Supporting Late-Shift Workers

Their Transportation Needs *and* the Economy

AMERICAN PUBLIC TRANSPORTATION ASSOCIATION

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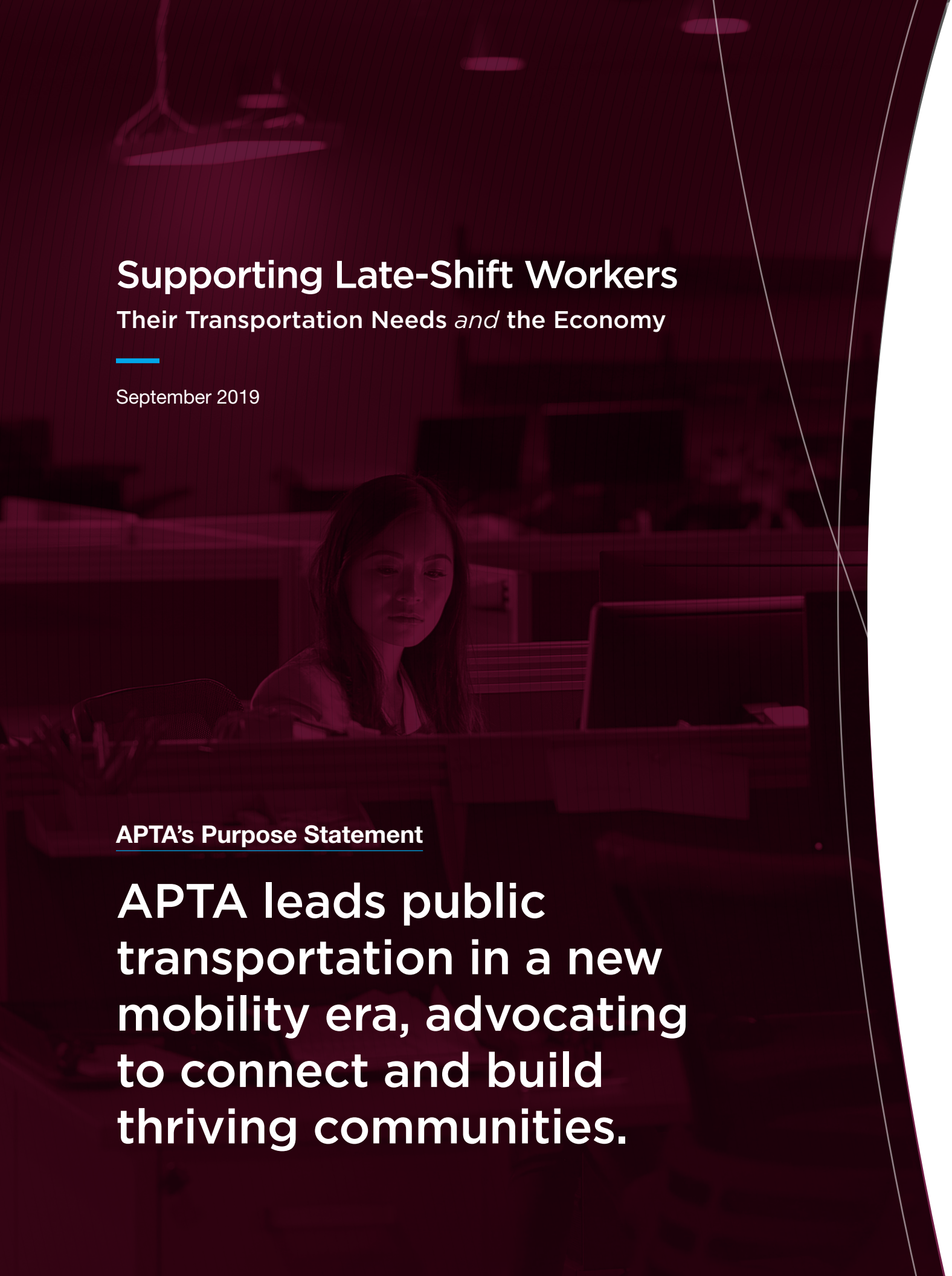
September 2019



APTA's Purpose Statement

APTA leads public transportation in a new mobility era, advocating to connect and build thriving communities.

CONTENTS

Executive Summary

The American Public Transportation Association (APTA) commissioned this study to better understand the needs of late-shift commuters and the ways public transit providers and decision-makers can improve commuting options for this growing segment of the U.S. workforce.

What Is the Late-Shift?

America's late-shift is large and diverse. This report focuses specifically on the late-shift in metropolitan areas, or metropolitan statistical areas (MSAs). The country's MSAs account for 86 percent of the population, including the overwhelming majority of public transit ridership. Over the past 50 years, as the country has become increasingly metropolitan, many of the formerly "rural" areas of the country have been absorbed into nearby MSAs (Van Dam, 2019). More than 17 percent of the workforce in MSAs work the late-shift, and those workers play an essential role in the economy, from ensuring that goods and services are available late into the night to maintaining critical medical and emergency services 24/7.

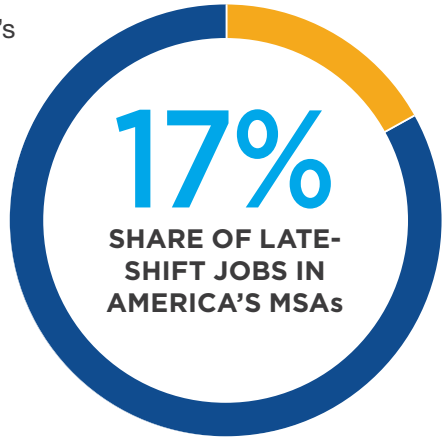
The late-shift is only growing in importance. Many of the largest late-shift sectors, such as healthcare, food services and hospitality/leisure, are expected to grow faster than overall employment over the next five to 10 years.

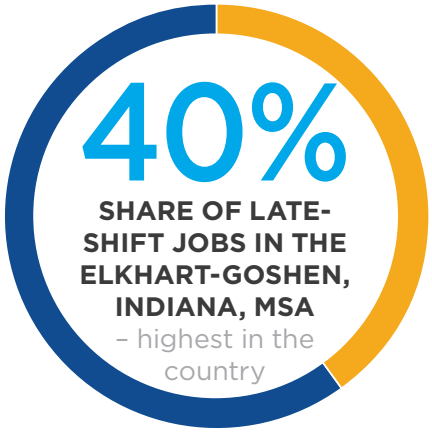
Who Works the Late-Shift?

The late-shift should be of concern to policymakers across the nation and political spectrum. The late-shift workforce represents a key voting demographic for both Republicans and Democrats:

- Seventeen percent of America's MSA workforce works the late-shift. A much larger percentage of Americans, at least infrequently, completes paid work during this time.
- Of all workers at all times of day, the lowest educational attainment (percent college educated) is found among people who report to work between 9 p.m. and 5 a.m.

The late-shift is a key source of employment for working-class Americans without advanced degrees. Large-scale manufacturing relies on the late-shift to keep factories humming 24/7, and small manufacturing centers like Elkhart, Indiana, and Clarksville, Tennessee, have among the largest proportion of total workers employed during the late-shift in the country.





$28 BILLION

IN ANNUAL WAGES brought home by late-shift workers

$84 BILLION

IN ANNUAL SALES facilitated by late-shift workers

Why Is Public Transit Important for the Late-Shift?

APTA sees expanding public transit service to the late-shift as critical due to the commuting challenges this segment of the workforce already faces. Many late-shift jobs today require a car to access. Data shows that late-shift workers are disproportionately likely to be transportation-cost burdened. The annual median wage for late-shift workers is $30,000, $5,000 lower than the median wage of daytime employees; the average annual cost of car ownership equals 30 percent of the median pre-tax earnings of late-shift workers. High transportation costs lead to greater financial stress on late-shift workers or exclude potential workers from taking advantage of late-shift jobs.

Better public transit during the late-shift is also important for employers. Interviews conducted by APTA demonstrate the impact limited public transportation options have on worker truancy and turnover. Late-shift workers have above-average turnover rates, and the cost of rehiring and retraining workers is substantial. Previous research shows that employee turnover is lower in counties where public transportation is available; a reduction in turnover of 1,100 to 1,200 manufacturing workers per year translated to between $5.3 million and $6.1 million in savings to employers, according to one study. (Faulk, D. and Hicks, M.J., 2016)

Late-shift public transit commuters represent a small share of today's late-shift workforce but already have a large economic footprint: These workers bring home $28 billion in wages per year and facilitate an estimated $84 billion in annual sales.

How Public Transit Agencies Can Address Late-Shift Commuting Needs

The late-shift is particularly challenging for public transit agencies to serve. Lower overall travel demand, combined with fiscal and operating constraints, often restrict public transit agencies from providing the same types and level of service as they do during the daytime. Public transit providers use a range of strategies to meet the needs of the late-shift:

- **Extend span of service:** One of the most common methods of improving late shift public transit is to simply extend the span of service of existing public transit routes. By increasing the operating hours of a route, public transit agencies can make existing services more convenient and flexible for riders. Operating the same routes at night as during the day reduces the need for riders to learn a whole new set of routes and saves agencies from creating additional branding and signage for late-night bus service. Extending the span of service comes at an opportunity cost for public transit systems, especially rail systems: Longer spans of service reduce the window of time a system has to conduct upkeep and maintenance.

- **Create a special night bus network:** In some instances, operating the same public transit network at night as during the day is not feasible. Lower levels of service, less convenient transfers, safety concerns, and operational limitations all impact nighttime service. To improve the efficiency of public transit during the night, some agencies run a separate night-bus network. While there are several ways to structure a night-bus network, common strategies include concentrating transfers at only a handful of hubs, scheduling routes to minimize transfer waiting times, and creating longer routes that provide a one-seat ride between a large set of origins and destinations.

- **Seek employer funding:** In instances where late-night public transit service disproportionately benefits a handful of employers, public transit agencies increasingly are pursuing private-sector partnerships. These partnerships can result in employers subsidizing the cost of late-night public transit service, promoting public transit usage among their workforce, and assisting public transit agencies in optimizing schedules around shift times.

- **Enter into a partnership with on-demand providers:** A growing number of public transit agencies is partnering with transportation network companies (TNCs) such as Uber and Lyft, and microtransit operators such as Via, to operate alternatives to late-night fixed-route service. Due to lower demand at night, these services in some instances may be more cost-effective to operate than fixed-route bus service.

In addition to providing a means for workers to access late shift jobs, improving public transit at these times has been shown to have a positive impact on ridership at all times of day; public transit providers that increase their span of service see ridership gains even during periods with no increase in service (Simmons & Haas, 2016). Often public transit is already available for one end of the late shift, but because it is not available at the other the workers cannot take public transit. By increasing public transit in the late night, those workers will be able to also use the public transit that already existed.

Next Steps for Policymakers

This study has identified several ways policy-makers at the local, state and national levels can improve mobility for late shift commuters:

- **Establish funding programs dedicated to funding late shift public transportation operations.** Providing public transportation during the late shift is challenging due to lower ridership and overall travel demand during this period. However, lower ridership should not be equated with this period having a lesser need for public transit. Operating late shift public transit (along with alternative modes like demand-response service, carpools and vanpools) is essential for expanding workforce opportunities. Without new funding for late shift public transportation at the state and federal levels, public transit agencies are forced to subsidize these needs within their already-constrained budgets.

- **Increase investment in public transit system state of good repair and shrink the backlog of deferred maintenance.** Aging public transit systems have a reduced capacity to operate late-night public transit service because of maintenance and upkeep needs. As rail systems fall out of a state of good repair, a larger window of time is needed to perform inspections and maintenance at night. Investing in public transit infrastructure will give agencies more flexibility to expand their hours of service.

- **Continue to embrace innovative partnerships to meet late-shift mobility needs.** Fixed-route public transit may not be appropriate for serving all types of late-shift travel needs. Programs like Aequitas in Battle Creek, Michigan, and Night Shift in Detroit illustrate the value of partnering with private or nonprofit organizations to fill gaps that fixed-route public transit cannot serve. For many late-shift employees, carpool and vanpool programs are a better option than public transit. The public sector can support these efforts by managing ride-matching services and providing services such as guaranteed ride home for when a carpool partner is unavailable.

- **There is still a lack of research on the costs and benefits of new mobility partnerships.** As these programs expand, it's important that policy-makers take a critical look at how these programs perform and whether they are meeting their intended objectives.

- **Formalize frameworks to allow employers to subsidize late-shift public transportation.** Private businesses directly benefit from expanded late-shift public transit. Already there are examples of major employers financially supporting public transit service aligned to nontraditional work schedules. Public transit providers could work to expand this by creating a standardized process for agency–private sector partnerships. In many cases, single businesses may not have the resources or scale to subsidize late-shift public transit on their own, but public transportation management associations or similar collective actions can pool the necessary resources to invest in impactful public transit.

Conclusion

Late-shift mobility should be a key concern for decision-makers across the country, regardless of location or political affiliation. APTA's research shows a need in communities of all shapes and sizes, from the Midwest to the Sun Belt, Hartford to Honolulu. The late-shift is a growing source of opportunity for Americans, and many key late-shift industries are expected to add jobs at a faster rate than overall employment. The lack of adequate late-night mobility options is costing both employees and employers. The need to own a car makes late-shift jobs unavailable (or unaffordable) for a segment of the American population. Commuting challenges also hit employers by increasing truancy and turnover, costing the U.S. economy billions of dollars a year. With coordinated action, decision-makers, transit providers and the private sector can come together to improve public transportation for America's late-shift through new funding, public policy and innovative service models.

Introduction

The public discourse on commuting too often focuses on public transportation for those working "traditional" 9-to-5 jobs. However, a growing share of Americans work the late-shift—broadly defined as jobs that start between 4 p.m. and 6 a.m.

Late-shift workers represent an underserved segment of America's transit riding public, as many public transit systems do not operate, or operate at reduced schedules, when late-shift workers are commuting to and from work.

APTA initiated this study to better understand the needs of late-shift commuters and the ways public transit providers and decision-makers can improve commuting options for this growing segment of the U.S. workforce. What APTA found was a late-shift commuting base that is as diverse and multifaceted as the economy as a whole. Late-shift jobs play a crucial role for our nation. Yet many of these workers are also the segment of the population most at risk of being burdened by high transportation costs and reduced opportunities due to limited travel options.

Public transit systems across the country struggle to meet the needs of late-shift commuters. Lower overall demand for public transportation during late-night hours makes it challenging from a cost perspective for agencies to expand service. Moreover, there are several distinct operational and organizational barriers to expanding late-shift public transportation.

Numerous strategies are being used to better serve late-shift mobility needs. Several of the public transit providers profiled in this study have steadily increased late-night public transit service to meet growing demand. Additionally, new mobility services and technologies are enabling new types of partnerships and on-demand solutions for late-night public transportation.

This report is organized into four broad sections. The first highlights the economic importance of the late-shift, including the size and significance of the U.S.'s late-shift workforce. This section quantifies the total wages generated by late-shift public transit riders and the demographic and industrial differences in late-shift commuting needs.

The second part of this report profiles the state of commuting during the late-shift. Here the report explores how public transit usage differs substantially between the day and night, along with the geography of late-shift public transit usage. This section highlights the impacts that limited public transit during the night has on both employees and employers.

The third section discusses the challenges and approaches to operating late-shift public

transit. Here the study discusses the various barriers public transit providers face in extending nighttime public transit service. Several models for late-shift public transportation are discussed.

Finally, the report ends with a conclusion, including a call to action for how policymakers can better support the commuting needs of late-shift workers.

Research Approach

The research for this study was accomplished primarily through three methods.

Literature Review

APTA's study team began by reviewing the range of existing literature available on late-shift employment and travel behaviors. Some key sources of information include the American Time Use Survey and Bureau of Labor Statistics (BLS) reports. Academic and policy papers were reviewed to better understand the challenges of operating late-shift public transportation.

Data Analysis

From that starting point, the team generated additional findings through an analysis of publicly available demographic and employment data. The analysis was based on five-year estimates (2013-2017) from the American Community Survey (ACS), as well as the 2016 Public Use Microdata Sample (PUMS) accessed using IPUMS USA (Ruggles, et al., 2018). PUMS consists of individual records for a sample of ACS responses. The individual records allow for an analysis of the interaction of different factors not possible using the pre-aggregated ACS data products available to the public.

This analysis considers the commute patterns and characteristics of late-shift workers in America's 381 metropolitan statistical areas (MSAs); late-shift workers are defined as individuals who arrive at work between 4 p.m. and 6 a.m. The U.S. Office of Management and Budget defines an MSA as a geographic region with high levels of economic and social integration anchored by a core urbanized area of at least 50,000 people. Eighty-six percent of the U.S. population live in an MSA, including nearly all public transit riders.

