acres, more or less.

Continued on Page 2
COMPANY RW-01C (11-01-03)

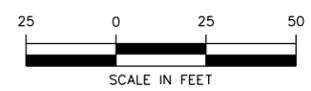
13:58 File: U:\Projects\2018\18077-DRW-R-UTA-Weber to Box Elder\18077-UTA\right of way\Sheet Files\NECR1096-Aerial.dgn



CURVE TABLE					
CURVE	RADIUS	DELTA	LENGTH	CHORD LENGTH	CHORD BEARING
C1	5729.65'	02°55'25"	292.36'	292.33'	N03°30'08"W

NOTES:
 (DEED) = RECORD DISTANCE PER VESTING DEED
 (SUB) = RECORD DISTANCE PER SUBDIVISION PLAT

PARCEL NO.	OWNER	SQ. FEET	ACRES	EXIST. R/W SQ. FT. IN DEED	NOTE
SEG3: 1070:T	DUTCH "A" LLC	1,632,572	37.479	NONE	WARRANTY
SEG3: 1071:T	BOX ELDER COUNTY FEDERAL CREDIT UNION	164,025	3.766	NONE	WARRANTY



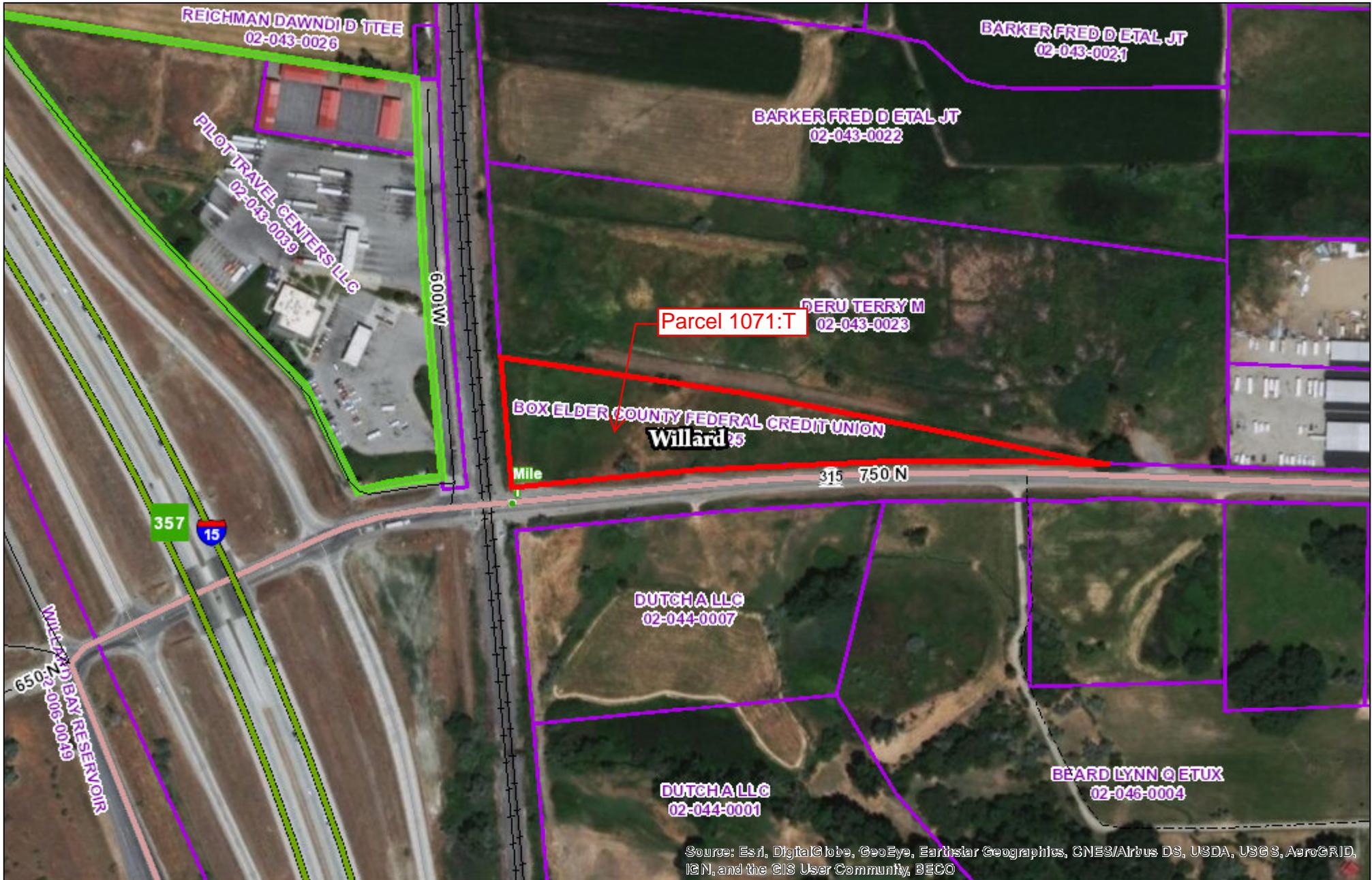
MEI NO: 18077 SUBMITTAL: 10P

UTA PROJECT NO: MSP-140 PIN NO: 880051

FRONTRUNNER NORTH EXTENSION
 RIGHT OF WAY PLAN
 SEGMENT 3

SUBMITTAL DATE
 03/03/2020
 SHEET No:
 R1096

Box Elder County Web Map



1:4,514

Search Results: Tax Parcels

Override 1

Box Elder County

Cities

Mile Markers

Freeway Exits

MEMORANDUM TO THE BOARD



TO: Utah Transit Authority Board of Trustees
THROUGH: Carolyn Gonot, Executive Director
FROM: Bob Biles, Chief Financial Officer
PRESENTER(S): Todd Mills, Senior Supply Chain Manager

BOARD MEETING DATE: July 22, 2020

SUBJECT:	Pre-Procurements
AGENDA ITEM TYPE:	Contract Pre-Procurement
RECOMMENDATION:	Informational report for discussion
BACKGROUND:	Utah’s Public Transit District Act requires all contracts valued at \$200,000 or greater be approved by the UTA Board of Trustees. This informational report on upcoming procurements allows Trustees to be informed and provide input on upcoming procurement projects. Following the bid solicitation and contract negotiation process, final contracts for these projects will come before the board for approval.
