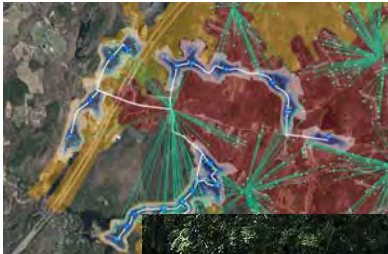## Acton-Boxborough Regional School District
Two-Tier School Bus Routing Analysis to Accommodate Delayed High School Start Time

Acton-Boxborough Regional School District
School Committee Presentation

April 27, 2017

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Acton-Boxborough Regional School District
Two-Tier School Bus Routing Analysis to Accommodate Delayed High School Start Time

1. Existing Transportation Practices
2. Proposed Transportation Practices
3. Proposed Fleet Requirements
4. Potential Start Times
5. Cost Implications
6. Conclusions
7. Questions

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Acton-Boxborough Regional School District
Two-Tier School Bus Routing Analysis to Accommodate Delayed High School Start Time

Existing Start-Time/Routing System

TIER	School	Start Time	End Time
1	Acton-Boxborough Regional High School	7:23 AM	2:18 PM
1	RJ Grey Junior High School	7:30 AM	2:06 PM
2	Douglas Elementary School	8:40 AM	2:50 PM
2	Gates Elementary School	8:40 AM	2:50 PM
2	Blanchard Elementary School	8:40 AM	2:50 PM
3	Conant Elementary School	9:20 AM	3:30 PM
3	Merriam Elementary School	9:20 AM	3:30 PM
3	McCarthy-Towne Elementary School	9:20 AM	3:30 PM

TIER	School	# Students*	# Routes (AM/PM)	# Drivers (AM/PM)
1	Acton-Boxborough Regional High School	2694	32/32	32/32
1	RJ Grey Junior High School			
2	Douglas Elementary School	1243	33/33	33/33
2	Gates Elementary School			
2	Blanchard Elementary School			
3	Conant Elementary School	1444	33/33	33/33
3	Merriam Elementary School			
3	McCarthy-Towne Elementary School			

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Constraining Factors

1. School Choice
2. Geography and Topography
3. Door-to-Door Service
4. Regional District Transportation Requirements
5. Fiscal and Storage Capacity
6. Athletics
7. Drop-off/Pick-Up Window
8. Lack of Neighborhood Schools

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Existing Student Density

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Two-Tier School Bus Routing Analysis to Accommodate Delayed High School Start Time