Interviews

Finally, APTA conducted interviews with a variety of public transit agencies, businesses and nonprofits to get a more complete picture of the on-the-ground realities of late-shift commuting. These interviews were indispensable in highlighting many of the nuances related to late-shift commuting.

Interviewees were the following:

- Aequitas Mobility Services
- Arizona Charlie's Decatur Hotel and Casino
- Battle Creek Unlimited
- Detroit Department of Transportation (DDOT)
- Los Angeles County Metropolitan Transportation Authority (Metro)
- Pittsburgh International Airport
- Port Authority of Allegheny County
- Quonset Development Corporation
- Regional Transportation Commission of Southern Nevada (RTC)
- Southeastern Pennsylvania Public Transportation Authority (SEPTA)
- The Orleans Hotel and Casino
- Unite Here, Orange County

Significance of the Late-Shift Economy

Late-shift employment is an important and growing part of the U.S. economy. Seventeen percent of jobs in America's MSAs start between 4 p.m. and 6 a.m. Many of these jobs are in rapidly growing sectors that provide opportunity for low- and mid-wage earners.

Late-shift work is essential work, from maintaining the logistical and other services that support businesses to providing crucial 24-hour services like ambulatory care and emergency response.

Late-shift employment plays an important role for the economy across the country, not just in large urban areas. From factories in the Midwest to hospitality and leisure jobs in the Sun Belt and medical and financial services jobs in the Northeast, few regions of the country lack an economically vital late-shift sector.

To demonstrate the importance of the late-shift, APTA looked at four key components:

- Demographics of the late-shift
- How late-shift public transit commuters sustain economic activity across the U.S.
- The concentration of late-shift jobs across a variety of industries
- The concentration of future job growth in the late-shift

Who Works the Late-Shift?

The late-shift workforce in the United States is significant in size, and America stands out among high-income countries for the large share of the workforce working nights and weekends. Seventeen percent of Americans living in an MSA arrive at work between 4 p.m. and 6 a.m.[1] According to a cross-national study of time-use diary data, 27 percent of Americans report doing some paid work at night (defined as 10 p.m. to 6 a.m.) compared with 19 percent of people from the U.K., 13 percent of Germans, and only 7 percent of people in the Netherlands and France (Hamermesh & Stancanelli, 2015).

The characteristics of late-shift workers vary across industry and time of day. Generally, the late-shift can be further broken down by arrival time to work by evening (4 to 10 p.m.), late night (10 p.m. to 3 a.m.) and early morning (3 to 6 a.m.).

[1] This is based on 2016 American Community Survey (ACS) Public Use Microdata Sample (PUMS) accessed using IPUMS USA (Ruggles, et al., 2018).

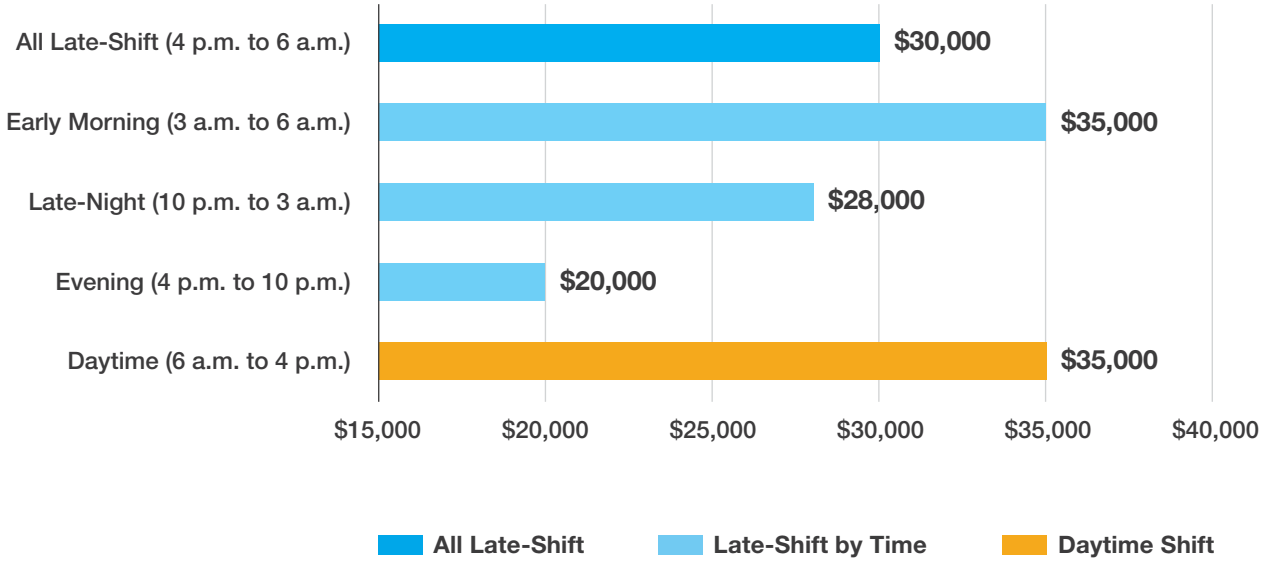
Demographics of the Late-Shift Workforce

A Population Reference Bureau report summarized the demographic composition of late-shift workers as well (Saenz, 2008). According to the report, late-shift workers are on average less educated and earn a lower hourly wage than the workforce as a whole. More recent data from the American Community Survey confirms these findings:

- The median wage or salary of late-shift workers is 14 percent lower than their daytime peers *(see **Figure 1**)*.
- African-Americans and Latinos are more likely than the overall workforce to arrive at work in the evening, late-night and early-morning hours. While people of color represent 39 percent of the U.S.'s daytime workforce, they account for 45 percent of evening and early-morning workers and 52 percent of late-night workers *(see **Figure 2**)*.
- Of all workers at all times of day, the lowest educational attainment (percent college educated) are found among people who report to work between 9 p.m. and 5 a.m. (Saenz, 2008)

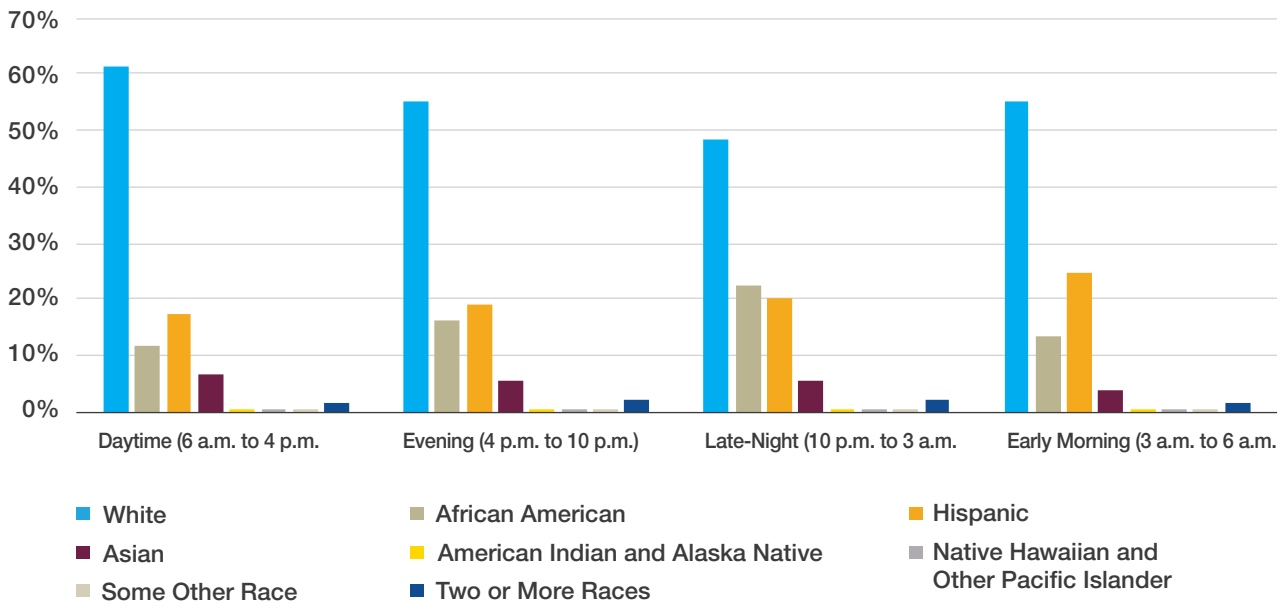
As shown in ***Figure 1***, median wages are lower for late-night workers when compared with daytime workers, although this varies across different portions of the late-shift; workers who arrive in the early morning have similar wages to daytime workers. Variations in occupations by time period likely account for these differences *(see **Figure 5**)*. Low-paying food preparation and serving jobs dominate the evening time period, while jobs in construction, which tend to be higher paying, are prevalent in the early-morning.

Figure 1: Difference in Wages by Daytime and Late-Shift Workers
Averages All MSAs



SOURCE: Research team analysis using 2016 American Community Survey 1-Year Estimates, Public Use Microdata Sample (Ruggles, et al., 2018).

Figure 2: Distribution of Workforce by Race/Ethnicity, Time of Arrival at Work



SOURCE: Research team analysis using 2016 American Community Survey 1-Year Estimates, Public Use Microdata Sample (Ruggles, et al., 2018).

Geography of Late-Shift Jobs

Seventeen percent of jobs in America's MSAs occur during the late-shift, and no major metropolitan area has a share of late-shift employment below 10 percent *(see **Figure 3**)*. The MSA with the greatest share of late-shift jobs is Elkhart-Goshen, Indiana, with 40 percent of jobs occurring in the late-shift. The region is the center of the nation's recreational vehicle industry, and the high rate of late-shift employment reflects the size of its industrial base. Other regions with high rates of late-shift employment, such as Clarksville, Tennessee; Yuma, Arizona; Las Vegas; and Ogden, Utah, illustrate that the late-shift is an important sector regardless of a region's geographic location.

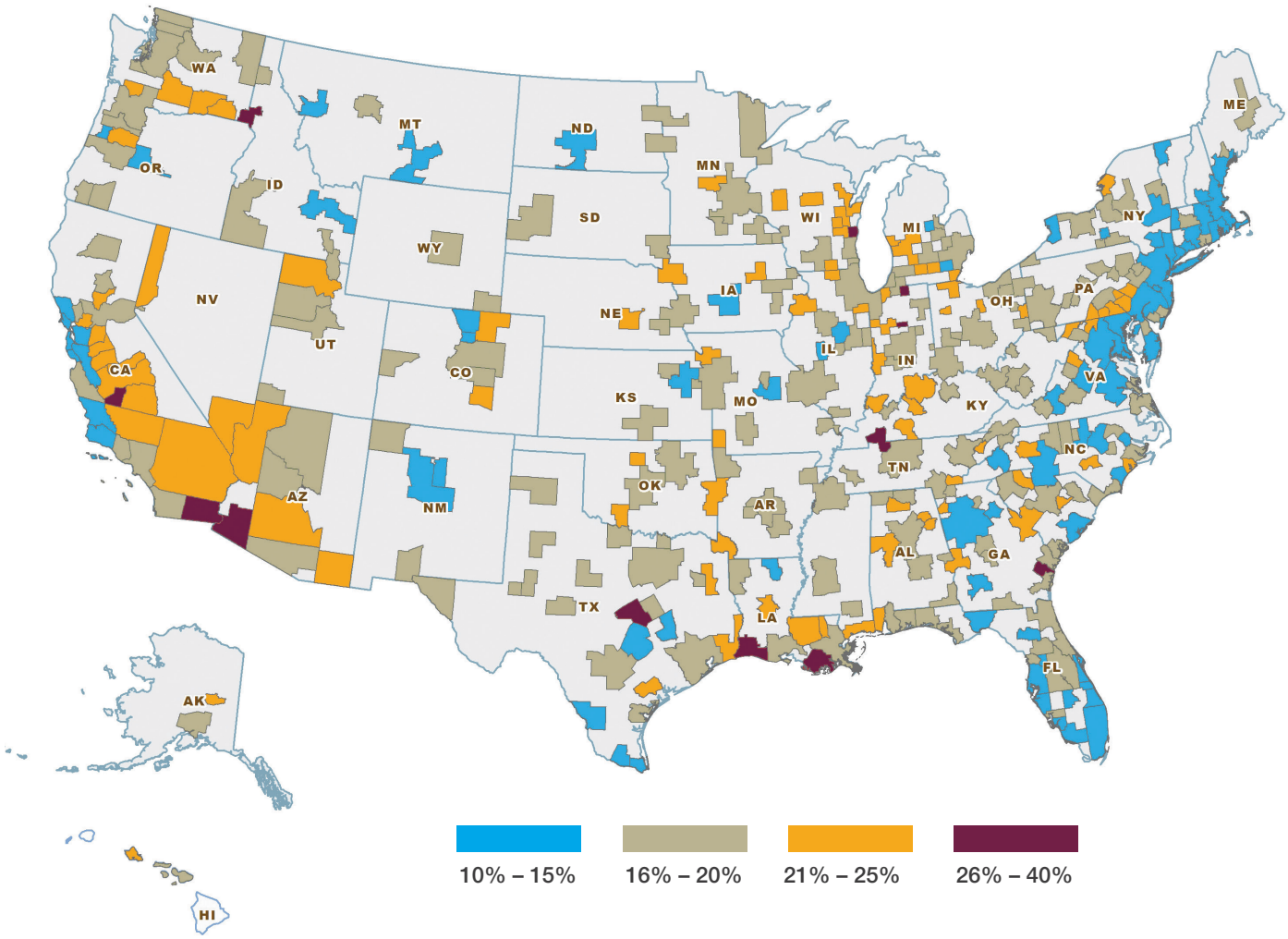
Late-Shift Public Transit and the Economy

The late-shift in its entirety generates $812.6 billion in annual wages. Across all U.S. metropolitan areas, over 790,000 late-shift workers rely on public transit as their primary mode of commuting. In total, late-shift public transit commuters earn over $28 billion in wages (3.5 percent of the late-shift total) and help businesses sell over $84 billion in goods and services annually.[2] ***Table 1*** shows the industries with the most late-shift workers who commute by public transit. Key take-aways from this data include the following:

- Food services and drinking places employ nearly 143,000 late-shift public transit commuters, more than double the transit-supported late-shift jobs of any other industry.
- Administrative and support services, hospitals, and educational services also employ significant numbers of late-shift workers who use public transit.

[2] Sales estimates are based on IMPLAN ratios of sales to total compensation per industry. Wages were assumed to be approximately equivalent to total compensation. Additionally, ratios are based on industry averages. Sales generated by transit-supported late-shift jobs within each industry may differ from industry averages.

Figure 3: Late-Shift Employment as a Share of Total Employment, MSAs



SOURCE: Research team analysis using 2016 American Community Survey 1-Year Estimates, Public Use Microdata Sample (Ruggles, et al., 2018).

- In terms of wages paid to late-shift public transit commuters, professional, scientific and technical services top the list; late-shift workers who take public transit in this industry are paid a total of $2.9 billion in wages a year.
- Wages for public transit-using late-shift workers in the food services and drinking places industry and the finance and insurance industry also top $2 billion apiece.
- Late-shift public transit commuters in the finance and insurance industry generate over $9 billion in sales annually, more than any other industry.
- Sales generated by late-shift public transit commuters in the food services and drink places industry; the professional, scientific, and technical services industry; and the real estate industry each exceed $5 billion as well.