DISCUSSION:	<p>The following projects, services, or products have an approved requisition by the Executive Director and are ready for bid solicitation:</p> <ul style="list-style-type: none">• FrontRunner Operational Service Analysis. This is a procurement for a consulting firm to be on-call for Frontrunner service modeling. The successful firm will conduct various service simulations based on investment levels and other system enhancements. Some of these include Positive Train Control, double-tracking, 15-minute headways during peak hours, extending the service on North and South lines, electrification of the corridor for hybrid locomotives, longer train consists, etc.. FrontRunner enhancements are a prominent feature in local and regional transportation plans. Both Regional Transportation Plans (RTPs) in UTA’s transit district include improvements to FrontRunner commuter rail. This contract will have a term of 3 years, with two 1-year options. The procurement will be conducted as a RFP with selection based on technical criteria in addition to price. (Req 8297)• Scheidt & Bachman TVM Service Contract – Sole Source. This is a sole source procurement for Scheidt and Bachman to provide Ticket Vending Machine (TVM) annual system maintenance and support for 2 years. After asking for COVID-19 concessions, Scheidt & Bachman is offering a 15% discount for a 2-year contract. This contract has a total value of \$220,412 and removes annual rate increase for the contract time-period. Total savings over the 2-year period from current rate is \$38,896. This 2-year timeframe will allow UTA (Fares) to go out with an RFP for replacement TVMs, as well as give us time for system configuration, and implementation. (Req 8254)

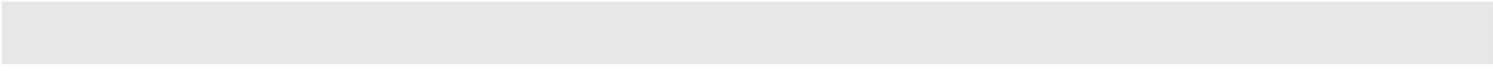


MEMORANDUM TO THE BOARD

TO: Utah Transit Authority Board of Trustees
THROUGH: Carolyn Gonot, Executive Director
FROM: Mary DeLoretto, Chief Service Development Officer
PRESENTER(S): Mary DeLoretto, Chief Service Development Officer

