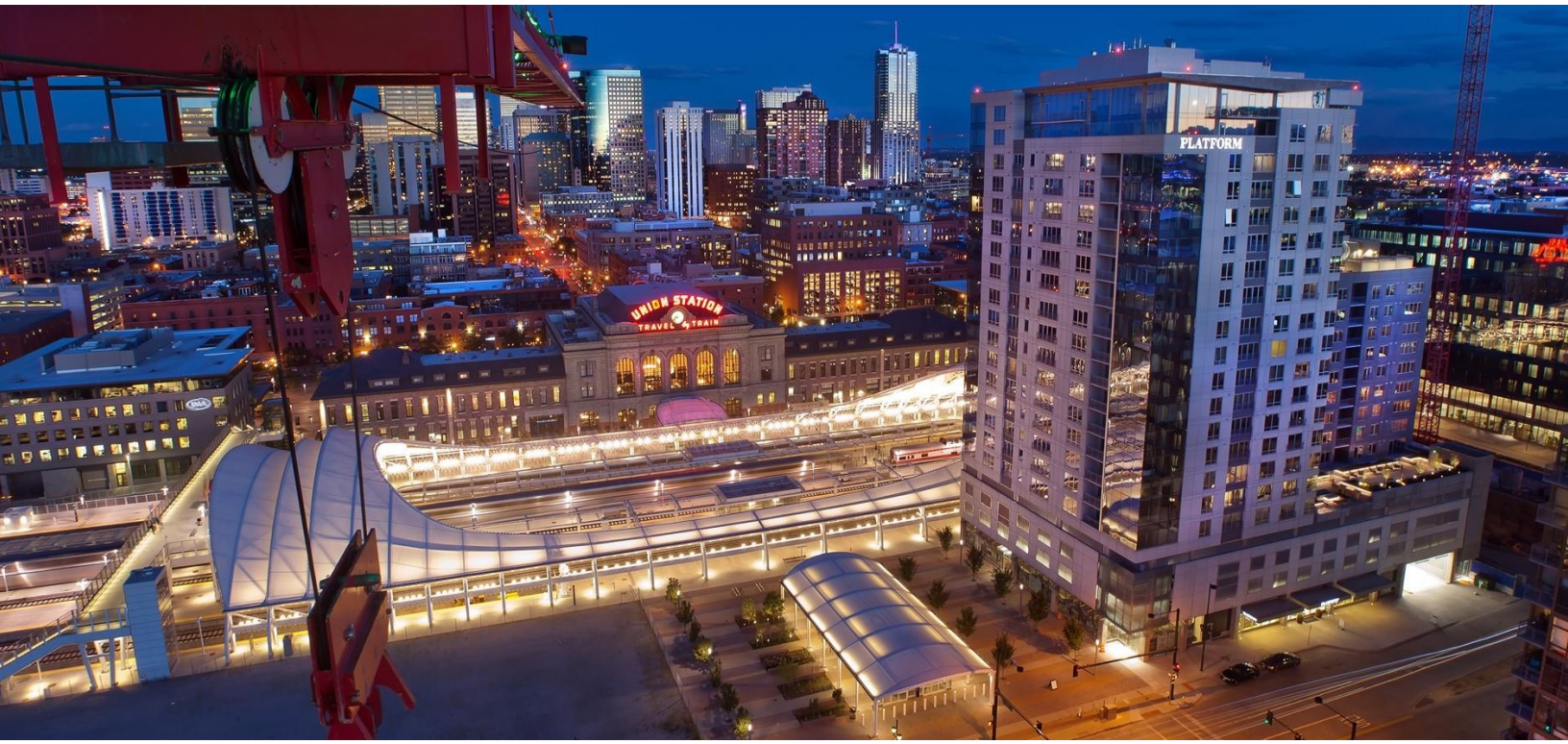

RESEARCH REPORT

Is Federal Infrastructure Investment Advancing Equity Goals?

Examining How the Distribution of New Infrastructure Funding May Address Historic Racial and Economic Inequities

Yonah Freemark *Mel Langness* *Amanda Hermans* *Gabe Samuels*
Tomi Rajninger *David Blount*

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Executive Summary

Federal investment in infrastructure substantially increased over the past two years with the passage of the 2021 Infrastructure Investment and Jobs Act (IIJA). Executive departments will distribute hundreds of billions of dollars to states and localities to invest in enhanced transportation, water supply systems, broadband networks, housing, and more. These projects can improve the quality of life for thousands and reinvigorate decaying built structures across the country. Federal funding programs, however, may not be distributing resources fairly. In the past, public infrastructure projects have deepened racial and social inequities—such as by bulldozing communities of color to build highways or depriving families with low incomes of the quality housing they deserve. It is essential to examine how infrastructure funds are being apportioned to understand whether investments are expanding support for disinvested communities or, in contrast, reinforcing historic inequities.

To explore the distribution of infrastructure funds, our research team developed a first-of-its kind, comprehensive database of projects funded in fiscal year 2022 through 66 federal grant programs contained within IIJA or from the US Department of Housing and Urban Development (HUD). These multibillion dollar programs fund transportation, water, energy, broadband, housing, and community development infrastructure, and are allocated to states and localities either automatically by formulas set by Congress and federal agencies or through merit-based competitions judged by federal executive departments. We identify funding distributed directly to entities in nearly 3,000 counties; all 50 states; Washington, DC; and several US territories.

Pursuing a more equitable society requires targeting federal investments to places and people experiencing historical injustice and compounded disadvantage, so that funds can start to close longstanding gaps in outcomes. We primarily focus on measuring the distributional equity of infrastructure funding by assessing how federal assistance to states and counties responds to patterns of racial, ethnic, and class demographics; program-related needs; and local bureaucratic capacity, as expressed through 59 demographic and need-related indicators. Each of these comparisons is designed to examine whether programmatic funding is being distributed to support infrastructure development in the communities that need it—to meet our criteria for addressing a community's needs, funds must address racial differences, economic disparities, and/or communities' specific infrastructure conditions. Our findings can help enable federal, state, and local stakeholders assess the degree to which they are

advancing the fair distribution of benefits and burdens across communities, while seeking solutions to make up gaps. This report—and its accompanying interactive tool, Spending on Infrastructure toward Equity (SITE)[1]—is the end product of a year's worth of data collection and analysis.

Federal Programs Reinforce Historic Patterns

About 80 percent of IIJA funds and the vast majority of HUD dollars are distributed through formulas that rarely change. For example, IIJA dramatically increased funding for several preexisting large highway and transit programs, but Congress and federal agencies chose not to update the associated allocations. The use of decades-old formulas reinforces historic precedent. Road funding is biased toward jurisdictions with more automobile reliance, whereas transit funding is disproportionately distributed to places with more bus and train use—doing little to change existing patterns or diversify transportation options for communities that may need it. Similarly, HUD's affordable housing programs (which were not expanded by IIJA) disproportionately allocate support to communities that decades ago chose to invest in affordable housing units; thus, these programs may fail to develop new opportunities for families with lower incomes in areas with a shortage of affordable housing. In these cases, the geographic patterns of funding distribution are based on past choices made at the state and local levels. The result is that formula programs are not designed to assist communities that want to make change or require communities to address longstanding exclusion—instead, they often reinforce decades of policies rooted in systemic inequity.

Many Formula Grants Undermine the Federal Commitment to Racial Equity—but Housing and Community Development Programs May Be Better than Others

Federal investments in roadways, broadband, and water distributed through formula programs tend to disproportionately benefit states with lower shares of people of color[i] because these programs provide

[i] We use the term "people of color" throughout this work to refer to any individuals who self-identify as Asian, Black, Hawaiian or Pacific Islander, Hispanic or Latine, Indigenous, or two or more races.

more funding to states with greater per capita land area and smaller populations, which are the states that are more likely to have a smaller share of people of color. Consider funding distributions from the National Highway Performance Program (NHPP), the largest formula program that we studied. The five states with the highest shares of people of color—Hawai'i, California, New Mexico, Texas, and Nevada—four of which have high shares of their populations living in urban areas, received an average of $91 in per capita funding from NHPP. The five states with the highest shares of white residents—Maine, West Virginia, Vermont, New Hampshire, and North Dakota—all of which have relatively small populations and are largely rural, received an average of $165 in per capita funding. Most federal funding streams for roadways allow awardees to flex funds for other uses, such as public transportation or pedestrian and bicycling projects. Thus, states with a higher share of people of color and with a higher share of people living in urban areas are missing out on a fair share of funding that they could use for the transportation investments of their choice.

Formula funds from HUD, on the other hand, are distributed in a fashion that better reflects the overall demographics of the US and that sometimes concentrates investments in communities with a higher share of people of color. For example, the roughly 25 percent of counties with the highest share of people of color nationwide receive almost 38 percent of the US's Community Development Block Grant funding and 40 percent of its Housing Choice Voucher support. Even so, low spending in jurisdictions with predominately white populations may reinforce exclusionary conditions; the federal government's decision to allocate few affordable housing dollars in these communities may contribute to regional racial segregation.

Competitive Infrastructure Grants Are Allocated to a Small Subset of the Nation's Counties—but Transportation Dollars Concentrate in Communities of Color

Federal funding is mostly distributed via formula, leaving a relatively small percentage for grants competitively allocated by executive departments. This scarcity of competitive funds means the vast majority of communities across the country do not receive support; for example, even the popular Rebuilding American Infrastructure with Sustainability and Equity (RAISE) program, which supports multimodal transportation investments, only funded 7 percent of US counties in 2022. RAISE will

distribute more than $7.5 billion over five years; most other, smaller programs funded fewer counties. This makes federal choices about the distribution of competitive funds all the more important.

We find that many competitively distributed transportation funds are concentrated in counties with a statistically significantly higher share of people of color than the national average; the median metropolitan-area county funded by RAISE, for example, has a population that is about 37 percent people of color—versus 29 percent for unfunded counties in metropolitan areas. Similarly, the roughly 25 percent of the national population living in counties with the highest shares of people of color receive more than 60 percent of funds from the All Stations Accessibility Program (ASAP) program, which funds accessibility improvements for transit stations. In selecting projects for competitive awards, federal transportation officials have prioritized these historically underinvested communities.

Moreover, using a detailed analysis of project locations, we find that awarded projects under a broad set of competitive transportation programs are disproportionately located in census tracts with higher shares of people of color and people living under the federal poverty line than comparable areas without funded projects. RAISE grants, for example, are on average allocated to tracts with shares of people of color up to 9 percentage points higher and poverty rates up to 5 percent higher than comparable tracts elsewhere in funded counties. This finding is a promising demonstration of federal ability to distribute funds in a way that supports communities of color. A substantial gap between infrastructure funding and need remains, however, since the large majority of counties do not receive competitively distributed funds at all.

Formula and Competitive Grants Tend to Underfund States and Counties with Lower Household Incomes

We find that infrastructure investments disproportionately underfund jurisdictions that have lower median household incomes. Transportation and broadband formula programs are closer to meeting the needs of lower-income communities than housing and community development formula programs, but they still fall short of progressively matching need. Most competitive transportation program dollars are not reaching residents of the lowest-income counties. For example, the typical metropolitan county funded by the Capital Investment Grants program, which funds new transit lines, had a median income of almost $75,000—compared to $63,000 for unfunded counties in metropolitan areas. The counties inhabited by the quarter of the national population with the lowest median household incomes received *none* of the federal government's competitively allocated funding for bridge improvements or transit

capital projects. However, in our tract-level analysis, we did find instances where tracts that received transportation project awards had lower median incomes than tracts that did not. The average tract in which a competitively funded road expansion project was located, for example, had statistically significantly lower median incomes—up to $6,000 lower—than similar tracts elsewhere in the same county. This suggests that while program awards are going to higher-income counties and states, funds may end up affecting the lower-income neighborhoods within those counties.

Low Bureaucratic Capacity Clearly Limits Counties' Ability to Win Grants

Counties with low levels of bureaucratic capacity—defined in terms of per capita staff members working in local government offices—received disproportionately low funding across most competitive programs we studied. In metropolitan areas, the median funded county had higher local staff capacity than unfunded counties for all competitive programs. Controlling for other local demographic variables, we find that doubling local transportation staff capacity is associated with a 31-percentage-point higher likelihood of a metropolitan county winning a RAISE grant, for example. This is further evidenced by the fact that many competitive programs disproportionately fund projects in higher-income counties. This indicates that low-capacity communities may have difficulty applying for and winning federal competitive grants. While many federal agencies have taken steps to streamline application processes, these processes may still be prohibitively time- and resource-intensive for local jurisdictions.

Many Infrastructure Programs Are Addressing Specific Community Needs

Infrastructure investments generally have explicit goals of responding to tangible issues related to the built environment, and indeed, we found that many competitive transit and broadband programs are distributing higher shares of funds to the places with higher program-related needs. Broadband programs, for example, appear to be heavily targeted toward areas with lower broadband speeds. And the roughly 25 percent of the national population living in counties with the lowest shares of households with internet access receive 80 percent of national ReConnect program resources and almost 60 percent of Enabling Middle Mile program spending. Transit programs, meanwhile, are distributing a higher share of funds to places with more transit stops and commuters who bike, walk, or

take public transit (or at least, those jurisdictions are more likely to apply for funding). Housing program funds have a less clear relationship with programmatic need.

