

"Walking and riding trolleys to Yale Bowl for a football game." Photo courtesy of Yale University.

Yale University 2017 Transportation Survey Report

February 2018

A campus-wide transportation survey was first created and distributed in 2007 to provide Yale University with an accurate baseline assessment of its transportation and parking initiatives and how the university population commutes to and from campus. Now conducted biennially, the results from these surveys constitute a baseline for the University to measure progress against itself and compare to peer institutions. In addition, the data lends support for implementing programs and initiatives that will help increase the use of more sustainable modes of transportation, rather than driving alone, and provide direction for new transportation initiatives.

As the vast majority of undergraduates live on-campus and do not commute, they are excluded from the transportation surveys. At the time of the first survey in 2007, Yale's employee and graduate population was 19,914 (70% employees and 30% graduate students). By Yale's ninth transportation survey in 2017, the population had risen to 21,877 (67% employees and 33% graduate students).

Report Highlights

Most Yale commuters use sustainable transportation modes.

- In 2017, the majority (60%) of Yale commuters utilized sustainable transportation methods, i.e., transit (22%), walking (23%), biking (8%), ridesharing (5%), and telecommuting (2%), while 40% used a single-occupancy vehicle to get to work or class.
- The commuting habits of Yale employees have changed slightly since 2015, when the last survey was conducted, with the most notable difference found in the 3% increase in single-occupancy vehicle use. Rideshare increased by 1%, while walking, transit, and biking decreased by 1%. The decrease in gas prices since 2013 has likely contributed to the slight increase in employee drive-alone rates.

Commute satisfaction is higher for those who use sustainable transportation.

- As in previous years, employees who never drive alone to campus have the highest commute satisfaction, while those who drive alone every day have the lowest.

More employees are using public transit.

- Among employees who use transit (bus or train), more are commuting via CTTransit and Shoreline East than in 2015. Both modes saw a 5% increase among transit riders, while the Yale Shuttle saw a 1% decrease.

The same three reasons for driving alone have been the most common since 2009: irregular hours on campus, need car for errands or appointments, and driving alone takes less time.

- “Infrequent special circumstances,” which was added as a new choice in 2015, remains the fourth most popular reason.
- Employee awareness that Yale offers a guaranteed ride home in the event of an emergency has remained steady, at around 31% awareness, since 2013.

More employees may be willing to switch to a sustainable commute, with the right incentives.

- In 2017, 15% of employees who drive to work every day indicated that they would “very likely” try a new commute mode if they were offered a discount on a monthly transit pass, compared to 11% in 2015.
- In addition, 19% of employees who drive to work every day indicated they would be “very likely” to try a new commute if they had flexible hours to better fit transit schedules, compared to 14% in 2015.

New survey questions revealed high rates of teleworking.

- Telecommuting (working in a location remote from the typical worksite), has remained steady since 2008 at around 2%.
- For the first time, commuters were asked about their teleconference (using electronic means to hold a virtual meeting or event) habits. Nearly 40% of commuters use teleconferencing technology at least once per month, with nearly 13% using it more than once per week.

Introduction

In October-November 2017, Yale faculty, staff, postdoctoral researchers, and graduate and professional students were surveyed to track their commute behavior and patterns over time. A representative sample of 1,170 was used for the survey based on guidance from the U.S. Environmental Protection Agency Best Workplaces for Commuters Program Evaluation Guide.

The comparison chart below indicates the changes in population from 2015 to 2017. Since 2015, the total population has grown by 8.5%. However, the proportion of each affiliation category to the total population has remained relatively steady.

University Affiliation	Total Population		% of Total		Sample Size	
	2017	2015	2017	2015	2017	2015
Faculty	4503	3745	21%	19%	241	217
Postdoc	1244	1137	6%	6%	67	66
C&T Employee	3593	3559	16%	18%	192	207
M&P Employee	4366	3985	20%	20%	234	231
S&M Employee	921	960	4%	5%	49	56
Graduate Student	7250	6769	33%	34%	388	393
Total	21877	20155	100%	100%	1171	1170

TABLE 1: YALE UNIVERSITY POPULATION AND TRANSPORTATION SURVEY SAMPLE SIZE (2015 AND 2017)

One of the goals of providing more sustainable transportation options on the Yale campus is to reduce vehicle-related greenhouse gas emissions. Therefore, the more relevant target audience is Yale employees. Although employees comprise 67% of the total population, they represent over 90% of the population utilizing Yale's parking facilities.

Methodology

Yale's transportation survey was conducted primarily online, but was also distributed in paper form to employees who do not have regular internet access at work. These employees received the survey from their department supervisors. The survey asked faculty, staff, and graduate students about the commute modes they used to get to campus the week of October 23 - 27, 2017.

Survey Process

The survey used a stratified random-sample methodology that followed guidance developed by the EPA for evaluating commuter benefit programs pursuant to air quality regulatory requirements for states.¹ A sample size of 1,170 is prescribed for organizations with 20,000 or more individuals. Using a random skip interval of applicable employees and students in the following stratified categories, six separate sample survey tracts were constructed.

¹ See *Guidance for Quantifying and Using Emission Reductions from Best Workplaces for Commuter Programs in State Implementation Plans and Transportation Conformity Determinations* (U.S. Environmental Protection Agency, 2007).