BOARD MEETING DATE: July 22, 2020

SUBJECT:	FTA Public Transportation Innovation Program – Rail Defect Detection Research
AGENDA ITEM TYPE:	Grant Application
RECOMMENDATION:	Informational report for discussion
BACKGROUND:	<p>The Federal Transit Administration released a notice of funding opportunity on May 26, 2020 to solicit project proposals for Real-Time Transit Infrastructure and Rolling Stock condition Assessment Demonstrations. Proposed projects should demonstrate and evaluate innovative technologies and designs to improve the state of good repair and safety for transit agencies. Projects should provide approaches to eliminate or mitigate known infrastructure deficiencies. The minimum match is 20%.</p>
DISCUSSION:	<p>The proposed project will provide innovative information regarding the condition of UTA’s current rail infrastructure. UTA would partner with the University of Utah and Autofill (from the Netherlands) for this project. The University of Utah is proposing a system for internal defect detection of rail track and tie structures through polarized infrared thermography. Autofill has external rail scanning technology that completes the comprehensive vehicle detection package.</p> <p>The project will include a research and/or synthesis phase, a development phase, and a demonstration phase. The project will benefit UTA’s asset management activities by earlier detection of defects; tracking and monitoring deficiencies before they negatively impact transit operations; and optimizing resource allocation for prevention of defects rather than critical maintenance. In addition, if proven effective, the technology could potentially be used before and after scanning in earthquake events to quickly identify possible damage.</p>
ALTERNATIVES:	If the grant is not pursued, a State of Good Repair research opportunity will be delayed or missed.
FISCAL IMPACT:	The total project cost is estimated at \$536,000 with \$430,000 being sought in federal funding. The University of Utah and Autofill will be providing the minimum 20% match



	required. UTA staff time will only be needed to provide access to UTA facilities and rail. UTA staff time is allowable as in-kind over-match.
ATTACHMENTS:	1) Figures & Bibliography_v0.docx