Recommendations to Advance Equity Goals through Infrastructure Investment

Both formula-distributed and competitive grants tend to underfund communities with lower household incomes, regardless of racial demographics. Our analysis of project locations further raises concerns that low-income communities are being overexposed to negative externalities resulting from projects, such as air pollution from roadway expansions. To address these concerns, we recommend several key changes to the federal investment process:

- For formula grants, Congress and federal agencies should review program formulas to align funding flows to communities based on current conditions. Because formula grants are rarely changed and often reflect decisions made decades ago, they tend to reinforce existing conditions. Congress and federal agencies should reevaluate large transportation programs, in particular, to increase the equality of spending across the US. This is an important step toward reaching more equitable outcomes overall. Housing and community development program formulas should be reevaluated to ensure they best meet the needs and challenges of people on the ground, such as housing cost burdens and reducing segregation. One key opportunity is linking the distribution of federal formula funding to meet local affirmatively furthering fair housing requirements. Federal government agencies should also track the degree to which federal funds are flowing into communities of color and lower-income communities.
- For competitive grants, federal officials should further prioritize funding to historically disinvested communities by giving a reasonable leg up to funding applications from communities with higher shares of residents of color, places where people with low incomes predominate, and areas with demonstrated need for infrastructure improvements. They should also consider the negative externalities associated with certain types of projects and seek to minimize them. This requires continued monitoring and measurement, as well as connecting departmental equity commitments and implementation plans with other strategic and performance plans so that multiple federal agencies are held accountable.
- The federal government, as well as the nonprofit and philanthropic sectors, should provide support to low-capacity communities to expand their ability to apply for federal grants while

seeking opportunities to continually improve the grant application and review processes. In addition to facing challenges in applying to competitive grants, many low-capacity communities also have smaller populations and therefore receive less federal funding via direct formula appropriations. These compounded disadvantages necessitate greater federal funding to expand the capacity of local governments to shape equitable development in their communities. The federal government could support, in particular, applications that seek to best meet community needs, developed through associations of local governments, residents, and nonprofit organizations in communities with low capacity.

While some federal departments have made strides toward aligning infrastructure funding streams with equity goals, there is still a great deal of work to be done. Our findings and recommendations offer an opportunity to improve the distribution of forthcoming infrastructure investments, such as awards in the remaining years of IIJA funding and investments made through the Inflation Reduction Act (IRA), the fiscal year 2023 omnibus, and other legislation.

We identify several limitations to this work. First, our analysis only explores one year of federal funding. It excludes some smaller programs funded through IIJA and HUD, as well as programs whose fiscal year 2022 awards had not yet been announced at the time of analysis. Moreover, we did not analyze the distribution of any downstream awards made with formula dollars by states to smaller jurisdictions, and we were unable to identify the specific project locations of formula funds, which is important given the nonuniform distribution of people within counties and states. In addition, our analysis does not compare differences in funding approaches between urban and rural jurisdictions.

Given these limitations and the critical nature of infrastructure in our communities, there are multiple opportunities for additional research that could build on this initial study. Future research could supplement our work by further examining specific elements of program formulas that may produce inequitable outcomes or analyzing future years of formula and competitive infrastructure investments. And while our work focused on the equity of funding distribution, future work may examine the equity of the *outcomes* produced by funded projects.

Is Federal Infrastructure Investment Advancing Equity Goals?

Ideally, infrastructure links all people to the resources they need to live a full life. It connects people to places, provides quality homes, carries clean water, and facilitates the 21st-century economy. When done right, infrastructure can increase racial and social equity, expand access to opportunity, and reduce environmental contamination. Historically, however, race and class have played a part in determining who has access to infrastructure, who can benefit from it, and who is harmed from its construction and operation. Some urban renewal and highway construction projects in cities throughout the United States, for example, razed entire communities, intensified racial and economic segregation, and continue to expose communities of color to higher levels of air pollution than wealthier, predominantly white neighborhoods (Archer 2020; Karas 2015; Lane et al. 2022). Similarly, contaminated water in aging, lead pipes of older homes harms children of color at higher rates than white children (Benfer 2017) still today. Areas with high numbers of Black residents, in particular, see structural racism manifest in the built environment. For example, evidence demonstrates that predominantly Black communities receive the brunt of flood damage from storms due to overwhelmed sewer systems and inadequate flood protections in both urban and rural communities (Hendricks 2022; Hendricks and Van Zandt 2021).[2] Such inequitable conditions create distressing disparities in overall life outcomes. Today, the choices that federal, state, and local agencies make about public investments in infrastructure have the potential to reverse—or reinforce—some of these inequitable dynamics.

The federal government recently expanded investment in infrastructure-related projects through appropriations enabled by the 2021 Infrastructure Investment and Jobs Act (IIJA)—building on preexisting spending from agencies like the Department of Transportation (DOT) and the Department of Housing and Urban Development (HUD). Since January 2020, the Biden Administration has issued a series of executive orders encouraging agencies to center equity goals in the distribution of new funds.[3] Specifically, the administration launched the Justice40 Initiative, which established a goal of ensuring that 40 percent of the benefits of most federal infrastructure investments flow to "disadvantaged communities that are marginalized, underserved, and overburdened by pollution."[4] These promising commitments raise several questions about the translation of equity goals to the actual distribution of IIJA and HUD grant dollars:

- Is federal investment in transportation, housing, energy, water, and broadband infrastructure concentrated in counties and states with a greater share of residents who are people of color,

with a greater share of households with low incomes, or with otherwise greater needs that can be addressed through infrastructure funding?

- Are federal officials more likely to award competitive grants to projects in census tracts with a higher concentration of people of color and households with low incomes?
- Are counties with limited local capacity—defined in terms of per capita public-sector employment—receiving a fair share of competitively allocated funds?

In this report we explore the distribution of funds from major IIJA and HUD programs to answer these questions. Our work puts the Biden administration's pledge to "allocat[e] federal resources to advance fairness and opportunity"[5] to the test by examining the characteristics of communities receiving project funds and provides a unique opportunity to consider distributional equity along racial and economic lines. This report—and its accompanying tool, Spending on Infrastructure toward Equity (SITE)—is the end product of a year's worth of data collection and analysis. We assembled data about how funds were distributed in fiscal year 2022 to all counties and states nationwide from 66 multibillion-dollar federal infrastructure programs. We generated 59 indicators, also for every county and state, that help inform our understanding of whether programmatic funding is being distributed in a fashion that reflects the goal of increasing support for the communities that need it. Finally, we created a series of measures that we used to assess the relative performance of each county, state, and federal program in terms of meeting the goal of distributional equity. In this report, we also explore how the competitive funding application processes and the formulas used by Congress and agencies to allocate funding may affect procedural equity related to federal funding.

BOX 1

Background on This Project

The Melville Charitable Trust funded this work as a component of the Partnership for Equitable and Resilient Communities, a new justice initiative that aims to build cross-sector collaborative partnerships nationwide that are prepared to secure and implement public funds specifically focused on advancing economic development, housing, and civic infrastructure. The Partnership for Equitable and Resilient Communities works with cities to strategically form and activate powerful coalitions that center the voices and expertise of Black, Indigenous, and Latine communities; deliver measurable and results-based outcomes; and ultimately, redefine the decisionmaking process for investment, implementation, and long-term impact of public funds.

The venture launched with Cleveland, Ohio; Durham, North Carolina; St. Paul, Minnesota; and Selma, Alabama, as its first sites.

By creating the first-ever accessible database and comprehensive report pairing equity measures with federal infrastructure-related award distribution data, this research project supports the Partnership for Equitable and Resilient Communities' goal to disrupt ineffective traditional modes of investment and build conditions for enduring systems that redefine how public funding is procured, distributed, and implemented in order to build economic mobility in Black, Indigenous, and Latine communities.

Measuring Equity

Our work seeks to measure the **distributional equity** of infrastructure funding from the federal government, specifically as it relates to **race and income.** In this section, we review how extant literature operationalizes equity considerations in the federal funding landscape before defining the use of equity in this project context.

Conceptualizing Equity

Equity is "the state, quality, or ideal of being just, impartial and fair."[6] As an end goal, an equitable state ensures each person and group receives a response that is in line with their needs. Arias, Draper-Zivetz, and Martin (2017:110) define equity—in opposition to equality, or "sameness"—as "fairness in outcomes across race, ethnicity, class, and other status." In the realm of public policy, this focus on outcomes highlights how policies or administrative decisions impact people differently based on their context, identity, and set of lived experiences. To assess the equity of something is to seek to

understand how some phenomenon has historically affected specific groups of people differently—and to explore the possibility that differing intensity or types of approaches may be necessary to meet different peoples' needs. Pursuing equity entails providing higher resources for higher need resulting from historical injustices and compounded disadvantage. Variations in need develop from a history of systems, practices, and ideas to exclude and neglect the needs of people with certain identities and lived experiences—commonly falling along lines of race/ethnicity, class, and gender. As such, the White House defines equity in Executive Order 13985 as "consistent and systematic fair, just, and impartial treatment of all individuals, including individuals who belong to underserved communities that have been denied such treatment."[7] In table 1, we define three major equity concepts from the literature to distinguish our focus on distributional equity from opportunities for future research.

TABLE 1

Operationalizing Equity

Equity concept	Definition in the context of grant funding
Procedural equity	Ease of access for local applicants to respond to federal grantmaking processes, and fair criteria and selection processes that address longstanding needs. One question worth evaluating is the degree to which, for example, stakeholders from communities with lower median household incomes are able to robustly participate in competitive funding application processes.
Distributional equity	Fair distribution of benefits and burdens across all segments of a community, prioritizing those with highest need. Highest need can be determined based on indicators such as socioeconomic status, health, and the environment. In the United States, these indicators are often closely associated with race and ethnicity.
Spatial equity	Fair distribution of benefits and burdens across geography. This is a mechanism to measure levels of access to resources based on where they are located.

Source: Definitions developed by the authors and informed by Balu et al. (2023).
Notes: It may be reasonable to assess "programmatic equity," meaning whether a program is funding projects that support equitable outcomes, but that is beyond the scope of this report.

We focus specifically on the distributional equity of funding from federal programs. Our distributional equity measures seek to evaluate where funding goes and what priorities the distribution of funds reflects. These characteristics may include specific geographic, racial, economic, environmental, or administrative capacity-related attributes of grant recipients—which may be governments, government agencies, institutions, programs, or organizations. Distributional equity can be assessed in terms of **horizontal equity,** which can mean that equivalent areas receive equivalent funding (e.g., two counties with similar populations receive the same amount of funding), or **vertical equity,** which can mean that areas with more need receive more funding (e.g., a county with more failing bridges receives more funding for bridge repairs). When we investigate distributional equity, we consider demographics (we assume that counties and states with a high concentration of people of

color and people with low incomes have greater need given historical disinvestment) and local needs (we assume that funding should reflect a demonstrated need).

Research suggests that some federal initiatives have continued the history of inequitable public investment. Over the past decade, researchers have identified distributional inequity in federal public education spending (Allegretto, García, and Weiss 2022; Spurrier, Hodges, and O'Neal Schiess 2021), COVID-19 relief funds (Buxbaum and Rak 2021), disaster recovery assistance (Muñoz and Tate 2016), and infrastructure investments (Hammer and Hansen 2022; Lowe, Reckhow, and Gainsborough 2016)—meaning funds are disproportionately allocated to jurisdictions with a higher share of people who are white and people with higher incomes. We investigate the degree to which infrastructure funding may reflect or move beyond these inequitable dynamics writ broadly in this report.

Applying an Equity Lens to Infrastructure Investment

As noted throughout this report and detailed further in appendix B, scholars have demonstrated myriad racial disparities in public infrastructure quality and investments. For instance, one study identified that between 2016 and 2019, drinking water systems that consistently violated the Safe Drinking Water Act were 40 percent more likely to be located in communities with higher shares of residents of color (Fedinick, Taylor, and Roberts 2019). People of color are more likely to live with underdeveloped and underfunded water systems that increase risk and the incidence of contamination because of current and historic racial segregation in the built environment (Mueller and Gasteyer 2021). Such contamination has been linked to adverse health effects, including cancer and childhood developmental delay (Ahmad et al. 2021). The disproportionate burdens related to federally funded infrastructure that communities of color have faced—and continue to face—demonstrate the need to focus on racial equity in investments as a key outcome of our work. Racial equity can be defined as "a state in which life outcomes are no longer predictable by race" (The Ferguson Commission 2015). The process of achieving racial equity requires eliminating racial disparities and improving outcomes for everyone through reparative systemic change (PolicyLink 2021).

Economic equity may assess individuals' relative access to employment and advancement opportunities, investment, and wealth-building opportunities as well as labor protections and class stratification (Brown and Robinson 2016; Gould 2020). Access to infrastructure can be directly tied to economic resources: For example, investments in public transportation and affordable housing can reduce cost of living for people with low incomes, allowing them to spend more money on opportunities to expand their future incomes, such as education, or increase quality of life, such as recreation

(Talmage and Frederick 2019). Public transportation investments can also reduce commute times, which has a significant correlation with economic mobility (Chetty et al. 2014).

Given the demonstrated context of historical disinvestment and harm experienced by communities with higher concentrations of people of color and people with lower incomes, thinking about distributional equity and infrastructure funding means thinking about how funds are or are not being distributed in a way that not just reaches, but *prioritizes*, communities comprising people of color and/or households with lower incomes. Taken together, the research team defines **distributional equity** as a condition in which programs and policies result in fair distribution of benefits and burdens across all segments of a community, prioritizing those with highest infrastructure need related to a history of racial injustice and economic disparities. Thus, we investigate the distributional equity of IIJA and HUD grant dollars—or the extent to which awards for infrastructure projects may be well positioned to advance racial and economic equity by assessing counties' and states' preexisting characteristics—meaning both demographics and local needs related to program goals—that award dollars are reaching.

It is important to recognize that distributional equity is different than equity in outcomes or impact. Rather than examining the direct outcomes or impacts of these federal investments, the definition of distributional equity we employ in this project considers the amount of federal dollars distributed as the outcome. As outlined in appendix B, each project funded by IIJA or HUD awards will generate positive and negative externalities that could deepen or create new problems for communities, even if their initial receipt of award dollars indicates progress toward some equity goal. Questions related to the outcomes of funded projects, including their short- and long-term impacts, are beyond the scope of this report but ripe for future research, as detailed in the conclusion.