Category	Population	Population (%)	Sample Size (Rounded)	Survey Responses	Survey Responses (%)
Faculty	4503	20.58%	241	187*	15.98%
Postdoc	1244	5.69%	67	67	5.73%
C&T Employee	3593	16.42%	192	192	16.41%
M&P Employee	4366	19.96%	233	287*	24.53%
S&M Employee	921	4.21%	49	49	4.19%
Graduate Student	7250	33.14%	388	388	33.16%
Total	21877	100.00%	1170	1170	100.00%

TABLE 2: 2017 TRANSPORTATION SURVEY POPULATION

Sample returns reflect only the first survey responses up to the goal number in each category. The target response rate was met in all population categories except Faculty. As noted by an asterisk (*) in the table above, additional Managerial & Professional Staff responses were used to make up for the low response rate. In future surveys, more Faculty respondents should be included in the initial survey outreach to ensure that the proportions are as accurate as possible

The survey provided both quantitative data on campus commuting and qualitative data for Yale to use as supportive information for implementing campus-wide transportation demand measures (TDM). The first 17 questions were required, with the exception of questions #3 (gender) and #7 (age), which were optional. Question 18 was the dividing question for respondents who never drive alone to campus and those who do. The latter group went on to the second part of the survey expressly designed for collecting information about respondents in the sample who drive alone to campus. New questions in the 2017 transportation survey covered satisfaction with the Yale Shuttle, business travel, and audio and video conferencing technologies.

In the combined employee and student results, 34% indicated they drive alone to campus five days per week and 31% drive alone less often. Thirty-five percent indicated they never drive to campus. Therefore, of the 1,170 total in the sample, 758 respondents went on to the second part of the survey. This section was designed for gathering opinions about possibilities for changing commute behavior, so many of the questions allowed respondents to select multiple answer choices.

Baseline Trips and Mode Split Process

Data results from survey question 7, “Please indicate how you commuted to campus each day last week, October 23 – 27, 2017,” were totaled for each day by 15 different commute methods. The data was then totaled by trips per week for each mode and summarized into the commute trips chart provided below. To arrive at the total estimated one-way trips by total population (all employees and students), the total number of Yale’s 21,877 employees and graduate students was multiplied by the number of days in the work/class week (five). The result equaled 109,385 estimated total trips taken by all commuters at the University. Respondents who were not on campus are not counted in the trip chart below.

Commute mode	Trips taken by sample population	÷	Total trips taken by sample population	=	Proportion of trips by mode	x	Total one-way trips (total population x five days)	=	Estimated trips by total population
Drive alone	2258	÷	5,602	=	40.32%	x	109,385	=	44,099.61
Carpool	302	÷		=	5.39%	x		=	5,896.87
Vanpool	0	÷		=	0.00%	x		=	0.00
Public transit ²	1244	÷		=	22.20%	x		=	24,280.66
Bicycle	425	÷		=	7.59%	x		=	8,298.58
Walk	1269	÷		=	22.65%	x		=	24,778.57
Telecommute	104	÷		=	1.86%	x		=	2,030.71
TOTAL	5602	÷		=	100.00%	x		=	109,385.00

TABLE 3: 2017 MODE SPLIT CALCULATION

Commute Mode Split Trends

The charts in this section illustrate the 2017 mode split and trends since 2013. In 2017, the majority (60%) of Yale commuters utilized sustainable transportation methods, i.e., transit (22%), walking (23%), biking (8%), ridesharing (5%), and telecommuting (2%), while 40% used a single-occupancy vehicle to get to work or class. The commuting habits of Yale employees have changed slightly since 2015, with the most notable difference found in the 3% increase in single-occupancy vehicle use. Rideshare increased by 2%, while walking, transit, and biking decreased.

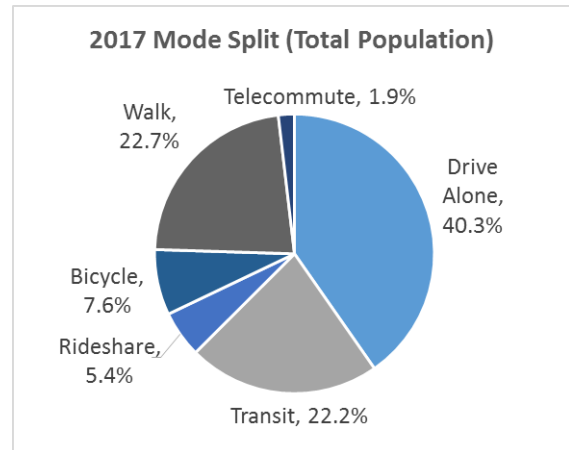


CHART 1: 2017 MODE SPLIT

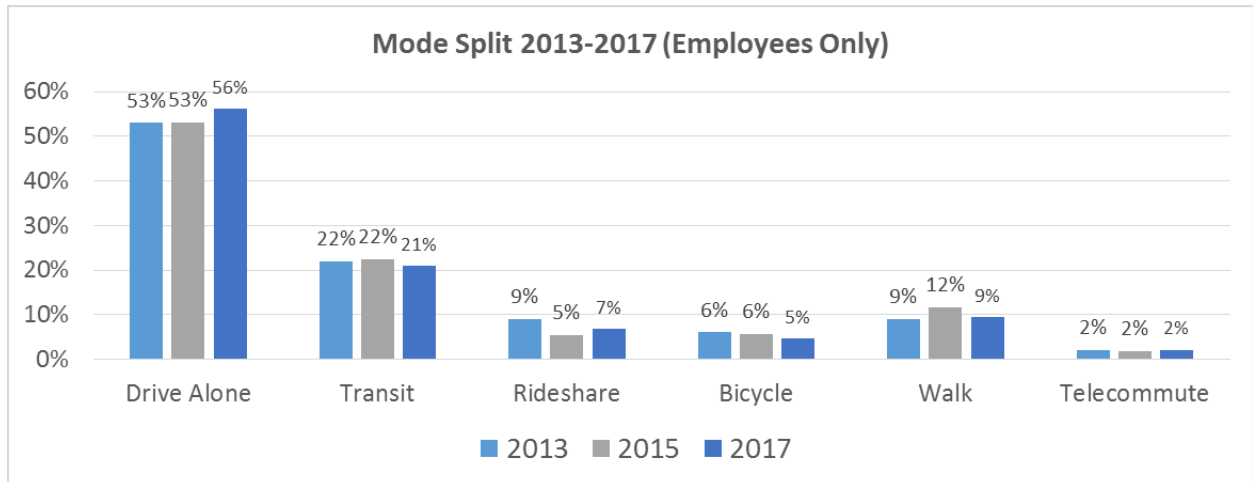


CHART 2: EMPLOYEE MODE SPLIT COMPARISON 2013-2017

² Public transit includes the Yale Shuttle, Shoreline East and Metro North Trains, CTTTransit Bus, and Amtrak.