Figures

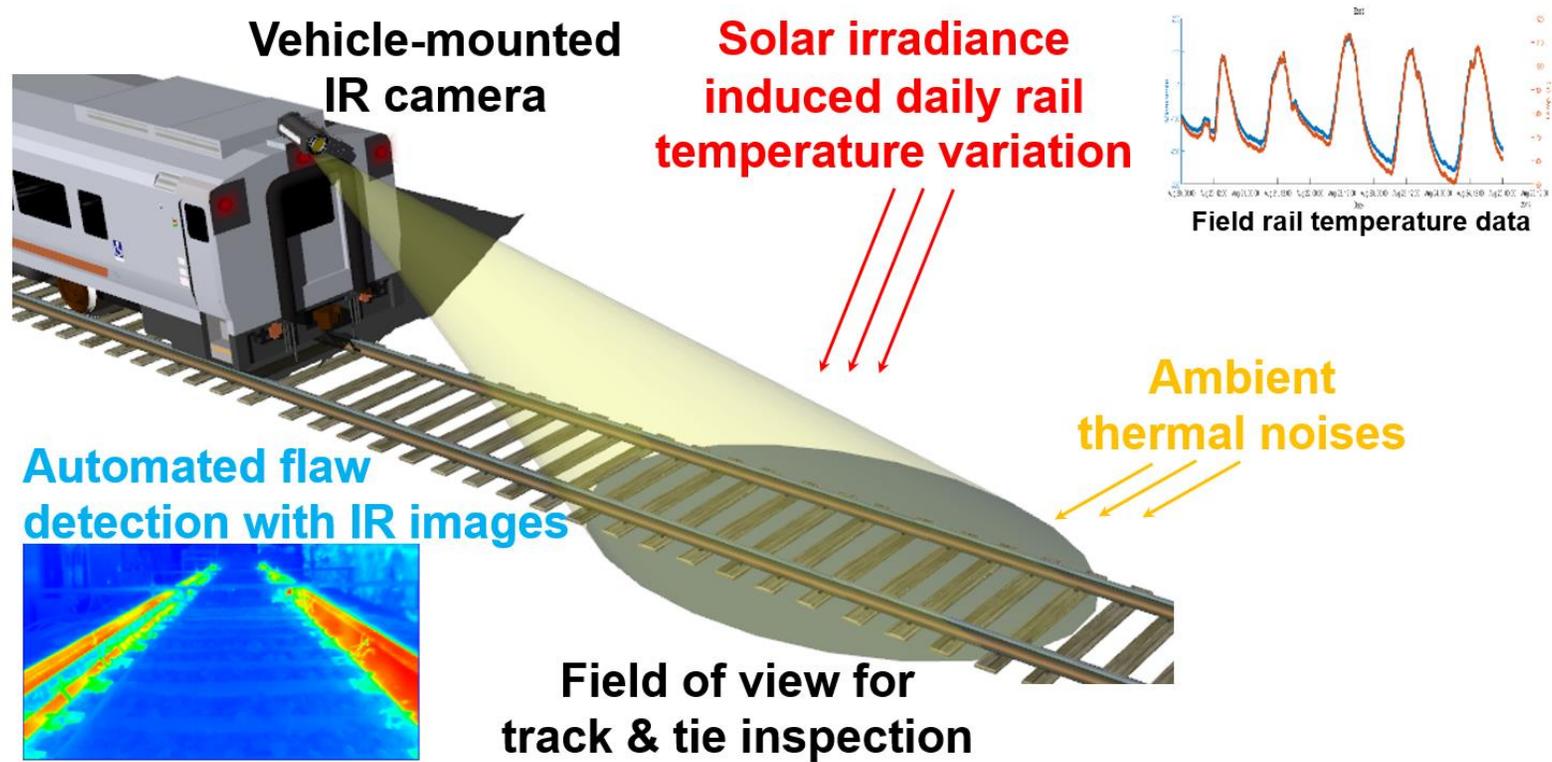


Figure 1- Concept of fully developed system for in-motion rail track and tie inspection

