Waiting for the Bus?

Transit Infrastructure at America's Community and Technical Colleges

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Public Transit Infrastructure at Community Colleges

Transit accessibility is a key equity issue that cuts across higher education, workforce development, and infrastructure investments. The Biden Administration has highlighted that 40% of Americans lack access to affordable public transit. For **community college students** already juggling family, work, and school commitments, car ownership can be a prerequisite for success. Community college faculty often note that their students are "one flat tire away from dropping out."

According to SHSF, 57% of community and technical college main campuses have stops within walking distance. Notably, SHSF identifies a major opportunity: by extending existing infrastructure, an **additional 25% of community colleges could be made accessible by public transit.**

Why is transit accessibility critical for community college students?

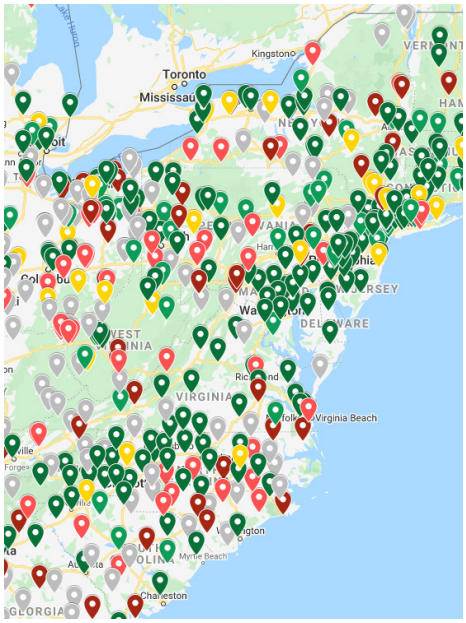
36%
of today's students attend community college

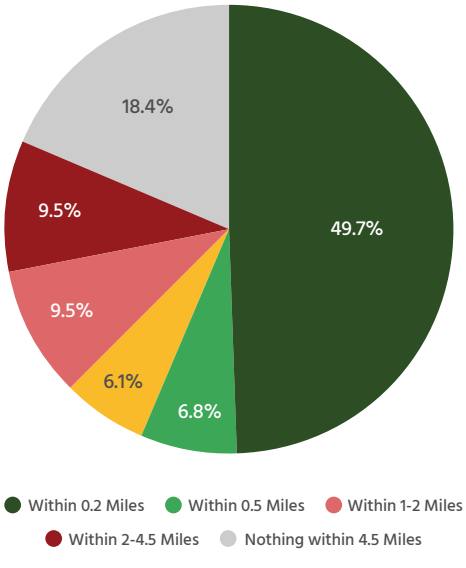
99%
of community college students live off-campus

$1,840/year
is the average transit spending for a community college student

Citations available at www.shs.foundation.

How far is it to the nearest transit stop?





Learn more about the **SHSF Public Transit Map** at www.shs.foundation

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INTRODUCTION

Are community colleges transit accessible? About 36% of undergraduates attend community or technical colleges,[1] and 99% of those students commute to and from campus.[2] Working students, parenting students, students of color, and low-income students are overrepresented at public two-year institutions. The Biden Administration recently highlighted that 40% of Americans lack access to affordable public transit. Without question, students juggling family, work, and school commitments live this inequitable reality.

Transit infrastructure is a critical component of community college access and affordability, but the absence of national survey data and analysis has hampered coordinated support for students. Through the **Seldin/Haring-Smith Foundation (SHSF) Public Transit Map**, our team offers a first look at transportation accessibility at America's community and technical colleges.

Community college presidents often observe that their students are "one flat tire away from dropping out." Today's community college students spend an average of $1,840 per year on transportation, a significant expense not always fully accounted for in financial aid packages.[3]

Notably, current financial aid regulations prevent institutions from including the cost of purchasing a vehicle in the cost of attendance.[4] Wraparound support programs like CUNY's ASAP often include free or reduced-price transit passes, and benefits enrollment services like Single Stop help students access subsidized transit. While these programs and services have proven effective in improving college completion,[5] they reach only a small percentage of students. At a local level, individual college systems work with their local transit systems to secure subsidized passes, relevant schedules and routes, and on-campus stops for their students. Everett Community College, Montgomery College, and others have been engaged in these types of partnerships for years, and recent investments by the Kresge Foundation have highlighted the importance of these efforts. Institutions have also invested in shuttle programs to cover gaps in public transit access and found positive impacts on equity; the College of Staten Island began a shuttle service program in 2008 that has yielded increased enrollment among students of color.[6]