The Promise and Shortcomings of Federal Investment

Major federal investment efforts in the 20th century—such as the New Deal policies of the 1930s and the Great Society policies of the 1960s—funded housing production; brought better water, energy, and roadway infrastructure; and introduced new possibilities for public transportation. These programs helped ensure that most US residents could benefit from higher-quality homes, reliable electricity, and faster access to more destinations (Fishback 2017; Wilson, Glickman, and Lynn 2015). The expanded roadway systems made possible through the Federal-Aid Highway Act of 1956, for example, enhanced the connectivity of people and services across the country (Deakin 2006).

The intended benefits of these federal investments, however, were not felt by all. Neighborhoods and cities where people of color and/or people living below the federal poverty line were concentrated were broadly excluded from funding and projects that produced positive externalities—and instead experienced (and continue to experience) harm from infrastructure projects' planning and implementation. Investments in homeownership, for example, became a symbol of the American dream in the 20th century but often excluded people of color in practice. The housing programs designed as part of the New Deal intensified racial and economic segregation and deepened the racial wealth gap (Faber 2020). Between 1934 and 1968, 98 percent of home loans distributed by the Federal Housing Administration went to white Americans (Fullwood 2016). Race was and continues to be a major factor determining who is qualified for and receives investments in housing (Abramovitz and Smith 2021).

When federal investments were concentrated in communities of color, projects were largely intended to benefit a wider (white) public, and the use of these funds had harmful effects on those communities. For example, officials advancing Interstate Highway System projects at the local and state levels intentionally targeted Black communities for clearance and removal to make room for massive new roadways—on which white people disproportionately drove (Murphy et al. 2022). New highways rerouted vehicles to drive dangerously close to existing homes and places of work, overly burdening those nearby with air and noise pollution. These harms continue today. People of color are systematically exposed to more nearby traffic and transportation-related pollutants than white people (Clark, Millet, and Marshall 2017; Rosenlieb et al. 2018), deepening racial disparities in rates of negative health outcomes like asthma (Archer 2020; Gray et al. 2014; Samuels and Freemark 2022). Highway construction represents just one way that historic federal investment decisions rooted in systemic racism still have harmful repercussions today.

Even so, when effective, federal infrastructure investments have the potential to improve peoples' lives (Blackburn et al. 2022). Programs funded by IIJA and distributed by HUD to support mobility, housing, water resources, and more have the potential to reverse existing inequities in funding distribution and downstream program outcomes (Huang and Taylor 2019). Many IIJA programs are new or have received significantly higher levels of funding than in past years; as such, no research has yet identified how, exactly, these funds are being distributed. Our research seeks to assess whether federal programs distribute funding equitably to ensure that people of color and families with low incomes benefit as much as—or more than—other US residents, while also comparing funding with program-specific indicators of local need.

How Does the Federal Government Invest in Infrastructure?

The US federal government distributes infrastructure funds through two primary means: formula and competitive grant awards. **Formula grants** are awarded to eligible entities based on funding formulas established by Congress and/or federal agencies in advance of funding distribution—formulas often developed based on population and other local characteristics. Many formulas are updated only rarely, sometimes relying on decades-old demographic information.[8] Once they have received their allocation of formula funds, state and local governments (provided that they abide by federal regulations) have wide discretion over how those funds are used.[9] **Competitive grants,** on the other hand, are awarded by offices within federal agencies through a competitive proposal-based process. These may also be called discretionary grant programs. Competitive programs are typically oversubscribed, meaning local and state governments apply for many more funds than the federal government is able to distribute because of funding limitations.[10] Recipients of federal infrastructure funds tend to be states, tribal governments, and general-purpose localities (like cities and counties), but funds can also be distributed to individual projects, regional coalitions, private entities, and specific governmental agencies, depending on the program.[11]

BOX 2

Federal Grant Application Processes

The federal grantmaking process is a key mechanism used by the US government to distribute funds to other levels of government, public agencies, and sometimes private entities. Below, we detail the order of procedures involved in the use of most types of federal grants.

Formula Grants

A majority of funds distributed through IIJA programs and from HUD are awarded by formula. For formula grants, the major actors involved are Congress and/or the federal agencies, which set funding levels and formulas for funding distribution, depending on the program involved, and the local officials deciding how to use funds after receiving them. Congressionally developed formulas are referred to as codes or statutes, while agency-written formulas are referred to as regulations or rules. In rare cases, formulas can also be by-notice, such as for the Community Development Block Grant Disaster Recovery program. Formulas—equations for determining what gets funded—differ by program, reflecting a variety of relevant metrics, such as population distribution and program-specific issues (such as the number of highway miles in a state). In some cases, such as for highway programs, formulas were written decades ago and have not been updated; Congress and/or federal agencies simply reallocate funding based on previous standards, often with a baseline minimum funding level for individual states. In many cases, states redistribute federal formula funds to units of local government or public agencies and combine them with other state- or locally generated revenues to fund investments (many federal formula programs require a nonfederal "match").

1. Legislators in the US Congress or federal agencies establish funding formulas for disbursement for a specific program (formulas differ based on relevant metrics such as population distribution and program-specific issues).

2. Agencies distribute funds to states, federally recognized tribal recipients, local governments, and other agencies, depending on the program and assuming they meet federal standards.
3. States can redistribute federal formula funds to others, such as units of local government or public agencies.
4. For formula programs that require "matching funds," states can combine federal funds with state or locally generated revenues to fund investments.
5. Using funds, recipient agencies implement projects that meet federal requirements for the use of that program's funding.

Competitive Grants

A smaller share of federal funds is distributed through competition, though IIJA includes large competitive grant programs that will distribute $100 billion for transportation programs alone between fiscal years 2022 and 2026. For these competitive grants, the major actors are Congress, which sets funding levels and general program guidelines; executive departments, which create scoring systems for judging projects; and local and state officials, who propose project ideas for potential funding. Requests for proposals describe program goals and rules for fund use as well as the criteria that the administering agency will use to decide how to distribute funds. These criteria are typically described in federal law passed by Congress but further interpreted by executive branch agencies.

1. Federal agencies release requests for proposals for specific programs, whose total funding has been set by the US Congress. The requests describe the particular programs' goals and rules for fund use as well as criteria for deciding how to distribute funds.
2. Governmental jurisdictions, public agencies, and private corporations respond to requests by submitting applications for funding with project details. Jurisdictions with limited capacity sometimes work with a grant writer and/or nonprofit organization to complete applications.[12]
3. Reviewers from the program's awarding agency evaluate applications based on merit. This process generally consists of four steps:
    a. initial screening to ensure a complete application
    b. programmatic review and assessment of the application's substance
    c. financial review of the proposed budget
    d. award decision and announcement
4. Federal agency distributes grants.
5. Awardees implement projects and report.
6. Agency monitors grant distribution through the White House Equitable Data Working Group.
7. Agency closes out the grant.

Source: The authors, based on a review of federal program funding processes.

State and local governments control most investment decisions for infrastructure projects in their jurisdictions. They prioritize which projects or which types of programs to support with federal formula funds and then allocate combinations of federal funds and state/local dollars to meet those priorities. When it comes to competitive funds, localities at the state level and below are responsible for designing projects, applying for federal grants, and executing the work. The federal government rarely makes any specific plans itself, rather relying on subnational government units, and their public officials, to plan.

The exception is for federal agencies that manage some infrastructure-related projects, such as the Corps of Engineers. We must, therefore, consider the characteristics of the governmental entities applying for and receiving funding.

As a start, recent research examines whether certain types of jurisdictions are more likely than others to receive federal competitive dollars. Some scholars find that municipalities with higher capacity—as defined by total agency employees or operating budgets—are more capable of applying for and receiving grants by developing more compelling proposals (Lowe, Reckhow, and Gainsborough 2016). Indeed, as state departments of transportation have lost capacity through a reduction in staff, they have struggled to ensure that the projects they sponsor are as effective as possible (Liscow, Nober, and Slattery 2023). Others identify a positive correlation between measures of local capacity and total federal grants received per capita as well as the quantity of federal awards received from federal grant programs (Collins and Gerber 2006; Hall 2008a). In our research, we focus on a measure of local capacity defined as public-sector staff per capita.

It is worth noting that strong intergovernmental relationships may also influence the ability of local governments to successfully win federal grants (Bickers and Stein 2004; Lowe, Reckhow, and Gainsborough 2016). At the regional level, localities that can leverage strong regional economic organizations are more likely to be able to make the case for federal funds (Hall 2008b). Some researchers find that connections such as partisan alignment between federal administrations and state governors lead to increased funds for programs, such as those serving unhoused populations (Lee 2021). Collaboration among local business leaders (Alpert, Gainsborough, and Wallis 2006; Weir, Rongerude, and Ansell 2009) and civic capacity, which can be measured by the presence of nonprofit or advocacy organizations in an area (Lowe, Reckhow, and Gainsborough 2016), are also associated with the capacity to attract grant funding. While this report does not assess characteristics of applicants nor proposals and their relationship to successful receipt of infrastructure grant funding, we do assess relationships between a measure of local capacity and funding distribution to highlight an additional factor in federal funding processes that impacts distributional equity.

Project Methods

In this report, we follow the flow of funds from major federal infrastructure programs to state and county governments to understand which communities are receiving an equitable share of support for infrastructure-related projects and which communities are being left out or harmed.[13] Our work is the first known attempt to systematically analyze the racial and economic equity implications of infrastructure funding decisions across a broad array of programs funded by the federal government, including HUD-funded housing and community development investments. While IIJA did not fund housing projects specifically, we believe that housing is an essential element of the country's infrastructure that plays a key role in contributing to quality of life for the public and thus considered HUD investment in our data collection.

The following three research questions guided our work to understand the equity of funding distribution by these programs:

1. Is federal investment in transportation, housing, energy, water, and broadband infrastructure concentrated in counties and states with a greater share of residents who are people of color, households with low incomes, or with greater needs that can be addressed through infrastructure funding?
2. Are federal officials more likely to award competitive grants to projects in census tracts with a higher concentration of people of color and households with low incomes?
3. Are counties with limited local capacity—defined in terms of public-sector employment—receiving a fair share of competitively allocated funds?

Data Collection

In the first phase of our research, we collected funding information on all major IIJA and HUD programs from official websites of and/or media announcements from the various departments and agencies that administer these programs. We defined major programs as those expected to distribute at least $1 billion in fiscal year 2022 (for HUD) or at least $1 billion in fiscal years 2022–2026 (for IIJA, over the course of that law's lifetime). We collected program data and identified fiscal year 2022 funding allocations through the spring of 2023 for a total of 66 programs meeting our criteria (37 were formula and 29 competitive). We excluded 43 other programs that did meet our funding thresholds because

they had incomplete data or their fiscal year 2022 awards had not yet been announced at the time of analysis.

For formula programs, we identified the jurisdictions (or entities within jurisdictions) that received funds in fiscal year 2022. While HUD already identifies county-level funding distributions, most formula funds from IIJA are distributed at the state level. For these programs, we were unable to identify the county where the money was eventually spent, because this would require analyzing each state's project-level expenditures.[14] However, we were able to identify many recipient jurisdictions of IIJA formula public transportation investments, which are allocated to states or by urbanized area. We assigned these funds by county in each relevant urbanized area using areal interpolation (meaning dividing funds by share of land area in each urban area), which provides an approximation reflecting county boundaries.[15] For formulas that directed funding to tribal government, we assigned funding to the counties or states where the tribal land is located.

For each competitive program where data were available, we compiled a list of every individual project funded in fiscal year 2022 via departmental press releases and supplemental searching. We captured a range of descriptive data for each project, including (but not limited to) funding amount, county (or counties) where funds are expected to be used, and a project description. When possible, we collected project specifics, typically from local news sources, and mapped the projects using open-source geospatial software to generate project location spatial data. This allowed us to assign many projects to specific locations within counties. In circumstances in which projects spanned multiple jurisdictions, we listed all of the counties where the project was located and assumed that funds were distributed evenly across them. When funding was allocated directly to a tribal government or other tribal entities and an explicit project location was unclear, we assigned funding to the county (or counties) where the tribal land is located.

Through this cataloguing, we sought to understand the mechanisms by which grants are distributed, from federal departments to programs, and from programs to jurisdictions or projects. Altogether, in our research, we identified 2,990 counties that received some level of funding in fiscal year 2022 *directly* from IIJA or HUD programs—nearly 93 percent of the 3,221 counties and county equivalents nationwide (the other counties likely received federal funding indirectly through state pass-throughs). Funds were allocated and awarded to all 50 states; Washington, DC; Puerto Rico; and several US territories.