As shown in Chart 3 below, employees drive alone to campus much more often than graduate students. Graduate students walk and bike more often, as they typically live closer to campus. These differences are consistent with survey results from previous years.

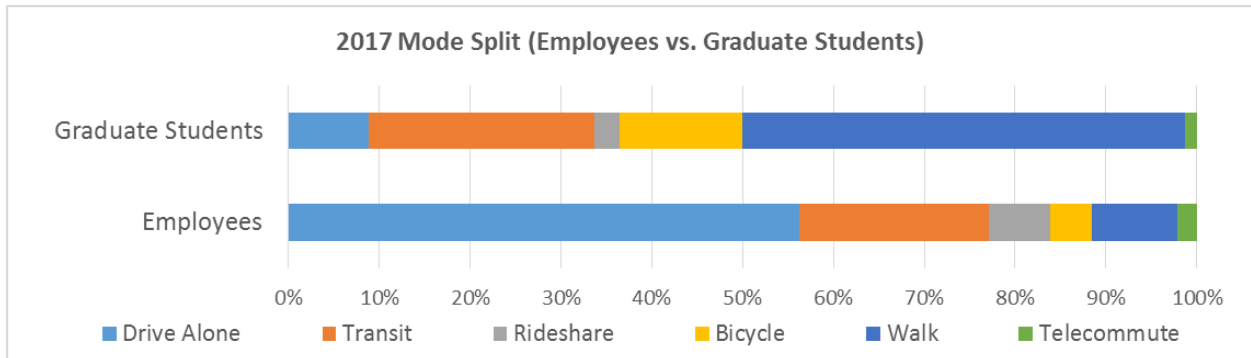


CHART 3: 2017 EMPLOYEE AND GRADUATE STUDENT MODE SPLIT COMPARISON

Intra-Campus Travel

Respondents were also asked whether they travel between campus locations during their day, and if so, what methods of travel they use. Respondents were able to choose more than one travel mode.

As Yale’s campus has grown, travel between campus points during the typical day has become more common for employees and graduate students. In 2017, 40% of commuters indicated that they travel between campus locations during a typical workday or between classes, up slightly from 39% in 2015. Of those, a quarter said they travel between campus points at least twice per day, and half traveling at least once per day.

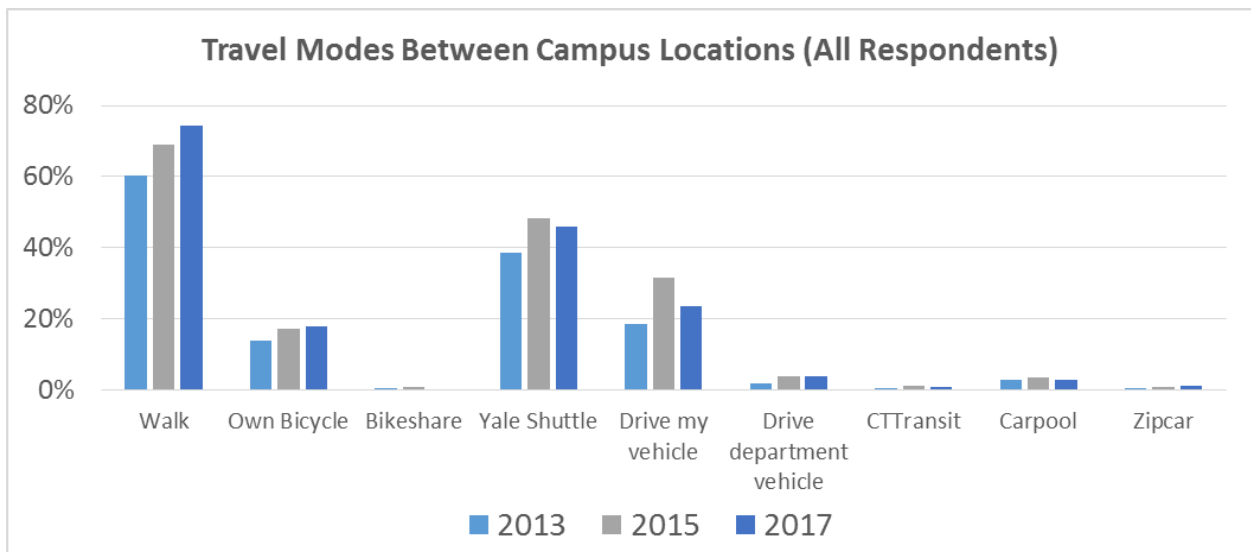


CHART 4: TRAVEL BETWEEN CAMPUS LOCATIONS COMPARISON 2013-2017

As shown in Chart 4 above, intra-campus travel modes have changed slightly in the last four years. The most dramatic shift is in walking between campus points, having increased over 5% since 2015. In addition, driving personal or department vehicles decreased since 2015, a sign that Yale’s campus is becoming more conducive to traveling via sustainable transportation modes.

Employee Top Ten Zip Codes

Since the first transportation survey in 2007, New Haven has remained the most popular town for employees to live. Although the population has fluctuated somewhat, over a quarter of employees lived in the city in 2017. The next most popular towns are Hamden (6% of employees), Branford (4%), North Haven (4%), and East Haven (4%).

This is significant because, as shown below, Yale employees living in New Haven tend to have more sustainable commutes than those living in surrounding towns. The University is committed to neighborhood revitalization in the city of New Haven through initiatives such as the Yale

Homebuyer Program, which provides up to \$30,000 for employees to buy homes in New Haven and has benefited over 1,200 faculty and staff since its creation in 1994. In addition, Yale’s New Haven Hiring Initiatives program provides jobs and training opportunities for New Haven residents.