Existing Ridership

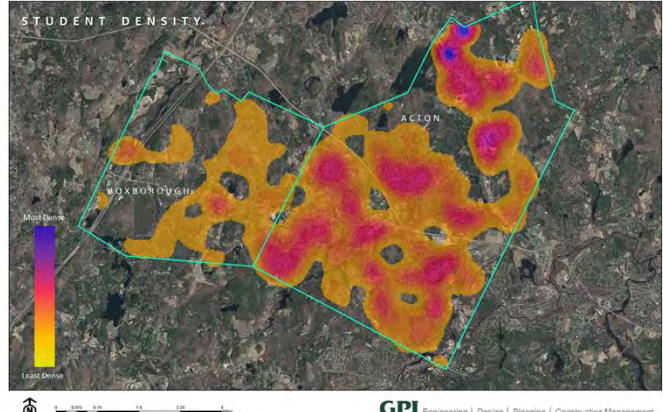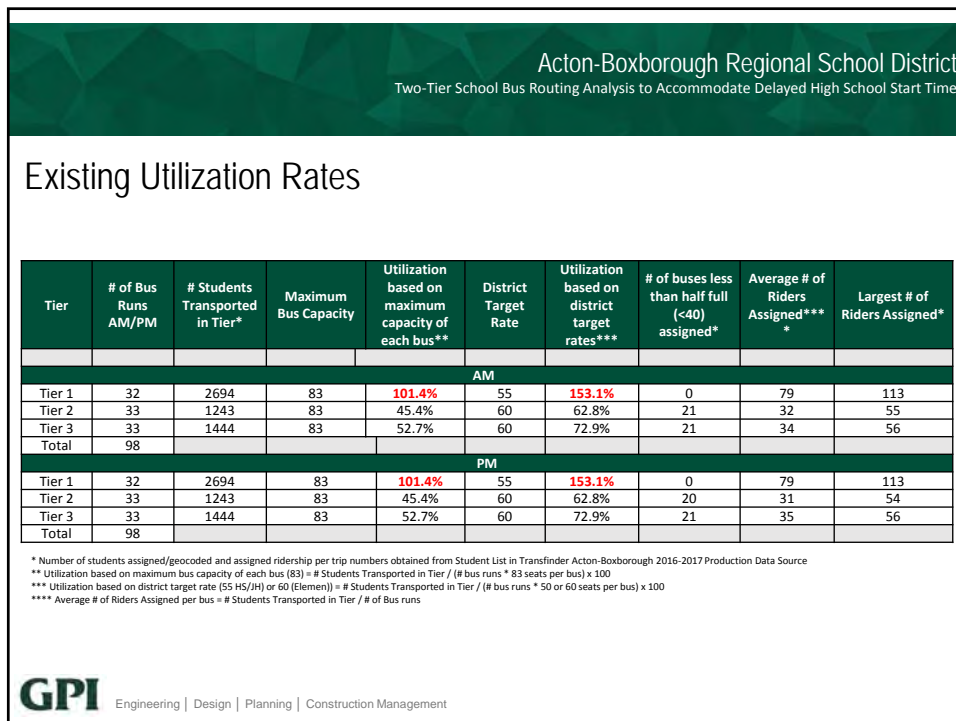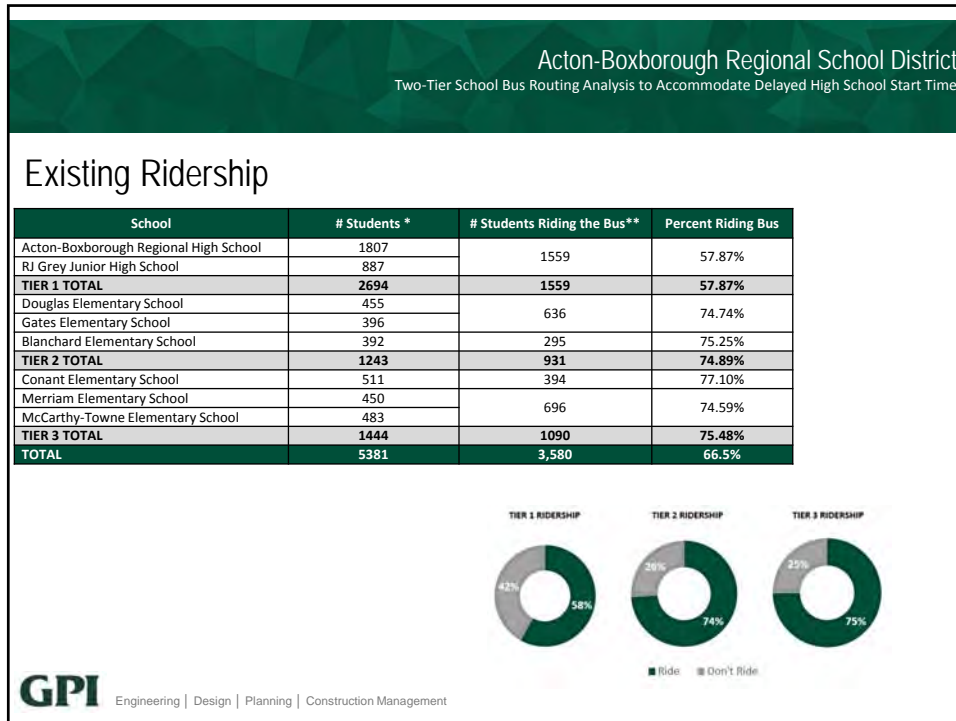| School	# Students *	# Students Riding the Bus**	Percent Riding Bus
Acton-Boxborough Regional High School	1807	1559	57.87%
RJ Grey Junior High School	887		
TIER 1 TOTAL	2694	1559	57.87%
Douglas Elementary School	455	636	74.74%
Gates Elementary School	396		
Blanchard Elementary School	392	295	75.25%
TIER 2 TOTAL	1243	931	74.89%
Conant Elementary School	511	394	77.10%
Merriam Elementary School	450	696	74.59%
McCarthy-Towne Elementary School	483		
TIER 3 TOTAL	1444	1090	75.48%
TOTAL	5381	3,580	66.5%