Once we collected information about all 66 programs of focus, we sought to understand how program funds were distributed in comparison with local demographics. This helps tell us whether

federal funding is supporting increased allocations to historically underinvested communities—communities where people of color or households with lower incomes predominate—or reinforcing historic disinvestment. We collected key data about local demographics for each county and state we analyzed from the US Census 2016–2020 American Community Survey, including the share of residents who are people of color (including those who are Hispanic or Latine), the share of residents who are living under the federal poverty line, and the median household income. We measure the share of people of color, rather than indicators like the share of Black or Hispanic residents, because the distribution of people by race and ethnicity in the US is uneven. This approach allows us to compare a state like Hawai'i, where, according to Census data, most people of color self-identify as being Asian or Pacific Islander, with a state like Mississippi, where most self-identify as Black. We also collected data on population density, which is a useful proxy for the degree of urbanization of individual jurisdictions and which allow easy comparison between communities. These are what we refer to as **demographic indicators.**

Next, we sought to compare funding distributions with local characteristics that reflect potential need for investment based on a program's goals. To repeat our example from above, to get a sense of whether a bridge repair program is meeting county needs, we can compare funding to the share of each county's bridges that are in poor condition. We developed a list of 55 indicators that are relevant to the goals of IIJA and HUD programs, and we refer to these as **need indicators.** Using these indicators, we identified whether counties were receiving funds in proportion to local need; in other words, following the assumptions of vertical equity, we assume that a county with a higher share of deficient bridges would receive more bridge repair funding. We collected need indicator data from a variety of public sources, such as the US Census 2016–2020 American Community Survey and government agencies such as the US Environmental Protection Agency, DOT, and HUD. (See appendix D for a list of data sources). We assigned indicators to each program based on what we know about what types of need might be relevant to a programmatic investment. Broadly, we organized indicators into a series of categories relevant to the program goals of IIJA and HUD spending, which include the following:

- **broadband access**, containing measures of internet access and connectivity (e.g., broadband speed, households with internet access)
- **mobility,** highlighting the ability of individuals to move around their local environment, such as by walking, driving, biking, or using public transportation (e.g., commute time, car access, frequency of fatal accidents)
- **environmental safety**, including measures of local environmental conditions that can impact public health (e.g., superfund site, diesel particulate matter level)

- **housing access**, including measures of housing affordability, quality, and supply (e.g., housing cost burden, homelessness, complete plumbing and kitchen, housing permits per capita)
- **local bureaucratic capacity**, measuring government staff levels per capita in transportation, housing/community development, or environmental sectors
- **program-specific data**, meaning information relevant to a specific program (e.g., the number of public housing units in a county is relevant to the amount of funding a county receives from HUD's public housing program)

We acknowledge that the list of indicators we developed is, definitionally, limited and may not fully reflect programmatic specifics. We believe, however, that the indicators we chose offer a rounded view of the characteristics of the communities where federal infrastructure funds have been distributed and enable us to assess the equity of that distribution. We describe a small portion of these need indicators in this report; we provide users the ability to explore all relevant indicators on the interactive website.

Analytical Methods: National Equity Scoring

After collecting the data and establishing the indicator categories, we analyzed the data. We ran a set of analyses to determine whether funds are more likely to support communities with certain characteristics by comparing the distribution of funds across states and counties with the demographic and need indicators that we defined above.

To do so, we first calculated the percentile rankings for both the per capita funding for each program and all of the indicator values in each state and county. We use per capita funding as a baseline to allow comparisons between states and counties of all different population sizes. In other words, the least-funded county on a per capita basis would be at the 0 percentile, while the most-funded county would be at the 100th percentile. We then took the difference between a county or state's funding percentile in a given program and its indicator percentile for each relevant indicator. This calculation produced an **equity metric** for each program and relevant indicator combination, for each county and state, ranging from −1 to +1. We compute this metric once for all jurisdictions (whether or not they actually received funding) and again for only funded jurisdictions. A metric of 0 means that the jurisdiction's funding is proportional to this indicator. A negative metric means the jurisdiction is getting less funding than the indicator would imply; a positive metric means the jurisdiction is getting more funding than the indicator would imply.

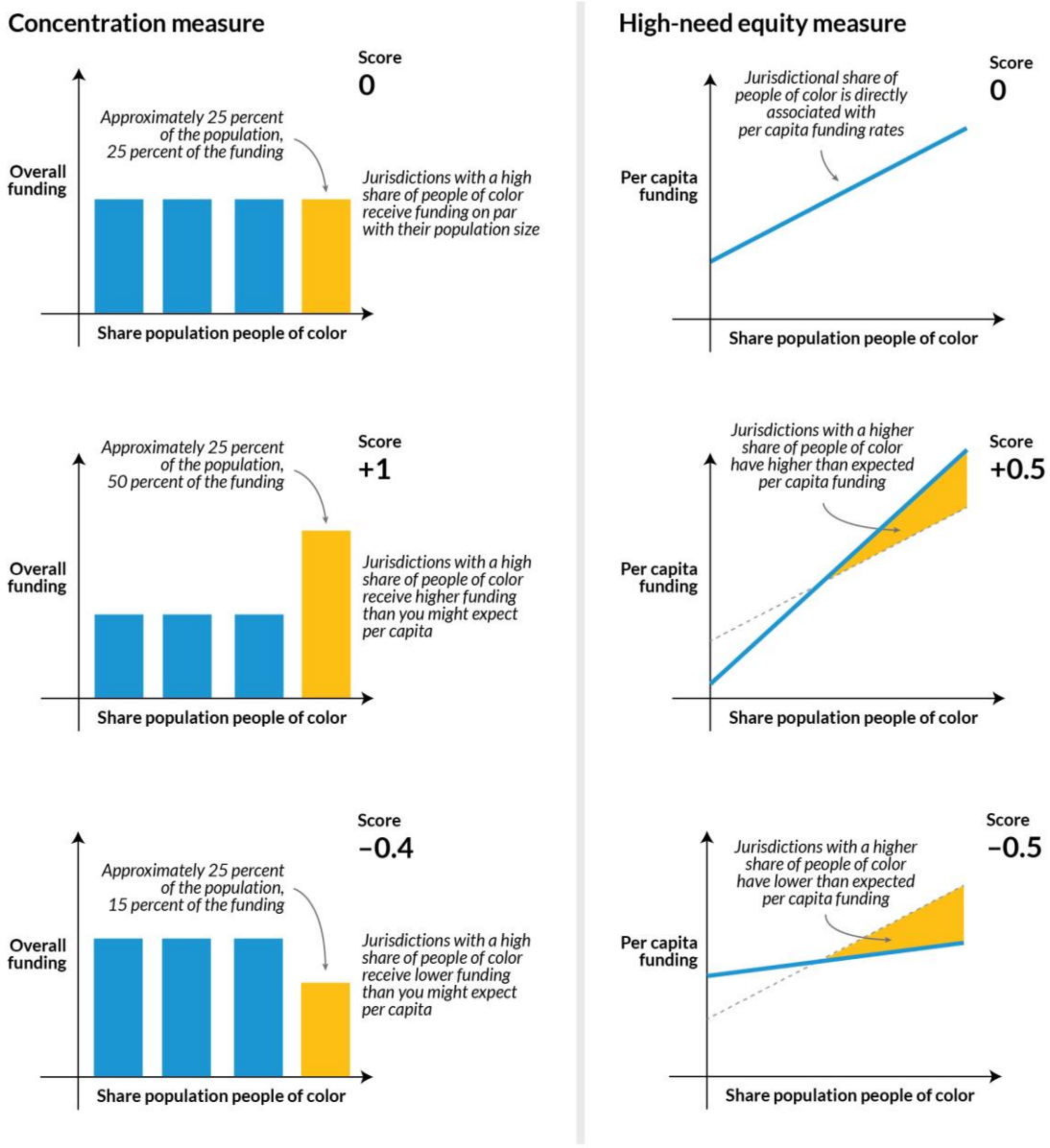
This equity metric gives us information about how each program performs at the jurisdiction level, across a variety of relevant indicators. To then determine how programs perform as a whole, across all jurisdictions, we developed three additional program-level measures.

The first measure that we calculated at the program level is the **variability measure**, which measures equality of funding across states. The variability measure presents the degree to which a specific program's state-level per capita funding aligns with the program's overall national per capita funding. In other words, it measures how evenly the program funding is distributed across the country. This measure gets at the idea of funding *equality* before we explore *equity* in the additional measures described below. A score close to 0 would mean that most states receive per capita funding close to the national per capita rate. A higher score means the program's funding is far from reflecting the national distribution of funding. We construct this measure only for formula programs since these programs generally distribute large amounts of funding to all states (whereas competitive programs with more limited funds may only be able to award specific projects in a narrower set of states). Note that we expect certain programs to have high levels of variability because they incorporate minimum funding floors for small states.

Next, we created a **concentration measure**, which measures whether programs concentrate funding in jurisdictions with high shares of people of color, households with low incomes, or disproportionate programmatic need. This measure indicates the share of national funding for each program that is distributed to the jurisdictions that comprise the approximately top 25 percent of the US population along a given indicator. We make this calculation twice, once with county-level data and once with state-level data. For each, we take the jurisdictions with the highest indicator values that contain approximately 25 percent of the total US population. We then look at the share of total program funding that those jurisdictions receive to compute our measure. This measure's scores range from −1 to +3. A score of 0, for example, would mean that the 25 percent of the population living in the counties with the highest share of people of color receive roughly 25 percent of the funding. A lower score means that these jurisdictions receive less than 25 percent of the funding, and a higher score means that these jurisdictions receive more than 25 percent of the funding. The left side of figure 1 illustrates the concentration measure.

FIGURE 1

Illustrating the Functions of the Concentration and High-Need Equity Measures



Source: Framework developed by the authors.

Finally, we take our analysis further by computing the **high-need equity measure**, which measures whether funding is correlated with state or county characteristics for the jurisdictions with the highest share of people of color, households with low incomes, or disproportionate programmatic need. This measure shows, for each program and relevant indicator combination, how close funding is to meeting

the existing need of the median high-need jurisdiction (i.e., the jurisdictions above the 50th percentile for a given indicator), as indicated by the distribution of that specific indicator. Paired with the concentration measure, this measure provides information about whether high-indicator jurisdictions are receiving progressively more funding than lower-indicator jurisdictions. We compute this measure once with county-level data and once with state-level data, and again for all jurisdictions (whether or not they actually received funding) and for only funded jurisdictions. This measure's scores range from −1 to +1. A score of 0, for example, would signify that the median county with an above-average share of residents of color is receiving equally higher-than-average levels of funding; negative values would signify the opposite. The nature of this high-need indicator makes it very difficult to achieve a positive score on this measure (since, on average, we would expect jurisdictions—including those above the 50th percentile in terms of an indicator—to be receiving funding at about the 50th percentile). We instead focus primarily on this score's distance from zero to get a sense of how close programs are to meeting the distribution of certain indicators. The right side of figure 1 illustrates the high-need equity measure.

We provide equations and detailed explanations of these equations in appendix A.

Analytical Methods: Census Tract Analysis

Finally, we completed a selective local analysis of several programs by examining funded projects at the census tract level (similar in scale to a neighborhood in urban locales). We first developed a method to compare tracts where projects were funded with a set of reasonably comparable tracts where projects were *not* funded. Using the project-specific location data that we collected from mapping, we then examined whether the US government is disproportionately awarding projects in certain types of tracts and not others. The goal of this analysis was to assess infrastructure funding decisions in terms of their local context, not in terms of their distribution by jurisdiction, as we undertake above.

As a team, we chose to select a series of transportation project types with known local impacts and for which we had been able to map successfully based on information collected from the federal government. We specifically chose among programs for which funds are distributed competitively; as noted, this means that localities and states submit project ideas, and federal departments select among them. The project types we chose included the following:

- **pedestrian or bicycling infrastructure**, meaning any investment that improves accessibility and/or safety for pedestrians and/or bikers

- **Rebuilding American Infrastructure with Sustainability and Equity (RAISE) projects**, or all projects funded by the RAISE program, which supports a wide range of multimodal surface transportation projects
- **road capacity increases**, meaning projects that add lanes to existing roadways or create new roadways
- **road design improvements**, meaning any investment or construction on roads that does not include adding lanes or creating new roadways
- **transit projects**, which include any projects designed to expand transit systems with new fixed-guideway investments, whether rail or bus

Note that the project types are sometimes overlapping (e.g., some RAISE projects were bicycling infrastructure). For each of these project types, we conducted detailed tract-level analyses independently as the impacted areas—and the types of impacts—vary. We identified reasonable "buffer areas" based on a review of extant scholarship for project impacts, either positive or negative, choosing different buffers for each project type.

To evaluate the demographics of the tracts where funded projects are located, we established a set of three sometimes overlapping comparison groups. These three comparisons allow us to make more confident claims about the distribution of projects around the country, since each comparison group has its own limitations. First, Comparison Tracts A represent all tracts outside of the treatment buffer but in the same county. Comparison Tracts B encompasses all those that *neighbor* the treated tracts. Finally, we establish a third comparison group, C, that represents tracts in the same county that are similar in terms of population density to the treated tracts. We select just those tracts in each county where a project was funded that have a population density that is at most 25 percent higher or 25 percent lower than the average of treated tracts in that county. For more detail, see appendix A.

Findings

The federal government's infrastructure investments have the potential to transform communities throughout the US. Thanks to funds dedicated to transportation, housing, broadband, water, and other projects, states and localities will be able to invest in improving access and quality of life for millions of residents. Understanding *where* these funds are distributed—and to which communities, with what sorts of residents—then, is essential. They can help us evaluate whether federal investments are expanding support for disinvested communities—or reinforcing historic inequities.

In this section, we describe results from our analysis of 66 federal infrastructure programs. Our key findings related to the equity of funding distribution include the following:

- **Federal investments in roadways, broadband, and water distributed through formula programs tend to disproportionately benefit states with lower shares of people of color because of their emphasis on providing minimum funding to states with low populations and providing substantial support to states with more roads.** The result is a doubling down on existing inequitable patterns of infrastructure investment. This is a concern for highway funding especially, given that most federal road funding can be leveraged for other uses, such as public transportation or pedestrian and bicycling projects; states with a higher share of people of color are missing out on a fair share of funding that they can use for the transportation investments of their choice.
- **Housing and community development formula funds are distributed in a fashion that better reflects the US and that concentrates investments in communities with a higher share of people of color.** Even so, the concentration of funding in such communities may be contributing to inequitable outcomes because it means *less* funding for affordable housing in historically exclusionary cities and towns.
- **Many competitively distributed transportation funds are concentrated in communities with a higher share of people of color—but there is more work to be done to support such areas.** Many of the competitive transportation dollars are genuinely focused in communities of color, likely following agency equity plans they have developed over the past few years. But there is little evidence that the federal government provides progressively more funding to communities with the largest share of people of color or low-income populations, compared to the rest of the country. The federal government could further target grantmaking for these areas.