Beginning in 2013, data was calculated for employee-only commute trips by zip code and by mode in order to gain a better understanding of the modes employees are using to commute from the top ten zip codes. Table 4 below provides detail on where the majority of Yale’s employees commuted from and their mode choice in 2017.

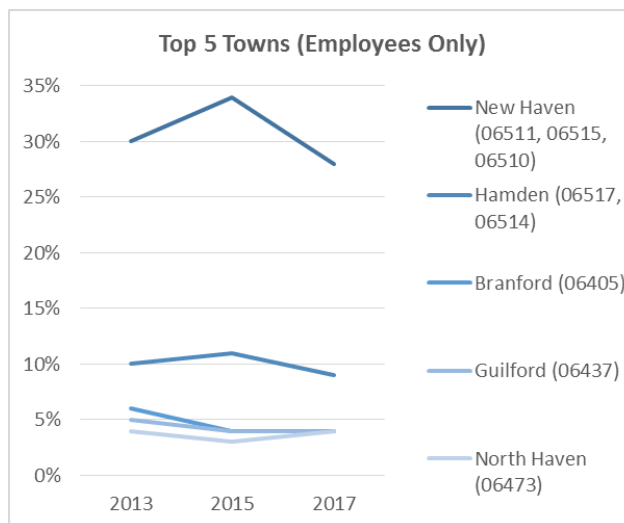


CHART 5: 2017 TOP 5 TOWNS BY EMPLOYEE ZIP CODE

Zip Code	Town	% of Employees	Drive Alone	Transit	Bike	Walk	Rideshare	Other ³
06511	New Haven	22%	14%	32%	14%	31%	4%	5%
06517	Hamden	6%	62%	16%	8%	4%	6%	4%
06405	Branford	4%	66%	20%	0%	3%	5%	6%
06473	North Haven	4%	79%	11%	0%	0%	9%	1%
06515	New Haven	4%	46%	28%	7%	1%	14%	4%
06512	East Haven	4%	75%	11%	0%	0%	10%	5%
06437	Guilford	4%	43%	30%	0%	0%	8%	6%
06492	Wallingford	4%	83%	2%	0%	0%	8%	7%
06443	Madison	3%	52%	25%	3%	0%	8%	12%
06525	Woodbridge	3%	82%	0%	2%	0%	9%	6%

TABLE 4: COMMUTE MODE SPLIT FOR TOP 10 EMPLOYEE ZIP CODES (2017)

As expected, the drive alone rates for employees living in New Haven are much lower than those for surrounding towns, with 21% on average across all three New Haven zip codes as compared to 68% on average from the other top zip codes.

³ “Other” includes telecommute and out of office.

Employee Commute Satisfaction

The 2017 transportation survey asked respondents to indicate how satisfied they are with their current commute. Chart 6 below shows that commute satisfaction for employees varies based on how often they drive alone to work.

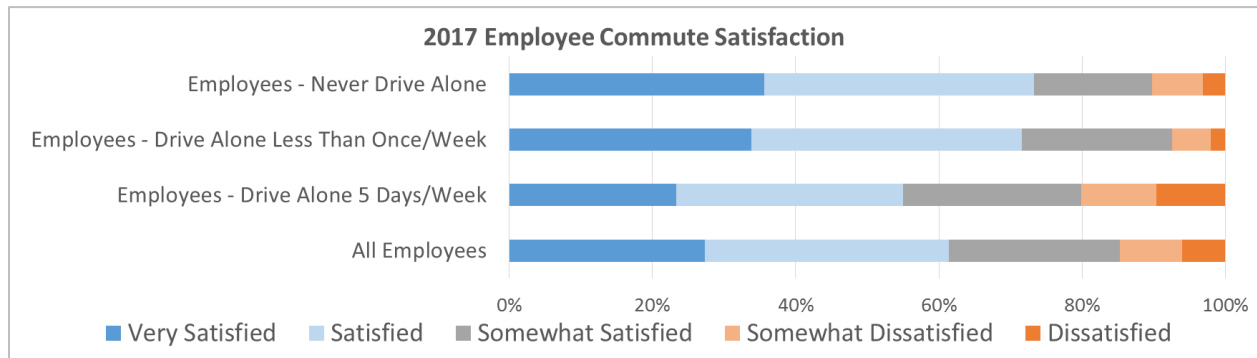


CHART 6: 2017 EMPLOYEE COMMUTE SATISFACTION

Employees who never drive alone to campus have the highest satisfaction, while those who drive alone every day have the lowest. On average, employees who drive alone to work occasionally (less than once per week) are 8% more satisfied⁴ with their commute than those who drive alone five days per week.

Respondents who indicated dissatisfaction with their commute were asked a new survey question in 2017 about the reasons for their dissatisfaction. Respondents were able to choose multiple reasons. Among the choices given, 30% of respondents who drive alone to work every day chose "traffic congestion, 25% chose "cost of commute," and 24% chose "length of commute." For commuters who never drive alone to campus and indicated dissatisfaction with their commute, only 15% indicated dissatisfaction because of cost of commute, and only 12% chose "traffic congestion."

Public Transit Mode Comparison

Since 2015, transit ridership by employees has decreased by 1%, to 21% of commuters. Since 2013, ridership of the various transit modes has remained relatively steady. There has been a gradual increase in public transit ridership, with nearly a quarter of transit riders taking the public CTTransit bus to work. The Yale Shuttle has remained the most frequently used transit mode since the first transportation survey in 2007. In 2017, nearly half of all employees using public transit indicated that they use the Yale Shuttle, as shown in Chart 7 below.

⁴ The average of "very satisfied" and "satisfied."