TIER 1 RIDERSHIP — 42% / 58% TIER 2 RIDERSHIP — 26% / 74% TIER 3 RIDERSHIP — 25% / 75%

■ Ride ■ Don't Ride

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Acton-Boxborough Regional School District
Two-Tier School Bus Routing Analysis to Accommodate Delayed High School Start Time

Existing Utilization Rates

Tier	# of Bus Runs AM/PM	# Students Transported in Tier*	Maximum Bus Capacity	Utilization based on maximum capacity of each bus**	District Target Rate	Utilization based on district target rates***	# of buses less than half full (<40) assigned*	Average # of Riders Assigned***	Largest # of Riders Assigned*
AM									
Tier 1	32	2694	83	101.4%	55	153.1%	0	79	113
Tier 2	33	1243	83	45.4%	60	62.8%	21	32	55
Tier 3	33	1444	83	52.7%	60	72.9%	21	34	56
Total	98								
PM									
Tier 1	32	2694	83	101.4%	55	153.1%	0	79	113
Tier 2	33	1243	83	45.4%	60	62.8%	20	31	54
Tier 3	33	1444	83	52.7%	60	72.9%	21	35	56
Total	98								

* Number of students assigned/geocoded and assigned ridership per trip numbers obtained from Student List in Transfinder Acton-Boxborough 2016-2017 Production Data Source
** Utilization based on maximum bus capacity of each bus (83) = # Students Transported in Tier / (# bus runs * 83 seats per bus) x 100
*** Utilization based on district target rate (55 HS/JH) or 60 (Elemen)) = # Students Transported in Tier / (# bus runs * 50 or 60 seats per bus) x 100
**** Average # of Riders Assigned per bus = # Students Transported in Tier / # of Bus runs

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Acton-Boxborough Regional School District
Two-Tier School Bus Routing Analysis to Accommodate Delayed High School Start Time

What does this tell us?

High school/Junior High School Tier is OVERUTILIZED

Currently, if every enrolled high school and junior high school student were to ride the bus, there would not be enough seats to service every student and every bus would be servicing greater than 55 students, the district target rate for high school/junior high school students. This indicates that there are currently not enough buses to safely service all of the students enrolled in the high school and junior high school. Since utilization rates are above 100%, additional buses will be required to service high school/junior high school tier at a healthy utilization rate.

Elementary Tier is UNDERUTILIZED

Both Tier 2 and Tier 3 require a greater number of buses to service half of the students than that of Tier 1. Once again, this is due to the existing "breathing" structure of transportation routing network as well as the need to balance both ridership and trip length. Over 60% of the elementary morning runs are assigned less than 40 students, suggesting that there are more buses than necessary to service elementary children and that these trips need to be optimized to gain greater efficiency.

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Two-Tier School Bus Routing Analysis to Accommodate Delayed High School Start Time
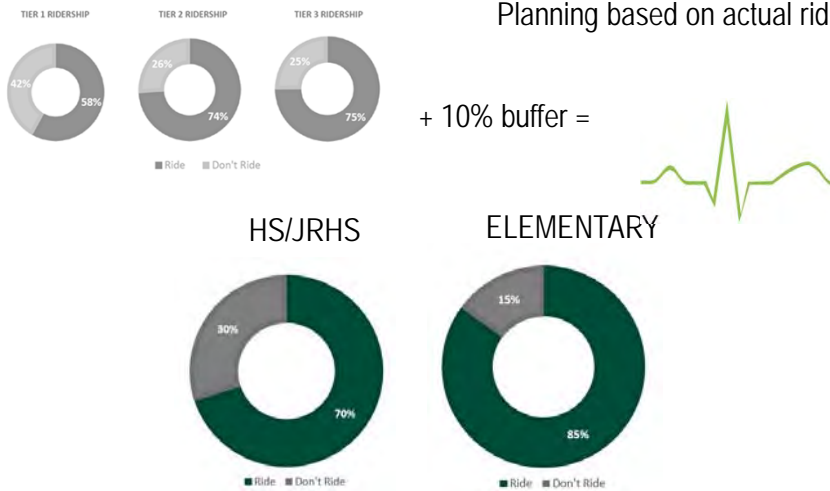
If ABRSD were to maintain current practices, routes, and stops currently in place within a two-tier structure, a total of **66** buses would be required, but there is not enough money to secure the additional equipment and personnel to do so, nor would this be an efficient system.

Therefore, modifications must be made to reduce number of buses required.