- **Both formula and competitively distributed grants tend to underfund communities with lower household incomes.** Most competitive transportation programs are sending disproportionately low funding—zero dollars, in some cases—to the lowest-income counties. However, we did find instances that suggest that while funding is going to higher-income counties, it may be going to lower-income neighborhoods *within* those counties.
- **The distribution of federal funds often reflects differences in program-related needs on the ground.** We compared funding distributions with a number of measures relating to program purpose and found that competitive transit and broadband programs are generally distributing higher shares of funds to the places with higher programmatic need. Broadband programs, for example, appear to be heavily targeted toward areas with lower broadband speeds and shares of households with internet access (meaning the programs are helping to fill a gap), while transit programs are distributing a higher share of funds to places with more transit stops and commuters who bike, walk, or take public transit (meaning these programs are reinforcing funding for areas with less automobile dependence). Housing programs have a less clear relationship with programmatic need.
- **Federal transportation officials have selected projects for competitive funding that are disproportionately located in tracts with higher shares of people of color and lower household incomes than comparable areas.** This suggests federal staff are prioritizing investment in underinvested communities—but raises concerns about whether those same communities are being overexposed to negative externalities resulting from projects, such as air pollution from roadway expansions.
- **Counties with low levels of bureaucratic capacity—defined in terms of per capita staff members working in county and local government offices—have received disproportionately low levels of funding across most competitive programs we study.** This is further evidenced by the fact that many competitive transportation programs disproportionately fund projects in higher-income counties. This indicates that federal officials have not yet made adequate advances to ensure that low-capacity communities can apply successfully for federal grants.

The distribution of these funds is the product of choices made by local and state officials who apply for grants, members of Congress and staff at federal agencies who decide on funding formulas, and officials at those agencies who allocate competitive funding. They all have a role to play in informing the degree to which infrastructure funding supports more equitable outcomes. Decisions are often quite political in nature. It is worth emphasizing, however, that the role of these individual actors is mediated by historical forces. Formulas are designed to reward certain states and localities instead of others, in

part based on *past* federal funding choices. Present and future efforts to advance social and economic equity across the country will be directly shaped by today's infrastructure investment choices.

The results we present in this report reflect just a small share of the knowledge to be gained from an evaluation of the database that we have constructed. As a result, we invite readers to also explore the interactive website we constructed, which has vastly more data, available for investigation at the programmatic, state, and county levels.

Major Funding Programs Are Expanding Investment in US Infrastructure

The expansion in funding support for federal infrastructure programs thanks to IIJA—and the continued investment in housing and community development through HUD programs—requires an in-depth evaluation of program funding distribution. In this section, we describe several of the major federally funded infrastructure programs and identify their variability in terms of per capita funding to the country's states and counties.

Formula Program Funding Varies Dramatically between States and Counties

Programs distributed by formula account for about 80 percent of IIJA funds and almost all HUD funding. The degree to which different jurisdictions benefit from these investments, then, is a product of choices made by Congress and the federal agencies about how to design those formulas. What is clear is that federal formula programs provide massive sums of money to both states and localities to invest in infrastructure. Table 2 lists the 10 largest formula funding programs in our database, ordered by total funding size. These programs (with the exception of US Army Corps projects, which are a special case) fund all states. And the funding levels are relatively high—up to $119 per resident of the average state for the National Highway Performance Program (NHPP), for example.

TABLE 2

Formula Grants Are a Key Source of Revenue for State Governments

The 10 largest formula grant programs in our database, ordered by program funding

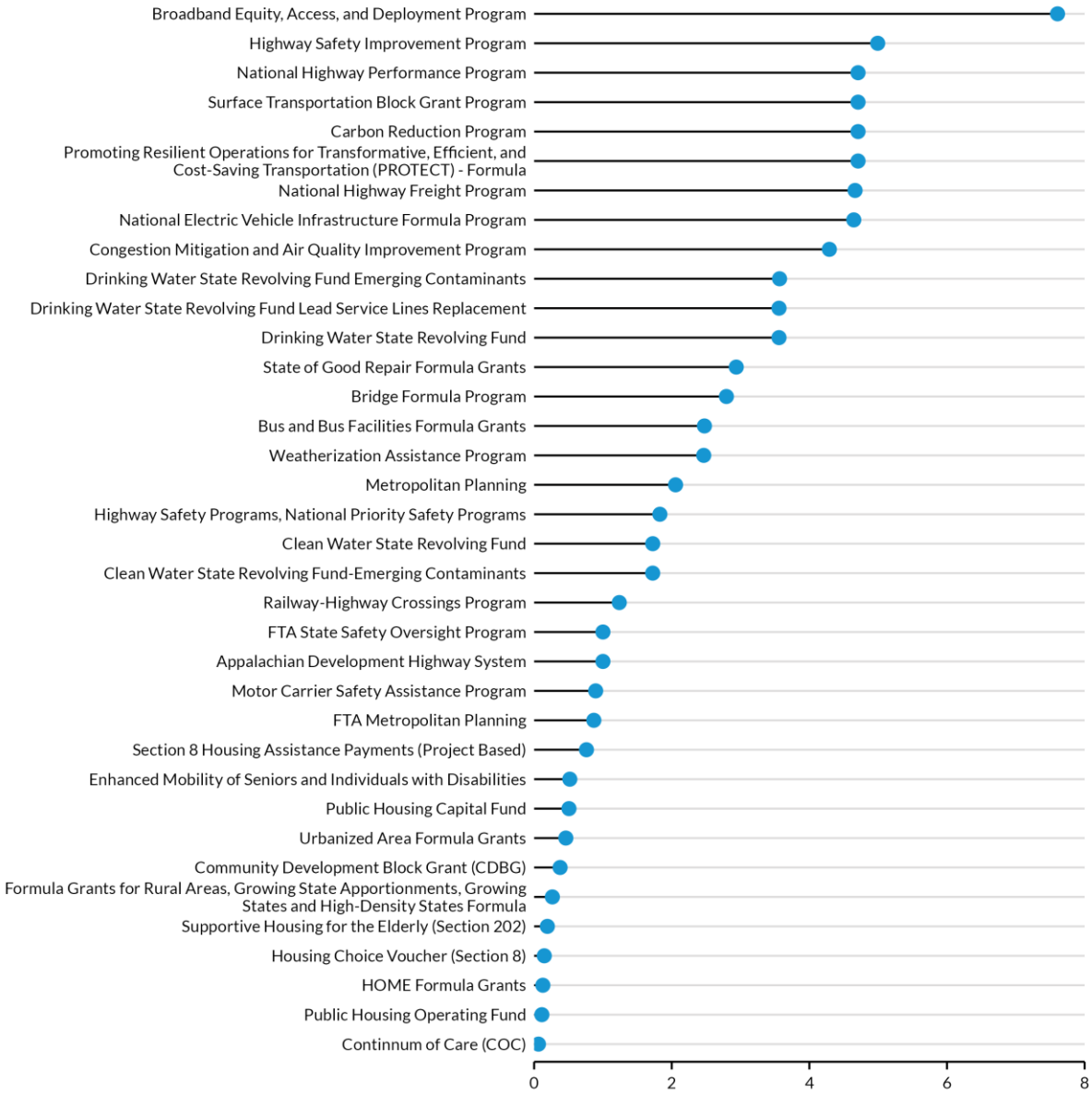
Program	Granting agency	Annual funding (billions)	Average per capita grants to states	Share of US states receiving grants
National Highway Performance Program	DOT	$28.4	$119	98%[a]
Housing Choice Voucher	HUD	$24.7	$70	100%
Section 8 Housing (project based)	HUD	$17.7	$55	100%
Surface Transportation Block Grant Program	DOT	$13.8	$58	98%[a]
US Army Corps of Engineers IIJA projects	USACE	$7.2	$41	63%
Urbanized Area Transit Formula Grants	DOT	$6.9	$18	100%
Bridge Formula Program	DOT	$5.3	$26	100%
Broadband Equity, Access, and Deployment Program	DOC	$5.2	$43	100%
Public Housing Operating Fund	HUD	$5.0	$15	100%
Drinking Water State Revolving Fund Lead Service Lines Replacement	EPA	$4.1	$21	100%

Source: The authors, based on an analysis of fiscal year 2022 federal grants and 2016–2020 American Community Survey data.
[a] Puerto Rico does not receive these funds. US states include District of Columbia and Puerto Rico. DOT = US Department of Transportation; HUD = US Department of Housing and Urban Development; IIJA = Infrastructure Investment and Jobs Act; USACE = US Department of Defense Army Corps of Engineers; DOC = Department of Commerce; EPA = Environmental Protection Agency.

These programs, however, vary tremendously in terms of how they mete out funding. We leverage our measure of funding variability (described above) to test the divergence of each major formula program's funding from the norm (figure 2). Some programs distribute funding to states in a fashion that is closely associated with state population size, meaning per capita funding at the state level is similar to the national per capita funding for that program. This is the case for several of the housing programs, such as the Public Housing Operating Fund, and for several of the programs designed to support public transportation, such as the Urbanized Area formula grants. (Even so, there is much more variation in terms of funding between *counties* for these programs, which we describe in further detail below.)

FIGURE 2

Funding Variability Scores for Formula Programs Studied at the State Level



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Source: The authors, based on an analysis of fiscal year 2022 federal grants and 2016–2020 American Community Survey data.
Note: This plot excludes two programs, Tribal Transportation Program and US Army Corps of Engineers IIJA Construction Projects, which were extreme outliers. FTA = Federal Transit Administration. A lower variability score means programs distribute funding to states in a fashion that is closely associated with state population size.

Figure 2 shows much more variation in state per capita funding for other programs. The largest roadway programs, like NHPP and the Surface Transportation Block Grant Program (STBG), vary tremendously between states in terms of their per capita funding allocated. The same is true for the

largest internet infrastructure program, the Broadband Equity, Access, and Deployment Program—a product of the fact that its initial funding distribution provided the same $100 million to each state, no matter its population. The remainder of this report seeks to decipher this variation.

Transportation Formula Funds Are Weighted toward Great Plains States—Whereas Housing Formula Funds Are Weighted toward the Northeast

Federal transportation funds are not evenly distributed across states: Some states receive considerably more support due to formulas developed by Congress, which do not assign funding on a per capita basis but rather use a varied set of criteria to determine which areas get funding. In figure 3, we compare per capita state funding for six of the largest formula transportation programs, including NHPP, STBG, the Highway Safety Improvement Program, Urbanized Area transit grants, Bridge formula grants, and the Congestion Mitigation and Air Quality Improvement Program (CMAQ). This map shows how much each state receives on a per capita basis compared to the *most*-funded state; this allows comparisons between the different programs, whose overall allocations vary widely (table 2 shows that NHPP distributes more than four times the annual funding of the Urbanized Area transit program). Note that we do not assume that even distribution of funding on a per capita basis is a good idea necessarily, nor that the funding distributed to one state or another is adequate.

FIGURE 3

The Largest Roadway Programs Disproportionately Fund Low-Population States

Formula transportation program funding per capita as a percentage of highest state recipient

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Source: The authors, based on an analysis of fiscal year 2022 federal grants and 2016–20 American Community Survey data.
Note: NHPP = National Highway Performance Program; STBG = Surface Transportation Block Grant Program; Safety = Highway Safety Improvement Program; Urbanized = Urbanized Area formula grants; Bridge = Bridge Formula Program; CMAQ = Congestion Mitigation and Air Quality Improvement Program. Map should be read as follows: Montana received about 50 percent of the per capita funding for the NHPP of Alaska, which received the most per capita funding of all states.

The distribution of these programs' funds varies based on their goals. Transit grants, for example, are concentrated in states with high transit use—such as Massachusetts, New Jersey, and New York. This reflects the fact that that program's funds are appropriated (mostly to urban areas) based not only on population but also on a combination of population density, revenue service miles provided by local

operators, and passenger miles traveled.[16] This approach to funding transit has its benefits—it supports areas where transit already exists—but also, by definition, **it provides less support to areas with less public transportation available, maintaining a status quo.**

On the other hand, transportation programs like NHPP and STBG are generally weighted much more to Alaska and upper plains states, which then receive considerably more per capita roadway funding than most states in the Southeast, for example. This results from the choice of the US Congress to award these funds based on previous formulas that give a minimum amount of funding to even the smallest-population states and prioritize each state's number of roadway miles, vehicle miles traveled, land area, diesel fuel used, and taxes paid by state residents, among other criteria.[17] This approach rewards states with more roads and more driving, which might be intuitive when it comes to maintenance but also has the tendency to encourage more and more road construction. For example, in 2018, Indiana and Massachusetts had roughly the same population—but Indiana received 57 percent more federal highway funding; the explanation is that Indiana had more than double the lane miles of roadways and significantly more vehicle miles traveled (Kirk 2019).