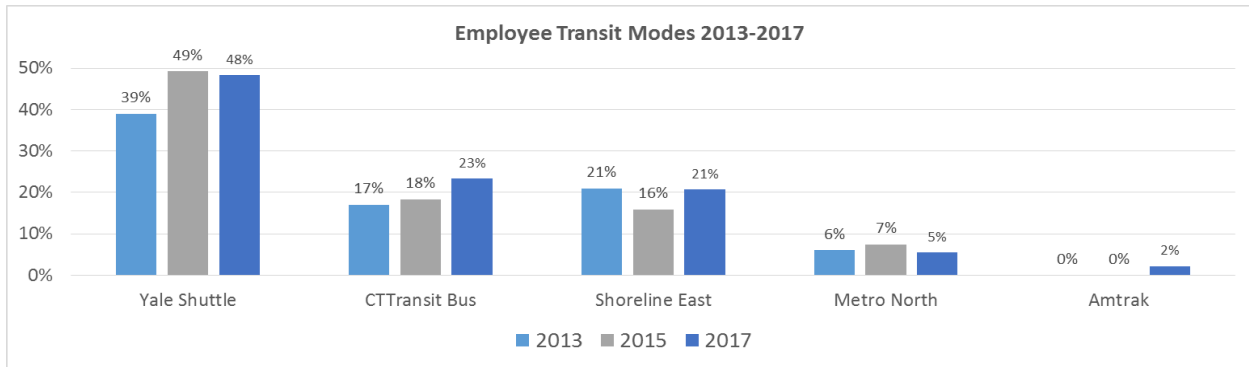


CHART 7: EMPLOYEE TRANSIT MODE COMPARISON 2013-2017

Yale Shuttle Ridership

New survey questions were added in 2017 to gather data on Yale Shuttle ridership rates and satisfaction. As shown in Chart 8, the Shuttle enjoys a high ridership rate among all Yale commuters. Employees and graduate students who ride the Shuttle at least a few times per year indicated high satisfaction with: ability to find a seat (91% at least “somewhat satisfied”), ease of use of the Transloc tracking app (87%), convenience of routes and stop locations (86%), convenience of schedules (84%), and time of travel compared to other transportation options (79%).

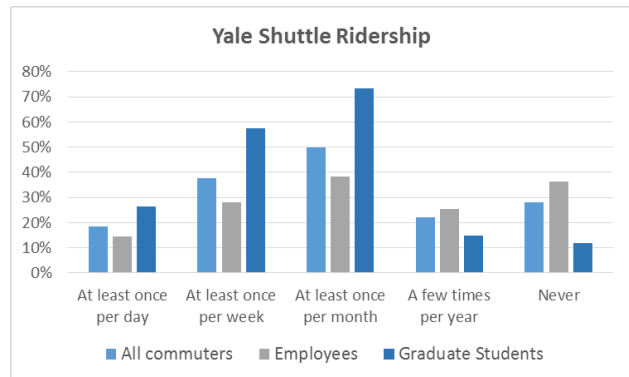


CHART 8: 2017 YALE SHUTTLE RIDERSHIP

Changing Behavior

As shown in Table 5 below, the top reasons for employees driving alone have been fairly consistent in recent years. The same three reasons have been the top choices since 2009: need car for errands or appointments; driving alone takes less time; and, hours on campus are irregular. “Infrequent special circumstances,” such as an event or late workday, was added as a new choice in 2015, and remains the fourth-most popular.

2017		2015	
Need car for errands or appointments	42%	Hours on campus are irregular	41%
Driving alone takes less time	40%	Need car for errands or appointments	41%
Hours on campus are irregular	39%	Driving alone takes less time	38%
Infrequent special circumstances	33%	Infrequent special circumstances	34%
Need car in case of emergencies	29%	Enjoy my privacy, prefer to drive alone	26%
2013		2012	
Hours on campus are irregular	28%	Hours on campus are irregular	27%
Driving alone takes less time	24%	Need car for errands or appointments	23%
Need car for errands or appointments	23%	Driving alone takes less time	22%
Need car in case of emergencies	16%	Transit does not work with my schedule	18%
Enjoy my privacy, prefer to drive alone	15%	Need car in case of emergencies	17%

TABLE 5: TOP 5 REASONS FOR EMPLOYEES DRIVING ALONE (2012-2017)

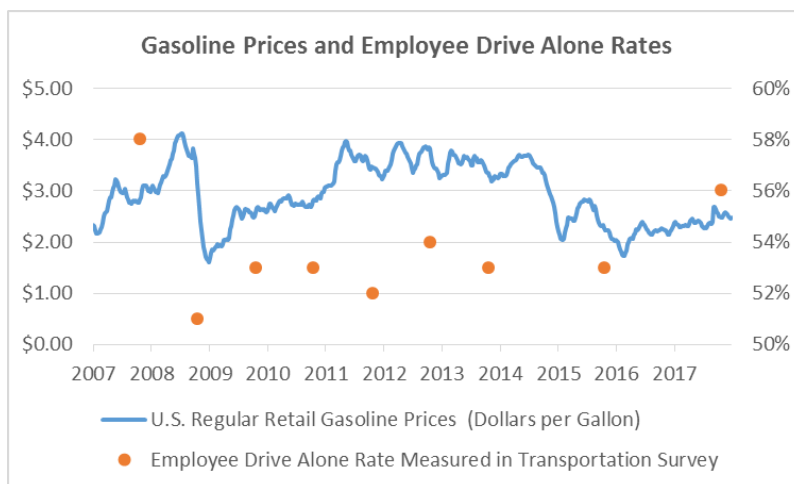


CHART 9: WEEKLY U.S. REGULAR RETAIL GASOLINE (ALL GRADES) PRICES AND YALE TRANSPORTATION SURVEY EMPLOYEE DRIVE ALONE RATES 2007-2017

External economic factors also play an important role in the drive alone rate for employees. As shown in Chart 9, drive alone rates were generally lower when gas prices were higher, and the drive alone rate has increased in recent years as gas prices decreased. Economic recovery in the U.S. also affects driving rates.⁵ The decrease in gas prices could contribute to the higher drive alone rates among Yale commuters. In addition to increased single-occupancy vehicle travel, lower gas prices have “hidden costs” such as more pollution, energy consumption, and traffic congestion.⁶

Incentivizing Sustainable Behavior

Survey respondents who drive alone to campus were asked whether various incentives would change their transportation mode choice. Chart 10 below shows the percentage of employees who indicated they may switch based on these incentives.