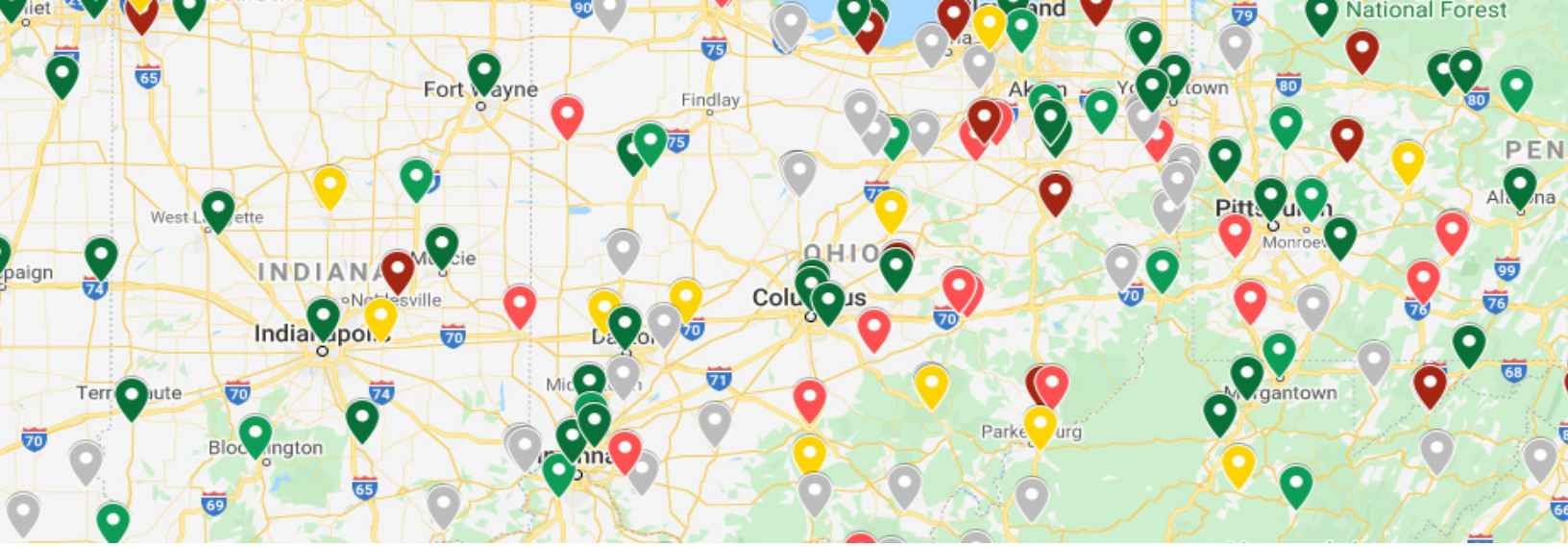
Are public colleges accessible via public transportation?

Does a student need a car to attend community college?

At this moment of national reckoning on infrastructure priorities, the SHSF Public Transit Map and associated tools will enable deeper consideration of the needs of today's students as we build back better. Beyond physical stops, transit accessibility requires planning for subsidies and schedules that ensure public transportation is affordable and useful for students pursuing education after high school.

1. U.S. Department of Education. "College Scorecard: 2018-19." Washington, D.C.: U.S. Department of Education, 2019. https://collegescorecard.ed.gov
2. As calculated using the 2016 NPSAS data. U.S. Department of Education. "National Postsecondary Student Aid Study: 2016." Washington, D.C.: U.S. Department of Education, 2016. https://nces.ed.gov/surveys/npsas
3. College Board, "Trends in College Pricing." 2020, https://research.collegeboard.org/trends/college-pricing
4. Federal Student Aid, "Federal Student Aid Handbook, Volume 3: Calculating Awards and Packaging." 2019, https://fsapartners.ed.gov/knowledge-center/library/handbooks-manuals-or-guides/2019-08-30/volume-3-calculating-awards-and-packaging
5. Lindsay Daugherty & Tiffany Tsai, "A One-Stop Approach to Supporting the Nonacademic Needs of Community College Students: An Evaluation of Single Stop's Impact in North Carolina." Santa Monica, CA: RAND Corporation, 2018, https://www.rand.org/pubs/research_reports/RR2767.html

   Diana Strumbos & Zineta Kolenovic, "Six-Year Outcomes of ASAP Students: Transfer and Degree Attainment." New York, NY: City University of New York, 2017, http://www1.cuny.edu/sites/asap/wp-content/uploads/sites/8/2017/01/201701_ASAP_Eval_Brief_Six_Year_Outcomes_FINAL.pdf
6. Meredith Kolodner, "Can better transportation increase diversity on college campuses?" The Hechinger Report, November 4, 2015, https://hechingerreport.org/can-better-transportation-increase-diversity-on-college-campuses



Data

The SHSF Public Transit Map shows the location of **1,373 public community colleges,** which primarily grant Associate's degrees and certificates, and public non-degree-granting technical schools. We included all public sector institutions that predominantly offer two-year and less than two-year degrees, as defined by College Scorecard.[7]

The locations of colleges on our map are derived from the longitude and latitude coordinates in the College Scorecard database. As some public community or technical colleges report federal data at the system or state-level, the College Scorecard does not capture all relevant institutions. (Indiana's Ivy Tech, the Community College of Rhode Island, and the Community College of Vermont are reported in the College Scorecard at the system-level, and therefore identify only one community college location for each state. To create a more complete picture, we geocoded the locations for individual campuses for these three systems using addresses provided on their system websites.)

The SHSF Public Transit Map shows only the main campus for each institution; branch campuses and satellite locations are excluded. The College Scorecard does not include information about all branch campuses, as many systems opt to report at the college district level. For example, Austin Community College District has 11 campuses, but College Scorecard data provides only one address for the entire institution.

While the Postsecondary Education Participants System (PEPS) contains addresses for all individual campuses, using this database was not feasible for this project. PEPS data includes many campuses that are no longer operational, as well as a variety of non-campus locations such as high school dual enrollment programs, instructional centers that offer limited courses, or worksite programs. Unfortunately, few state agencies publish accessible lists of all branch campus locations. The generation of reliable lists of branch campus locations would be invaluable for future stages of this project and for many others in the fields of higher education and transportation.

7. While we limited our map and initial analysis to public community and technical colleges, we assess all public and private non-profit institutions in a broader analysis included in the appendices.

Methods

With the main campus of each school serving as our anchor points, we used the Google Places API to identify the nearest transit stop to each location. For this project, a "transit stop" means a bus stop, a passenger rail station of any kind, or anything else Google's data has coded as a transit station (such as a ferry terminal or funicular).