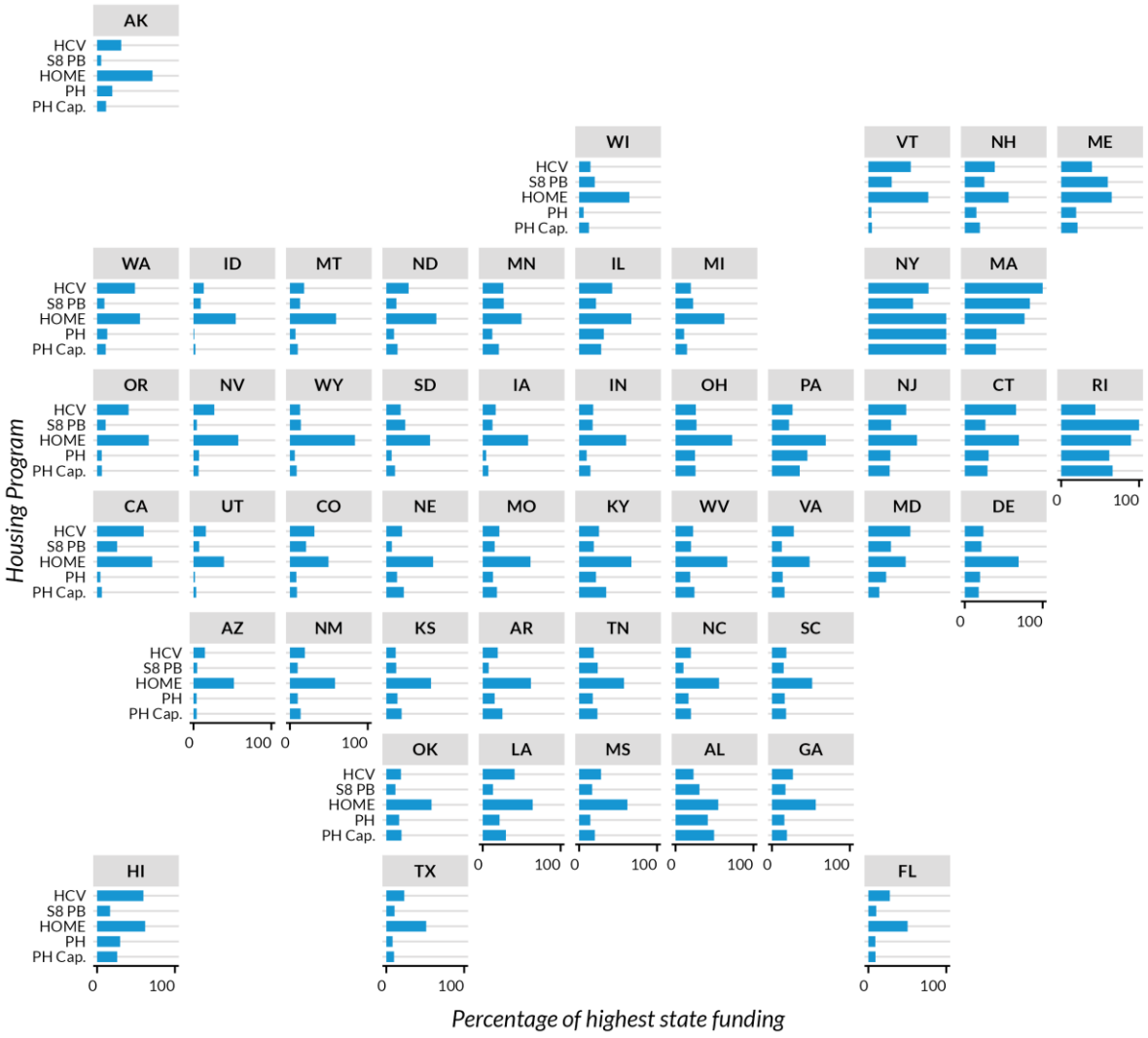
These outcomes occur despite the fact that many transportation programs can be leveraged for the use of transit, pedestrian, or other mobility projects. For example, NHPP funds can be allocated to transit investments on the federal road network. Moreover, most roads programs—including NHPP and STBG—can be "flexed" by state governments to transit programs if states desire it, meaning that these "roads" programs are in fact potentially multimodal transportation programs.[18] This fact does not seem to have influenced Congress and agencies' decisions about formula allocations.

There are also significant discrepancies in funding across states for housing. In figure 4, we show that among five major federal formula housing programs, states in the Northeast receive considerably more per capita funding than many states in the Southwest, especially. Most HUD dollars that we capture here are distributed not to state governments themselves but typically to local housing authorities and other housing providers, depending on the program. Massachusetts, New York, and Rhode Island receive the largest per capita allocations on most programs, with the significant exception of Arkansas, which is the national leader in terms of per capita HOME Investment Partnerships Program (HOME) funding. States like Arizona, Nevada, Texas, and Utah receive very few funds across most of these programs.

FIGURE 4

Federal Housing Programs Disproportionately Fund Northeastern States

Formula housing program funding per capita as a percentage of highest state recipient



URBAN INSTITUTE

Source: The authors, based on an analysis of fiscal year 2022 federal grants and 2016–2020 American Community Survey data.
Note: HCV = Housing Choice Voucher (Section 8); S8 PB = Section 8 Housing Assistance Payments (Project Based); HOME = HOME Investment Partnerships Program; PH = Public Housing Operating Fund; PH Cap. = Public Housing Capital Fund. Map should be read as follows: Vermont received about 50 percent of the per capita funding for the HCV program of Massachusetts, which received the most per capita funding of all states.

Again, the differences we illustrate in figure 4 are to a large degree a reflection of the structure of the formulas used to distribute funding. Funding for the Public Housing Capital Fund, for example, is distributed to local and state housing authorities based on the number of public housing units it has in place, capital needs for renovation, and local real estate indicators.[19] This means that localities with a

larger number of older public housing units—such as New York City—are likely to receive more per capita funding. On the other hand, HOME funds are distributed by a formula that integrates the goal of not "allocat[ing] funds excessively to any one community or state" as well as a variety of indicators related to housing costs and need.[20] This is one explanation for why HOME funds are more evenly distributed than public housing supports. Another is that the history of housing investment in the United States has concentrated federally supported subsidized units (including public housing as well as Project-Based Section 8 units) in some places and not others. While states like Massachusetts and New York—and their constituent municipalities—invested heavily in public housing, others resisted it. In California, for example, voters placed severe limits on public housing construction in 1950.[21]

Moreover, the growth trajectory of the US has not matched housing investment. While the federal government supported large investments in public housing until the 1970s, for example, it has provided little for new units in that program in the years since—exactly the years when states like Arizona, Florida, and Texas have become more populous (Vale and Freemark 2012). From the perspective of producing a more integrated society, it may also be problematic to focus housing investment in communities that chose to invest in subsidized housing decades ago. For example, this could mean limited funding in areas that have used exclusionary zoning policies to prevent the construction of new affordable housing over time.

There is significant variation in housing program funding not just at the state level but also among counties. For example, the Public Housing Capital Fund and Continuum of Care (COC) programs are both moderate-sized programs ($3.2 billion and $1.9 billion, respectively, in 2022). Among funded counties, 39 percent received between $2 and $6 per capita in COC funds (the median was about $4 per capita). But public housing support was far more dilute. Though the median was about $12 per capita, just 13 percent of funded counties received between $10 and $14 per capita of those funds (with the majority of counties receiving amounts either higher or lower than this range). This divergence is indicative of the differences in how these programs fund communities: COC provides a small amount of funding on average, but in a consistent way, while the Public Housing Capital Fund provides more funding on average, but in a less consistent way.

Federal Competitive Funding Fails to Reach the Vast Majority of US Counties

IIJA includes large allocations of funds distributed competitively by federal agencies. As noted, these programs require localities, state governments, and public agencies (and sometimes other entities) to submit applications for grant awards, which are then judged on their merits by federal staff. We list the

10 largest competitively distributed grant programs that we study in table 3. The amount of funding distributed to counties from many of these programs on a per capita basis is relatively large—but that is because relatively few counties receive grants for projects within their boundaries. Indeed, only a small share of counties nationwide received funding from any of the competitive programs we studied.

TABLE 3

Competitive Grants Distribute Considerable Funds to a Small Number of Counties Nationwide

The 10 largest competitive grant programs in our database, ordered by overall program size

Program	Granting agency	Annual funding	Average per capita grants among funded counties	Share of counties receiving grants[a]
Capital Investment Grants (transit)	DOT	$3.7 b	$103	1%
RAISE	DOT	$2.2 b	$257	7%
Bridge Investment Program	DOT	$2.1 b	$306	1%
Rural Development Broadband ReConnect Program	USDA	$1.6 b	$751	8%
INFRA	DOT	$1.5 b	$669	1%
Low or No Emission Vehicle Program	DOT	$1.1 b	$32	5%
Civil Nuclear Credit Program	DOE	$1.1 b	$3,900	0%[b]
Tribal Broadband Connectivity Program	DOC	$1.0 b	$668	3%
Airport Terminal Program	DOT	$968 m	$39	3%
Clean School Bus Program	EPA	$933 m	$63	11%

Source: The authors, based on an analysis of fiscal year 2022 federal grants and 2016–2020 American Community Survey data.
Note: RAISE = Rebuilding American Infrastructure with Sustainability and Equity; INFRA = Nationally Significant Multimodal Freight and Highway Projects; DOT = Department of Transportation; USDA = Department of Agriculture; DOE = Department of Energy; DOC = Department of Commerce; EPA = Environmental Protection Agency.
[a] We include all grants received by entities within each county, so this includes not only the county government itself but also municipalities, public agencies, and private entities.
[b] Only one project was funded under this program so far.

The fact that the majority of counties did not receive funding from the competitive grants that we study does not, in and of itself, reflect poorly on federal decisionmakers. It is worth emphasizing that, compared to the large formula grants (table 2), most of the competitively awarded grants are just much smaller in terms of overall funding allocations. As a result, if the federal government were to distribute funds evenly among all 3,221 counties in the US, the amount of money each would receive would be much too small to fund anything of substance. Consider the transit capital grants program, which funds large public transportation projects that can cost hundreds of millions or billions of dollars to complete. Were that program's annual funds distributed evenly to all counties, the federal government would be able to provide barely more than $1 million per county—far less than needed to contribute substantially

to the costs of a new transit line. Thus, understanding *which* counties benefit from the limited funds available is key to examining the equity of competitive programs.

The Equity of Funding Distribution Varies Substantially by Program

The variations in per capita funding by county and state documented above raise the first key question that motivates our research: Is federal investment in transportation, housing, energy, water, and broadband infrastructure concentrated in counties and states with a greater share of residents who are people of color, with a higher proportion of households with low incomes, or with greater needs that can be addressed through infrastructure funding? In this section, we explore the degree to which programmatic funds are being distributed in terms of racial, social-economic, and need-related variables. We organize our findings by program area, beginning with transportation programs, then exploring housing programs before concluding with a discussion of other infrastructure such as broadband and water programs. We examine both formula and competitive programs but divide our analysis between the two to reflect differences in the ways their funding is allocated.

Before describing our findings in more detail, we want to emphasize that there are multiple reasonable interpretations of our results. Consider a hypothetical program that funds highway infrastructure projects and that provides a disproportionate share of funds to communities with a high share of people of color. On the one hand, this could be a positive sign in terms of racial equity: It could mean more investment in road improvements in communities that have suffered from historic disinvestment. On the other hand, it could mean that the people living in those communities—who have suffered from disproportionate exposure to air and noise pollution—will be exposed to even more of that pollution in the coming years because of new projects if the residents most directly impacted are not part of the decisionmaking process for infrastructure projects. We invite readers to interpret our findings in a nuanced way, then, and encourage them to read the table of project-related externalities in appendix B to learn more about the potential positive and negative implications of infrastructure investments in communities.

Federal Transportation Formula Programs Benefit States with Few People of Color

We have documented above that, from a per capita funding perspective, large formula programs for highway programs are weighted toward low-population states with large land areas—particularly

Alaska and those in the upper plains portion of the United States. Because of the distribution of the country's demographics, this weight has racial equity impacts. States with the highest share of people of color—including Hawai'i, Maryland, Georgia, Mississippi, and California, in that order—receive relatively few per capita funds from these programs. (It is worth noting that Alaska, Montana, and South Dakota, which receive large funding, have some of the US's largest Native American populations.)

To further explore the equity of the distribution of transportation programs distributed by formula, we analyze the programs' concentration and high-need equity measures as described in our methods section. Table 4 lists the state-level concentration and high-need equity measures in terms of share of people of color and median household income for 10 major formula transportation programs.

The concentration measures—which measure the amount of program funding flowing into the highest-indicator states with approximately 25 percent of the population—show that, in general, many formula transportation programs are distributing a disproportionately low level of funds to states with high shares of people of color. Negative scores on this measure indicate that this group of high-indicator states is receiving less than 25 percent of the national funding for that program. This bias toward funding states with a higher white population share is particularly clear for the Bridge Formula Program. Only CMAQ; Metropolitan, Statewide, and Non-Metropolitan Planning; and Urbanized Area transit grants distribute more than 25 percent of funding to the states with the highest shares of people of color. CMAQ, for example, distributes about 33 percent of funding to the 25 percent of states, by population, with the highest share of people of color. This may result from the fact that, nationwide, people of color are more likely to live in urban areas, where public transportation and air quality issues are more relevant to quality of life; the transit and CMAQ funding formulas reflect those two issues, respectively.

The concentration measures for median household incomes show that for about half of programs, states with the lowest median incomes are receiving at or slightly above their proportional share of program funding. The other half of programs are distributing disproportionately low amounts of funding to the lowest-income states where 25 percent of the national population lives. Here, the Urbanized Area transit funding program and CMAQ perform particularly poorly; they allocate only about half as much per capita funding to those states as you might expect, were funding to be evenly distributed. This is likely a result of the fact that the US's most rural states, where transit and congestion alleviation are less needed, also have disproportionately lower household incomes.

TABLE 4

Many Major Formula Transportation Programs Underfund States in Terms of Their Share of People of Color and Median Household Income

State-level equity measures for major federal transportation formula programs

	Higher Share of People of Color		Lower Median Household Income	
Program	Concentration	High-need equity	Concentration	High-need equity
Bridge Formula Program	−0.2	−0.4	−0.2	−0.4
Bus and Bus Facilities Formula Grants	0.0	−0.4	−0.2	−0.5
CMAQ	0.3	−0.2	−0.5	−0.5
Highway Safety Improvement Program	−0.1	−0.4	0.1	−0.1
Metropolitan, Statewide, and Non-Metropolitan Planning	0.1	−0.2	−0.2	−0.4
National Highway Freight Program	−0.1	−0.4	0.0	−0.2
NHPP	−0.1	−0.4	0.1	−0.2
PROTECT	−0.1	−0.4	0.1	−0.2
STBG	−0.1	−0.4	0.1	−0.2
Urbanized Area transit grants	0.1	−0.2	−0.5	−0.4

Source: The authors, based on an analysis of fiscal year 2022 federal grants and 2016–2020 American Community Survey data.
Note: CMAQ = Congestion Mitigation and Air Quality Improvement Program; NHPP = National Highway Performance Program; PROTECT = Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation; STBG = Surface Transportation Block Grant Program. Concentration measures fall between −1 and +3, with a score of 0 meaning the highest-indicator counties that comprise approximately 25 percent of the population receive approximately 25 percent of program funds. High-need equity measures fall between −1 and +1, with 0 meaning the median high-indicator county is receiving funding on par with the distribution of the indicator.