Ambient infrared sources



Buildings
Vehicles
Lights
Clouds



Reflective rail head

Rusty web & foot

Rusty surface

Reflective surface

Rail track

Polarizer Filter IR camera

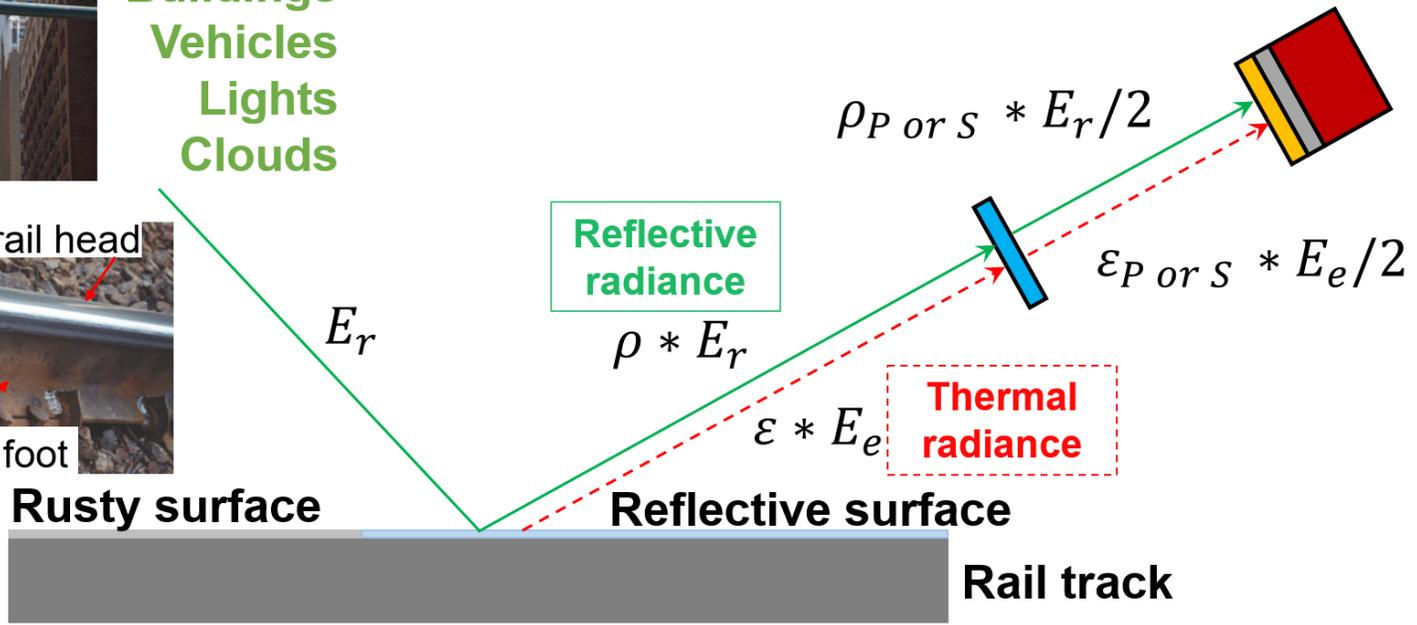


Figure 2 - Radiation energy detected by IR camera for rail track inspection

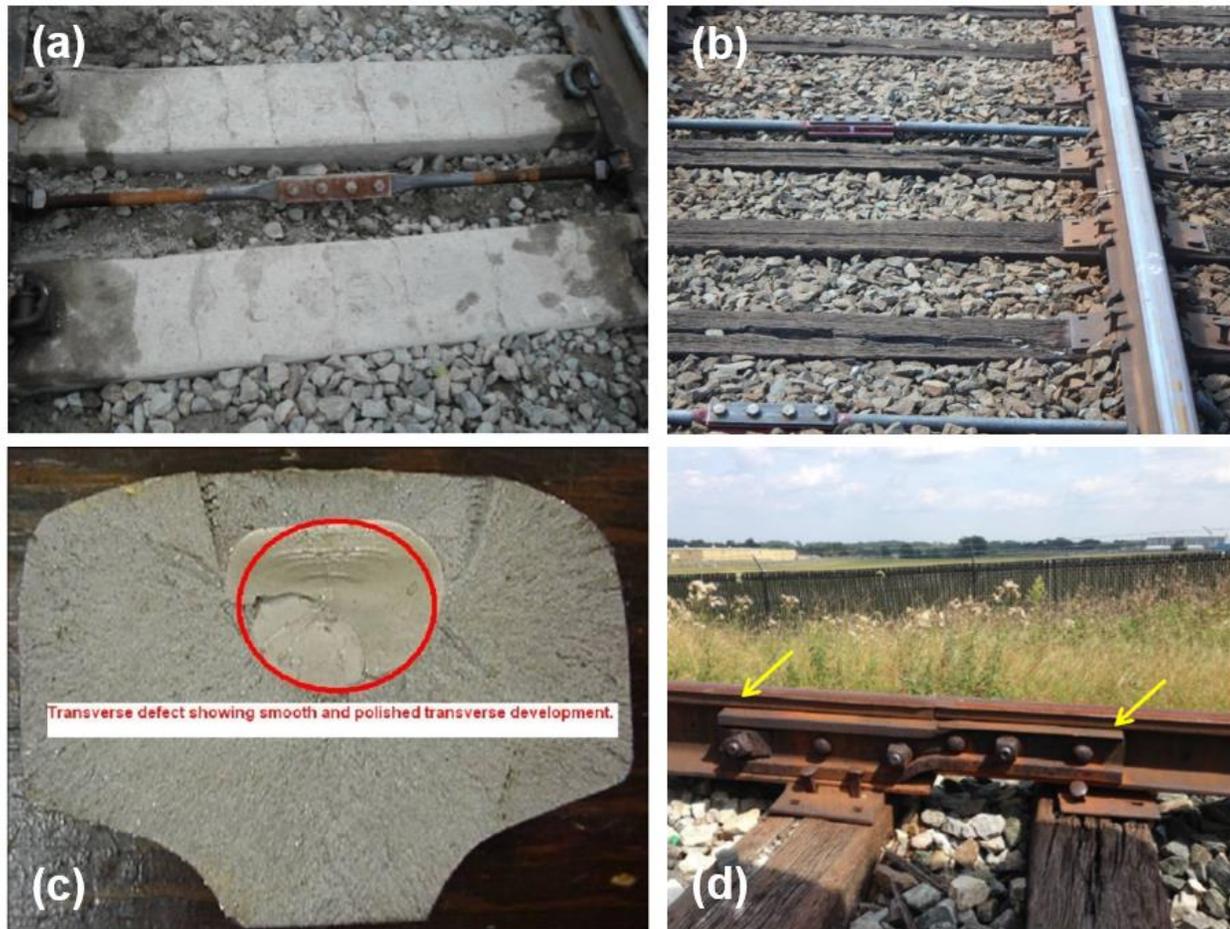