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Two-Tier School Bus Routing Analysis to Accommodate Delayed High School Start Time
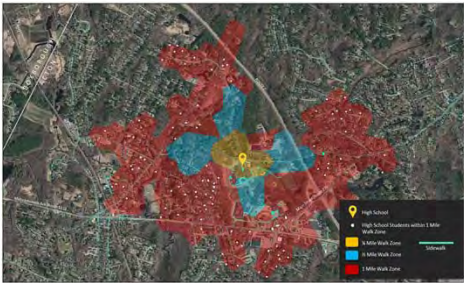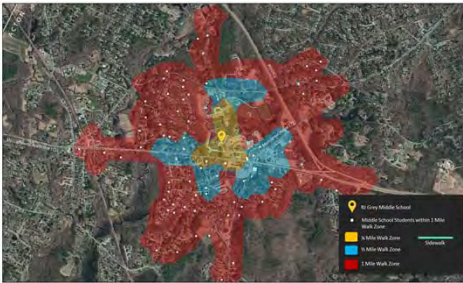
Proposed Transportation Practices

1. Planning based on actual ridership
2. Removal of Cul-de-Sac Service
3. Walk Zones
4. "Cluster" stop approach
5. Maximum # of Students assigned per bus
6. Trip Length and Pick-Up/Drop-Off

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Two-Tier School Bus Routing Analysis to Accommodate Delayed High School Start Time

Planning based on actual ridership

+ 10% buffer =

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Slide 1

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Two-Tier School Bus Routing Analysis to Accommodate Delayed High School Start Time

Removal of Cul-de-Sac Service

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Slide 2

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Two-Tier School Bus Routing Analysis to Accommodate Delayed High School Start Time

Walk Zones

195 Students with 1 Mile Buffer = reduction of at least 2 buses

REQUIRES POLICY CHANGE

Grade	Walk Zone
PK-6	-
7-8	1 Mile
9-12	1 Mile

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Two-Tier School Bus Routing Analysis to Accommodate Delayed High School Start Time

"Cluster" Stop Approach

Grade	Walk Zone
PK-K	-
1-6	0.15 miles
7-8	0.25 miles
9-12	0.25miles

Average number of students per stop and route

Average number of stops and total stop time

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Two-Tier School Bus Routing Analysis to Accommodate Delayed High School Start Time

"Cluster" Stop Approach: Performance Measures

Tier	Measure	Existing	Proposed
High School/Junior High	Average # Stops per Route	19.3	10
	Average # Students per Bus	51	55
	Average # Students per Stop	2.61	5.5
	Total Stop Time	9 minutes 52 seconds	5 minutes 17 seconds
Elementary	Average # Stops per Route	21.65	18
	Average # Students per Bus	30.62	54
	Average # Students per Stop	1.413	3.33
	Total Stop Time	10 minutes 57 seconds	9 minutes 16 seconds

46% reduction in total stop time in HS/JRHS Tier

15% reduction in total stop time in Elementary Tier

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Slide 1

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Two-Tier School Bus Routing Analysis to Accommodate Delayed High School Start Time

Maximum Number of Students Assigned to a Bus

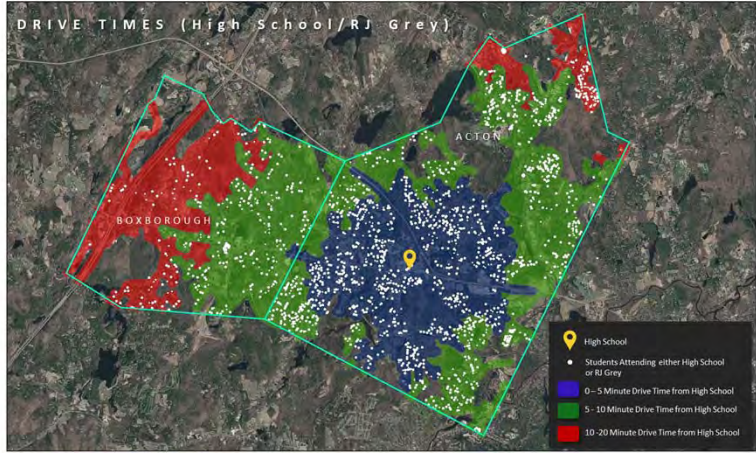| Tier	Max. Bus Capacity	District Target Capacity	Max. Students Assigned per Bus
Elementary: K-6	83	60	70
High School/JR: 7-12	83	55	75