The high-need equity measures also presented in table 4 add more detail to this story. We find that even the federal transportation formula programs that distribute the most money to states with high shares of people of color do not do so in a way that progressively increases that funding to reflect greater possible needs in those areas. The high-need equity measure shows how close funding is to meeting the existing need of the median high-need jurisdiction (i.e., the jurisdictions above the 50th percentile of a given indicator), as indicated by the distribution of a specific demographic characteristic (here, share of people of color and median household income). Every program—for both share of people of color and median household income—has a negative high-need equity measure score. This means that even where programs are distributing higher-than-proportional funding to the highest-indicator states, they are not funding the median high-need state at the level that its relative indicator value might suggest. A high-need equity score of −0.3, for example, might translate into meaning that the median high-need county is at the 60th percentile of the national distribution in terms of share of

people of color but receives funding at only the 30th percentile of the country (rather than at the 60th percentile, which would result in a high-need equity score of 0).

It is important to note that the nature of the high-need equity measure means the vast majority of programs will not achieve positive scores. This does not necessarily mean those programs are failing in terms of achieving their equity goals. Each indicator is one measure against which to compare funding distributions. We can instead use the high-need equity score's distance from zero as a proxy for how close some of these programs may be to matching their funding distributions to the distributions of certain key indicators. For example, CMAQ; the Metropolitan, Statewide, and Non-Metropolitan Planning program; and the Urbanized Area transit grant program, with high-need equity scores of −0.2 for funding to areas in terms of their share people of color, are much closer to meeting the distribution of states' racial and ethnic demographics than the other major formula transportation programs.

To further contextualize the measures described above, we can take a closer look at how specific transportation program funding is distributed in relation to demographic characteristics. In figure 5, we show that, on average, the states with the lowest shares of people of color receive higher per capita funding from STBG. Montana, for example, has a population that is more than 85 percent non-Hispanic white, and it received $138 in per capita funding in STBG support—compared with an average of $42 for the country as a whole. On the other hand, California, with a 36.5 percent white, non-Hispanic population, received just $30 in per capita STBG funds. These trends are similar for the other major formula highway programs, whose funding is distributed in a similar manner.

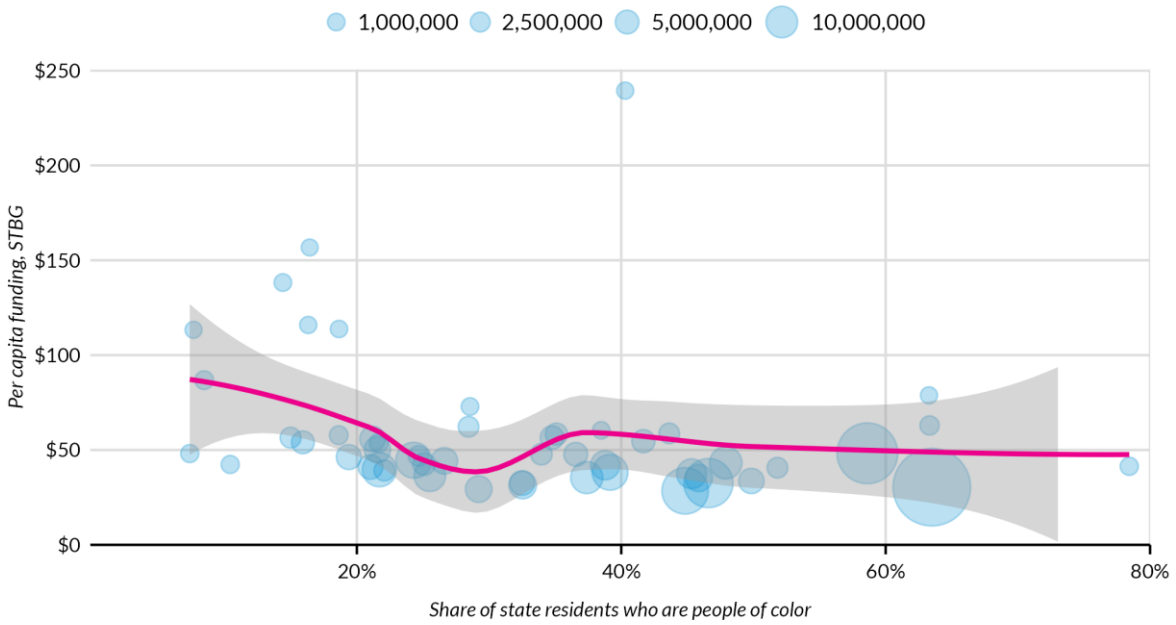
On the national scale, federal highway funds are allocated away from states with more people of color. On average, the 10 states with Black population shares of less than 2 percent (mostly Western and rural New England states) receive $74 in per capita STBG funding—compared with just $48 per capita for the states with populations that are more than 16 percent Black (mostly Southeastern states). This difference is even more acute when comparing states by Hispanic populations; the 10 states with the highest Hispanic populations receive $39 per capita—compared to $81 for the 10 states with the lowest Hispanic populations.

Formula funding through NHPP, the largest formula program that we studied, is allocated in a similarly inequitable manner. The five states with the highest shares of people of color (Hawai'i, California, New Mexico, Texas, and Nevada) received an average of $91 in per capita funding from NHPP, compared to an average of $165 in per capita funding for those with the highest shares of white residents (Maine, West Virginia, Vermont, New Hampshire, and North Dakota).

FIGURE 5

Large Federal Transportation Formula Grants Are Weighted toward States with Few People of Color

Share of state residents who are people of color versus per capita STBG funding, scaled by state population size



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Source: The authors, based on an analysis of fiscal year 2022 federal grants and 2016–2020 American Community Survey data.
Note: Line is a best-fit LOESS curve. STBG = Surface Transportation Block Grant Program

There is no such inverse relationship between a jurisdiction's share people of color and its funding for the formula-based Urbanized Area transit program—the largest federal support program for public transportation in the country. We find no relationship between local racial demographics and funding. Counties with high shares of people of color receive similar amounts of funds per capita than those with residents who are almost all white. That said, counties in *metropolitan areas* with the highest share of residents of color receive substantially more federal transit formula dollars than those with the lowest shares of those residents. This difference in outcomes likely results from the fact that the funds from this program are not distributed significantly to nonmetropolitan counties (of which there are many).

Interestingly, transit formula funds *do* increase with county median income, on average (figure 6). The 85 large counties in metropolitan areas with median household incomes of less than $60,000 average $15 per capita funding in federal transit formula funds. This compares to $56 in the 48 large metropolitan counties with median household incomes of greater than $90,000. This result raises some major concerns about the formula used to distribute transit funding: By prioritizing population density,

existing transit service, and existing transit ridership, the formula appears to be providing funding preferences to counties with higher incomes.

FIGURE 6

Transit Formula Funds Are Generally Higher in Counties with Higher Resident Incomes

Median county household income versus per capita urbanized area transit funding, scaled by county population size

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Source: The authors, based on an analysis of fiscal year 2022 federal grants and 2016–2020 American Community Survey data.
Note: Represents funds from Federal Transit Administration (FTA) 5307 and 5340 programs (Urbanized Area formula grants). Figure illustrates just counties with more than 250,000 residents, located in metropolitan areas. Line is a best-fit LOESS curve.

Federal Competitive Transportation Fund Distribution Is Weighted toward Counties with Higher Shares of People of Color

We next study the trends related to what types of counties win competitive transportation grant awards. We begin by conducting a series of t-tests to assess the statistical differences in means between counties that receive such grants and those that do not. This analysis allows us to assess whether officials at US DOT are specifically choosing projects from communities with distinctive demographic traits. Here, we conduct two types of analyses: In some cases, we examine only counties that have a minimum of 100,000 residents and are located in metropolitan areas (78 percent of the

American population resides in such counties) because a majority of competitive grant funds are distributed to such counties. When possible, we also examine awards outside of metropolitan areas, which are more likely to be rural in character.

We find that competitive funding allocations are largely weighted toward counties with a higher share of residents who are people of color. In table 5, we examine these comparisons across eight competitive programs. For all eight programs, we find that the median funded metropolitan-area county has a population with a higher share of people of color than the median unfunded metropolitan-area county. We find that this difference is statistically significant across six of those programs. For example, the average county that received a RAISE grant has a population that is roughly 37 percent people of color—versus just 29 percent for those counties that did not receive such a grant. DOT's funding strategy, then, appears to be having clear effects in terms of focusing on counties where more people of color live (we reaffirmed these findings in a multivariate regression analysis, not shown). Similarly, the roughly 25 percent of the national population living in counties with the highest shares of people of color receive more than 60 percent of funds from the All Stations Accessibility Program (ASAP), which funds accessibility improvements for transit stations. We found that having a higher share of people of color living in a county was statistically significantly associated with a higher likelihood of that county's winning most federal competitive transportation grants, even after controlling for local population density, household incomes, and several measures of programmatic need.

TABLE 5

Federal Competitive Funds for Transportation Are Funding Counties with Disproportionately High Shares of People of Color, on Average

Demographic differences between metropolitan-area counties that received funding and those that did not

Competitive program	Median Share of People of Color			Median Household Income		
	Funded counties	Unfunded counties	Significant difference?	Funded counties	Unfunded counties	Significant difference?
RAISE	36.9%	28.6%	***	$62,373	$64,045	—
ASAP	41.8%	29.4%	*	$76,238	$63,110	*
Transit Capital Investment Grants	47.5%	28.8%	***	$74,842	$62,873	**
INFRA	52.1%	29.3%	***	$59,963	$63,690	—
Bridge Investment Program	39.0%	29.5%	—	$71,517	$63,063	—
Bus Facilities	37.8%	29.4%	—	$71,425	$63,046	—
Low or No Emission Vehicle Program	34.3%	28.8%	***	$66,541	$63,046	*
Reconnecting Communities Pilot Program	45.7%	29.0%	***	$62,166	$63,918	—

Source: The authors, based on an analysis of fiscal year 2022 federal grants and 2016–2020 American Community Survey data.
Note: RAISE = Rebuilding American Infrastructure with Sustainability and Equity; ASAP = All Stations Accessibility Program; INFRA = Nationally Significant Multimodal Freight and Highway Projects. Only includes counties located in metropolitan areas and with populations of more than 100,000 residents. Differences in capacity between funded and unfunded counties is statistically significant at the level of *** $p < 0.001$; ** $p < 0.01$; * $p < 0.5$.

We make similar findings when we evaluate differences in the racial and ethnic composition of funded versus unfunded counties *outside* of metropolitan areas. Among the 81 nonmetropolitan counties funded with RAISE grants, the median county was 23 percent people of color, compared with 13 percent people of color for the 1,901 counties that did not receive grants. This difference is statistically significant.

In terms of the median household incomes of funded versus unfunded counties, the story is less clear. We find that funded metropolitan counties have statistically significantly *higher* median household incomes for three of the programs (ASAP, transit Capital Investment grants, and Low or No Emission Vehicle Program grants). For example, the typical metropolitan county funded by the Capital Investment Grants program, which funds new transit lines, had a median income of almost $75,000—compared to $63,000 for unfunded counties in metropolitan areas. Each of these programs is oriented toward transit projects, and it is possible that counties with more significant transit infrastructure have higher incomes, which may explain this differential. But we also find that *non*metropolitan counties funded with RAISE grants have significantly higher median incomes than unfunded ones (not shown).

We suspect that the fact that funded counties have higher median incomes than unfunded ones may reflect local capacity; it may be that higher-income counties are more capable of applying for grants—and creating effective applications. This could reflect differences in local bureaucratic capacity, which we describe in a section that follows.

To further explore the equity of the distribution of competitive transportation dollars, we again analyze the programs' concentration and high-need equity measures, including counties in both metropolitan and nonmetropolitan areas. Table 6 lists these measures in terms of share of people of color and median household income for 10 major competitive transportation programs. The concentration measures—which measure the amount of program funding flowing into high-indicator counties with approximately 25 percent of the population—show that, in general, many competitive transportation programs are distributing a disproportionately high level of funds to counties with high shares of people of color. This may mean that these programs are succeeding in the federal goal of addressing historic racial inequities.

ASAP, for example, has distributed approximately 62.5 percent of all funds to counties that have the highest share of people of color and that contain 25 percent of the population (leading to a concentration measure score of 1.5). Federal officials involved in selecting projects have targeted areas with more people of color living in them. The Bridge Investment Program, Reconnecting Communities Pilot Program, and Rural Surface Transportation Grant Program are the only programs we analyze here that have distributed less than 25 percent of funding to the counties with the highest shares of people of color.

The concentration measures for median household income, on the other hand, again tell a somewhat different story. Most competitive transportation programs have a negative score, meaning disproportionately little funding is flowing into counties with the lowest median incomes. The Bridge Investment Program and Capital Investment program, in particular, see *zero* funding targeted to the lowest-median-income counties containing 25 percent of the US population. That said, the RAISE and Nationally Significant Freight and Highway Projects programs do provide higher-than-proportional amounts of funding flowing into these communities; about 30 percent of RAISE program funds are distributed to the counties with the lowest incomes containing 25 percent of the national population.

