

Philadelphia Bus Network Choices Report

JUNE 2018

SEPTA

JARRETT WALKER + ASSOCIATES

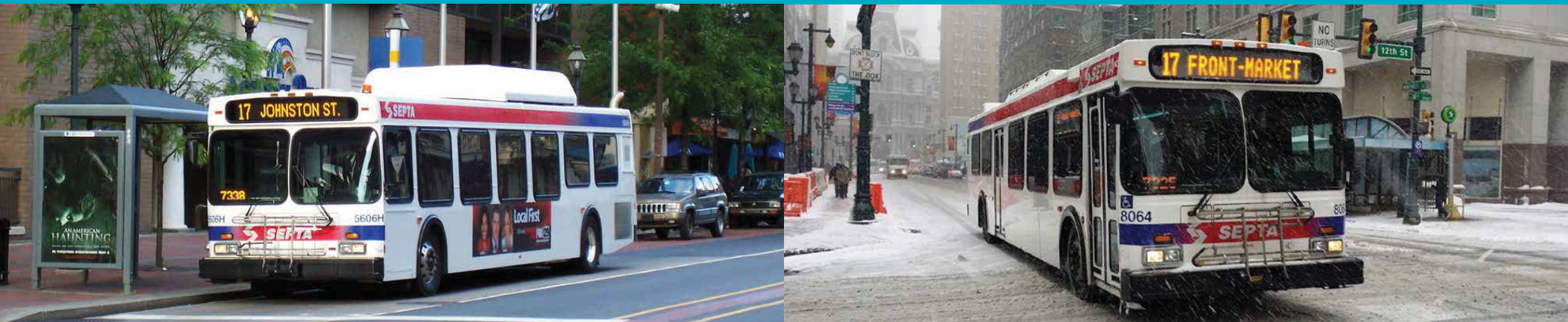


Table of Contents

Executive Summary	7
What if transit gave us more freedom?	8
What is this report?.....	8
The main conclusions	9
What is happening to ridership?.....	9
What are other cities doing?.....	10
The key to freedom: frequency and connections.....	10
About 10% of service is duplicative.....	10
Some routes have too much peak-hour service	11
Speed needs improvement	11
Reliability needs improvement, but is better than it sounds	11
Transit has competing goals: How will they be balanced?.....	12
<i>The existing balance of goals</i>	13
Evening and weekend service	13
Eliminate the Fare Penalty for Changing Buses	14
City leadership is critical	14
Try All-Door Boarding.....	14
The network can be more legible.....	15
Girard trolley is a barrier to travel.....	15
Summary of network design strategies.....	16
What should happen next?.....	17
Outline of this report	17
1	
Introduction	18
What is a “Choices Report”?	19
Why focus on buses?.....	19
<i>Limitations in Space</i>	19
Introducing the Network	20
<i>Center City, University City, and South Philadelphia</i>	21
<i>Center City, West, and North Philadelphia</i>	22
<i>Southwest Philadelphia</i>	23
<i>Northwest and Upper North Philadelphia</i>	24
<i>North and Lower Northeast Philadelphia</i>	25

<i>Far Northeast Philadelphia</i>	26
What are the recent trends?	27
2	
Is Transit Useful? Key Indicators	30
Ridership Arises from Usefulness	31
Frequency Comes First.....	32
Span: Is transit there when you need it?.....	34
<i>Frequent Service Standards</i>	36
<i>Connections</i>	38
<i>Buses are Getting Slower</i>	38
<i>On-Time Performance Is Poor</i>	39
<i>Better Measures of Reliability</i>	40
<i>Probability of Waiting at SEPTA</i>	41
All door boarding.....	42
3	
Improving Speed and Reliability: The Role of City Leadership	43
Some Problems are Outside SEPTA’s Control.....	44
<i>Prioritizing Center City Streets</i>	45
<i>Curb Management</i>	46
Leadership in Other Cities	47
<i>Seattle</i>	47
<i>New York City</i>	47
<i>San Francisco</i>	48
<i>Baltimore</i>	49
Philadelphia Experience	50
4	
Market Assessment	51
Development Patterns Matter.....	52
Residents.....	54
Jobs	55
Activity	56

Table of Contents

Linearity 57
 The Pattern of Boardings..... 58
 Continuity..... 59
 Income and Poverty 60
 Median Income.....60
 Low-income Density 61
 Zero Vehicle Households 62
 Race and Ethnicity..... 63
 Density of Transit Commuters 64
 Density of Walk and Bike Commuters 65