Industries with a Concentration of Late-Shift Employment

Industries with a high share of late-shift workers are the most affected by the availability of late-night public transportation. ***Figure 4*** lists the industries that have the largest share of late-shift workers to total employment, along

Table 1: Late-Shift Jobs, Wages and Sales Supported by Late-Night Public Transit
(Ranked by Total Jobs)

INDUSTRY	Public Transit Commuters	Wages (Millions)	Sales (Millions)
722- Food Services and Drinking Places	142,763	$2,502	$5,384
561- Administrative and Support Services	67,622	$1,731	$2,195
622- Hospitals	39,870	$1,850	$3,456
611- Educational Services	37,564	$1,314	$1,802
541- Professional, Scientific, and Technical Services	32,479	$2,880	$7,495
23- Construction (not further specified)	31,273	$1,309	$4,544
445- Food and Beverage Stores	29,984	$552	$1,332
721- Accommodation	27,014	$839	$2,698
452- General Merchandise Stores	24,217	$425	$1,109
621- Ambulatory Health Care Services	20,307	$823	$1,286
485- Transit and Ground Passenger Transportation	18,433	$691	$2,452
624- Social Assistance	18,188	$414	$1,037
623- Nursing and Residential Care Facilities	18,066	$489	$639
448- Clothing and Clothing Accessories Stores	17,174	$328	$1,184
52- Finance and Insurance (not further specified)	14,376	$2,419	$9,443
713- Amusement, Gambling, and Recreation Industries	12,825	$280	$718
531- Real Estate	12,064	$429	$6,547
92- Public Administration (not further specified)	11,847	$829	$3,227
812- Personal and Laundry Services	11,753	$256	$1,017
711- Performing Arts, Spectator Sports, and Related Industries	10,841	$284	$1,482
All Other Industry Classifications	191,561	$7,721	$25,243
Total	**790,222**	**$28,362**	**$84,291**

SOURCE: Research team analysis using 2016 American Community Survey 1-Year Estimates, Public Use Microdata Sample (Ruggles, et al., 2018) Sales estimates are based on ratios from 2017 National IMPLAN Industry Detail. Industry codes are from the North American Industry Classification System (NAICS). Note: Late-shift jobs defined as jobs that start between 4 p.m. and 6 a.m.

with their respective transit mode share. Food and shopping-related industries (food services and drink places, food and beverage stores, and general merchandise stores), as well as public transit and ground passenger transportation, have the highest share of late-shift workers. For each of these industries, late-shift workers make up more than 25 percent of all workers. Other industries including hospitals, nursing and residential care facilities, and recreational and entertainment industries also rely significantly on late-shift workers (20 percent or more of their workforce).

The rate of public transit usage varies widely by industry, from only 2 percent of late-shift commutes in construction to 10 percent for the accommodations and financial industries. Overall, approximately 4 percent of late-night commute trips in MSAs are made using public transportation, compared with 6 percent

across all time periods. Many of the industries with significant numbers of late-night public transit commuters exceed this mode share, such as administrative and support services; accommodations (e.g., hotels); clothing stores; and performing arts, sports and other entertainment venues.

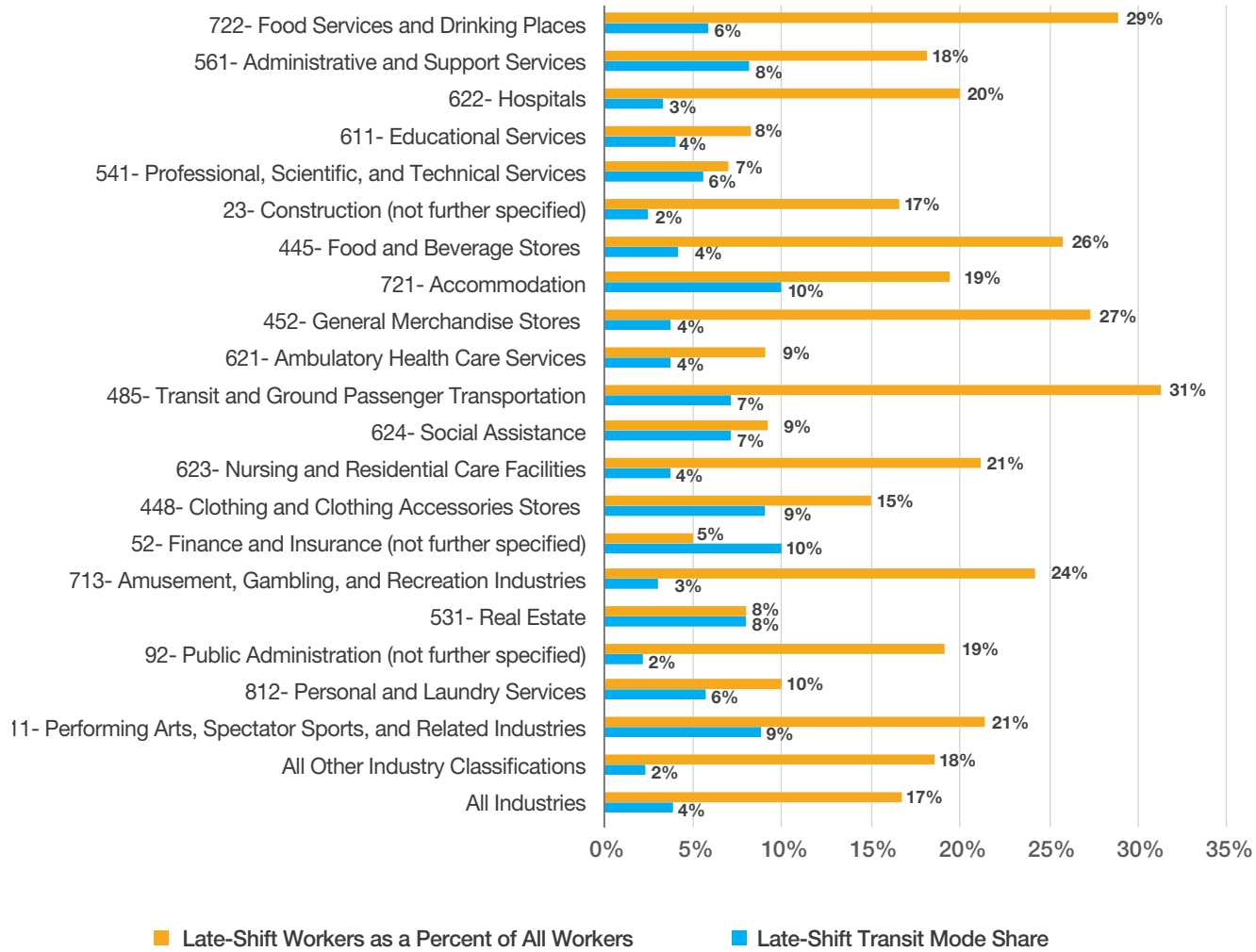
Differences in Late-Shift Employment by Time of Day

The distribution of jobs by industry and occupation vary during the late-shift by time of night. For example, jobs in food services have a relatively high share of workers employed in the evening and a correspondingly small share of workers employed in the early morning.

According to an analysis of 2016 American Community Survey Data:

- During the evening (jobs starting between 4 and 10 p.m.), employment is concentrated in sectors that sell goods and services to residents and visitors (e.g., hospitality, food services, retail), as well as transportation and healthcare *(see **Figure 5**).*

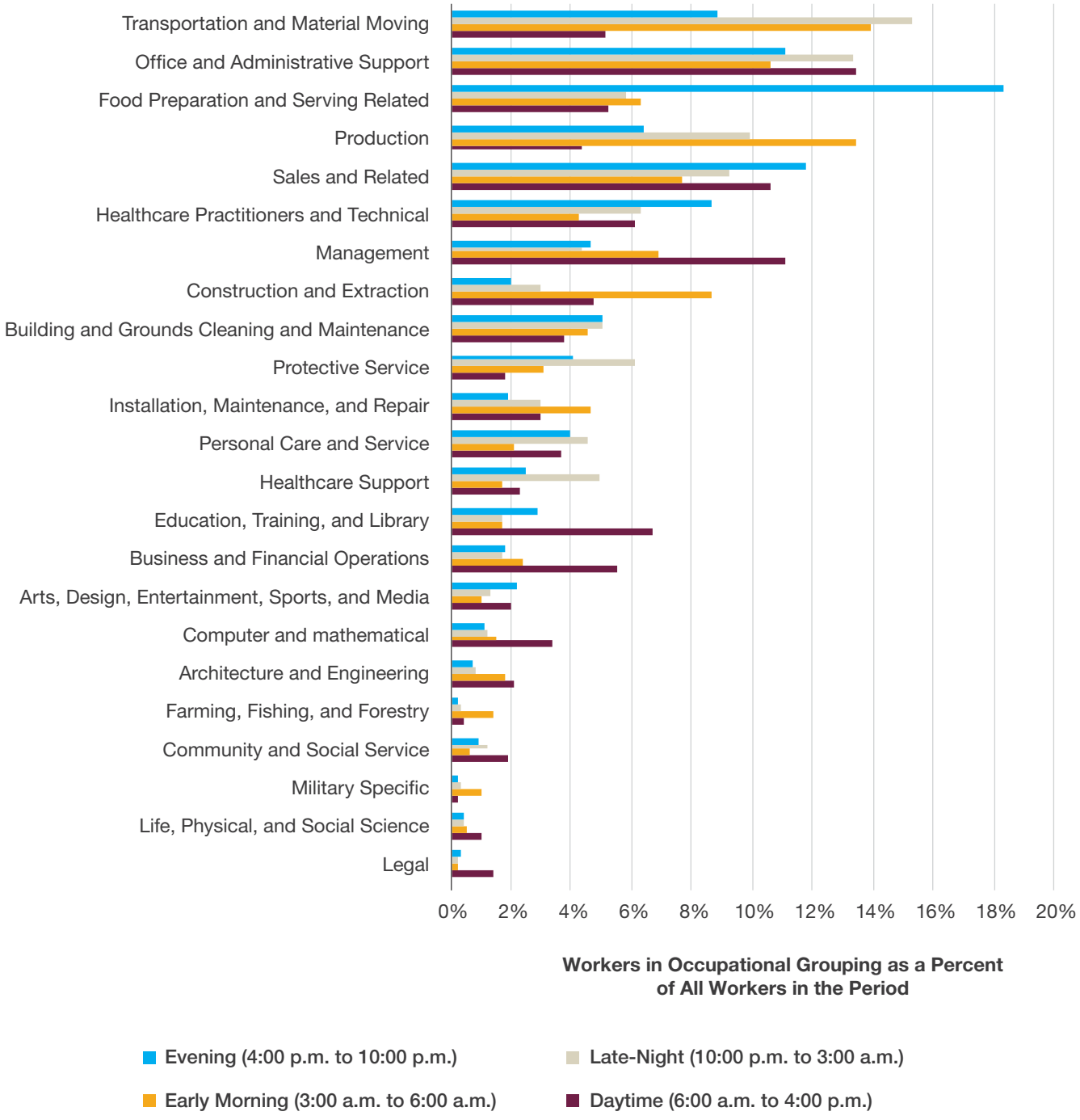
Figure 4: Late-Shift and Public Transit Reliance by Industry



SOURCE: Research team analysis using 2016 American Community Survey 1-Year Estimates, Public Use Microdata Sample (Ruggles, et al., 2018). Industry codes are from the North American Industry Classification System (NAICS). Note: Late-shift jobs defined as jobs that start between 4 p.m. and 6 a.m.

- Sectors with high levels of late-night employment (jobs starting between 10 p.m. and 3 a.m.) include those that produce, process and transport physical goods, as well as public administration (including protective services and military).
- Sectors with high early-morning employment (jobs starting between 3 and 6 a.m.) include those that produce and transport goods and agriculture, as well as the utilities sector.

Figure 5: Occupations of Late-Shift Workers

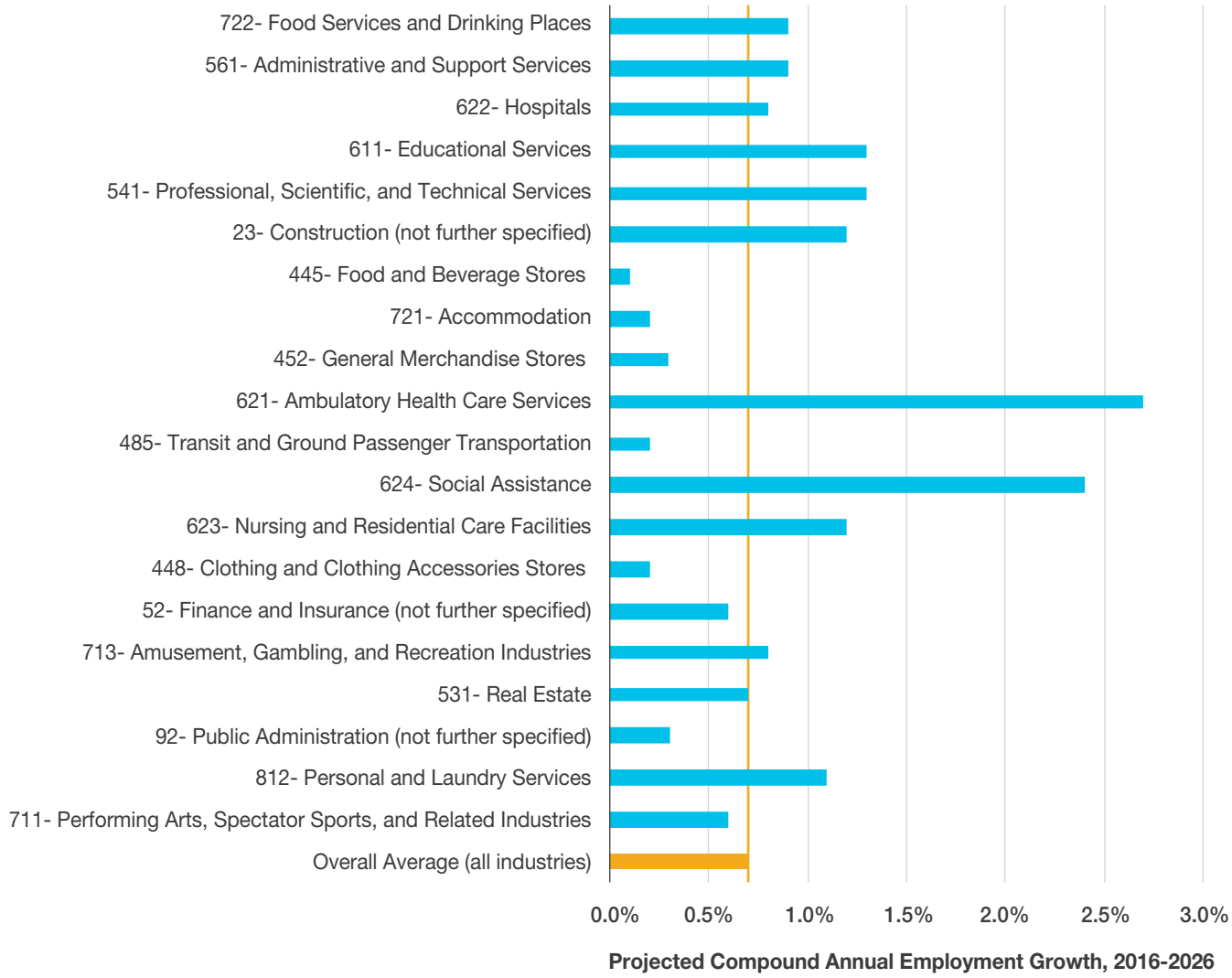


SOURCE: Research team analysis using 2016 American Community Survey 1-Year Estimates, Public Use Microdata Sample (Ruggles, et al., 2018).

The Late-Shift Economy is Forecast to Grow

Many of the industries that have the most public-transit-dependent late-shift workers also have high projected job growth, according to BLS estimates. The top six industries, in terms of the number of late-shift workers who commute by public transit, shown at the top of ***Figure 6***, are all projected to grow faster than the national average. Ambulatory healthcare services and social assistance, industries that collectively support over 18,000 transit-reliant workers each, are notable for their high projected compound annual growth rates of 2.7 percent and 2.4 percent respectively. These are the second- and third-highest projected growth rates of any industry. Therefore, the role of late-shift public transit in supporting these industries is likely to become even more important over time.

Figure 6: Projected Employment Growth, 2016-2026, by Industry
(Ordered by the Number of Late-Shift Public Transit Commuters)



SOURCE: Research team analysis, Bureau of Labor Statistics Employment and Output by Industry Projections (Table 2.7) https://www.bls.gov/emp/tables/industry-employment-and-output.htm Note: Public administration (not further specified) uses a weighted average of estimates for industries categorized as federal, state and local government. Industries are ordered by the number of late-shift public transit commuters. Industry codes are from the North American Industry Classification System (NAICS).

Commuting During the Late-Shift

Commuting to late-shift jobs by public transit can be difficult because of service limitations, resulting in lower rates of late-shift public transit usage compared with the day. This can result in an increased cost burden for workers and can limit segments of the workforce from accessing these job opportunities. Poor public transit service at night also impacts employers; a lack of late-night transportation options increases turnover and absenteeism.

Nationwide Mode Choice for Late-Shift Commuters

Nationally in MSAs (which contain 86 percent of the country's population), late-shift workers are approximately 40 percent less likely to use public transit for commuting than their peers commuting during the day *(see **Table 2**)*. Commuting mode choice is governed by several factors, such as location, car ownership, sociodemographic factors and access to alternative modes of transportation. The demographic characteristics of late-shift workers suggest that they should be using public transit to a greater degree; as mentioned in the first section, a higher proportion of late-shift workers are low income earners and people of color than the overall workforce (Ruggles, et al., 2018) (Saenz, 2008), demographic groups that ride public transit at above-average rates.