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Slide 2

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Two-Tier School Bus Routing Analysis to Accommodate Delayed High School Start Time

Trip Length and Pick-Up/Drop-Off Window

Maximum Time Student is on Bus Target: 40 Minutes

30 Minute Window

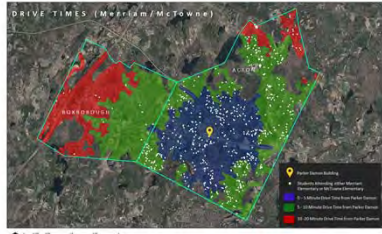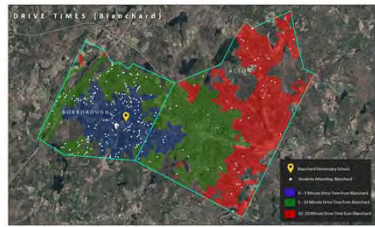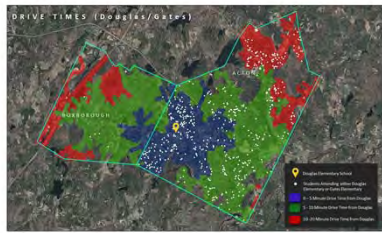GPI Engineering │ Design │ Planning │ Construction Management

Acton-Boxborough Regional School District
Two-Tier School Bus Routing Analysis to Accommodate Delayed High School Start Time

PROPOSED FLEET REQUIREMENTS

Tier	# Students in Tier	# Students Actually Riding (+10% Buffer)*	# of Buses (Limit 83 Students per Bus)**	# of Buses to Meet District Target Rates***	Required # of Buses for Efficient Service****	Recommended Spare Buses	Total Number of Buses
Elementary (K-6)	2687	2284	33	39	42	5	47
HS/JRHS (7-12)	2694	1886	33	35	38	5	43

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Acton-Boxborough Regional School District
Two-Tier School Bus Routing Analysis to Accommodate Delayed High School Start Time

PROPOSED UTILIZATION RATES

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POTENTIAL START TIMES: Scenario A

Acton-Boxborough Regional School District
Two-Tier School Bus Routing Analysis to Accommodate Delayed High School Start Time

Proposed 2-Tier: Scenario A			
Tier 1	Start	End	Duration
Elementary All	7:50 AM	2:20 PM	6 hours 30 minutes
Tier 2	Start	End	Duration
High School	8:30 AM	3:10 PM	6 hours 40 minutes
Junior High School	8:30 AM	3:06 AM	6 hours 36 minutes

Tier	# of Bus Runs AM/PM	Target Pick-Up (AM)	Target Drop-Off (PM)
Tier 1 (Elementary)	42	7:10 AM	3:00 PM
Tier 2 (HS/JRHS)	38	7:50 AM	3:50 PM
Total	80		

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POTENTIAL START TIMES: Scenario B

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Two-Tier School Bus Routing Analysis to Accommodate Delayed High School Start Time

Proposed 2-Tier: Scenario B			
Tier 1	Start	End	Duration
High School	8:00 AM	2:40 PM	6 hours 40 minutes
Junior High School	8:00 AM	2:36 PM	6 hours 36 minutes
Tier 2	Start	End	Duration
Elementary All	8:40 AM	3:10 PM	6 hours 30 minutes

Tier	# of Bus Runs AM/PM	Target Pick-Up (AM)	Target Drop-Off (PM)
Tier 1 (HS/JRHS)	38	7:20 AM	3:20 PM
Tier 2 (Elementary)	42	8:00 AM	3:50 PM
Total	80		

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Acton-Boxborough Regional School District
Two-Tier School Bus Routing Analysis to Accommodate Delayed High School Start Time

Merging to a two-tier routing system will result in an addition in equipment and personnel…

TIER	ROUTES (AM/PM/TOTAL)			TOTAL BUSES*			TOTAL DRIVERS**		
	Existing	Proposed	Change	Existing	Proposed	Change	Existing	Proposed	Change
Elementary	66/66/132	42/42/84	-24/-24/-48	36	47	+11	34	45	+11
HS/JRHS	32/32/64	38/38/76	+6/+6/+12	36	43	+7	34	41	+7
TOTAL	Reduction in 34 total trips			Increase of 11 buses			Increase of 11 drivers		

* Includes 5 spare buses
** Includes 3 spare drivers

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Two-Tier School Bus Routing Analysis to Accommodate Delayed High School Start Time

Total increase of $750,900.00 to the transportation and personnel budget in the first year of operation (2018-2019)

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Acton-Boxborough Regional School District
Two-Tier School Bus Routing Analysis to Accommodate Delayed High School Start Time

State provides reimbursement for regional transportation costs for all students who reside more than 1.5 miles from the school they attend.