5

Network Assessment 66
 System-wide Productivity 67
 System-wide Coverage 68
 The Grid Network 69
 Transfers or Connections 70
 Barriers to Connections 71
 Duplicative Network Design..... 72
 Inconsistent Route Spacing 73
 Transfer Fees Encourage Longer Routes 74
 Complex Patterns Make Routes Indecipherable..... 75
 Route Productivity 76
 Productivity of North–South Routes..... 77
 Productivity of East–West Routes 78
 Productivity of Crosstown Routes..... 79
 Productivity of BSL Connector Routes..... 80
 Productivity of MFL Connector Routes..... 81
 Regional Rail Integration..... 83
 Responding to Specialized Demands 84
 Circuitous Routing to Minimize Transfers 85
 Legacy Elements 86
 Trolley Modernization: Opportunities and Challenges 87
 The Girard Trolley: A Service or a Barrier?..... 88

Peak Service 89

6

More Service Without More Money: Strategies and Choices..... 90
 More Service without More Money 91
 Remove Duplicative Route Segments 92
 Remove Excess Peak Service 92
 Consistent Route Spacing..... 92
 Consistent and Wider Stop Spacing 93
 Focus on All-Day Markets First 94
 The Ridership-Coverage Trade-off..... 95
 The existing balance of goals 96
 Network Redesign Process..... 96
 Network Concepts..... 96
 What about the long term?..... 96