The lower mode share of public transit during the evening and night is likely explained by the quality of public transit during this period. Often, public transit systems operate reduced or no service during overnight hours, which limits late-shift workers' transportation options.

According to U.S. Census–derived PUMS data and as shown in ***Table 3***, average commute times for late-shift workers in MSAs are twice as long (48 minutes) by public transit

Table 2: Public Transit Commute Mode Share by Arrival Time at Work

Arrival Time at Work	Percentage of Workers Who Commute by Transit
Daytime (6 a.m. to 4 p.m.)	6.5%
Evening (4 to 10 p.m.)	5.2%
Late-Night (10 p.m. to 3 a.m.)	5.2%
Early Morning (3 a.m. to 6 a.m.)	2.6%
All Late-Shift (4 p.m. to 6 a.m.)	3.8%
All Times	6.1%

SOURCE: Research team analysis using 2016 American Community Survey 1-Year Estimates, Public Use Microdata Sample (Ruggles, et al., 2018).

Table 3: Mean Travel Time to Work for Late-Shift Workers by Mode in Minutes
(All U.S. MSAs)

	Evening Workers	Late-Night Workers	Early-Morning Workers	All Late-Shift Workers	All Daytime Workers
Public Transit	50	53	43	48	51
Private Vehicle	23	24	24	24	26
Taxi	18	26	21	20	21
Non-Motorized	13	16	13	14	15
Other	33	36	29	32	37

SOURCE: Research team analysis using 2016 American Community Survey 1-Year Estimates, Public Use Microdata Sample (Ruggles, et al., 2018).

than by private car (24 minutes). Reduced congestion during the evening and late night makes driving a more attractive means of commuting than during the day; commutes by private car are about two minutes shorter for late-shift workers compared with daytime workers. Reduced public transit service can make late-night public transit trips (including wait times) much longer than daytime public transit trips, even when the public transit vehicles can travel at higher speeds at night.

However, only commuters arriving in the late night period have longer average public transit travel time than daytime public transit commutes, according to PUMS analysis. This suggests commuters facing very long public transit commutes opt for different modes.

Geography of Late-Shift Public Transit Usage

There is a wide variation in late-shift transit mode share among MSAs in the United States (***Figure 7***). In the New York City metropolitan area, 25 percent of late-shift workers commute by public transit. Conversely, in two-thirds of MSAs, the late-shift public transit mode share is less than 1 percent. To address late-shift mobility, it's important to understand why late-shift public transit usage varies so widely.

Regional Population Size

Larger metropolitan areas tend to have higher rates of public transit usage, and this trend continues to apply to late-shift public transit. Bigger metropolitan areas are likely to have lower rates of car ownership, high-density urbanized areas and sociodemographic characteristics that relate to public transit ridership. Analysis of U.S. Census data shows that while population size does have a statistically significant impact on late-shift public transit usage, the effect is weak. For example, the Ithaca, New York, MSA has just over 100,000 residents, yet the transit mode share of late-shift commuters is six-times that of Oklahoma City, which has over 1.3 million residents.

Size of the Late-Shift Workforce

Across all MSAs, there is no clear correlation between the proportion of workers employed during the late-shift and the proportion of late-shift commuters using public transit. In fact, six of the 10 MSAs with the highest late-shift public transit usage have late-night workforces that are proportionally smaller than the nationwide average.

Type of Late-Shift Workforce

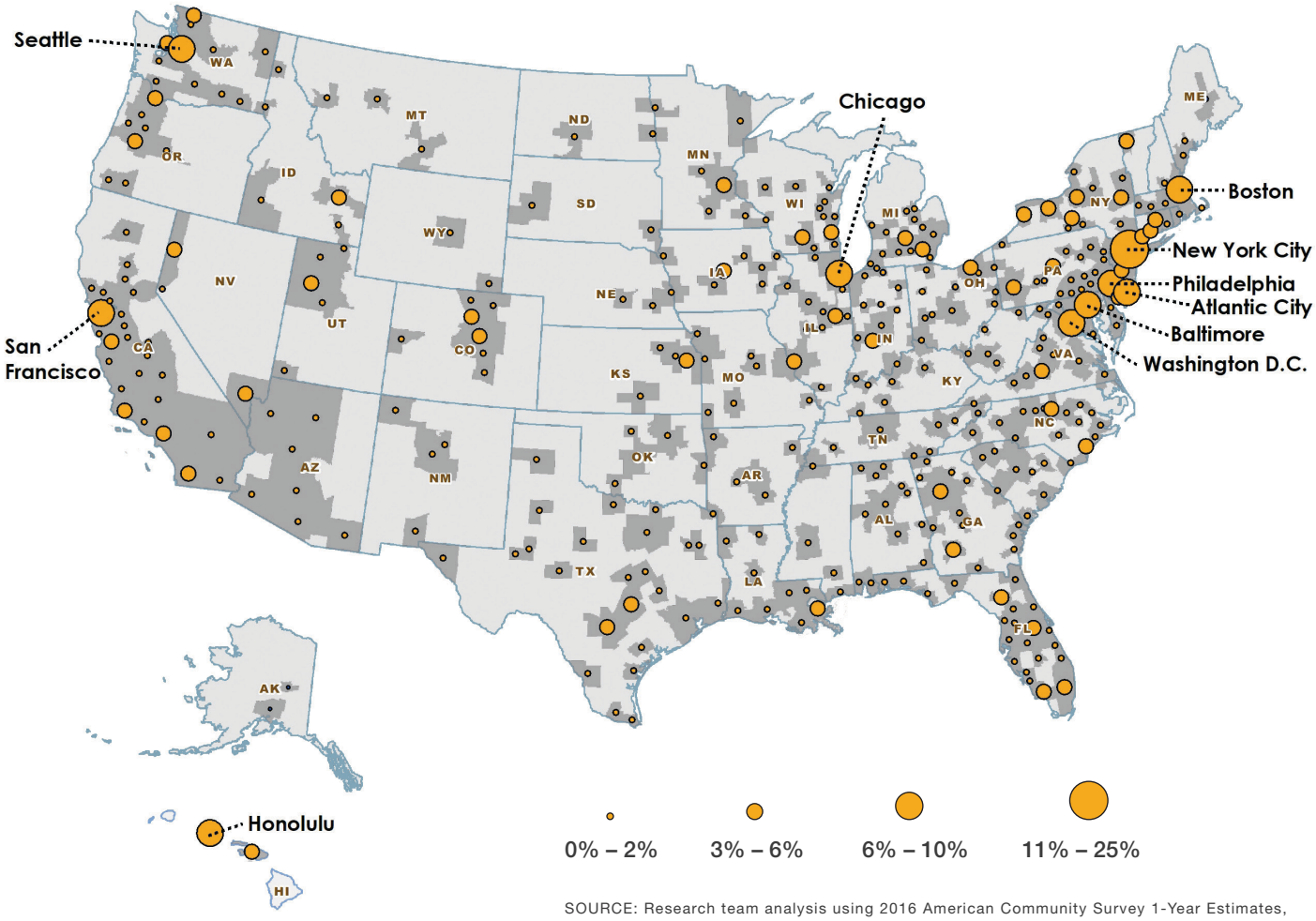
There is one key exception to the finding that large late-shift workforces do not correlate

with large late-shift public transit usage: metropolitan areas where the hospitality and tourism industry dominate. Regions like Las Vegas, Atlantic City and Honolulu all have high rates of late-shift public transit usage; in the case of Las Vegas and Atlantic City, transit mode share among late-shift workers is higher than daytime workers. Hospitality jobs typically pay less than jobs in other late-shift dominant industries such as manufacturing and healthcare. Moreover, major tourist destinations like the Las Vegas Strip or Honolulu's Waikiki Beach are centrally located and therefore relatively easy to serve by public transit.

Daytime Public Transit Usage

The factor most correlated with late-night public transit mode share is daytime transit mode share. This finding illustrates that late-night public transit usage is influenced by the same factors as daytime usage. Some of these variables are intrinsic characteristics of the metropolitan region. Public transit thrives in places with low rates of car ownership and dense and mixed-use development patterns. However, transit mode share is also a reflection of the level of public transit service. Metropolitan regions with high public transit usage have robust, frequent and dependable public transportation networks.

Figure 7: Transit Commute Mode Share by MSA: People Arriving at Work Between 4 p.m. and 6 a.m. (Top 10 MSAs by transit mode share labeled)



SOURCE: Research team analysis using 2016 American Community Survey 1-Year Estimates, Public Use Microdata Sample (Ruggles, et al., 2018).

Level of Investment in Nighttime Public Transit Service

It may seem like an obvious finding, but it's important to state that providing more late-night public transit service results in more late-night public transit ridership. Regions including Las Vegas and Detroit have made concerted efforts over the past decade to expand public transportation for people working nontraditional hours. These investments have resulted in public transit accounting for a greater mode share during the late-shift than during the day shift in these regions.

Investments in late-night public transit service appear to have a self-supporting effect on public transit ridership, and public transit providers that increase their span of service see ridership gains even during periods with no increase in service (Simmons & Haas, 2016). Late-shift commuters are less likely to take public transportation if it is not available at both ends of their commute; for example, extending bus service to 2 a.m. would make public transit a viable option for someone who currently drives to a 6 p.m. to 1 a.m. job.

Providing late-night service has an impact on the perception of public transit service quality for riders regardless of the time of day they ride (Ryus, et al., 2017). Longer spans of service make public transit a more viable substitute to other modes of travel, as riders know that in instances where they have to break from their typical travel times, public transit will still be able to serve their trips.

Impact of the Lack of Late-Shift Public Transit on Workers

Public Transit Can Provide an Affordable Transportation Option to Workers

One of the key benefits of public transportation is its ability to provide a more affordable transportation option relative to other available choices. This is particularly true for low-income workers who may not be able to afford car ownership. Using data gathered for a set of illustrative public transit markets, *Table 4* compares per-mile travel costs of public transit and alternatives available to people without cars. As shown in the data, public transit is significantly less expensive on average than other available private transportation options. Late-shift workers are especially sensitive to transportation costs due to the prevalence of low-wage and mid-wage jobs during the late-shift.

As previously stated, late-shift workers' median wages are 14 percent lower than median daytime wages. The income gap is most substantial during the evening, when median annual income is fully $15,000 less

Table 4: Comparison of Per-Mile Travel Costs of Public Transit and Feasible Non-Private-Automobile Alternatives

	Detroit	Los Angeles	Las Vegas	Pittsburgh	Philadelphia
Public Transit	$0.16	$0.16	$0.27	$0.37	$0.32
Shared TNC	Not available	$1.44	$1.63	Not available	$1.76
TNC	$1.42	$1.62	$1.63	$1.92	$1.92
Taxi	$1.82	$2.97	$1.91	$2.08	$2.54

SOURCE: APTA analysis using the following data sources: Public transit is from NTD Transit Profiles 2017, based on total fare revenue divided by passenger miles. TNC is from ridester.com. Taxi is from taxi-calculator.com, except Pittsburgh, which is from taxifarefinder.com. TNC and taxi fares assume a 12-mile, 26-minute commute (average commute according to 2017 National Household Travel Survey, Summary of Travel Trends).

Las Vegas: 24-Hour Public Transit for a 24-Hour City

Las Vegas is a classic example of a metropolitan area with a disproportionately large late-shift workforce. Twenty-four percent of workers start work between 4 p.m. and 6 a.m., the second-largest share in the country among major metropolitan areas (500,000+ residents). Las Vegas' large proportion of late-night and early-morning commuters is largely due to its hospitality-based economy. The region's economy is anchored by the casinos, hotels, entertainment venues and exhibition spaces that serve more than 40 million annual visitors.

Las Vegas' large late-shift workforce is reflected in regional indicators of public transit usage. The MSA is one of the few in the nation to have a higher transit mode share during the late-shift (4.1 percent) than during the day (3.8 percent). As a large number of hospitality and tourism entry-level jobs are lower-wage and centrally located, these workers are highly dependent on public transit for commuting.

The Regional Transportation Commission (RTC) of Southern Nevada is the primary public transit operator in Las Vegas. It has responded to Las Vegas' distinct economy and employment patterns by running extensive late-night bus service. The public transit network serving late-shift workers is essentially the same as the one serving daytime users; 13 of the system's 39 bus routes operate 24 hours a day. Most of the remaining routes have service spans that go past midnight and start as early as 4 a.m., effectively meeting the needs of late-shift workers.

Las Vegas MSA Statistics (2016)

Metro area population	2,112,436
Top industry clusters by employment	Hospitality & Tourism, Business Services
% White	44%
% Black or African American	11%
% Hispanic or Latino (of any race)	31%
% Other	14%
Median household income	$54,882

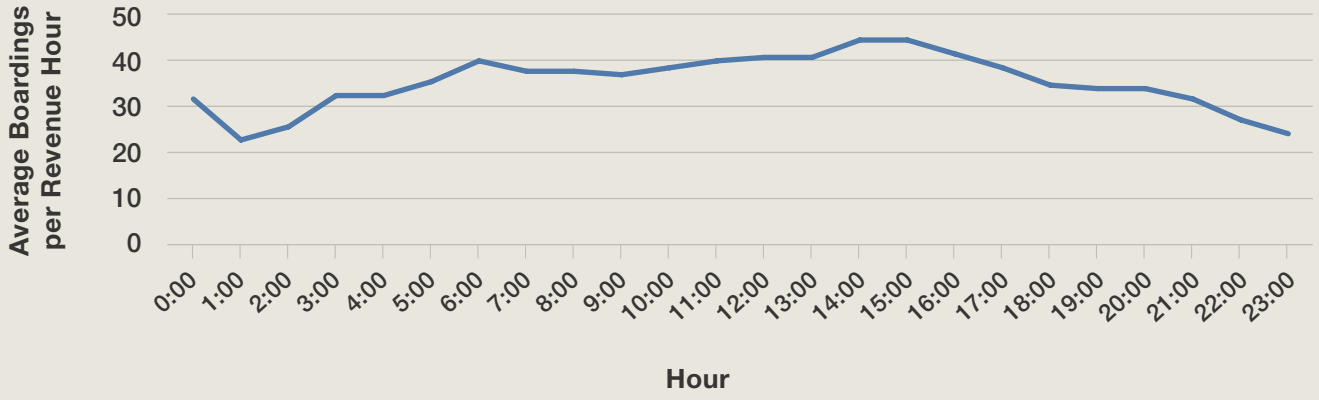
SOURCE: Demographic data from U.S. Census Bureau, 2013-2017 American Community Survey 5-Year Estimates. Industry clusters as identified by U.S. Cluster Mapping (http://clustermapping.us), Institute for Strategy and Competitiveness, Harvard Business School.

Agency staff feel that RTC's level of off-peak service is higher than many of its peers. Moreover, productivity of evening and late-night service is strong, with boardings per revenue hour exceeding 30 on routes late into the night.

Due to the atypical hours of the hospitality industry—for both workers and patrons—the system does not have as pronounced of an a.m. and p.m. peak as other systems. Serving the late night is essential for meeting the needs of its riders and not seen as something the system must subsidize to meet public policy goals. Adding service during the late night increases ridership in other periods by making public transit a reliable round-trip travel option.

One of the challenges Las Vegas is dealing with is how to adequately serve travel demand on the periphery of the fast-growing region. Growing employment sites in the manufacturing and logistics industry are located on the edge of the urbanized area and are poorly connected by public transit. RTC is engaging employers to identify ways fixed-route service or a new-mobility partnership can meet these needs.