Figure 3 – Typical track and tie defects: (a) Cracks at centers of ties at POD (NSTB RAB1411); (b) Deteriorated cross-ties at accident location (NSTB RAB1606); (c) Transverse defect of rail track (FRA track inspector reference manual 2015); (d) Compromise joint bar (NSTB RAB1409)

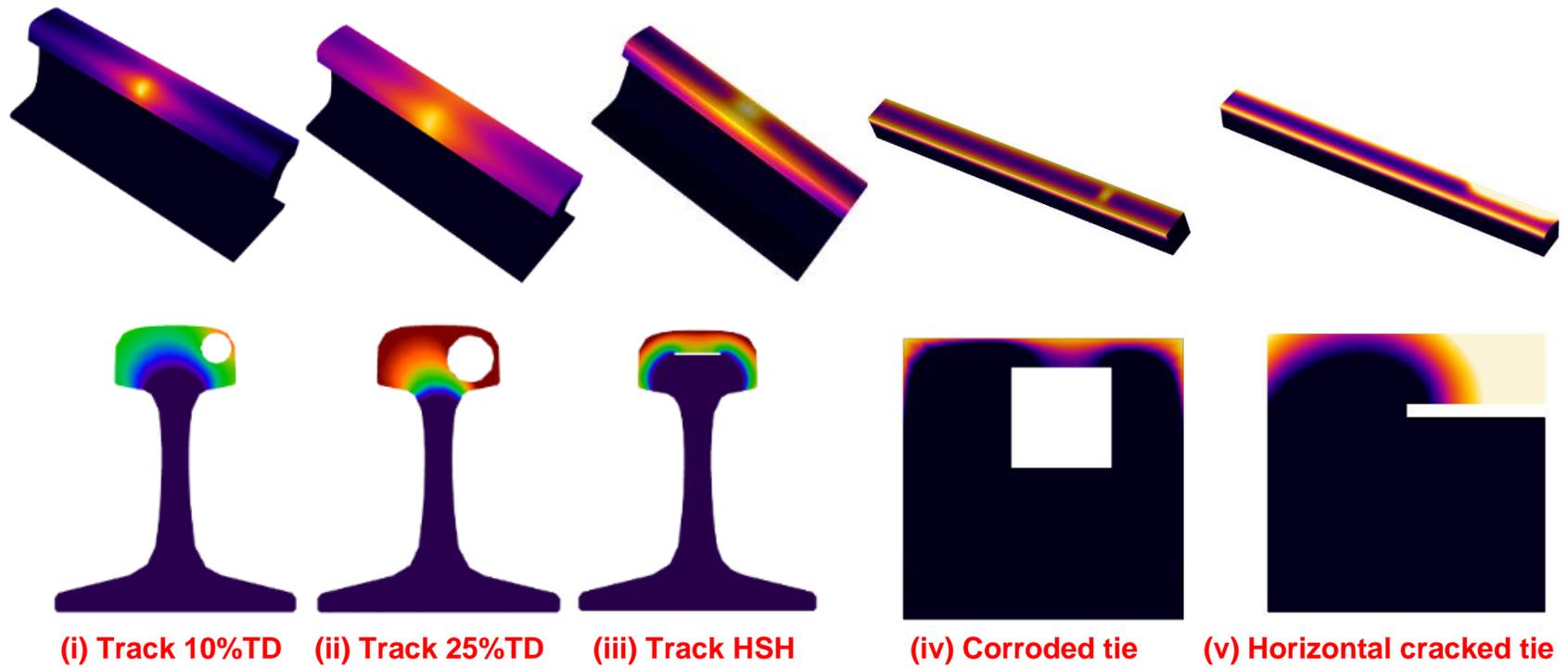


Figure 4. Full field and cross-sectional temperature distribution based on track and tie models