⁵ See <https://www.npr.org/2016/02/23/467768203/cheap-gas-contributes-to-record-u-s-traffic-volumes>.

⁶ See <http://usa.streetsblog.org/2015/11/19/the-high-price-of-cheap-gas/>.

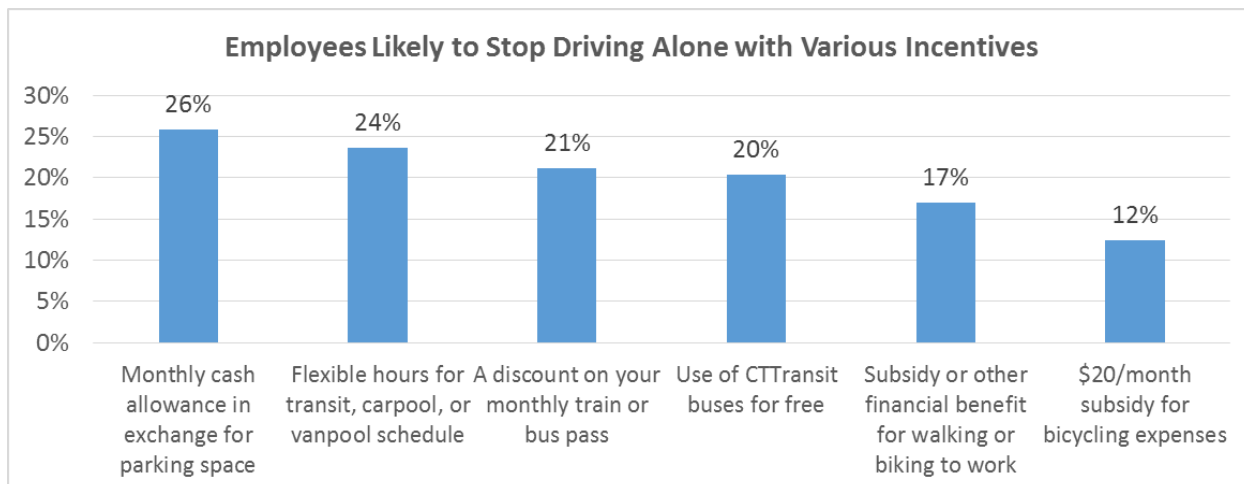


CHART 10: PERCENTAGE OF EMPLOYEES LIKELY⁷ TO STOP DRIVING ALONE WITH VARIOUS INCENTIVES

The top three incentives in the 2017 survey that could motivate employees who drive alone to work to switch to alternative modes are as follows:

1. **Monthly cash allowance in exchange for parking space:** 26% of Yale employees who drive alone to work indicated on average⁸ that they would likely change their mode choice if they received a monthly cash allowance in exchange for their parking space. Using a rule of thumb for actual behavior change that only 10% of those who answer a “what if” choice question would actually consider switching modes, this could mean a potential 213 employees would likely change.⁹ This incentive remained the most popular since 2015.
2. **Flexible hours to accommodate transit, carpool, or vanpool schedule:** 24% of Yale employees who drive alone to work indicated on average that they would change their mode choice if they had flexible hours to accommodate transit, carpool, or vanpool schedules. Using the calculation outlined above, this could mean a potential of 197 employees who would likely change. This incentive remained the second-most popular since 2015.
3. **Discount on monthly train or bus pass:** 21% of Yale employees who drive alone to work indicated on average that they would change their mode choice if they received a discount on monthly train or bus passes, resulting in a potential 172 who would likely change.

Since 2015, more employees may be willing to switch to a sustainable commute, with the right incentives. In 2017, 15% of employees who drive to work every day indicated that they would “very likely” try a new commute mode if they were offered a discount on a monthly transit pass, compared to 11% in 2015. In addition, 19% of employees who drive to work every day indicated they would be “very likely” to try a new commute if they had flexible hours to better fit transit schedules, compared to 14% in 2015.

⁷ “Likely” is the average of “very likely” and “somewhat likely” responses.

⁸ “Likely” is the average of “very likely” and “somewhat likely” responses.

⁹ The actual change number is based on the 2017 drive alone rate of 56% or 8,191 employees. Of the employees who drive alone, 26% say they would likely change or 2,129 employees. Recognizing the probability that 10% of the 2,129 would likely change, approximately 213 employees might actually switch from driving alone to using alternative modes.

The University can use this data to assess different ways to decrease the drive alone rate for employees and either create new programs or expand education and outreach on existing ones. For example, the University already offers resources for employees and their supervisors to propose flexible scheduling.

Awareness of Yale Transportation Services

Since 2012, all Yale commuters have been asked if they know that Yale offers various commuter services in order gauge how well the University is marketing these services. As illustrated in Chart 12

below, employee knowledge of services such as the TransLoc shuttle smartphone app, pre-tax savings on transit passes, and Zipcar remain high. Awareness of certain programs has increased significantly in the last four years, such as \$8 daily rate parking (9% increase) and bicycle safety training classes (9% increase).