Figure 8: Average Systemwide Boardings per Revenue Hour by Time of Day, Weekday (RTC, 2019)



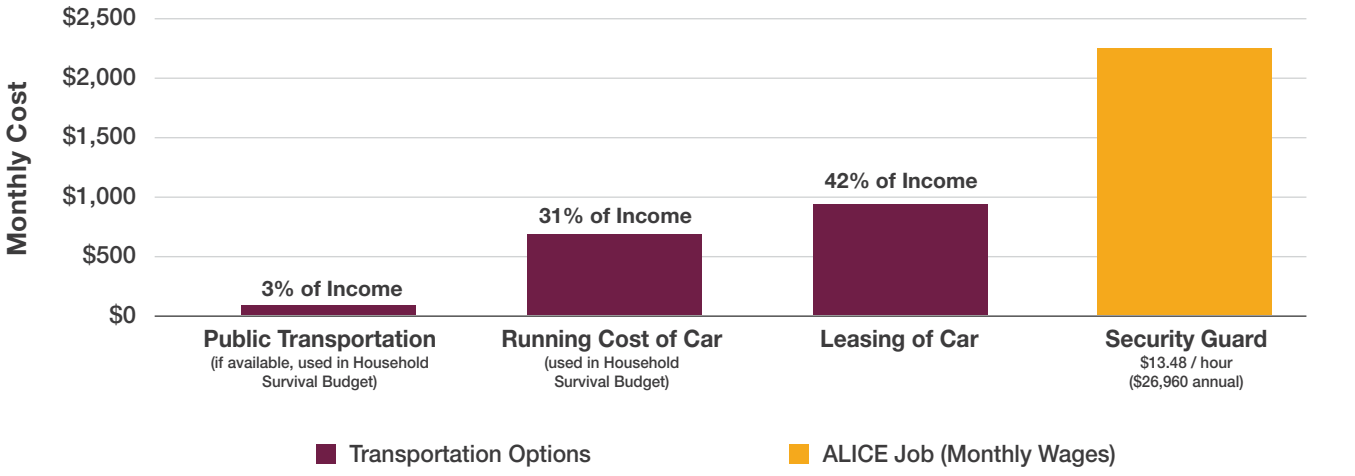
than the daytime median wage *(see **Figure 1**, page 10)*. People with household incomes below the poverty line are more than twice as likely to start work in the 3 to 7 p.m. period, compared with those having household incomes above the poverty line.

Without Adequate Public Transit Service, Workers Face Hard Choices

While public transit is typically the most affordable mobility option, it is not always a feasible one. Particularly in the case of late-shift workers, public transit service may not be available at all the relevant times of day or may be available in such a restricted fashion that commutes are prohibitively long. In these situations workers, and particularly low-income workers, can face difficult choices.

One approach to understanding the implications of transportation costs is to consider transportation affordability within the context of an overall household budget. For example, the Center for Neighborhood Technology (CNT) evaluates communities by comparing average housing and transportation costs. These factors both vary significantly across

Figure 9: Monthly Transportation Costs and Percentage of an ALICE Income, 2014



SOURCE: (United Way, 2017) ALICE: The Consequence of Insufficient Household Income

locations and have an impact on overall financial well-being and affordability. Based on research into metropolitan areas of varying sizes and levels of public transit service, CNT has identified 15 percent of income to be "an attainable goal for transportation affordability" (CNT, 2017).

While this threshold is a useful target, it is still out of reach for some. The United Way ALICE[3] Project offers data and analysis to understand households that make less than the basic cost of living in their area (United Way, 2017). In partnership with 15 participating states, researchers for the project developed estimates of household survival budgets that represent the bare minimum required for housing, childcare, food, transportation and healthcare. Also as part of the project, a 2017 report looked at the trade-offs that face ALICE households due to their budget constraints (United Way, 2019). To illustrate the burden of transportation costs within a constrained budget, ***Figure 9*** (from that report) compares three monthly transportation budgets for a family of four to the salary of a security guard (a common late-night profession).

As can be seen from the chart, public transportation, where available, represents a far lower share of income and a less expensive option. The ALICE project estimated a monthly public transportation budget of $77. Where or when public transportation is not an option, however, the ALICE survival budget estimates car running costs including gas and maintenance based on the Consumer Expenditure Survey (CES). In 2014, this monthly budget was $692 nationally and represented 31 percent of the income a security guard would earn working full time. Finally, the third budget estimate also includes the costs of leasing a car, bringing the monthly estimate up to $945 per month (United Way, 2019).

These ranges of costs are also supported by other national estimates. As shown in ***Table 5***, in 2018 the American Automobile Association

[3] The acronym ALICE stands for Asset Limited, Income Constrained, Employed.

Table 5: Car Ownership Costs from AAA (2018)

Operating Costs	Per Mile	
Fuel	11.05 cents	
Maintenance, repair and tires	8.21 cents	
Total operating costs	**19.26 cents**	
Ownership Costs	**Per Year**	**Per Month**
Full-coverage insurance	$1,189	$99
License, registration, taxes	$738	$62
Depreciation (based on 15,000 miles annually)	$3,289	$274
Finance charge	$744	$62
Cost per year	**$5,960**	**$497**
Total Costs	**Per Year**	**Per Month**
Typical operating costs (19.26 cents × 15,000 miles per year or 1,250 miles per month)	$2,889	$241
Ownership costs	$5,960	$497
Total costs	**$8,849**	**$737**

SOURCE: : (AAA, 2018) YOUR DRIVING COSTS: How Much Are You Really Paying to Drive?

(AAA) estimated car ownership costs to be $8,849 per year or $737 per month, including operating costs (fuel, maintenance, repair and tires), as well as ownership costs (insurance, license, registration, taxes, depreciation and finance costs). Based on these numbers, AAA estimated the total cost of car ownership in 2018 at $0.60 per mile, which is more than mileage-based operating costs alone, and more than public transit (AAA, 2018).

In comparison, the 15 percent transportation affordability target (CNT, 2017) applied to a late-shift worker's average salary of $30,000 amounts to $375 per month. Even if certain ownership costs are excluded, such as depreciation and finance charges from car loans, the remaining monthly cost based on the AAA estimate of $401 is still greater than the affordability target of $375.

For households and workers that do not have a viable public transportation option and therefore cannot avoid car ownership, the ALICE project identifies several hard choices that such households make, including the following:

- Foregoing necessities (such as food, prescriptions and preventive medical care)
- Foregoing investments that could build wealth, particularly in housing
- Purchasing less expensive vehicles and keeping them longer, which can in turn result in higher operating costs and increased risk of work disruption when vehicles break down
- Avoiding ancillary costs associated with car ownership such as insurance or registration (while cost-saving in the short term, these decisions subject people to fines and penalties, as well as increased risk)

Some households are able to choose to live near public transportation but still face challenges associated with the current configuration of public transportation in the United States, including the following:

- Higher costs of living in areas with the best public transportation
- Longer commutes for those who must live or work farther from core urban and public transit service areas
- Limitations on job opportunities because of the availability of public transit
- Reductions in time available for work, increases in childcare needs, and time taken away from activities that enable a healthy and balanced life, such as exercise, shopping for and cooking healthy food, and involvement with community and family

These hard choices are also borne out by anecdotes from people's lived experience. A 2019 article in The Nation describes the time cost of limited public transit service at a large hotel complex in the suburbs of Washington, D.C.: "One lady [whose shift ended at 3 a.m.] used to sleep in the cafeteria until the bus starts running again" (Willams, 2019). Similar stories of hardship play out across the United States, from people being forced to walk long distances to reach the nearest bus stop to employees taking on the cost burden of car ownership simply to be able to get to work.

Late-Night Public Transit is a Vital Link to Economic Mobility

Looking beyond the immediate costs to individuals and households, insufficient transportation options can have broader impacts on people's ability to participate in the economy and achieve upward economic mobility. For this reason, affordable and equitable transportation access is often an emphasis of organizations focused on economic development.

Figure 10: Job Access by Time of Day and Industry in Greater New Haven

During the morning rush hour (7-9am) 69% of all jobs in Greater New Haven, Connecticut, are physically located within a quarter-mile of at least one active bus stop.

But in the late evenings (10pm-12am) and on Sunday mornings (7-9am) only 42% of jobs are located near an active bus stop.

Retail and restaurant jobs, which are crucial sources of employment, are even less likely to be located near active bus stops late at night. For workers who seek opportunities in retail, roughly two-thirds of jobs in our 15-town region may be inaccessible by public transit during weekday evenings.

SOURCE: DataHaven GIS analysis of 2011 Census LEHD data by NAICS code and Greater New Haven transit 2014 GTFS data (Abraham, 2014), "How Transportation Problems Keep People Out of the Workforce in Greater New Haven. New Haven," Greater New Haven Job Access and Transportation Working Group and DataHaven.

For example, in 2017 the Federal Reserve Bank of Philadelphia and the Scranton Area Community Foundation formed the Northeastern Pennsylvania Equitable Transit Planning Council in response to feedback from the community on the relationship between economic mobility and reliable transportation. Residents without cars reported transportation difficulties when "applying for and retaining employment" (DeMaria, 2018). Similarly, the Center for the Study of Economic Mobility at Winston-Salem State University was created in response to data on a troubling lack of economic mobility in North Carolina. One focus of the center's research has been on the "time tax" and the "bandwidth tax" imposed on bus riders by overly long commutes. The "time tax" refers to the opportunity cost of time spent traveling rather than earning additional wages. The "bandwidth tax" refers to the effect time scarcity can have on "a person's ability to retain information, engage in logical reasoning, plan ahead" (Richardson, 2019).

Focused specifically on the issues of employment access, a 2014 study by the Greater New Haven Job Access and Transportation Working Group (a collaboration between the region's MPO and the local chapter of the NAACP) found that "across the unemployed population in Connecticut, transportation is by far the most commonly reported barrier to getting a job" (Abraham, 2014). According to data cited by the study, in 2013, 84 percent of those registered for CTWorks, Connecticut's largest job placement program, reported transportation as a barrier to finding and maintaining a job. In comparison, 60 percent reported childcare and 23 percent reported education as the barrier (Abraham, 2014).

The same New Haven study also conducted a targeted analysis of variation in transit access to jobs by time of day, as shown in ***Figure 10***. Whereas 69 percent of jobs in Greater New Haven are near active bus stops during the morning rush hour, that number drops to 42 percent in late evenings and on Sunday mornings. This is particularly problematic for retail and restaurant jobs that are crucial sources of employment but largely inaccessible by public transit during key operating hours for those industries (Abraham, 2014).

Similar workforce access challenges were identified through interviews with employers, as discussed in more detail in the next section.

Late-Night Public Transit Provides a Safe Alternative to Driving

Late-night public transit that serves late-shift commuters can reduce vehicular accidents, injuries and deaths. Studies have shown that late-shift workers who drive to and from work may be at increased risk of crashes. A study evaluating late-shift workers driving after a shift found that 37.5 percent of the drivers in the study experienced a near-crash event in a controlled experiment. Drivers evaluated on the same test after a night of sleep did not have any near-crash events (Lee, M.L., et al., 2016). Another study using a driving simulator found that shift workers after a night shift got into (simulated) accidents sooner than the same drivers taking the simulator test after a night of sleep. After a night shift, the workers were also more likely to drive outside lane markers and to close their eyes (Åkerstedt, T., et al., 2005). Two studies that interviewed nurses working night shifts similarly found that the nurses reported drowsiness and near accidents on their commutes home (Scott, L.D., et al., 2007) (Dorrian, J., et al., 2008). Given these risks, late-night public transit can provide a safer alternative for late-shift workers, with benefits for both these workers and society more broadly.

Societal Costs per Crash (USDOT 2008)

$9,600,000
FATALITIES

$174,000
INJURIES

$3,200
IN PROPERTY DAMAGE

Impacts of the Lack of Late-Shift Public Transit on Employers

Whereas the prior section focused on the impacts of late-shift public transit on employees, this section addresses the needs of employers and why they depend on the availability of reliable transportation options to access their workforce and maintain efficient operations.

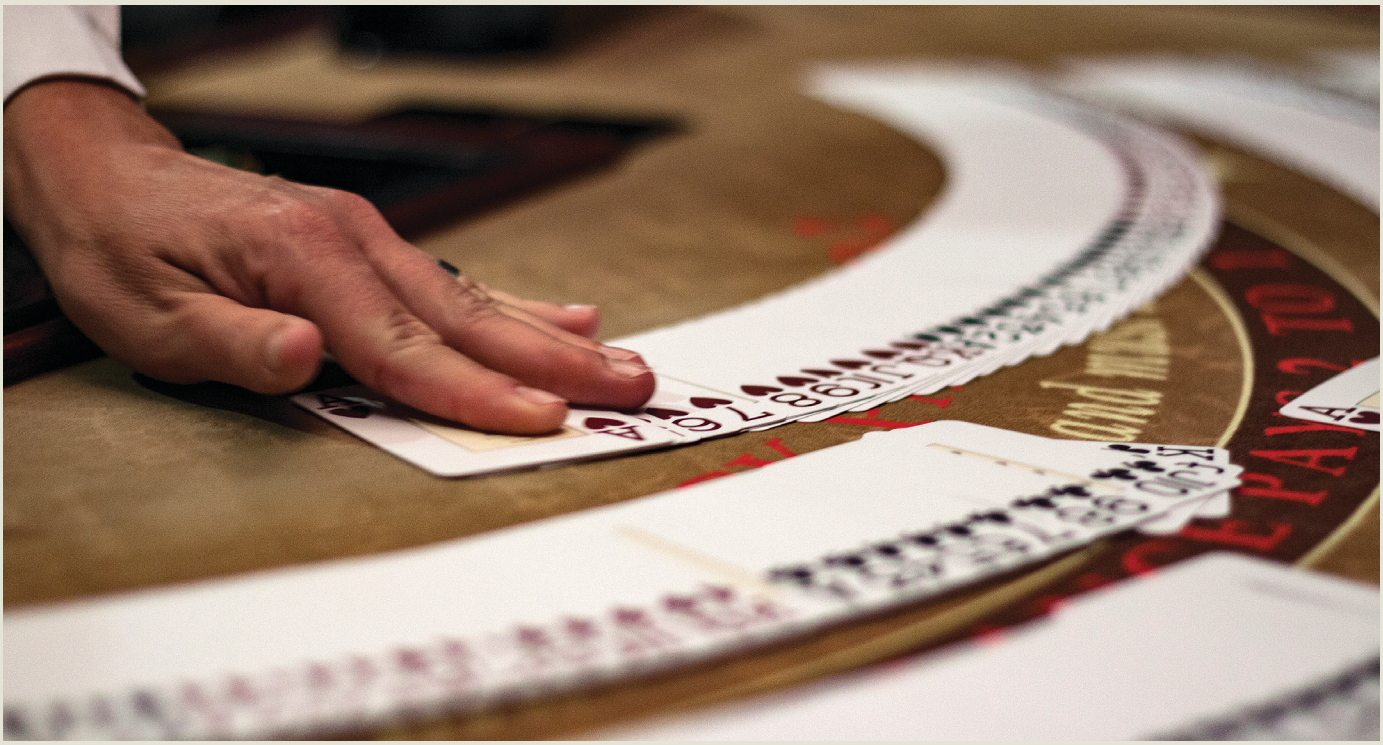
Late-Shift Workers Keep Businesses Up and Running

Approximately 17 percent of workers in MSAs start work between 4 p.m. and 6 a.m. Late-shift workers support economic output in a range of industries, as introduced earlier in this section. The presence of these jobs outside the day shift is necessary for the functioning of businesses and public services. In some cases, this is because peak demand occurs at these times. Food and drink businesses, for example, serve customers in the evening, when day shift workers have time to spend their money. In other contexts, critical services are needed around the clock. Such is the case for hospitals and other parts of the healthcare industry, for transportation sectors such as airports, and for administrative and support services including facilities maintenance and security. Finally, there are industries in which the ability to continue operating across multiple shifts maximizes the value of capital investments such as equipment. Many types of manufacturing fall into this category. The following case studies, derived from interviews with public transit agencies and employers affected by late-shift public transit service, paint a picture of how late-shift workers keep businesses up and running.

Insufficient Transportation Options Create Costs for Employers

While employers can obviously benefit from the availability of late-shift public transit,

Late-Shift Needs in Las Vegas Casinos



As discussed previously, Las Vegas is a major and fast-growing metropolitan area anchored by the leisure and hospitality industry. In Las Vegas, the Regional Transportation Commission of Southern Nevada (RTC) operates a public transit system with significant late-shift service *(see profile on page 21)*. Late-night service is important due to the region's service industry–based economy, which operates in three shifts rather than demonstrating typical a.m. and p.m. peaks. As part of this study, APTA interviewed businesses in Las Vegas to better understand the late-shift commuting dynamics.

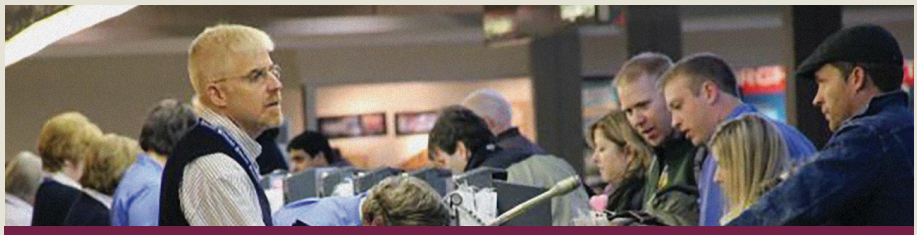
For example, the Orleans Hotel and Casino employs approximately 2,600 team members, according to estimates provided in interviews with casino staff. Between one-third and two-thirds of that overall figure work between 4 and 10 p.m., and about one-eighth work between 10 p.m. and 4 a.m. Special events and the weekend rush of Thursdays through Sundays also tend to make things busier during the late-shift. Late-shift workers include food and beverage team members, staff working the casino, and some housekeeping staff. Late-night operations are integral to the Orleans Hotel and Casino's business model. Las Vegas is a "24-hour town," and late-shift operations serve the customer market that occurs at night. Staff members estimate that approximately 5 percent of the late-shift workforce use public transit.