The state reimbursement for these additional transportation costs are estimated to be $378,454.00, leaving $372,446.00 to be covered in the ongoing school operating budget. (2019 +)

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Acton-Boxborough Regional School District
Two-Tier School Bus Routing Analysis to Accommodate Delayed High School Start Time

TWO-TIER COST IMPLICATIONS			
Personnel Costs			
	Units	Cost	Total
Salary 30 Hours (Could possibly reduce to 25 hours)	11	$30,000	$330,000
Health Insurance	11	$11,000	$121,000
Workers Comp/Unemployment		$15,000	$15,000
Total Personnel Costs			**$466,000**
Bus Costs			
Bus Lease	11	$13,500	$148,500
Gas/Fuel Costs	11	$5,500	$60,500
Maintenance& Miscellaneous	11	$3,000	$33,000
Property & Liability	11	$2,800	$30,800
Bus Storage	11	$1,100	$12,100
Total Bus Costs			**$284,900**
Total Costs of Single Tier Busing (First Year 2018-2019)			
Total Personnel Costs			$466,000
Total Bus & Maint Costs			$284,900
Total Costs First Year (2018-2019)			**$750,900**
Budgetary Costs After Reimbursement (Starting in 2nd Year 2019-2020)			
Total Costs of Single Tier Busing			$750,900
Costs Eligible for Reimbursement	70%	Number of Students over 1.5 miles	$526,630
Estimated Reimbursement available 2nd year (2019-2020)	72%	Reimbursement of Eligible Costs	**$378,454**
Cost of single tier busing after reimbursement (starting in 2019-2020)			**$372,446**

Acton-Boxborough Regional School District
Two-Tier School Bus Routing Analysis to Accommodate Delayed High School Start Time

COST PER STUDENT

$522⁰⁰

Existing AB 2018 Budget

$662⁰⁰

Proposed AB Budget

$961⁰⁰

National Average

Therefore, although the budget would increase, the Acton-Boxborough Regional School District will continue to transport students at a cost significantly less than that of the national average.

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Two-Tier School Bus Routing Analysis to Accommodate Delayed High School Start Time

CONCLUSIONS

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Acton-Boxborough Regional School District
Two-Tier School Bus Routing Analysis to Accommodate Delayed High School Start Time

Merging to a two-tier system is possible, but will require additional buses and drivers as well as several changes in transportation practices including the following…

1. Planning Based on Actual Ridership
2. Removal of Cul-de-Sac Service
3. Walk Zones
4. "Cluster" Stop Approach
5. Maximum # of Students assigned per bus
6. Trip Length and Pick-Up/Drop-Off Window

Adjustments required in order to minimize the number of buses needed to complete safe, efficient routes in the two-tier routing model.

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Acton-Boxborough Regional School District
Two-Tier School Bus Routing Analysis to Accommodate Delayed High School Start Time

It is understood that these changes will alter family schedules and potentially induce stress on the school community. Therefore, it is critical to involve all stakeholders from the very beginning with the intent of educating the public on the trade-offs of a delayed high school start time as well as to continue to create alternate start time scenarios that are responsive to family concerns.

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Acton-Boxborough Regional School District
Two-Tier School Bus Routing Analysis to Accommodate Delayed High School Start Time

The decision to alter the school schedule to accommodate for a delayed start does come at a price. The total increase in budget is expected to be $750,900.00 in the first year of operation and $372,446.00 in the second year of operation (after reimbursement).

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Acton-Boxborough Regional School District
Two-Tier School Bus Routing Analysis to Accommodate Delayed High School Start Time

Although the two-tier routing system will increase the transportation budget and pose a significant change for families, it will result in…

- healthy utilization rates
- efficient routing
- safe trips for students
- cross school collaboration,
- consistent elementary schedule
- facilitation of athletic and extracurricular programs
- achieve a delay for the high school start time.

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