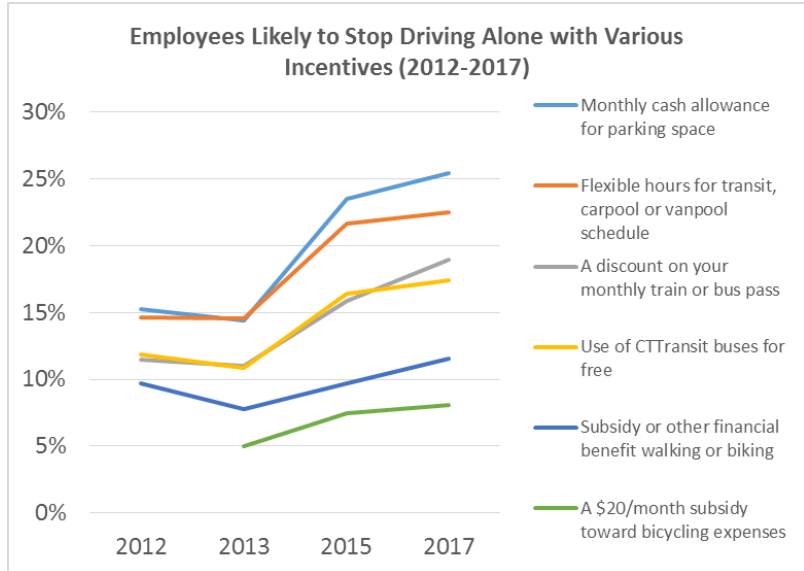


CHART 11: EMPLOYEES LIKELY TO STOP DRIVING ALONE WITH VARIOUS INCENTIVES COMPARISON 2012-2017

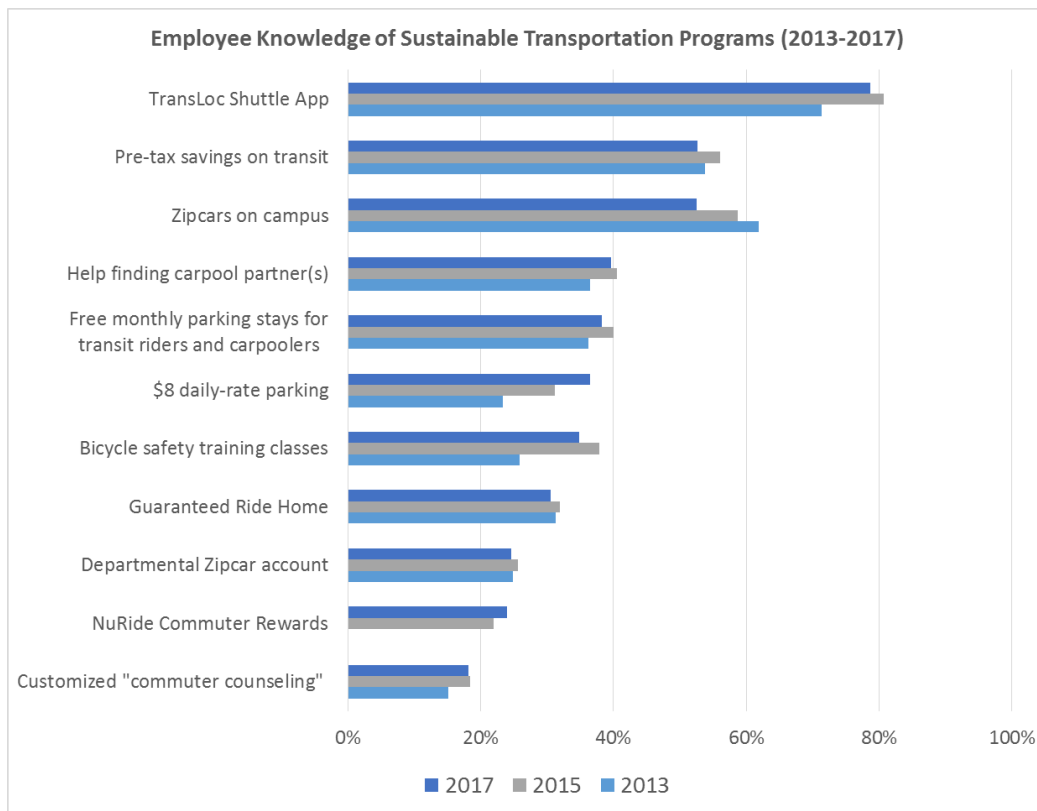


CHART 12: EMPLOYEE AWARENESS OF TRANSPORTATION PROGRAMS COMPARISON 2013-2017

However, awareness of other important programs, such as commuter rewards and customized commuter counseling offered by CTrides, a program of the Connecticut Department of Transportation, remains low. Efforts are being made to increase awareness of these programs. In the fall of 2015, the Office of Sustainability began presenting at every Yale New Employee Orientation, discussing programs such as NuRide and additional transportation options on campus. Increasing awareness of existing programs would be a very cost effective way that the University could increase use of alternative transportation among its current commuting population.

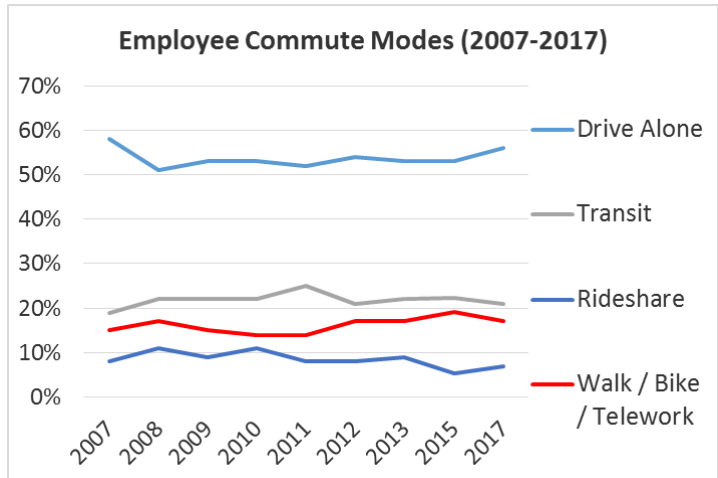


CHART 13: EMPLOYEE MODE SPLIT COMPARISON 2007-2017

Reducing Transportation Emissions

Yale has committed to a 43% reduction in greenhouse gas (GHG) emissions from 2005 levels by 2020, and to be carbon neutral by or before 2050. Scope 3 emissions, or those beyond the University’s direct control, including emissions from employee commuting, are not currently included in these goals but may be in the future as Yale works to reduce its carbon footprint. Therefore, it is critical that more of Yale’s commuting population shift from driving alone to transit, ridesharing, bicycling, walking, and teleworking. It is important to note that alternative transportation modes produce significantly less greenhouse gas emissions than single-occupancy vehicles – rail transit produces up to 75% less and bus transit 32% less. In addition, the more passengers that ride transit, the lower the emissions per passenger mile.¹⁰ Employee use of transportation modes that cause no GHG emissions (walking, biking and teleworking) has decreased slightly since 2015 to 17%, as shown in Chart 13. It will take additional incentives to motivate employees to switch to zero-emission modes and further reduce greenhouse gas emissions.