Orleans Hotel and Casino staff estimate that about 5 percent of the late-shift workforce use public transit, while the staff at Arizona Charlie's Decatur Hotel and Casino estimate that about 25 percent of late-shift commuters use public transit.

Similarly, Arizona Charlie's Decatur Hotel and Casino has approximately 600 total employees, approximately 40 percent of whom work late-shifts. The hotel and casino's swing shift starts around 4 p.m., and the graveyard shift starts around midnight. Late-shift workers include security, casino/slot operations, food and beverage service, hotel operations, and marketing. Staff estimate that about 25 percent of late-shift commuters use public transit. Arizona Charlie's Decatur offers its staff discounted bus passes for purchase via payroll deductions.

Pittsburgh International Airport: Public Transit Supports Late-Shift Operations

Pittsburgh International Airport is an important driver of the region's economy. Around-the-clock operations are needed to support the air connectivity required by businesses and residents in the Pittsburgh metropolitan area. The airport supports over $25 billion in economic activity, including nearly 150,000 jobs across Southwestern Pennsylvania and parts of West Virginia, Ohio and Maryland (ACAA, 2017). Thriving airports are essential for the economic well-being of urban areas, and most large airports cannot function without a robust late-shift.



Pittsburgh MSA Statistics (2016)

Metro area population	2,348,143
Top industry clusters by employment	Business Services, Education & Knowledge
% White	86%
% Black or African American	8%
% Hispanic or Latino (of any race)	2%
% Other	5%
Median household income	$56,073

SOURCE: Demographic data from U.S. Census Bureau, 2013-2017 American Community Survey 5-Year Estimates. Industry clusters as identified by U.S. Cluster Mapping (http://clustermapping.us), Institute for Strategy and Competitiveness, Harvard Business School.

Air service schedules include very early-morning as well as late-night flights. At the Pittsburgh International Airport, the first planes leave between 5:15 and 5:25 a.m., and the last flights are due in around 1 a.m. These flights can help travelers maximize time at their destination as well as the range of destinations that can be reached with single-day round trips.

Making sure that the airport can provide that level of access at those times requires a range of staff support, including cleaning staff. Cleaning staff serve the airport 24 hours a day, and the airport has shift changes at 10 p.m. and 6 a.m. These employees rely on late-night transportation. In prior years, the airport reached out to the Port Authority of Allegheny County, the public transit agency in the region, to request early-morning trips on the 28X Airport Flyer bus so workers would be able to get to and from the airport for their shifts. As a result, the first weekday 28X bus now departs from the city of Pittsburgh at 3:17 a.m. (Port Authority of Allegheny County, 2017).

ISS Facility Services is a cleaning company that contracts with the airport authority to clean public access areas. It has 111 employees as well as an additional 19 subcontractor employees. According to ISS Facilities Service management, approximately half of the 111 staff members work the overnight shift, an estimated 20 percent of whom use public transportation. Many of the 19 subcontractor employees also use the bus in the early morning. Both airport and ISS Facility Services representatives report that they had received reports of workforce access challenges prior to the implementation of the 28X bus schedule extension but that, since implementation, those issues have been largely addressed.

Nevertheless, barriers for some employees remain. For example, one employee still cannot get to the airport in time for the first shift starting at 6 a.m. because he does not have bus service that will allow him to reach the starting point of the 28X route early enough, so he has to be scheduled for another shift. Weekends with reduced service can also be a challenge if people don't have an available bus to take to get to the starting point of the 28X. Port Authority staff have observed people being dropped off by jitneys and friends to address this gap.

they also stand to lose when only insufficient transportation options are available to their workers. Transportation challenges can create costs for business in several ways:

- Increasing absenteeism and lateness
- Increasing employee turnover
- Difficulty in filling positions
- Unreliability in worker arrival times, with resulting operational inefficiency

Researchers from Australia found that longer commutes are associated with high absenteeism, both directly and via a negative effect of long commutes on commuting satisfaction, which in turn is associated with higher absenteeism (Ma & Ye, 2019).

Turnover can also be affected. A study of county-level data from Illinois, Indiana, Michigan, Ohio, Pennsylvania and Wisconsin found that employee turnover rates were lower in counties with bus transit (Faulk, D., and Hicks, M.J., 2016). For the region, they estimated that fixed-route public transit reduced manufacturing employee turnover by 1,100 to 1,200 workers per year and that the cost savings of this reduced turnover rate was $5.3 million to $6.1 million per year. For retail, they estimated reduced employee turnover of 900 to 1,000 workers and cost savings of the reduced turnover as $1.7 million to $1.9 million per year (Faulk, D., and Hicks, M.J., 2016). Findings from the interviews indicate that a lack of late-shift public transit service can create employer costs in the form of turnover or hiring difficulties, as described in the following case studies.

If (as evidenced by the interview findings) transportation challenges cause increases in employee turnover, this can have significant costs to employers. A study of hiring costs in the United States estimated that hiring costs an average of $4,000 per vacancy, varying from approximately $2,000 for blue-collar and manual labor workers to as much as $7,000 for professional and managerial employees (Dube, A., Freeman, E., and Reich, M., 2010). In addition, companies must train new employees, incurring additional costs. Another study found that turnover costs were approximately 16 percent of employee salaries for employees paid $30,000 or less (Boushey, H., and Glynn, S.J., 2012). Similarly, absenteeism and tardiness resulting from transportation challenges can also impact company productivity, and these costs may be significant. A study of absenteeism costs to companies in Canada estimated these costs made up between 15 and 20 percent of all direct and indirect payroll expenses (Kocakulah, M.C., Kelley, A.G., Mitchell, K.M., and Ruggieri, M.P., 2016). Other studies have similarly found that absenteeism costs are about 15 percent of payroll (Navarro, C., and Bass, C., 2006). In the U.S., the cost of tardy employees is estimated to reach $3 billion per year (DeLonzor, 2005). While not all these challenges are associated with public transit, reliable mobility options are an important determinant of the efficiency of employer operations.

A study of county-level data from Illinois, Indiana, Michigan, Ohio, Pennsylvania and Wisconsin found that employee turnover rates were lower in counties with bus transit. For the region, they estimated that fixed-route public transit reduced manufacturing employee turnover by 1,100 to 1,200 workers per year and that the cost savings of this reduced turnover rate was $5.3 million to $6.1 million per year.

Battle Creek, Michigan: Challenges of Insufficient Late Shift Public Transit

Above: Fort Custer Industrial Park in Battle Creek, Michigan.

(PHOTO COURTESY GOOGLE MAPS)

Battle Creek illustrates that late shift mobility is an important issue in regions of all sizes, economic makeup and voter affiliation. Battle Creek is a small city in southwest Michigan, best known for being the "Cereal Capital" of America. Calhoun County, home to Battle Creek, has leaned Republican in the most recent elections.

APTA interviewed a representative of Battle Creek Unlimited, a nonprofit corporation that works with the city to manage the Fort Custer Industrial Park (Battle Creek Unlimited, 2019), the largest industrial park in Michigan and the third largest in the Midwest. It houses 85 companies that employ 13,600 people. Approximately 30 percent of the workforce at the park works the second and third shifts in positions that include skilled manufacturing jobs, as well as plant and machine operators.

Seventy percent of the employees drive alone to and from work at the industrial park. Carpooling and public transit account for the other 30 percent of commute trips. The industrial park is served by public transit on weekdays from 5:15 a.m. to 6:10 p.m. and on Saturdays from 9:15 a.m. to 5:10 p.m. As a result, late shift employees have public transit service coverage for only one direction of their commute, making it a difficult option. Because of this, employees who do not have cars primarily use carpooling to get to and from work. Taxicabs are not considered an affordable option, and there is very limited TNC coverage in the area.

The lack of late shift commuting options negatively impacts businesses in the Fort Custer Industrial Park in a number of ways:

- Employee turnover rates are higher among those who do not have cars
- Employees forced to rely on carpooling are more likely to arrive late or have reliability challenges
- Businesses are forced to offer financial aid to assist workers with car purchases, given the lack of other viable alternatives. This translates into higher recruitment and hiring costs

Each of these impacts, in turn, directly affects the cost of doing business for companies located in the industrial park.

Some initial efforts have been made to improve mobility options for workers in Battle Creek. Aequitas Mobility Services is a new private transit provider formed in March 2018 as a nonprofit organization. Aequitas received grant funding in December 2018 and started providing transportation services at the end of January 2019. Riders have to schedule trips in advance, one day before the trip, and can schedule and pay for recurring trips in advance. The service focuses on filling the transit gap for the second and third shifts and currently transports between 10 and 13 people each night. One of the markets served by Aequitas is the Fort Custer Industrial Park, and some of its initial grant funding ($5,000) was in fact provided by the park because of the importance of solving late shift mobility challenges for workers. Aequitas is working to fill a gap in mobility that is difficult and expensive to serve with conventional public transit. It made the case for startup capital to employers in the industrial park by discussing turnover causes and costs. Anecdotal evidence indicated that tiredness at work and absenteeism were issues stemming from two primary causes: transportation and childcare issues.

Late shift employees at Fort Custer Industrial Park in Battle Creek have public transit service coverage for only one direction of their commute, making it a difficult option. The lack of late shift commuting options negatively impacts businesses, including high employee turnover rates.

Battle Creek MSA Statistics (2016)	
Metro area population	134,327
Top industry clusters by employment	Automotive Manufacturing, Business Services
% White	78%
% Black or African American	11%
% Hispanic or Latino (of any race)	5.0%
% Other	6%
Median household income	$46,213

SOURCE: Demographic data from U.S. Census Bureau, 2013-2017 American Community Survey 5-Year Estimates. Industry clusters as identified by U.S. Cluster Mapping (http://clustermapping.us), Institute for Strategy and Competitiveness, Harvard Business School.

Aequitas estimates that the cost of turnover is on the order of $3,500 to $4,000 per job. When seeking funding, Aequitas made its case to employers by suggesting they take a portion of expected cost savings from reduced turnover to instead put toward supporting employee access to work.

While still in its early stages of operation, Aequitas is an example of how a mobility provider can consider the value of its services based on costs experienced by employers due to inadequate late-shift mobility options.

Quonset Business Park: Impact of Accessibility on Hiring and Retention

Like many states in the Northeast, Rhode Island was hit hard by the decline of industrial employment. To help retain and grow the state's manufacturing base, Rhode Island has promoted the development of the Quonset Business Park, a 3,200-acre former military base that provides the large land parcels and excellent road, rail and port infrastructure needed by modern industry. Unlike older industrial centers, Quonset—like similar industrial parks across the country—is located near the edge of the urbanized area. Today Quonset's sprawling campus is home to the largest concentration of jobs in the state outside downtown Providence.

Quonset Development Corporation (QDC) is a quasi-governmental organization responsible for the development and management of the Quonset Business Park in North Kingstown, Rhode Island (Quonset Development Corporation, 2014). APTA interviewed a representative of the corporation regarding the challenges associated with insufficient late shift public transit.

Quonset Business Park is home to more than 200 companies, employing nearly 12,000 people in full- and part-time jobs. Logistics and manufacturing are the dominant industries in the park. Factories operate multiple shifts to maximize available industrial capacity. Electric Boat, a submarine manufacturer, is the largest employer in the park and has three shifts that result in continuous operations at its plant. Other manufacturers also have multiple shifts. Similarly, logistics-related employers also tend to have shifts that do not correspond to typical commute times.

Providence MSA Statistics (2016)

Metro area population	1,613,154
Top industry clusters by employment	Business Services, Distribution & E-Commerce
% White	77%
% Black or African American	5%
% Hispanic or Latino (of any race)	12%
% Other	7%
Median household income	$61,536

SOURCE: Demographic data from U.S. Census Bureau, 2013-2017 American Community Survey 5-Year Estimates. Industry clusters as identified by U.S. Cluster Mapping (http://clustermapping.us), Institute for Strategy and Competitiveness, Harvard Business School.

According to a survey of major employers at the park, 25 percent of the workforce works the late shift. Driving remains by far the dominant mode of commuting. First shift commuters are hard to serve with public transit, as connecting buses are often not running early enough to ensure that people can arrive for start times around 6:30 a.m.

In 2016, the QDC conducted a study of late shift mobility options. The study concluded that a lack of public transit service was driving a number of difficulties for businesses in the park:

- Lack of public transit reduces the ability of businesses to recruit temporary labor, which is important for seasonal industries
- Lack of public transit poses a challenge for retention of existing employees. When employees rely on others for carpooling, their job access is highly susceptible to risks such as the car breaking down or the driver having a change in life circumstance (e.g., moving) that means he or she can no longer drive

Recently, attempts have been made to provide additional public transit service to the park, though additional connecting service is necessary to enhance ridership.

Challenges and Approaches to Late-Shift Public Transit

The previous section illustrates the importance of America's late shift workforce, along with the social and economic costs associated with limited mobility during late shift working hours. These factors make a strong case for why investing in late shift public transit is important; however, simply recognizing the importance of the late shift is not enough.

Public transit agencies face distinct challenges to serving late-night and early-morning riders. APTA therefore has strived to understand these challenges and how public transit providers can overcome barriers to meet the needs of late shift commuters. Interviews with public transit agencies, analysis of available data and additional research help paint a more complex picture of public transit service during the late shift. The need to serve nighttime and early-morning riders is not new and public transit providers have adopted several models to provide this service.

Challenges of Providing Late-Night Service

Multiple factors inhibit public transit providers from providing more late-night service. Some of these would apply to any hour of the day, such as cost, while others are unique to late-night operations, such as security. To effectively address late-night public transit needs, it is important to first understand why late-night public transit riders are so hard to serve.

Productivity

Probably the biggest barrier to late-night service is the reduced demand for public transit during the late-night and early-morning hours. Lower ridership is driven by two factors: lower overall demand for travel during these periods and lower reliance on public transit for the minority of commuters working the late shift.

As discussed in the last section, late shift commuters are less likely to rely on public transit than their daytime equivalents. The average transit mode share for people arriving at work between 4 p.m. and 6 a.m. is 40 percent lower than for those arriving at work during the day shift. In cases where public transit is unavailable or inconvenient, commuters are forced to use other modes to get to work.

Looking at commuters does not tell the whole story of why late-night service struggles to attract riders. Many public transit agencies are able to sustain robust weekend service despite lower demand by commuters. Sustaining all-day public transit ridership requires attracting all kinds of trips, from work to leisure, social to retail. Intrinsically there's

simply less travel demand during the night, which makes sustaining a large public transit network more of a challenge.

Lower demand should not be conflated with a lack of need for late-night public transit service, however. As discussed previously, late-shift workers are significantly transportation cost-burdened. Providing late-night public transit service meets an important public policy objective by connecting workers to new opportunities. Moreover, public transit ridership benefits from the network effects of robust all-day service. One of the biggest predictors of whether a person takes public transit is whether or not that person owns a car, and car ownership is lower in communities where public transit is a viable option for travel during all times of day.

Competition from New Mobility Providers

Competition from TNCs like Uber and Lyft is increasingly cited as making late-night public transit service obsolete. TNCs are a fairly new mode of transportation, though, and more research needs to be done to fully understand how they impact public transit demand. Existing research shows that TNC demand peaks in the evening and late night (Feigon & Murphy, 2018) (SUMC, 2016). Research shows that public transit riders switch to TNCs most often due to comparable public transit service being unavailable or inconvenient (Clewlow & Mishra, 2017), suggesting that the lack of public transit service during these periods contributes to higher demand for TNCs.

While TNCs are especially competitive against public transit during the late night, existing literature suggests that these services are not a true alternative for commuters. Average fares for Uber and Lyft services are multiple times more expensive than comparable public transit trips (Schwieterman & Livingston, 2018). Only 21 percent of TNC riders report using the services for commuting; of those , fewer than half said they use a TNC more frequently than once a week for commuting (SUMC, 2016).

Based on the cost and usage patterns of TNC trips, it seems that evening and late-night TNC travel serves to facilitate trips more for recreational or entertainment purposes than actual commuting. In Chicago, for example, the average TNC trip that could be served by public transit costs between $10 and $16 one way, which can be more than the hourly wage for an entry-level job (Schwieterman & Livingston, 2018). Even if TNCs are not a realistic alternative for late-night commuters, by poaching a share of late-night trips that otherwise would occur on public transit they reduce overall transit demand in the evening and late at night.