We calculated the straight-line ("as the crow flies") distance between each school and its nearest transit station. While this method creates a known downward bias, it avoids the substantial noise in both directions associated with walking directions. Pedestrian infrastructure is not well mapped in most of the country (with only a "handful of alternative pedestrian paths" well documented), and imputing walking directions from road networks risks either missing a pedestrian path inaccessible to cars or assuming a dangerous highway is safe to walk along.[8] The distances we used are therefore a lower bound on the walk required of staff and students commuting to campus via public transit. The resulting distances were integrated with the College Scorecard dataset and plotted using Google Maps, with each node representing the main campus of a community or technical college, colored to correspond to the calculated distance from transit.

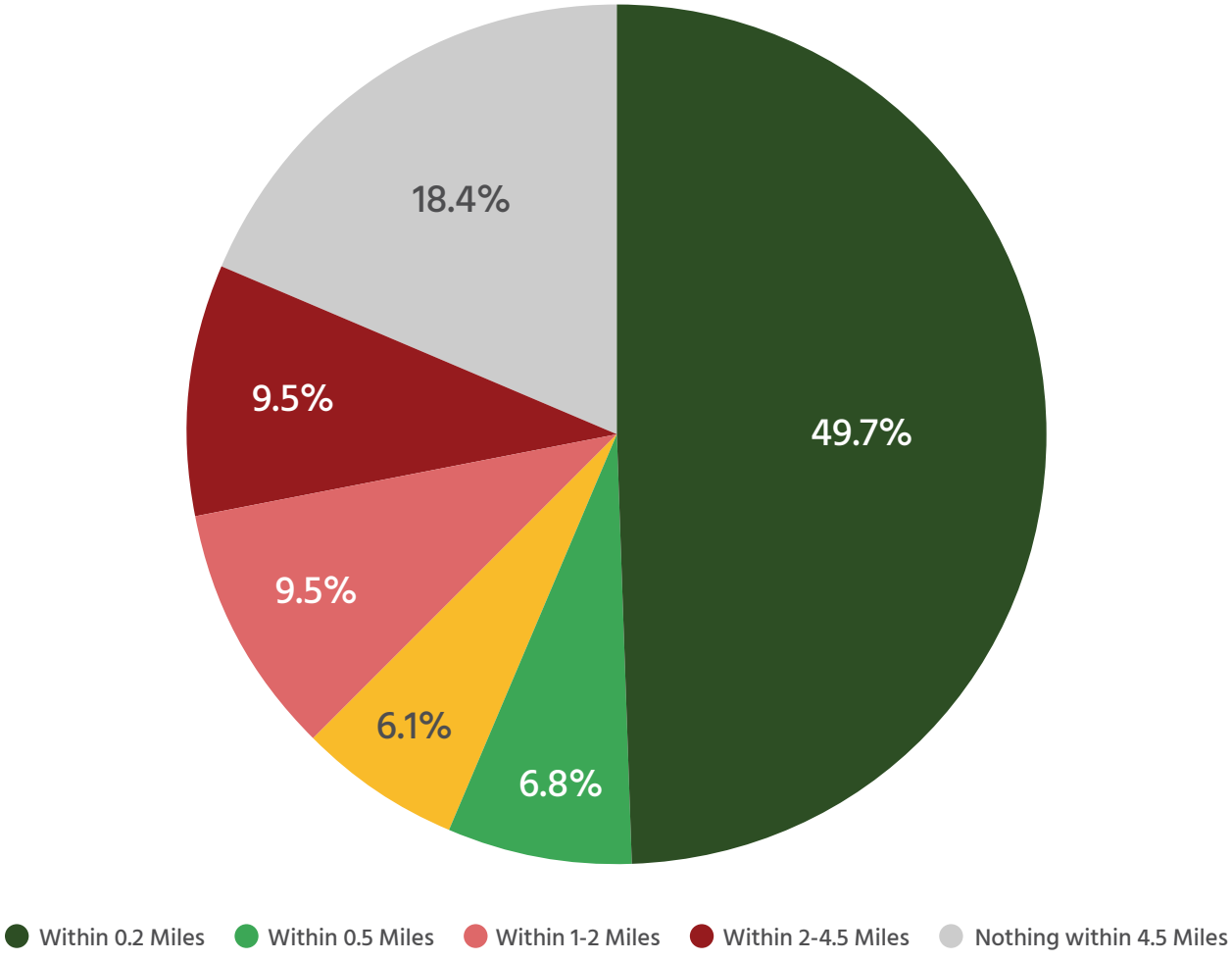
A more complete discussion of implementation details can be found in Appendix IV.

8. Nicholas Bolten & Anat Caspi, "Towards routine, city-scale accessibility metrics: Graph theoretic interpretations of pedestrian access using personalized pedestrian network analysis." PLoS ONE 16, no. 3 (2021): 1-20.

Are community and technical colleges accessible via public transit?

We identified 1,373 community and technical colleges along with their closest transit stop within 4.5 miles (if there is one), across all 50 states and outlying areas. 56.5% of these institutions are located within half a mile of the nearest transit stop; most of these are within 0.2 miles, or about a 5 minute walk for someone with a heavy backpack or a stroller. On the other end of the spectrum, 18.4% of institutions do not have a transit stop within 4.5 miles. As these institutions are typically located in areas without much of a pre-existing public transportation system, expanding accessibility through public transit may entail starting from scratch and therefore may be cost-prohibitive.

Distance of Community & Technical Colleges to Public Transit Stops



By extending existing infrastructure, an additional 25% of community colleges could be accessible by public transit.

Scattered throughout the United States are 345 institutions with a transit stop between 0.5 mile and 4.5 miles away from campus. **For these 345 community and technical colleges, extending public transit access can be affordable and a good investment.** In some cases, improvements would require extending an existing bus line; other schools would only require a slight route adjustment of a bus line to provide close access. In some situations, where the only nearby transportation is a rail station, a shuttle service could remove car ownership as a barrier to completing a program. Distance between transit stop and school represents a particular challenge for students and staff with disabilities, as well as those managing strollers.