Employee Vehicle Type

In addition to mode choice, employee commute vehicle type has a significant impact on the GHG impact of Yale’s commuters. Chart 14 below shows employee commute vehicle type trends between 2013 and 2017. Notably, ownership of electric, hybrid, or other alternative fuel vehicles continues to rise, now making up 13% of all employee commute vehicles. In addition, the decrease in mid-sized vehicles and increase in economy vehicles may indicate that employees are switching to smaller, more efficient cars.

¹⁰ See <http://www.fta.dot.gov/documents/PublicTransportationsRoleInRespondingToClimateChange.pdf>.

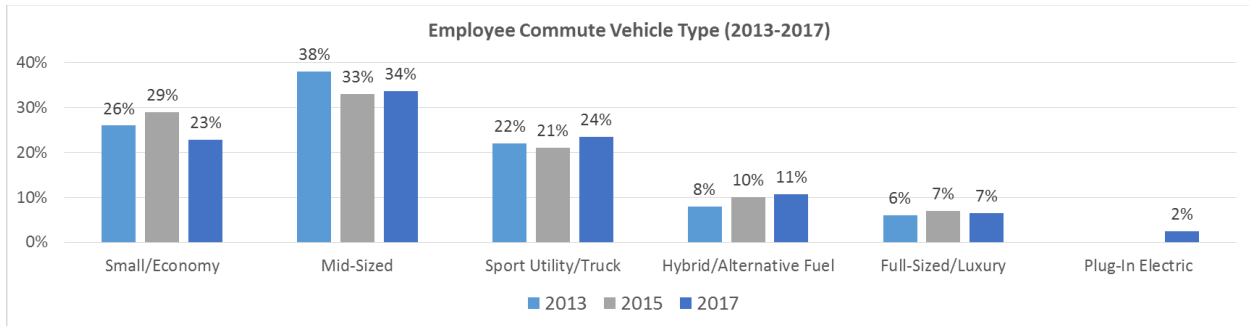


CHART 14: EMPLOYEE COMMUTE VEHICLE TYPE COMPARISON 2013-2017

Plug-in electric vehicle (PEV) was added as a choice for the first time in 2017. Although the proportion of employees driving PEVs is low, nearly 20% of driving commuters indicated that they are considering a PEV for their next vehicle. The majority (70%) of PEV drivers currently charge their vehicles at home, but Yale is working to increase its PEV infrastructure to facilitate more workplace charging and encourage employees to purchase cleaner vehicles.

Teleworking

Another strategy to reduce transportation emissions is to replace commuting or trips to meetings or classes with virtual options. The Yale Sustainability Plan 2025 contains a goal to increase teleworking by 25%. Teleworking includes telecommuting, or working in a location remote from the typical worksite, and teleconferencing, or holding a meeting facilitated by electronic

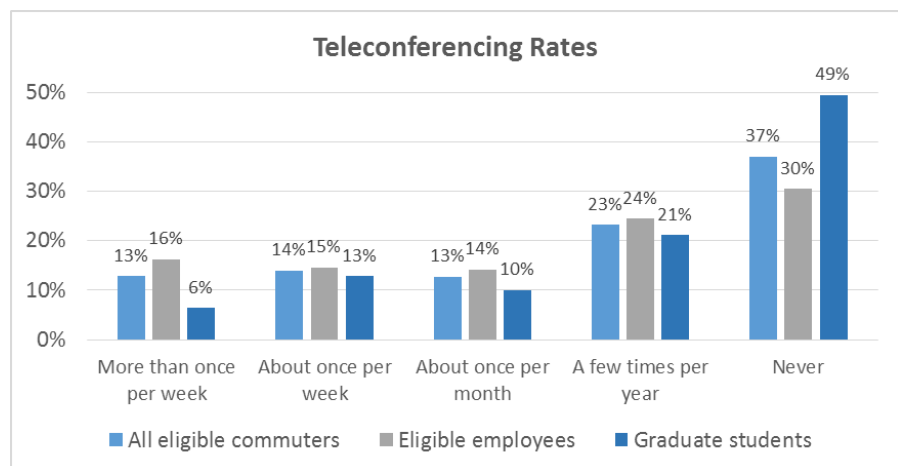


CHART 15: 2017 TELECONFERENCING RATES

means such as conference calling or videoconferencing. Telecommuting has remained steady among Yale commuters since 2008 at around 2%. For the first time in 2017, commuters were asked about their teleconference habits. Nearly 40% of commuters use teleconferencing technology at least once per month, with nearly 13% using it more than once per week as seen in Chart 15.

Respondents who teleconference were also asked about the tools they use to facilitate such meetings. For eligible employees, those whose positions typically allow for teleconferencing, the most popular choices were Skype (29%), Zoom (21%), the Yale MeetingPlace phone conference line system (21%), and other phone conference line systems (17%). Among graduate students, the most popular tools include Skype (57%), phone conference lines (15%), and Zoom (13%). In December 2017, the University phased out the Yale MeetingPlace system and replaced it with Zoom, which should help encourage the community to use this as an easy meeting option requiring no transportation.