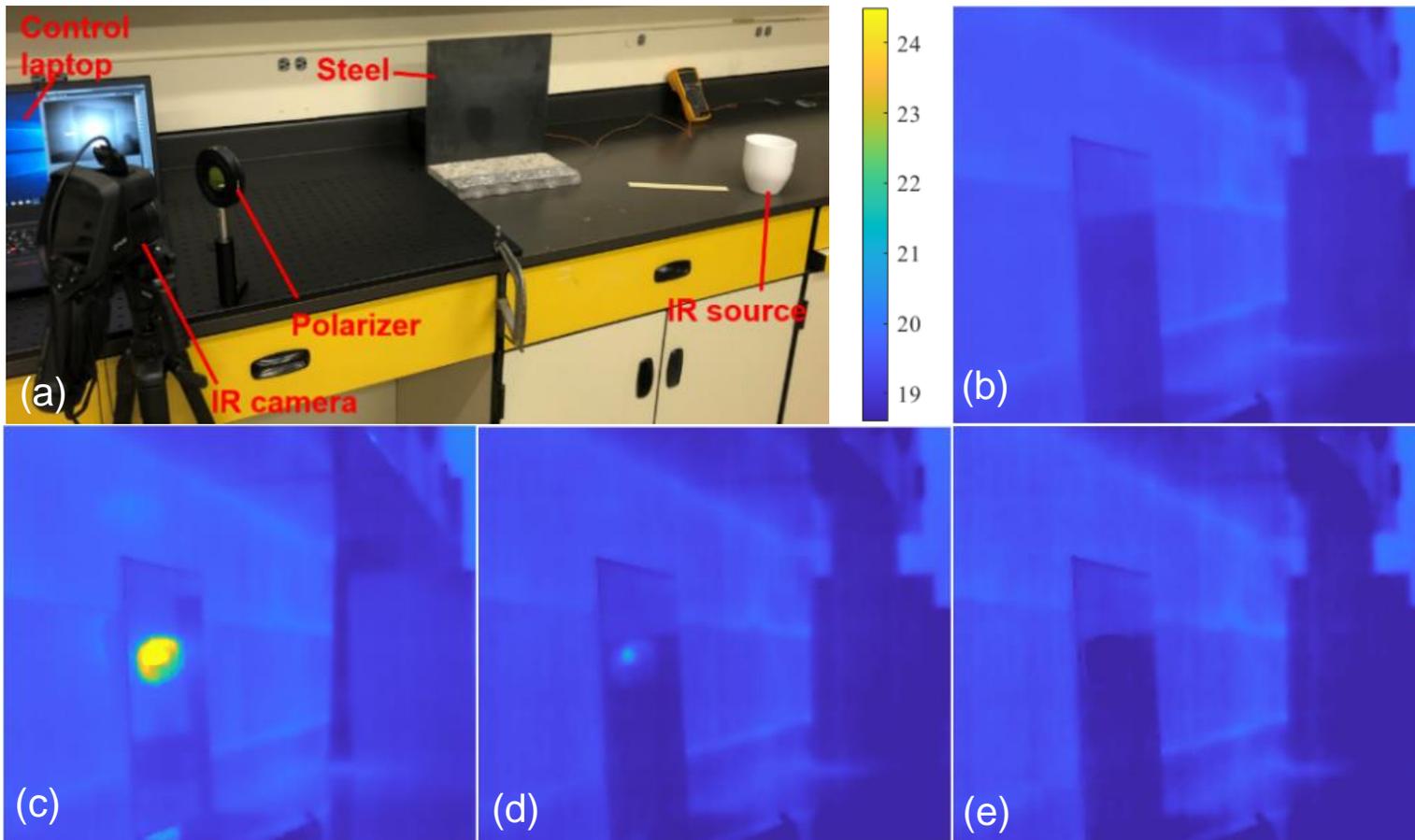


Figure 5. (a) Test setup for polarized IRT; temperature fields of steel plate (b) without IR source; (c) with IR source; (d) with IR source & polarizer; (e) with IR source & reflection compensation

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