The opportunity to expand transit accessibility at community colleges is distributed throughout most of the country.

Region	Schools within 0.5-4.5 miles of transit	Percent of region's schools
Far West (AK, CA, HI, NV, OR, WA)	7	3.6%
Great Lakes (IL, IN, MI, OH, WI)	55	25.9%
Mid-Atlantic (DE, DC, MD, NJ, NY, PA)	39	24.1%
New England (CT, ME, MA, NH, RI, VT)	14	18.7%
Outlying Areas (AS, GU, MP, PR, VI)	2	20.0%
Plains (IA, KS, MN, MO, NE, ND, SD)	49	37.7%
Rocky Mountains (CO, ID, MT, UT, WY)	15	28.3%
Southeast (AL, AR, FL, GA, KY, LA, MS, NC, SC, TN, VA, WV)	115	30.3%
Southwest (AZ, NM, OK, TX)	49	31.6%

The opportunity is distributed across all types of American communities. There are more target institutions in sparsely populated areas, but schools in denser areas tend to accommodate more students.

Community Type	Schools within 0.5-4.5 miles of transit	Percent of community & technical colleges
City	45	11.5%
Suburb	60	18.5%
Town	141	42.6%
Rural Area	99	30.4%

Community and technical colleges serving traditionally disadvantaged groups can also be assisted through this approach to improving transit accessibility. See Appendix II and III for an analysis of transit accessibility that includes private and four-year MSIs.

School Type See Appendix II and III for private and four-year MSIs.	Schools within 0.5-4.5 miles of transit	Percent of community & technical colleges
MSI (Minority-Serving Institution)	59	16.8%
HBCU (Historically Black Colleges and Universities)	5	45.5%
TCU (Tribal College or University)	6	23.1%
Above Average Pell Enrollment % (>37.7%)	167	28.1%

Discussion & Policy Implications

Today, car ownership is an implied prerequisite for attending many community or technical colleges. The SHSF Public Transit Map highlights the opportunity to eliminate this hidden cost at more than 75% of public community and technical colleges in the United States.

Equitable policy approaches to transit accessibility for community college students must address **stops, schedules** and routes, and **subsidies**.

Discussion & Policy Implications

Providing resources for communities to extend or reroute lines, create shuttle services, or add stops would change the display on the SHSF Public Transit Map, but alone, these kinds of solutions might not meaningfully impact students. Even at institutions with stops on campus, the cost of transit passes is a known barrier to student usage. Institutions like Montgomery College and Everett Community College provide subsidized transit passes for their students, but this approach is far from universal. In Connecticut, Governor Lamont's office has proposed the creation of the CTPass program to create affordable transit passes for college students at private institutions; an existing program, UPass, serves students at the state's public institutions. Affordable public transit may make enrollment feasible for prospective low-income students who would otherwise struggle to pay, especially as transit is not always accounted for in student financial aid packages.

We can invest in student success by improving transportation infrastructure.

Transit **stops** at community and technical colleges

Subsidies for enrolled students to use public transit

Schedules and routes that accommodate the real-life commitments of today's students

Similarly, students cannot benefit from public transit unless the routes and **schedules** match their realities. The working students and parenting students who comprise the majority of community college students require schedules and routes that connect with residential areas, public schools, and business districts; careful planning will be necessary to ensure that public transit is available when they need it. It is also critical that transit schedules are well aligned with class schedules (For example, hourly service that gives transit riding students the choice of arriving 45 minutes early or 15 minutes late to class each day is unnecessarily burdensome, but it is something that can be addressed with awareness and coordination).

The design of any pilot program to test new transit options must consider the impact on students who do not have alternative transportation. For example, what if a student enrolls due to the availability of a six month bus line extension? That student may need to drop out after half a year, creating an unintended negative impact of a "helpful" program. The same pilot program may intrigue another prospective student, but that student will never enroll for fear of losing the necessary access before completing a degree. The commitment to providing transportation must match or exceed the needs of prospective users of whatever new services or subsidies are being offered.

The (in)accessibility of community colleges via public transportation is a key equity issue that cuts across transit, workforce development, and higher education.

Accordingly, the benefits for "getting this right" will accrue to those communities that value coordination between institutions, local governments, and transit agencies. Even low-cost steps like synchronizing class schedules and transit schedules meaningfully impact students with time and resource constraints. As governments move to improve the transit accessibility at community and technical colleges, we hope they coordinate across stakeholder groups to ensure their solutions serve students effectively. Strong transit solutions can keep students on the path to graduation.

Known Limitations of Methods and Data

While the SHSF Public Transit Map and associated analyses comprise an important first step in capturing the transit accessibility of American community and technical colleges, there are some known limitations with the available data and the methods used.

Only Main Campuses
Data limitations prevent us from generating a comprehensive picture of satellite and branch campuses within systems that have not separated those campuses in their federal data reporting. (We did add Indiana, Rhode Island, and Vermont manually, since they report entirely at the system level.) Some of these omitted campuses are sites with only a few classes offered, while others offer enough courses for a student to complete an entire program without ever setting foot on the main campus.

COVID-19 Disruptions
In some cases, the Google Places API returns a transit stop not currently serviced due to the pandemic. An inherent assumption is that service will resume at some point. While that may not be true everywhere, in places where it is true, it could make serving community and technical colleges even more feasible, since resumption after a substantial break would be a natural time to implement route changes.

Reducing Campus to a Point
To calculate distances, we needed to reduce a campus to a single point. For some campuses, their longest dimensions measure longer than the walk from the nearest transit stop to the closest point on campus. For consistency with other research, we used the GPS coordinates provided in the College Scorecard dataset. Our own analysis shows that geocoding based on provided addresses produces functionally the same results for the national picture. In many cases, addresses and reported coordinates correspond to an administrative building that may not be centrally located on campus (and in a few cases, are actually off campus, though not always by enough that it would make a meaningful difference in distance calculations).