Appendix 97

Table of Figures

Figure 1: Isochrone map of access by walking and transit from 4th Street and Oregon Avenue.	8
Figure 2: Productivity graph indicates a ridership loss for SEPTA and most peers starting in 2013.	9
Figure 3: Public transit, bicycles, and cars use progressively more road space to move the same number of people.....	9
Figure 4: A high-frequency grid provides convenient one-transfer connections between any two points.	10
Figure 5: A one-seat ride on a low-frequency route is usually slower than a high-frequency connection.	10
Figure 6: Ridership and coverage goals produce very different networks.	12
Figure 7: About 70% of the current network is focused on a ridership goal. A network redesign study would consider a different balance in how resources are split.....	13
Figure 8: An example of the possible decision space of concepts for transit in Philadelphia.....	13
Figure 9: The City of Seattle Transit Master Plan took vague transit goals and turned them into specific actions and guidance for all departments. It also told a compelling story that motivated voter support for increased transit funding.	14
Figure 11: Good network maps highlight frequent routes and show how all services fit together. This example from Washington DC’s WMATA shows subway in black, frequent buses in red, and less-frequent buses in blue.....	15
Figure 10: A San Francisco bus headsign explains where the route goes: along Geary Blvd to end at the VA Hospital. In gridded cities like Philadelphia many routes can be described this simply.	15
Figure 12: Budget neutral strategies for increasing service.	16
Figure 13: Annual riders by mode of travel and area—45% of annual rides occur on city buses.	19
Figure 14: (right) The road space required to move the same number of people using public transit, bicycles, and cars	19
Figure 15: Overview map of SEPTA network in Philadelphia.....	20
Figure 16: Map of SEPTA network—Center City, University City, and South Philadelphia.....	21
Figure 17: Detailed map of SEPTA network in Center City.....	21
Figure 18: Map of SEPTA network—Center City, West, and North Philadelphia.....	22
Figure 19: Map of SEPTA network—Southwest Philadelphia.....	23
Figure 20: Map of SEPTA network—Northwest and Upper North Philadelphia.....	24
Figure 21: Map of SEPTA network—North and Lower Northeast Philadelphia	25
Figure 22: Map of SEPTA network—Far Northeast Philadelphia	26
Figure 23: Total boardings by bus for SEPTA and peers, 2007–2017. SEPTA ridership has declined since 2013.	27
Figure 24: Investment—annual bus service hours provided by SEPTA and peers per capita, 2007–2017. Investment in SEPTA service has been relatively flat in the past decade.	27
Figure 25: Relevance: passenger boardings by bus per capita for SEPTA and peers, 2007–2017. SEPTA’s ridership per capita is high compared to its peers, but has also been declining since 2013.....	28
Figure 26: Productivity: passenger boardings by bus per service hour for SEPTA and peers, 2007–2017. Flat investment and declining ridership has led to declining productivity since 2013.	28
Figure 27: A 50% gas price cut in the second half of 2014 is likely the most significant reason for Philadelphia’s decline in ridership.	29
Figure 28: Map of travel time isochrones for walking and transit from 4th St and Oregon Avenue.	31
Figure 29: Frequency and productivity relate for SEPTA bus routes in Philadelphia.....	32
Figure 30: Higher frequency is generally associated with higher productivity. Hex plot of routes in 23 North American cities and Philadelphia.....	33
Figure 31: Frequency and span of service for the 20 SEPTA routes with the longest spans of frequent service. Only four routes have frequent service for 15 hours a day or more.....	34
Figure 32: Frequency and span of service on Saturday and Sunday for the 20 SEPTA routes with the longest spans of frequent service. Most routes are not frequent on Sunday.....	35
Figure 33: Frequent service standards in four North American cities.....	36
Figure 34: Portland’s TriMet is one of many agencies that promotes the Frequent Network as a distinct product with bus stops (left) and a map (right).	36
Figure 35: Availability of frequent service at different times of day on weekdays and weekends. The frequent network shrinks significantly weekdays after 7 pm.	37
Figure 36: Scheduled bus speeds by time of day, 2014–2017. Bus speeds have declined since 2014 and average less than 12 mph during most of the day.	38
Figure 37: The high density of signals and stop signs along Routes 17, 23, 33, 45 and 47 are major factors in the slow speed of these routes.	38
Figure 38: A majority of SEPTA routes are not achieving the 80% on-time performance standard (conventional measure). For frequent services, this measure of on-time performance is not what matters.....	39
Figure 39: Different ways of describing reliability.	40
Figure 40: SEPTA’s frequent routes are performing relatively well by the headway reliability standard. But reliability is low in the afternoon.	41
Figure 41: San Francisco’s all-door boarding reduced boarding time by ensuring that all doors are in use. Without all-door boarding, passengers must use the front door while the rear doors are idle. Photo: SFMUNI	42
Figure 43: Traffic congestion leads to bunching and delays on Route 33 on Market Street on a Friday afternoon.....	44
Figure 42: On-street parking interferes with a bus stop on Route 47 at 8th and Norris Streets.....	44
Figure 45: East–west bus service in Center City is spread across five streets.	45
Figure 44: Parked vehicles in the bus lane on Market Street.....	45
Figure 46: Peak bus volumes in the afternoon reach about 50 buses per hour around City Hall.	45
Figure 48: Nearside stops on Chestnut and Walnut causes delays for buses from right turning traffic at every other intersection (in red).	46
Figure 47: Delivery vehicles in the bus lane on Chestnut.	46
Figure 49: Frequent service within the City of Seattle is funded in part by the city per city policy.....	47
Figure 50: Curb extension bus stop on an SBS route in New York.....	47
Figure 51: Transit priority and bicycle lanes on Market Street in San Francisco.....	48
Figure 52: Toolbox of approaches for improving speed and reliability from SFMTA MUNI Forward program	48
Figure 53: New and existing dedicated bus lanes in Baltimore	49
Figure 54: Transit priority corridors in Baltimore.....	49
Figure 55: Example of a queue jump lane from Seattle.	50
Figure 56: Example of MUNI Forward proposed improvements.....	50
Figure 57: The Ridership Recipe—four geographic elements for achieving high ridership	52
Figure 58: South Philadelphia, East of Broad Street—higher density, higher walkability, good linearity.	53
Figure 59: Andorra Shopping Center, Northwest Philadelphia—lower density, lower walkability, poor linearity.....	53
Figure 60: Residential density is high across many areas of Philadelphia and is high by the standards of North American cities.	54
Figure 61: Job density is highest in Center City and University City.....	55
Figure 62: Map of activity (residential and job) density in Philadelphia and surrounding counties.....	56
Figure 63: North Philadelphia—good linearity and clear grid pattern of routes.....	57
Figure 64: Morrell Park in Northeast Philadelphia—poor linearity in the street network requires inefficient, circuitous routing.	57
Figure 65: Bus boardings are highest at major transfer points in Philadelphia	58
Figure 67: The new Boulevard Direct service on Roosevelt has many features of BRT service, such as wide stop spacing, that fits the land use pattern of the corridor.....	59