Operating Concerns

Public transit providers face several operating challenges to running late-night service. Most large public transit systems rely on nighttime to conduct critical maintenance work. Additionally, safety and security concerns during the night carry their own associated risks and costs. While none of these concerns is insurmountable, they illustrate the various factors at play that disincentivize public transit providers from operating late into the night.

Maintenance and Upkeep

Several of the interviewees who participated in this study mentioned the importance of late-night maintenance for their operations. Many public transit agencies shut down or roll back service during the late night in part to accommodate system maintenance and upkeep. This is especially important for older rail systems that require ongoing maintenance and lack the redundancy of more than two tracks to accommodate maintenance and operations at the same time (Blumgart, 2014). Washington, D.C.'s Metrorail system illustrates the opportunity cost of operating late-night service. The extension of Metrorail's operating hours in the early 2000s narrowed the available window for maintenance work on the system; after several high-profile, state-of-good-repair-related incidents, the agency opted to temporarily roll back operating hours

Challenges of Providing Late-Shift Public Transit in Los Angeles

The Los Angeles County Metropolitan Transportation Authority (Metro) is the third-largest public transit operator in the country by ridership. Metro's experiences with late-night service are reflective of many of the challenges all public transit providers face in running late-night service. The Los Angeles region is the second-largest metropolitan area in the nation and sprawls over an area nearly the size of Connecticut. LA is home to a large immigrant community, and public transportation provides a lifeline service for the hundreds of thousands of Angelinos without access to a car.

Metro's bus system follows a grid of connecting routes that spreads out across the 1,500-square-mile service area. This network design is especially apt in a polycentric region like Los Angeles, where travel demand is not concentrated in a central business district. The challenge for Metro is that a grid-based network depends on high frequencies of service. During the late night, when routes may operate as infrequently as every hour, transfer times on a grid network are longer. Metro's night-time network is organized around 30 routes, most of which converge on downtown Los Angeles. Most late-night service operates on a pulse schedule, with buses arriving and departing downtown at 30- to 60-minute intervals.

There are drawbacks to operating this kind of network. For Metro, it limits the length of routes, as they have to be able to complete a round-trip journey within the constraints of the pulse schedule. For riders, having the network focus on downtown means more circuitous journeys than would be necessary during the day. The agency grapples with additional concerns related to running 24-hour service, such as homeless riders using the system for shelter and operator safety during the late night.

Los Angeles MSA Statistics (2016)

Metro area population	13,261,538
Top industry clusters by employment	Business Services, Distribution & E Commerce
% White	30%
% Black or African American	6%
% Hispanic or Latino (of any race)	45%
% Other	19%
Median household income	$65,331

SOURCE: Demographic data from U.S. Census Bureau, 2013-2017 American Community Survey 5-Year Estimates. Industry clusters as identified by U.S. Cluster Mapping (http://clustermapping.us), Institute for Strategy and Competitiveness, Harvard Business School.

Metro continues to operate late-night public transit in the face of all these constraints due to the important role it plays as a lifeline service. Los Angeles, as the second-largest city in the United States, has a 24-hour economy, and public transit is an essential link for its late-shift work-force. Metro is currently conducting its "NextGen Bus Study," which will recommend bus route redesigns with the goal of being more relevant for commuters.

to accommodate an accelerated maintenance schedule (Alpert, 2016).

While buses do not have the same degree of time constraints with maintenance as rail systems do, the late night is still an important window for maintenance at large public transit agencies. During these hours, buses are washed and fueled in preparation for the morning peak.

Lack of Federal Support

THERE IS A CONSPICUOUS ABSENCE OF FEDERAL GRANT PROGRAMS SUPPORTING LATE-SHIFT PUBLIC TRANSIT since the repeal of the Job Access and Reverse Commute (JARC) program in 2012. JARC was a grant program intended to improve access to entry-level jobs for low-income people, including late-night public transit service.

Congress passed The Moving Ahead for Progress in the 21st Century Act (MAP-21) in 2012. As part of this then-new transportation funding authorization bill, JARC funding was folded into the general formula funding grant programs for urbanized (5307) and rural (5311) areas.

JARC projects now share the same pot of federal money as other public transit capital and operating needs. Eliminating JARC gave public transit agencies more flexibility in how they spend their federal funding but also made it easier for late-shift public transit needs to become a reduced priority for cash-strapped public transit providers.

Safety and Security

Security concerns and vandalism are also inhibiting factors to expanding late-night service. The Southeastern Pennsylvania Transportation Authority (SEPTA) eliminated 24-hour subway service in Philadelphia in the early 1990s due to concerns over homelessness, litter and crime (24-hour service has since resumed on Fridays and Saturdays).

The existing literature is inconclusive on whether crime during the evening, late night or early morning is a serious problem or simply a perceived threat. SEPTA crime statistics from 2013 to 2018 show that only a small percentage of reported incidents occur after 10 p.m. (SEPTA, 2018). Conversely, an analysis of reported crimes near public transit stops in the Seattle region found that the highest volume of crimes occurs between 10 p.m. and 6 a.m. (26 percent of reported incidents) (Moudon, Bassok, & Kang, 2018). Bus operators are often the most exposed public transit employees to security threats. A 2011 Transit Cooperative Research Program (TCRP) study found that 48 percent of reported assaults on bus operators occurred in the evening and late night; the same survey showed that p.m. peak and school dismissal hours combined accounted for a similar share of assaults (Nakanishi & Fleming, 2011).

Perception of safety can play as great a role for public transit operators and riders as the actual rates of crime. The prevalence of homeless riders in the evening and late night can reduce the perception of safety. Metro Transit in Minneapolis found that, even as reported crimes declined, its light rail system saw an increase in customer complaints due to homeless riders relying on the system for shelter during the night (Editorial Board, 2017). Metro in Los Angeles said it had the same issue of perceived safety on its system due to homelessness. Public transit agencies, especially larger ones, grapple with customer complaints over perceived safety, hygiene and behavior of homeless riders (Boyle, 2016). Agencies across the country have been implementing a range of strategies, including increasing surveillance technologies and partnerships with social service agencies, to reduce behavioral issues on public transit without unfairly marginalizing law-abiding homeless riders (Boyle, 2016).

Costs and Funding

The marginal costs of operating late-night service should be lower, in theory, than daytime service; public transit systems have

unused capacity during evening and late-night hours that could be put to revenue service without incurring capital costs. However, there are some additional costs associated with late-night public transit. As mentioned, late-night periods are when many agencies carry out routine maintenance, and running service during these hours carries an opportunity cost due to reduced maintenance capabilities. Public transit providers also need to staff facilities and pay for police or security guards during late-night hours.

Related to costs is a lack of funding available specifically for late-night public transit service. All the public transit agencies interviewed rely on their general budget to support late-night service. Public transit agencies face funding constraints that require them to make tradeoffs on which services get funded and which do not. Especially as public transit funding is becoming more performance-based across the country, peak commuting periods are often prioritized over the late night, when rider demand is at its lowest. Several of the agencies interviewed for this study, including RTC in Las Vegas, Port Authority in Pittsburgh, and the Detroit DOT, mentioned that late-night service was one of the first targets of service cuts during funding shortfalls.

Partnerships with the private sector play an increasingly important role in funding late-night public transit service. However, this is most feasible when working with major institutions and employers with the demand (and resources) to fund service expansion. In some cases, public transit providers have gotten creative in how they support late-night public transit. In Washington, D.C., the Qatari government, as a "gesture of friendship and goodwill toward the local community," stepped in to fund late-night public transit service during Washington Capitals hockey games, highlighting the unusual partnerships often needed to expand public transit operating hours (Siddiqui, 2018).

Service Planning Limitations

There are several factors that make it challenging for public transit providers to replicate daytime public transit networks during the late night. Public transit systems function as a network, with individual routes fed in part by transfers from other services. During the late night, reduced service frequency and span reduce the functionality of the network by making transfers less convenient. Even if public transit providers operate additional service to meet certain late-shift employment needs, there may not be any connections available to get employees to their destinations.

The Rhode Island Public Transportation Authority (RIPTA) struggled with this very issue when exploring options for providing public transit service to the Quonset Business Park, Rhode Island's second-largest employment destination. Quonset is home to several large manufacturing and logistics facilities with early morning and late-night shifts. RIPTA's bus network operates as a hub-and-spoke system, with downtown Providence acting as the focal point for the network. Any public transit service to the park would rely on riders transferring downtown. However, in the early morning and late night only limited connections are available, as most other routes are not operating.

Likewise, the availability of public restrooms is a factor in planning where to end a bus route. Identifying locations with suitable all-night activity, bus layover space and restrooms for operators can sometimes be a challenge that limits the deployment of service.

Models for Providing Late-Night Service

As outlined, public transit providers face several challenges to operating late-night public transit service. Fortunately, there is a wide variety of strategies for serving late-shift

workers. Through its research and interviews, APTA found that there is no one standard model for operating late-night public transportation. Pilot programs are a common strategy across the country to test methods of late-shift public transportation. Pilot programs allow public transit providers to test a solution before committing to its long-term implementation. Data from pilots can lead to adjustments in strategy and more informed decision-making.

Extend the Span of Service or Increase Frequency of Existing Network During the Late-Shift

Many public transit agencies choose to extend the operating hours of daytime routes to better serve late-night travel demand. In many ways, this is the simplest solution: The routes and stops are already established, requiring little additional planning. Riders who already know the system will be comfortable with the routes.

The decision on whether to operate a bus route late into the night or 24 hours depends on demand. Routes that serve late-night traffic generators like key employment hubs, transfer nodes and airports are more likely to support public transit service. Public transit agencies are strategic about which routes to extend the span of service for, as resource and ridership constraints make it impossible to provide 24-hour operations across an entire service area. In Boston, for example, the latest iteration of late-night bus service focuses on connecting lower-income neighborhoods, like Dorchester, Roxbury and East Boston, neighborhoods with a concentration of late-shift commuting needs *(see profile on page 44)*.

The Las Vegas–area Regional Transportation Commission (RTC) of Southern Nevada operates a large percentage of its routes 24 hours a day, with only a few having different routing at night than during the day *(see profile, page 21)*. The commission sees late-night service as being quite productive. By operating late-night service on the same network as regular service, RTC is able to expand a regular route into later operation: If it gets a request for later service, and productivity is sufficiently high, it is able to add trips to gradually extend service (Maynard, Carter, Goldberg, & Simmons, 2019). Other public transit agencies interviewed did not all see the same productivity with their late-night services.

Some systems experiment with special branding to increase the visibility of routes that operate at night. For example, in 2016 the Detroit Department of Transportation rebranded its 10 24-hour trunk routes as "ConnectTen" and renumbered them as routes 1 to 10.

Extending the service span is most effective when the daytime network structure continues to function well for nighttime travel needs. For example, five of SEPTA's bus routes with 24-hour service operate to the Frankford Transportation Center in Northeast Philadelphia, where riders can connect to the Market-Frankford Line subway or late-night Owl bus service. The ConnectTen network runs on major corridors, with seven of the 10 routes converging on downtown Detroit. In both cases, transfers are concentrated at one node to reduce the need to transfer more than once and to ensure a certain volume of passenger activity even late at night.

Establish a "Night Bus" Network That's Different from the Daytime Transit System

Another method of serving the late-shift is to establish a night bus network that differs from the bus system operated during the day. Public transit agencies have several reasons to choose to create a specialized network for nighttime service. First, travel demand during the night is lower than during the day, resulting in lengthy headways. Transit providers can use a hub-and-spoke model at night to reduce transfer times and simplify their bus networks. Second, travel demand patterns at night may differ substantially from those during the day, leading to different focuses

Detroit: Rebuilding a 24-Hour Public Transit Network

Detroit's bankruptcy in 2012 forced the city to make painful cuts to public transit. In the intervening years, the Detroit Department of Transportation (DDOT) has been rebuilding the network, with an additional focus paid to improving evening and late-night transit. In 2016, DDOT created six 24-hour routes, and by 2019 DDOT had 12 routes with all-night service. The centerpiece of the bus network is ConnectTen, a network of 10 high-frequency bus lines that operate 24 hours a day.

The growing emphasis on late-night service is especially apt for Detroit; the region stands out because late-night transit mode share is as high as daytime transit mode share. Improving late-shift transit is essential for connecting Detroit's residents to new opportunities.

This service has been expanded with a focus on those who have to be at work at night: In introducing late-night service, as quoted in the Detroit Free Press, Detroit Mayor Mike Duggan said, "I run into people almost weekly who tell me that 'I was able to take that job because the 24-hour service was restored.' " (Lawrence, 2017). Major employers were also engaged in the process of establishing more late-night service, with hospital officials saying that about 20 percent of their staff members commute by bus (Laitner, 2016).

One concern some people have about late-night transit is safety at transit stops. In the city of Detroit's "Strategic Plan for Transportation" (2018), the city focuses on making transit safe by installing police cameras at transit stops, as well as continuing to improve lighting at bus stops (City of Detroit, 2018).

Detroit MSA Statistics (2016)

Metro area population	4,304,613
Top industry clusters by employment	Business Services, Automotive Manufacturing
% White	67%
% Black or African American	22%
% Hispanic or Latino (of any race)	4%
% Other	7%
Median household income	$56,339

SOURCE: Demographic data from U.S. Census Bureau, 2013-2017 American Community Survey 5-Year Estimates. Industry clusters as identified by U.S. Cluster Mapping (http://clustermapping.us), Institute for Strategy and Competitiveness, Harvard Business School.

"I run into people almost weekly who tell me that 'I was able to take that job because the 24-hour service was restored.' "

—MAYOR MIKE DUGGAN

Supplementing its investment in fixed-route late-night service, in 2018 Detroit launched a pilot program branded "Night Shift" that allows riders to use Lyft or taxis to or from a bus stop at night. The pilot is funded by a grant from the New Economy Initiative and gives riders a $7 credit for Lyft or cab rides that start or end at a bus stop along one of the city's all-night bus routes. The pilot will fund up to 2,000 trips and run until funding is exhausted. Night Shift is tied to late-night employment in the city's transportation plan; the pilot's stated goal is to "Make it easier for people to access jobs in Detroit" (City of Detroit, 2018).

of the network. Finally, as discussed previously, there are operational and safety concerns that make running the daytime network impractical during the late night.

Montreal's Société de transport de Montréal (STM) provides one model for how to operate late-night transportation. It operates a dedicated network of night routes that operate at a minimum headway of every 45 minutes. Bus routes are long and organized around key hubs to reduce the need for transfers. Female riders can request to alight between bus stops at night to reduce the walking distance to their destinations. Operators make these stops at their discretion, based on whether there is a safe and convenient location to pull over.

In Paris, the regional transportation authority organizes a special network of buses from 12:30 to 5:30 a.m., when regular bus and metro service ceases to operate. The network, branded "Noctilien," operates along the hub-and-spoke model, with most routes serving one of five main rail stations ***(Figure 11)***. The individual bus routes are run by several local bus operators. Paris' example is different from any North American system, as the various agencies operate service under a coordinated branding and route-numbering system.

There are downsides to providing a dedicated night bus network. Transit agencies have to invest in signage, wayfinding, maps and marketing materials specific to late-night service. Operating a late-night bus system that is significantly different from the daytime network can also be confusing to infrequent riders.

Several public transit agencies in the United States operate a hybrid between extending the daytime network into the late night and operating a dedicated night bus network. For example, Metro in Los Angeles and CTA in Chicago both operate an "Owl" service of late-night public transit that closely mirrors key daytime routes. Metro's Owl routes do not have any special route numbering, while CTA prefixes an "N" to routes operating continuously from midnight to 5 a.m. These two examples differ from the daytime network in how routes are organized and scheduled. The focus of the nighttime network in both Los Angeles and Chicago is downtown, with routes timed to make transfers easier between lines *(see Los Angeles profile on page 35)*.