To see the map and additional materials, visit www.shs.foundation/shsf-transit-map

Straight Line Distances

As mentioned above, pedestrian infrastructure is not well mapped outside of major metropolitan areas. Walking directions can be unreliable in both directions, missing shortcuts unavailable to cars or suggesting pedestrians walk down dangerous highways. Given the lack of public awareness of this issue and the inconsistency of the errors created by it, we opted for distances with a known downward bias that produce a lower bound for the distances walked.

No Schedule Data

A nearby transit stop is a necessary – but not sufficient – condition for a school to be accessible by public transit. If the stop is serviced too infrequently or at times that do not reflect student/staff needs, it will not meaningfully assist the local community. We view this project as an important first step in mapping transit accessibility, but without schedule data (both unavailable at a nationwide level and currently disrupted by COVID-19), it cannot provide a complete picture.

A nearby transit stop is a necessary – but not sufficient – condition for a school to be accessible by public transit.

Coding of Transit Stations

The stop-finding code can only be as good as the data behind it, and two types of errors are possible: incorrectly identifying something as a transit stop or missing an existing stop. Given the nationwide pressure on transit authorities' budgets and operations imposed by COVID-19, the data is much more likely to contain a stop that's been temporarily or permanently removed than it is to miss a stop that's been recently added. Furthermore, some locations may be coded as a transit stop because they offer bus and/or train service, but they may not do so in a way that we would consider public transportation for this project (e.g., a private bus company's stop or an Amtrak station with one or two trains a day). Details are discussed in Appendix IV.

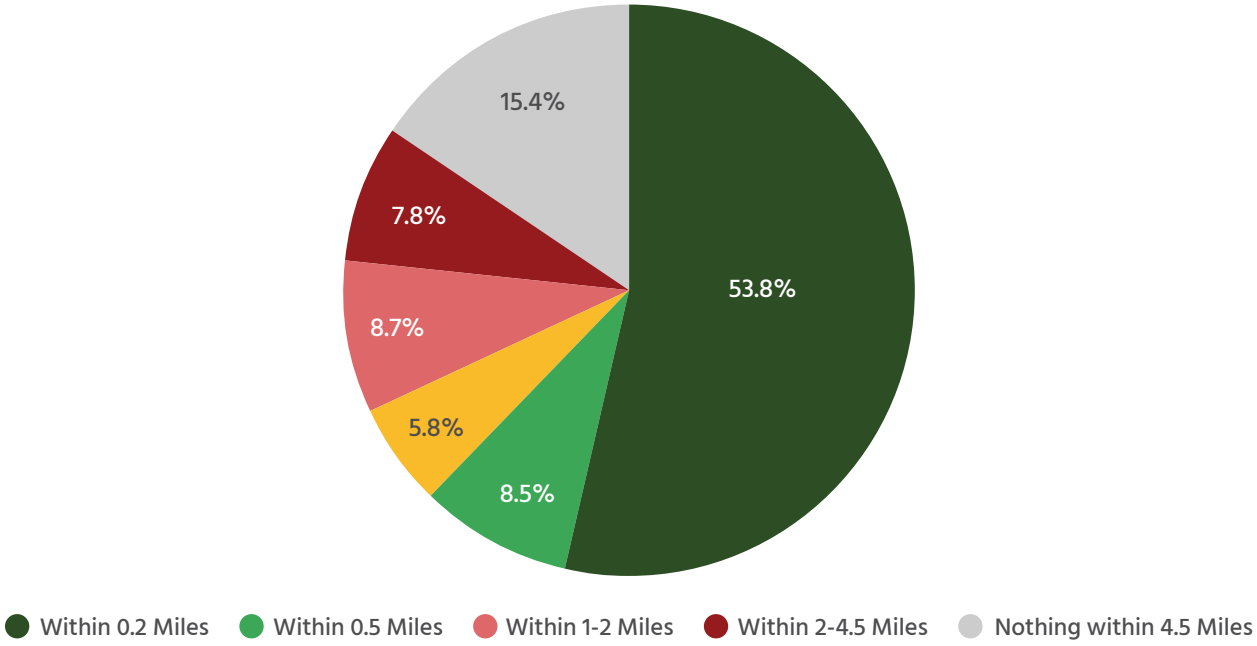
Limited Student Data (Affordability, Transit Access)

Frequent transit service to a stop near school only helps students who can access the public transportation network and afford to ride on it. We have limited information about the geographic variation of these students' situations, though it is assumed that transit-dependent people already live and/or work near transit stops. We have even less information about would-be students, those not currently enrolled but would begin or complete a degree if getting to school were more affordable and/or accessible. We do know that the cost of transit passes can be a barrier to success, and any successful expansion of public transit for community college students would need to include subsidies.

Appendix I: All Public Institutions

We identified 1,961 public colleges and universities across all 50 states and outlying areas. 62.3% of these institutions are located within half a mile of the nearest transit stop; most of these are within 0.2 miles, or about a 5 minute walk. 22.3% of institutions are between 0.5 miles and 4.5 miles from the nearest transit stop; these institutions represent the best opportunity to expand access, as they are in the vicinity of an existing transit system but are not themselves easily accessible. 15.4% of institutions do not have a transit stop within 4.5 miles, and are typically located in areas without a pre-existing public transportation system.

Distance to Public Transit Stops



The opportunity is also similarly distributed across all types of American communities, with more opportunities in towns and rural areas.

Community Type	Schools within 0.5-4.5 miles of transit	Percent of schools
City	64	9.4%
Suburb	75	16.7%
Town	195	40.8%
Rural Area	104	29.4%

Like opportunities for community and technical colleges, the opportunity to expand transit accessibility at all public institutions is distributed throughout most of the country.