Table of Figures

Figure 66: Comparison of bus boardings on Roosevelt Boulevard and Frankford Avenue in Northeast Philadelphia.....	59
Figure 68: Median household income is lowest in West and North Philadelphia.....	60
Figure 69: Density of low-income residents is highest in Center City and South Philadelphia.....	61
Figure 71: Broad swaths of Philadelphia have high densities of zero-vehicle households.....	62
Figure 70: Census block groups where median household incomes are low tend to be places with lower vehicle ownership.....	62
Figure 72: Density map of people by race or ethnicity in Philadelphia and surrounding counties.....	63
Figure 73: South and West Philadelphia have high densities of transit commuters.....	64
Figure 74: Bike and walk commuter density is highest in Center City and University City.....	65
Figure 75: At high density levels, a marginal increase in density has a smaller effect on transit demand because so many people walk or cycle.....	65
Figure 76: Productivity: passenger boardings by bus per service hour for SEPTA and peers, 2007–2017. Flat investment and declining ridership has led to declining productivity since 2013.....	67
Figure 77: People and jobs covered by transit in Philadelphia—most residents have access to some transit.....	68
Figure 79: A grid network covers South Philadelphia with consistent north–south and east–west routes creating easy connections.....	69
Figure 80: Comparison of radial and grid network structures.....	69
Figure 81: West Philadelphia has both radial and grid elements.....	69
Figure 78: A grid network provides a one-transfer trip between any two points.....	69
Figure 82: Routes 47 and 60 cross in North Philadelphia (in circle).....	70
Figure 83: Boarding activity where Routes 47 and 60 cross (in circle).....	70
Figure 84: Aerial imagery where Routes 47 and 60 cross.....	70
Figure 86: Riders who buy a pass transfer at a much higher rate than riders who use their travel wallet.....	71
Figure 85: In 2017, 32% of riders paid with cash or token and had to pay \$1 to transfer.....	71
Figure 87: Route 1 duplicates service provided by many other routes and therefore has relatively few boardings.....	72
Figure 88: Route spacing is inconsistent between north–south and east–west routes.....	73
Figure 89: Boarding activity on Route 2 in South Philadelphia.....	73
Figure 90: Boarding on Route 23 (above) and the graph of boarding and alighting patterns (left) indicate a lot of turnover at the Broad/Erie Station.....	74
Figure 92: The schedule for Route 14 is incredibly hard to decipher.....	75
Figure 91: Many SEPTA routes have numerous patterns, making schedules and routes hard to follow.....	75
Figure 93: Map of Route 14 from SEPTA schedule. Several Route 14 patterns are barely visible in dark grey.....	75
Figure 94: Frequency is correlated with productivity on SEPTA bus routes and different route types have different productivity.....	76
Figure 95: Some north–south routes serving Center City have relatively low productivity.....	77
Figure 96: Routes 5, 25, 61 and 32 compete with higher frequency routes for riders and rarely provide unique coverage.....	77
Figure 97: Most east–west routes serving Center City have high productivity.....	78
Figure 98: Network structure in West Philadelphia.....	78
Figure 99: Most crosstown routes have high productivity.....	79
Figure 100: Half of BSL Connector routes have high productivity.....	80
Figure 101: Map of SEPTA network showing connections to the BSL at Olney and Fern Rock.....	80
Figure 102: Most MFL Connector routes have relatively low productivity.....	81
Figure 103: The road and transit network transitions to a more radial system in Northeast Philadelphia.....	81
Figure 104: Express routes have relatively low productivity.....	82
Figure 105: Boardings for Route 27 show that ridership is much higher in the peak direction.....	82
Figure 106: With better headways and fare integration, Regional Rail could provide more access within the city.....	83
Figure 108: The pattern of boardings and alightings shows that most people who ride Route 47M are going to Market Street, not the Italian Market.....	84
Figure 107: Routes 47M takes frequency from northbound service on 7th Street to reduce walking distance to destinations on 9th Street.....	84
Figure 109: Route 89 is an example of a highly circuitous route. The map shows low average-weekday-boardings.....	85
Figure 110: The network in the area of Port Richmond has many legacy elements that are difficult to fix.....	86
Figure 111: Trolley routes (red and gray dashed lines) are primarily radial, to connect to Center City through the trolley tunnel.....	87
Figure 112: Trolley modernization will require platforms and other infrastructure to make trolleys ADA accessible.....	87
Figure 113: Without dedicated lanes, trolleys are more susceptible to unreliable conditions on the road than buses.....	88
Figure 114: As a trolley, Route 15 in West Philadelphia cannot reach 69th Street Transportation Center.....	88
Figure 115: Most routes have lower productivity in the peak than in the midday, suggesting excessive peak service.....	89
Figure 116: Budget neutral strategies for increasing service.....	91
Figure 117: Increasing spacing of north–south routes would free up resources to invest in areas of high potential ridership.....	92
Figure 118: Trade-off between stop spacing and travel time.....	93
Figure 119: Current stop spacing standards for SEPTA and peers.....	93
Figure 120: A high-frequency grid provides convenient one-transfer connections between any two points.....	94
Figure 121: Ridership and coverage goals produce very different networks.....	95
Figure 122: How existing service is tied to goals. A network redesign would remove duplication and excess peak service, and redeploy to serve the other goals, depending on local priorities.....	96
Figure 123: An example of the possible decision space of concepts for transit in Philadelphia.....	96
Figure 124: Division of service into duplication, ridership, and coverage categories.....	98