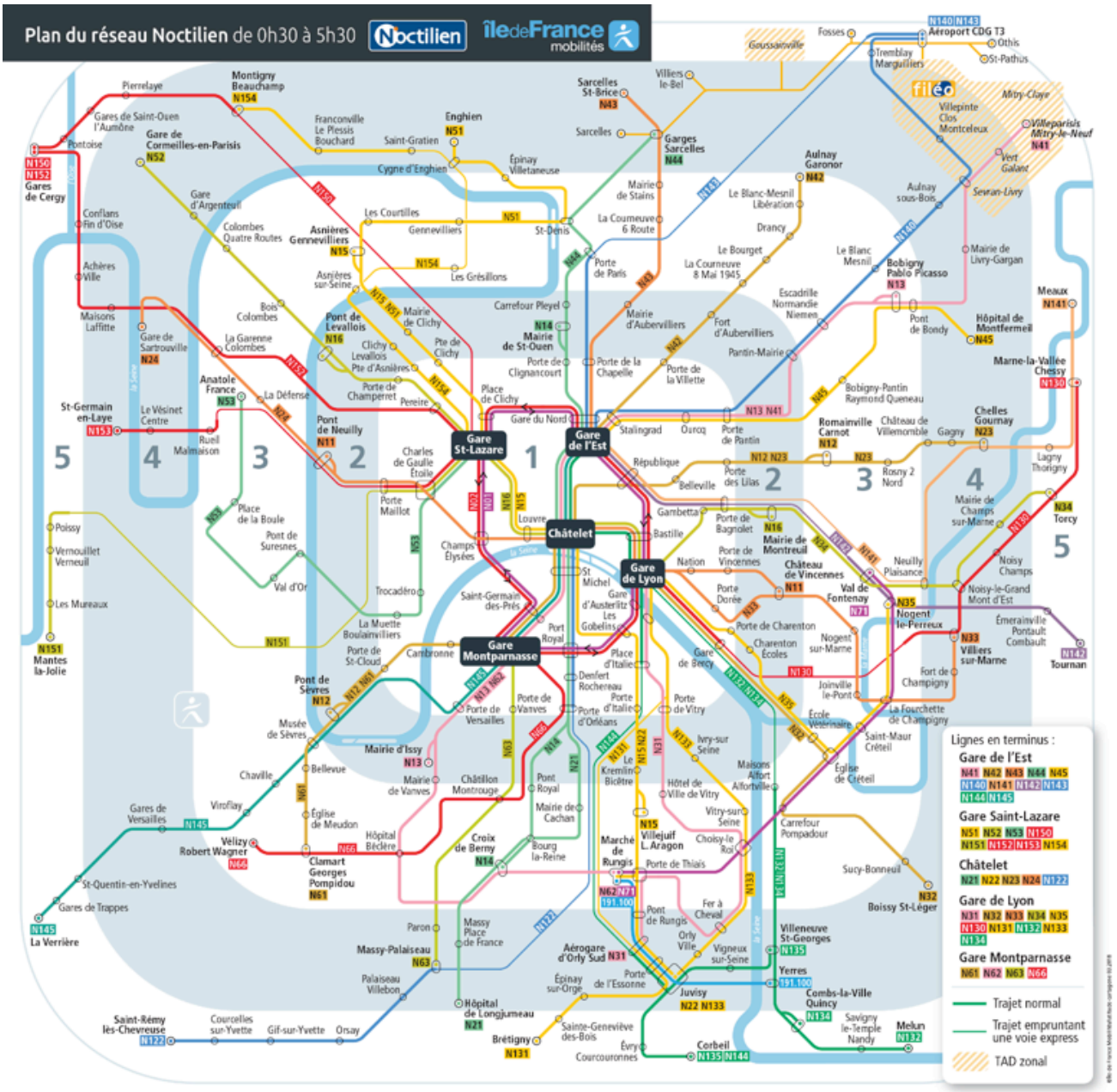
Provide Late-Night Rapid Transit Service

Only a handful of rapid transit systems in the United States operate late-night or 24-hour rail service. New York's Metropolitan Transportation Authority (MTA) runs continuously, as does the Port Authority Trans-Hudson Corporation (PATH), which connects northern New Jersey and New York City, and Port Authority Transit Corporation (PATCO), which connects southern New Jersey and Philadelphia. The CTA likewise runs two "L" trains through the night.

After ending 24-hour subway service in 1991, SEPTA restored 24-hour train service on Friday and Saturday nights in 2014 as a pilot. As shown on SEPTA advertisements at the time ***(Figure 12)***, this service was explicitly marketed to people going out to evening entertainment, and to some extent to late-shift employees (SEPTA Operations, 2016) (SEPTA, 2016). As shown in the snapshot on page 44, the Boston-area Massachusetts Bay Transportation Authority (MBTA) likewise experimented with late-night service on weekends, also aimed at people who had been out at evening entertainment, from 2014 through 2016. MBTA has since pivoted to adding late-night bus service to meet the needs of late-shift commuters.

Another variant of late-night rail service is a system of late-night bus routes that serve the same locations as daytime rail service. SEPTA in Philadelphia operates weeknight Owl bus routes with buses stopping at each subway stop.

Figure 11: Map of Paris' Noctilien Night Bus Network



State of good repair is an important consideration for public transit agencies looking to extend their late-night rail service. Agencies like WMATA and MBTA ultimately decided to shorten their span of service to address the backlog of maintenance and repair activity needed on their rail systems. The inability to operate late-night service due to maintenance needs is an unintended consequence of capital funding shortages and deferred investments in rail systems across the nation.

Provide Demand-Response Service

Transit providers across the country are forming partnerships with taxis and TNCs to resolve transportation challenges that fixed-route transit service is unable—or poorly suited—to address (Schwieterman, Livingston, & Van der Slot, 2018). Late-night transit is a potential space where TNCs and transit providers can be complementary rather than competitive, so providers are exploring partnership opportunities specific to late-shift

Figure 12: SEPTA Advertisement Promoting 24-Hour Weekend Subway Service

commute needs. In larger urban areas, partnerships mostly address first- and last-mile accessibility, while in smaller urban areas, partnering with TNCs can provide complete-trip alternatives to unproductive routes or provide service across greater time spans or geographic areas (Feigon & Murphy, 2018).

Detroit DOT (DDOT) is piloting a partnership with Lyft, in which DDOT is offering to pay the first $7 of any late-night first- or last-mile trip to or from its 10 late-night routes (ConnectTen). The pilot is being made possible through a private grant and will operate until funding for 2,000 trips is exhausted *(see profile on page 39)*.

Some partnerships are based on sharing information to encourage combining ridesharing and public transit options on the same trip. The Metropolitan Atlanta Rapid Transit Authority (MARTA), for example, has partnered with Uber to improve first- and last-mile connections, particularly guaranteed ride home programs and late-night services. MARTA passengers can link directly to Uber's site from the MARTA mobile app. In turn, Uber drivers receive information about when the bus or train will arrive so the car will be waiting (SUMC, 2017).

Pinellas Suncoast Transit Authority (PSTA), St. Petersburg, Florida, designed a pilot program to help low-income residents commute by providing riders up to 23 free on-demand rides per month between 9 p.m. and 6 a.m. These rides must end at either the rider's place of residence or place of employment (SUMC, 2017). PSTA uses a technology called Uber

Central that allows riders without access to a smartphone or credit card to call PSTA to have the agency order a ride for them (Irwin, 2016).

These partnerships could be with taxis as well. Topeka Metro in Kansas, in partnership with a local economic development corporation, subsidizes $5 taxi trips to six major employers in South Topeka. The program provides workers access to employers that may have non-traditional commuting hours and therefore may be poorly served by existing transit.

Finally, the existing literature calls out a lack of hard evidence on whether TNC partnerships meet their goals and objectives (Schwieterman, Livingston, & Van der Slot, 2018). Today, few of these partnerships make their data publicly available for evaluation and comparison. This lack of transparency makes it hard to determine the effectiveness of such programs. The Federal Transit Administration and Shared Use Mobility Center are working to address this knowledge gap and assist public transit agencies in implementing new mobility strategies.

Establish Funding Partnerships

Employers are a potential source of revenue for late-night transit. Second- and third-shift employers know their employees can have trouble getting to and from work and this can be a problem for employers: Tiredness, absenteeism, and turnover due to lack of transportation options have real costs. A lack of public transit to a late-shift job may also prevent an individual from applying for or accepting a position.

The Battle Creek, Michigan, community faced this issue, with both an industrial park and a casino with thousands of second- and third-shift employees located on the edge of the city. A new nonprofit private mobility provider, Aequitas Mobility Services *(see page 31)*, emerged to provide on-demand trips, focusing on these late-night shifts. Both the casino and the industrial park provided funding, while other funding came from a matching grant from a local professional organization that works with disadvantaged women, as well as a small-business loan. Aequitas is also pursuing federal 5310 (Enhanced Mobility of Seniors and Individuals with Disabilities) federal funding to provide discounted rides to seniors and individuals with disabilities. While the service is focused on the second and third shifts, it also provides non-emergency medical transportation to generate additional income in daytime hours.

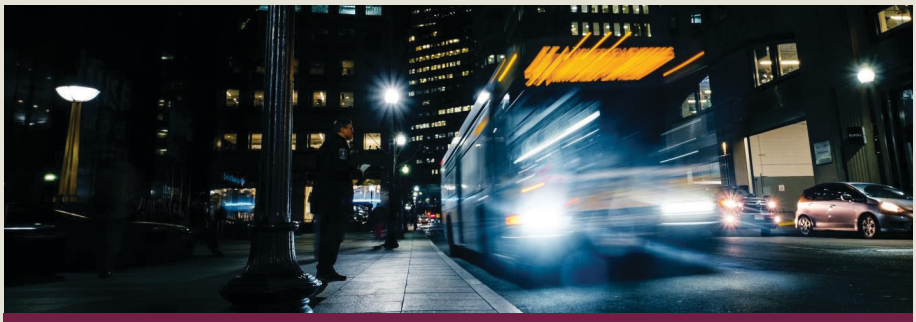
Smaller communities have particular opportunities and challenges with public transit services in general, including late-night service. Because there were only a few major late-night employers, Aequitas was able to engage directly with them to develop an understanding of how the lack of late-night transit effects those workplaces and their employees; these conversations also provided the opportunity for employer funding, as discussed. Smaller communities, however, are less likely to have some institutional infrastructure to support transit; for example, in Battle Creek there is no culture or infrastructure for commuter tax benefits.

Airports are another work site with many employees who need to be at work at hours that traditional public transit does not support. The Metropolitan Council of the Minneapolis/St. Paul region is partnering with employers at Minneapolis–St. Paul International Airport to fund demand-responsive late-night transit to and from the airport. Airport employers match the passenger fare and the Metropolitan Council takes on the rest of the cost. Employers have credited this service with increasing on-time openings (Metropolitan Council, 2017).

As described with Aequitas, grant funding is a mechanism to support late-night transit, but one that typically is finite. Detroit DOT's pilot with Lyft is funded by a grant from a nonprofit and will end when that money runs out.

Boston's Experiments with Late-Night Service

Boston is one of the country's major transit cities, with the fourth-highest overall transit ridership, including commuters and non-commuters (American Public Transportation Association, 2018), and the fourth-highest transit mode share (U.S. Census, 2013-2017a). The Boston area is an international center of education, finance, tourism and technology.



Boston MSA Statistics (2016)

Metro area population	4,771,936
Top industry clusters by employment	Business Services, Education & Knowledge
% White	72%
% Black or African American	7%
% Hispanic or Latino (of any race)	11%
% Other	10%
Median household income	$81,838

SOURCE: Demographic data from U.S. Census Bureau, 2013-2017 American Community Survey 5-Year Estimates. Industry clusters as identified by U.S. Cluster Mapping (http://clustermapping.us), Institute for Strategy and Competitiveness, Harvard Business School.

Boston does not have a high percentage of workers who work at night, with the fourth-lowest night mode share among MSAs with more than 500,000 residents. Nevertheless, many people still use the transit system at night: 8.5 percent of night workers in Boston ride transit, the fourth-highest nighttime mode share in the country (U.S. Census, 2013-2017a). As with many places in the country, people who work at night have lower incomes than those who do not: While the median wage in the Boston MSA is $45,000, for night workers it is $33,960 (Ruggles, et al., 2018).

The MBTA, the area's primary public transit system, has experimented with late-night service several times over the past few decades. From 2001 to 2005, the MBTA ran night buses until 2:30 a.m. on weekend nights, mostly radiating from a transfer location in the city center. Due to low ridership, the agency eventually eliminated the service. From 2014 to 2016, the subway and 15 bus routes ran until 3 a.m. on weekend nights. The state hoped to generate private sponsorships to support the service expansion; however, the MBTA cut late-night service in 2016 due to a combination of costs and operational impacts. Boston's subway network is the oldest in the nation and running late-night service reduced the authority's capacity to conduct maintenance. The agency felt that ridership during the late night did not warrant the cost. Additionally, as the service operated only on weekends, it failed to serve the needs of most late-night workers (Dungca, 2016).

The MBTA started another trial of providing late-night service in 2018. As opposed to previous late-night services in Boston, which focused on weekend service oriented toward recreation and social travel, this service is focused on employees who need to commute when traditional transit is not available.

Starting in the fall of 2018, buses run every night on several routes until 2 a.m., and others until 3 a.m., focusing on neighborhood trips to get people home from work. This latest incarnation of nighttime transit comes after sustained activism from local municipalities, elected officials and advocates, sometimes with the explicit goal to "Support 'Third Shift' and other Late-night/Early-morning Workers." (City of Boston, City of Cambridge, City of Somerville, and Transit Matters, 2017).

Conclusion

APTA undertook this late-shift mobility study to better understand America's late-shift employment and the magnitude of public transportation needs facing this subset of the workforce.

An analysis of public demographic and labor data; a review of available literature; and one-on-one interviews with public transit agencies, employers and nonprofits helped illustrate the complex issues facing late-shift public transportation. Seventeen percent of Americans living in an urban area start work during the late-shift and more than a quarter of all Americans at least infrequently do paid work during the nighttime hours of 10 p.m. to 6 a.m. The size of the late-shift workforce will only expand, as some of the fastest-growing occupations and industries over the next decade are those with high proportions of late-shift workers. Late-shift jobs keep America running, from ensuring that stores are open late into the night to staffing critical hospital and emergency services jobs.

Late-shift public transit riders earned approximately $28 billion in wages last year and helped generate $84 billion in sales. While public transit is already providing Americans access to new job opportunities during the late-shift, there continues to be an unmet need for better late-night public transit. Late-shift commuters are more reliant on their personal cars for commuting than their daytime peers. The cost of car ownership is a major burden for the low- and mid-wage jobs that dominate many late-shift occupations. A lack of public transit late at night essentially cuts out a segment of the U.S. population from participating in the expanding late-shift job market.

Public transit providers face challenges in operating during the late-shift. Lower demand during the nighttime means the high-frequency public transit networks that operate during the day may not be practical for many cities at night. Furthermore, late-night operations face a host of operational and service planning challenges, from selecting safe and convenient layover spots for drivers to preserving the needed window of time for system and vehicle maintenance. None of these challenges is insurmountable with the proper leadership and funding. Communities from Battle Creek, Michigan, to Los Angeles and from Las Vegas to Philadelphia illustrate that there is a diverse range of strategies for improving late-night public transportation.

Call to Action

This study has identified several ways policy-makers at the local, state and national levels can improve mobility for late-shift commuters:

- **Establish programs dedicated to funding late-shift public transportation operations.** Providing public transportation during the late-shift is challenging due to lower ridership and overall travel demand during this period. However, lower ridership should not be equated with this period having a lesser need for public transit. Operating late-shift public transit (along with alternative modes like demand-response service, carpools and vanpools) is essential for expanding workforce opportunities. Without new funding for late-shift public transportation at the state and federal levels, public transit agencies are forced to subsidize these needs within their already-constrained budgets.

- **Increase investment in transit system state of good repair, and shrink the backlog of deferred maintenance.** Older public transit systems have a reduced capacity to operate late-night public transit service because of maintenance and upkeep needs. As rail systems in particular work on attaining a state of good repair, a larger window of time is needed to perform inspections and maintenance at night. Investing in public transit infrastructure will give agencies more flexibility in their hours of service.

- **Continue to embrace innovative partnerships to meet late-shift mobility needs.** Fixed-route public transit may not be appropriate for serving all types of late-shift travel needs. Programs like Aequitas in Battle Creek and Night Shift in Detroit illustrate the value of partnering with private or nonprofit organizations to fill gaps that fixed-route public transit cannot serve. For many late-shift employees, carpool and vanpool programs are an effective public transportation option. The public sector can support these efforts by managing ride-matching services and providing services such as guaranteed ride home for when a carpool partner is unavailable.

- **Increase the transparency of new mobility partnerships.** Conduct cost-benefit analyses to determine whether such programs are meeting their overall objectives.

- **Formalize frameworks to allow employers to subsidize late-shift public transportation.** Private businesses directly benefit from expanded late-shift public transit. Already there are examples of major employers financially supporting public transit service aligned to nontraditional work schedules. Transit providers could expand this by creating a standardized process for agency–private sector partnerships. In many cases, single businesses may not have the resources or scale to subsidize late-shift public transit on their own. Transportation management associations or similar collective organizations can pool the necessary resources together to invest in impactful public transit.

There continues to be an unmet need for better late-night public transit

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