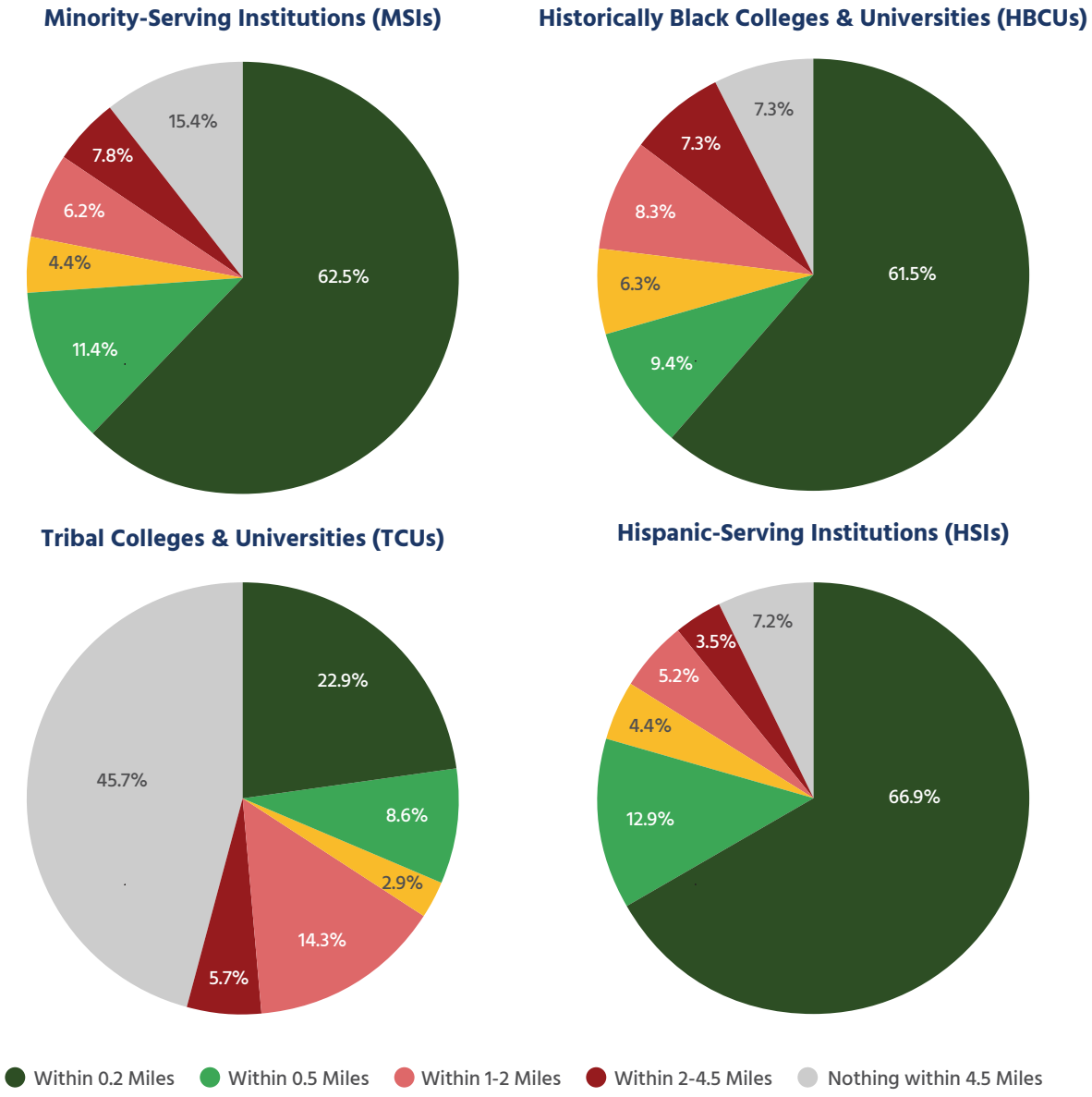
Region	Schools within 0.5-4.5 miles of transit	Percent of region's schools
Far West (AK, CA, HI, NV, OR, WA)	9	3.5%
Great Lakes (IL, IN, MI, OH, WI)	64	22.6%
Mid-Atlantic (DE, DC, MD, NJ, NY, PA)	53	20.0%
New England (CT, ME, MA, NH, RI, VT)	17	14.8%
Outlying Areas (AS, GU, MP, PR, VI)	4	16.7%
Plains (IA, KS, MN, MO, NE, ND, SD)	63	34.1%
Rocky Mountains (CO, ID, MT, UT, WY)	17	21.5%
Southeast (AL, AR, FL, GA, KY, LA, MS, NC, SC, TN, VA, WV)	143	27.0%
Southwest (AZ, NM, OK, TX)	68	30.2%

Public institutions serving traditionally disadvantaged groups can also be assisted through this approach to improving transit accessibility. See Appendix III for an analysis of transit accessibility that includes private MSIs.

School Type See Appendix II and III for private and four-year MSIs.	Schools within 0.5-4.5 miles of transit	Percent of public institutions
MSI (Minority-Serving Institution)	83	15.8%
HBCU (Historically Black Colleges and Universities)	13	26.0%
TCU (Tribal College or University)	7	25.0%
Above Average Pell Enrollment % (>37.7%)	219	25.6%

Appendix II: Minority-Serving Institutions

We identified 778 Minority-Serving Institutions (MSI), including 96 Historically Black Colleges & Universities (HBCU), 35 Tribal Colleges & Universities (TCU), and 459 Hispanic-Serving Institutions (HSI). 73.9% of all MSIs are located within half a mile of the nearest transit stop; most of these are within 0.2 miles, or about a 5 minute walk. 15.6% of institutions are between 0.5 miles and 4.5 miles from the nearest transit stop; these institutions represent the best opportunity to expand access, as they are in the vicinity of an existing transit system but are not themselves easily accessible. 10.5% of institutions do not have a transit stop within 4.5 miles, typically located in areas without a pre-existing public transportation system.



Nearly 71% of Historically Black Colleges & Universities (HBCUs) have transit stops within half a mile. Just 7.3% of HBCUs are located in areas without pre-existing transit within 4.5 miles. There are opportunities to improve transit access among HBCUS. 21.9% of campuses do not have an accessible stop, but are within 0.5 and 4.5 miles of existing transit.

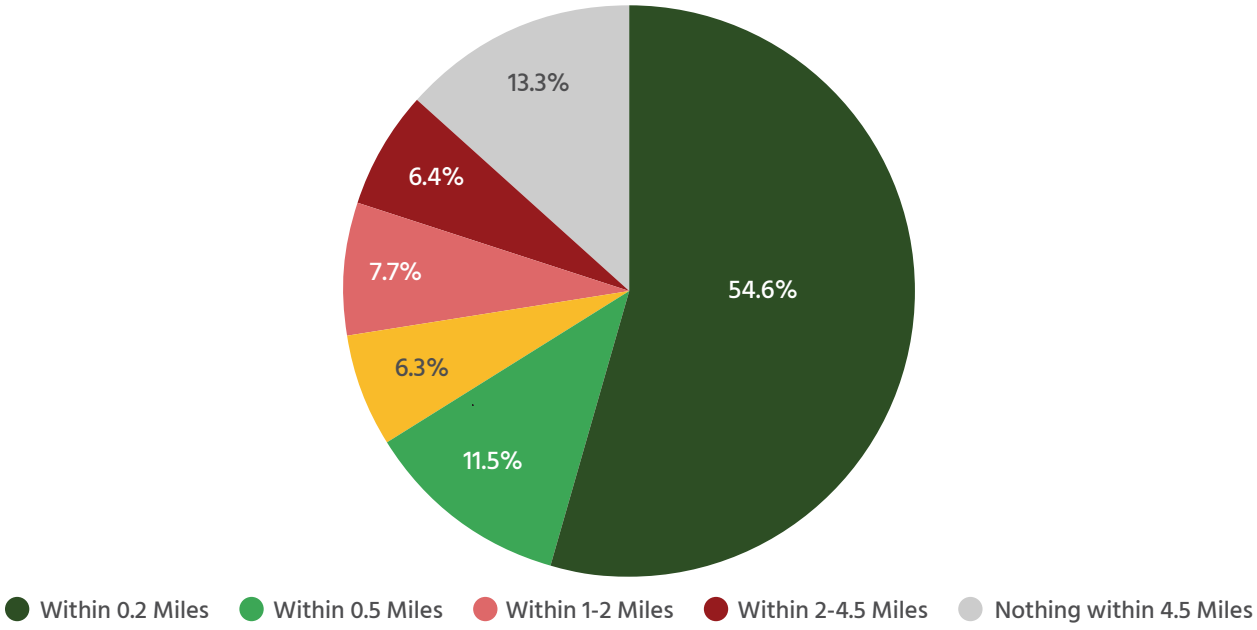
Just 31.5% of Tribal Colleges & Universities (TCUs) have a transit stop within half a mile from campus, and more than 45% are not within 4.5 miles of any transit. However, there is ample opportunity to improve transit access for TCUs – nearly 23% of campuses are between 0.5 and 4.5 miles of an existing transit system.

Hispanic-Serving Institutions (HSIs) are most accessible among these three types of MSIs. Nearly 80% of HSIs have a transit stop within half a mile of campus. But there is still opportunity for improvement. 13.1% of HSIs are within 0.5 and 4.5 miles of existing transit.

Appendix III: All Public and Private Non-Profit Institutions

We identified 3,495 public and private non-profit colleges and universities across all 50 states and outlying areas. 66.1% of these institutions are located within half a mile of the nearest transit stop; most of these are within 0.2 miles, or about a 5 minute walk. 20.4% of institutions are between 0.5 miles and 4.5 miles from the nearest transit stop; these institutions represent the best opportunity to expand access, as they are in the vicinity of an existing transit system but are not themselves easily accessible. 13.3% of institutions do not have a transit stop within 4.5 miles, typically located in areas without a pre-existing public transportation system.

Distance to Public Transit Stops



The opportunity is also similarly distributed across all types of American communities, with more opportunities in towns and rural areas.

Community Type	Schools within 0.5-4.5 miles of transit	Percent of region's schools
City	133	9.1%
Suburb	168	19.4%
Town	279	39.3%
Rural Area	136	30.2%

The opportunity to expand transit accessibility at all public and private non-profit institutions is distributed throughout most of the country.

Region	Schools within 0.5-4.5 miles of transit	Percent of region's schools
Far West (AK, CA, HI, NV, OR, WA)	21	5.0%
Great Lakes (IL, IN, MI, OH, WI)	104	20.1%
Mid-Atlantic (DE, DC, MD, NJ, NY, PA)	115	18.4%
New England (CT, ME, MA, NH, RI, VT)	33	14.0%
Outlying Areas (AS, GU, MP, PR, VI)	16	23.5%
Plains (IA, KS, MN, MO, NE, ND, SD)	97	28.6%
Rocky Mountains (CO, ID, MT, UT, WY)	18	16.2%
Southeast (AL, AR, FL, GA, KY, LA, MS, NC, SC, TN, VA, WV)	217	25.3%
Southwest (AZ, NM, OK, TX)	95	30.1%

Institutions serving traditionally disadvantaged groups can also be assisted through this approach to improving transit accessibility.

School Type	Schools within 0.5-4.5 miles of transit	Percent of schools
MSI (Minority-Serving Institution)	121	15.6%
HBCU (Historically Black Colleges and Universities)	21	21.9%
TCU (Tribal College or University)	8	20.5%
Above Average Pell Enrollment % (>39.2%)	348	22.8%

Appendix IV: Technical Notes

Missing Data from Three Systems

Due to missing data points, not every campus is included in every calculation (as not every campus has a value for every field in the dataset). The occasional error or disruption in collection can happen, as in any dataset, but there is one systematic way in which data are missing, which could introduce some bias: Some Indiana, Rhode Island, and Vermont colleges report data at the statewide system level, omitting individual data for each campus that was identified separately for the purpose of mapping. Most of the missing data for these schools is information regarding student body makeup.

A Note on Schools in "Outlying Areas" (and three "missing" schools)

The reason the "Outlying Areas" region isn't called "Overseas Territories" is because these data typically include three schools not on US soil: Palau Community College, College of the Marshall Islands, and College of Micronesia-FSM (Federated States of Micronesia). These schools were given a special designation by the U.S. Congress during the time the United States was responsible for administering the Trust Territory of the Pacific Islands, and they are still accredited by and have loose ties with United States organizations. They have been removed from the data in this project, in order to present a clearer picture of the transit situation in the United States (which doesn't control transportation policy in those areas any more), but researchers using College Scorecard or IPEDS data should note the discrepancy.

Geocoding in Google Sheets

For most states, we used the GPS coordinates from the College Scorecard data, for the sake of consistency with other research in this area. For Indiana and Rhode Island, where campuses were identified manually (due to those states reporting only one campus for an entire statewide system), we geocoded the campuses using a combination of Google Sheets and Google Maps (using this documentation as a guide). Note that the geocoding method outlined there is limited (by Google) to 1,000 free uses per day per Google account.

Finding Nearest Transit Stops - Data

The Google Places API contains 5 different types of public transportation stops:

1. transit_station
2. bus_station
3. train_station
4. subway_station
5. light_rail_station

Here, "station" can also mean "stop."

The **transit_station** designation is a general catch-all that can mean any of the other four, or serve as an "other" category. We found that functionally all locations which are coded as any type of rail station are also coded as transit stations (though there may be rail stations only coded as a transit station), while bus stops are a different story. Some bus stops are coded as both **transit_station** and **bus_station**, but plenty are coded as only one or the other. There are also locations, such as transit hubs, which are served by multiple modes. For these reasons, it is not possible to get specific numbers on the types of stops that comprise the set of nearest stops identified on the map. It also means that to find the closest public transit stop, one must scan for the **closest bus_station** and **transit_station**. (Searching for the other three as well would be more comprehensive, but in our development of the map we found that the three specific rail stops didn't find any closer stops than we would have found just using the first two.)

By clicking a node on the Google Map, users can see information about each school, including three pieces of information about the nearest transit stop:

The name of the transit stop	The place types associated with that location	The GPS coordinates for that location

Finding Nearest Transit Stops - Code

The code for the functions we used to identify nearby transit stops is included here as a resource. This part of the project is shared under Creative Commons License CC BY-NC (Attribution-NonCommercial).

```
// When your inputs are Latitude and Longitude, use findTransitFromLatLon
// This is the function you'll use in Google Sheets
function findTransitFromLatLon(LocLat, LocLon) {
  var nearbyPlaces2 = findNearbyPlaces2(LocLat, LocLon);
  Logger.log(nearbyPlaces2)
  var nearestTransit = formatPlaceInformation(nearbyPlaces2[0]);
  Logger.log(nearestTransit);
  return nearestTransit;
}

// Put your API key where it says "INSERT-YOUR-API-KEY-HERE"
// After "distance&types" in the second var line, put in what kind of location you're looking for
(bolded)
// choices for transit are: transit_station, bus_station, subway_station, train_station, light_
rail_station
// note that not all locations which fit more than one category are labeled with every category,
e.g., some bus stops are just bus, others are just transit
function findNearbyPlaces2(LocLat, LocLon){
  var API_KEY = 'INSERT-YOUR-API-KEY-HERE';
  var baseUrl = 'https://maps.googleapis.com/maps/api/place/nearbysearch/json';
  var queryUrl = baseUrl + '?location=' + LocLat + ',' + LocLon +
'&rankby=distance&types=transit_station&key=' + API_KEY;
  var response = UrlFetchApp.fetch(queryUrl);
  var responseText = response.getContentText();
  var responseJson = JSON.parse(responseText);
  Logger.log(responseJson);
  if (responseJson.status == "OK")  {
    return responseJson.results;
  }
  return responseJson.status + ": " + responseJson.error_message;
}

// Formats the output as a string for a spreadsheet cell
function formatPlaceInformation(place) {
  return Utilities.formatString("%s - (%s) (%f, %f)", place.name, place.types.toString(), place.
geometry.location.lat, place.geometry.location.lng);
}

// If you need to geocode addresses, and the free methods are insufficient, this function will do
that with the same API key from above
function geocodeAddress(address) {
  var API_KEY = 'INSERT-YOUR-API-KEY-HERE';
  var baseUrl = 'https://maps.googleapis.com/maps/api/geocode/json';
  var queryUrl = baseUrl + '?address=' + address + '&key=' + API_KEY;
  var response = UrlFetchApp.fetch(queryUrl);
  var responseText = response.getContentText();
  var responseJson = JSON.parse(responseText);
  Logger.log(responseJson);
  if (responseJson.status == "OK")  {
    return responseJson.results[0].geometry.location;
  }
  return responseJson.status + ": " + responseJson.error_message;
}
```