TABLE 6

Competitive Transportation Programs Are Overfunding Counties with High Shares of People of Color, Underfunding Counties with Low Median Household Incomes

County-level equity measures for major federal transportation competitive programs

	Higher Share of People of Color		Lower Median Household Income	
Program	Concentration	High-need equity	Concentration	High-need equity
ASAP	1.5	−0.2	−0.1	−0.4
Bridge Investment Program	−0.7	−0.3	−1.0	−0.1
Capital Investment Grants	0.5	−0.3	−1.0	−0.4
INFRA	0.0	−0.5	0.5	−0.1
Low or No Emission Vehicle Program	0.4	−0.4	−0.4	−0.2
Port Infrastructure Development Grants	0.1	−0.3	0.0	−0.1
RAISE Grant Program	0.0	−0.3	0.2	−0.1
Reconnecting Communities Pilot Program	−0.1	−0.3	−0.8	−0.2
Rural Surface Transportation Grants	−0.1	−0.4	−0.1	−0.4
Safe Streets and Roads for All	0.2	−0.2	−0.2	−0.2

Source: The authors, based on an analysis of fiscal year 2022 federal grants and 2016–2020 American Community Survey data.
Note: ASAP = All Stations Accessibility Program; INFRA = Nationally Significant Multimodal Freight and Highway Projects; RAISE = Rebuilding American Infrastructure with Sustainability and Equity. Concentration measures fall between −1 and +3, with a score of 0 meaning the highest-indicator counties that comprise approximately 25 percent of the population receive approximately 25 percent of program funds. High-need equity measures fall between −1 and +1, with 0 meaning the median high-indicator county is receiving funding on par with the distribution of the indicator. The high-need equity indicators in this table are computed only for counties that received funding.

Exploring the high-need equity measures in table 6 takes this analysis a step further. For both share of people of color and median household income, all programs have negative high-need equity measures. This means that while some programs are distributing higher-than-proportional funds to counties with high-indicator values (i.e., the programs have positive concentration measure scores), they are still not funding the median high-need county at the higher rate that the indicator might suggest. For example, a score of 0 would mean that a county at the 70th percentile in terms of people of color would receive program funding at the 70th percentile as well. That is not occurring for any of the programs we study here.

As with the formula transportation programs, a negative high-need equity measure does not necessarily mean those programs are failing in terms of their equity goals. Each indicator is one possible measure against which to compare funding distributions. By examining the high-need equity measure's distance from zero, we can get a sense of how close some of these programs may be to matching their funding distributions to the distributions of certain key indicators. Here, we can see that the Nationally

Significant Freight and Highway Projects program and the Rural Surface Transportation Grant Program have lower high-need equity metrics than the other competitive transportation programs in terms of share of people of color (−0.5 and −0.4, respectively), meaning those programs' funding distributions are farther from matching the county-level distribution of people of color throughout the country. For median household income, the Bridge Investment Program, Nationally Significant Freight and Highway Projects program, RAISE, and Port Infrastructure program (scores of −0.1) are closer to funding counties in a way that matches the distribution of median household income than are the other programs listed.

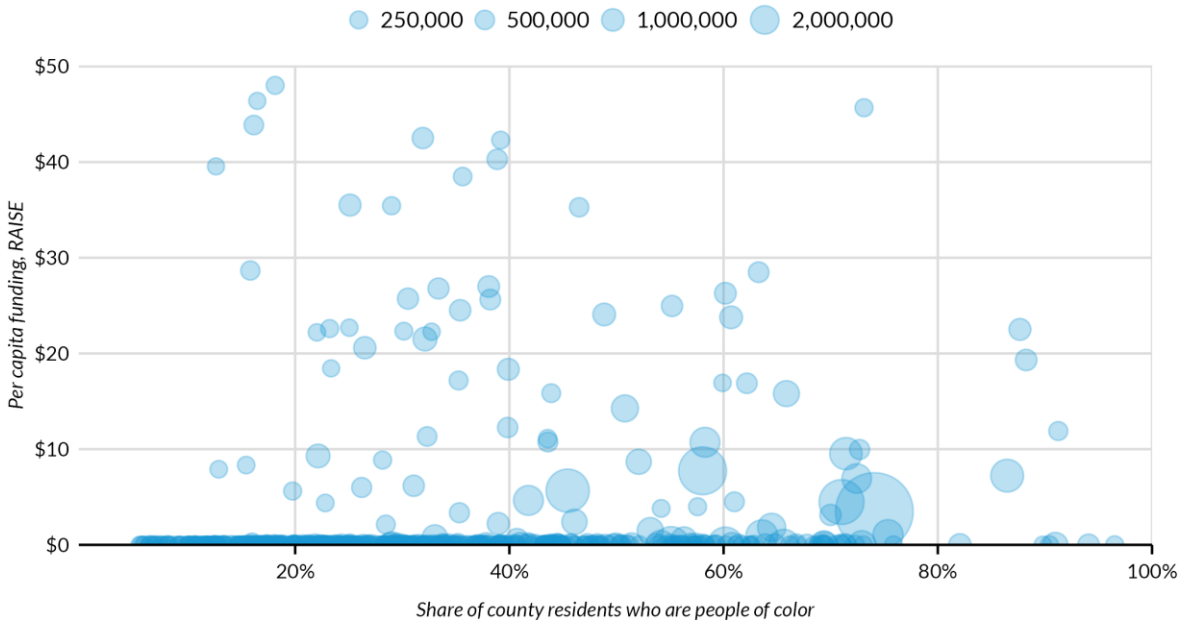
The high-need equity measures shown in table 6 were computed *only* using counties that actually received funding. We do not illustrate our findings from our computations across all counties, whether or not they received funding, which can reflect the demographics (and potential need) of counties receiving zero funding. Where adding in all counties makes the scores more negative, counties receiving zero funding are relatively higher in need, according to these indicators. For all the competitive transportation programs shown here, the high-need equity indicators for all counties are significantly more negative (between −0.8 and −0.7) in terms of both share of people of color and household income measures, meaning that counties receiving no funding have high shares of people of color and low household incomes.

The results we present above suggest a diversity of potential stories at play in the distribution of federal grants. We can visualize these trends by comparing metropolitan county share of people of color with the amount of funding distributed in grants from the RAISE program (figure 7). Here, several trends are apparent. First, the majority of counties across the spectrum in terms of racial demographics did not win any RAISE grants. This is reflective of the limited amount of funding availability for this program. But this figure also makes clear two additional findings. First, the 10 percent of large metropolitan counties with the highest share people of color received less per capita RAISE funding *on average* than the 10 percent with the lowest share. Second, those high–people of color counties were much more likely to receive a RAISE grant (36.5 percent of them did) than were low–people of color counties (just 9.2 percent of them did). This helps explain some of the negative high-need equity measures that we document for the RAISE program in table 6.

FIGURE 7

Among Metropolitan Counties That Received RAISE Grants, Those with Smaller Shares of Residents of Color Received More Funding Per Capita, on Average

Share of county residents who are people of color versus per capita urbanized area RAISE funding, scaled by county population size



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Source: The authors, based on an analysis of fiscal year 2022 federal grants and 2016–2020 American Community Survey data.
Note: Figure illustrates just counties with more than 100,000 residents, located in metropolitan areas. RAISE = Rebuilding American Infrastructure with Sustainability and Equity.

Unlike some health care or education program spending, infrastructure investments generally respond to tangible issues related to the built environment. Applications for competitive programs demonstrate this sort of need by highlighting states of disrepair and opportunities for improving present and historical conditions, such as rebuilding a washed-out bridge or increasing bus stop accessibility. The formulas developed by Congress or federal agencies weigh some federal data in their funding decisions; for example, the Bridge Formula Program directs funds to state bridges based on their condition classification in the National Bridge Inventory.

To address the idea that a specific program should address programmatic considerations in its distribution of funds, we looked directly at how programs were funding jurisdictions with various program-related "needs." We created a series of need indicators relative to each of the individual programs to help us assess the relationships between program funding dynamics and local

characteristics reflective of need for investment. We then used them to construct the same concentration and high-need equity measures described above.

We first examine a subset of seven major competitive transportation programs against three mobility indicators at the county level: share of the population that commutes by transit, walking, or bike (what we call green commutes); number of public transit stops per capita; and household transportation costs as a share of income. Table 7 shows the concentration and high-need equity measures for these programs and indicators. In terms of concentration, these programs distribute disproportionately high levels of funding to the counties that make up 25 percent of the population with the higher share of green commuters and number of transit stops. ASAP, for example, sent nearly 100 percent of its funding to the counties with the highest shares of green commuters. This makes sense, given that the areas that already have high levels of transit commuters likely have the highest numbers of stations or stops in need of renovations to increase accessibility. These programs' funding distributions, however, are not as well-aligned with transportation costs; ASAP and the Capital Investment grants program both distribute zero dollars to the counties with highest transportation costs as a share of household income.

TABLE 7

Competitive Transportation Programs Target Areas with More Public Transit Stops and Higher Shares of Commuters Using Green Transportation—But Not Areas with Higher Transportation Costs

County-level need equity measures for major federal competitive transportation programs

	Higher Share of Population Commuting by Transit, Walk, or Bike		More Transit Stops Per Capita		Higher Household Transportation Costs	
Program	Concentration	High-need equity	Concentration	High-need equity	Concentration	High-need equity
ASAP	2.8	−0.4	1.1	−0.3	−1.0	NA
Bus and Bus Facilities Competitive Grant	0.5	−0.2	0.9	−0.3	−0.6	−0.1
Capital Investment Grants	1.7	−0.4	1.4	−0.3	−1.0	NA
Low or No Emission Vehicle Program	0.9	−0.3	0.4	−0.3	−0.6	−0.1
RAISE Grant Program	0.2	−0.3	0.5	−0.4	0.1	−0.1
Reconnecting Communities Pilot Program	0.4	−0.4	1.7	−0.3	—	—

Source: The authors, based on an analysis of fiscal year 2022 federal grants, 2016–2020 American Community Survey data, the Center for Neighborhood Technology's Housing and Transportation Affordability Index, and US Department of Transportation and Bureau of Transportation Statistics National Transportation Atlas Database.
Note: ASAP = All Stations Accessibility Program; RAISE = Rebuilding American Infrastructure with Sustainability and Equity; NA = no funding went to the counties above the 50th percentile of need on this metric. Dashes indicate that scores were not computed for this program/indicator combination.

The high-need equity scores presented in in table 7 show that though many of these programs are distributing disproportionately high levels of funding to higher-need counties, they are still not funding the median high-need county at a level that matches need in terms of these transportation-related indicators. While each indicator is just one possible measure against which to compare funding distributions, we can use the measures here to examine whether the funding is addressing specific transportation needs adequately given limited funding. For example, the programs' funding distributions appear to be less aligned, generally, with the distribution of the share of green commuters (i.e., they have lower high-need equity scores), than with the share of transit stops (which have high-need equity scores that are closer to 0). While ASAP and transit Capital Investment grants distribute no funding to the counties with the highest household transportation cost burdens, the Bus and Bus

Facilities, Low or No Emission Vehicle, and RAISE programs are generally pretty close to distributing funding in a way that matches this need.

By comparing these findings with the analysis of formula programs above, we can begin to see differences in how funding is distributed in formula and competitive programs with similar programmatic aims. The competitive ASAP and Bus and Bus Facilities grants, for example, distribute no funds to counties with transit commuting share in the bottom 10 percent of large metropolitan counties (less than 0.2 percent of commuters). But the formula Urbanized Area transit grants are distributed a bit more evenly in terms of matching programmatic needed. Those low-transit-share counties still receive $11 per capita in such grants, compared to $33 per capita for the 10 percent of such counties with the largest transit commuting share (more than 5.5 percent of commuters). This is an important difference: The federal government seems to be focusing its competitive resources on the areas with the highest needs in terms of transit use (or at least those counties are more likely to apply for funding), while some formula transportation programs continue to provide funding to counties with a mix of transit use needs—including the counties with the least transit use.

Competitive Transportation Programs Fund Projects Disproportionately in Census Tracts with More People of Color

We conducted a tract-level analysis to explore the degree to which projects selected for funding by US DOT are located in neighborhoods that—compared with their surroundings—are disproportionately inhabited by people of color, have higher poverty rates, and have lower household incomes. This is different from the above analysis because it considers the conditions of the areas impacted by specific projects, not the counties or states selected for funding overall. We find that lower local incomes are particularly strongly associated with project funding across all of the project types we examined. The average tract where a competitively funded road expansion project was located, for example, had statistically significantly lower annual median incomes—up to $6,000 lower—than similar tracts elsewhere in the same county. These findings are robust to the alternative specifications made possible through the use of three comparison groups and appear both when examining differences in means and in multivariate regressions. These results indicate that DOT's choices about what to fund through competitive grants have been oriented toward projects in communities that face historical problems of disinvestment.

Table 8 details characteristics of the projects evaluated, the number of counties where projects were funded, and the number of tracts within those counties with a treatment (meaning a funded

project is located in the tract). We then show the mean population density, share of people of color, poverty rate, and household income for these treated tracts nationwide. In this table, we do not control these figures for other local characteristics, which we do below.

TABLE 8

Characteristics of Projects Evaluated and Treated Tracts

					County Mean			
Project type	Projects	Counties with projects	Treated tracts	Total tracts in counties with projects	Pop. density	Share people of color	Poverty rate	Median household income
RAISE[a]	163	159	1,510	21,515	2,639	48.3%	20.6%	$52,041
ASAP	148	171	943	17,940	8,254	58.7%	22.4%	$54,418
Bus and Bus Facilities	40	44	210	4,657	7,918	58.4%	21.7%	$54,455
Low or No Emission Vehicle Program	169	159	1,392	20,594	5,425	52.0%	22.0%	$51,571
Reconnecting Communities Pilot Program	121	135	2,871	22,873	14,632	55.9%	17.8%	$70,696

Source: The authors, based on an analysis of fiscal year 2022 federal grants and 2016–20 American Community Survey data.
Note: RAISE = Rebuilding American Infrastructure with Sustainability and Equity; ASAP = All Stations Accessibility Program.
[a] Capital projects.

In table 9, we compare tracts in the buffer area of funded pedestrian or bicycling projects with comparison tracts in the same county. The table shows that, depending on the method, treated tracts have a 0.9 to 9.3 percentage point higher share of residents of color, a 1.9 to 6.0 percentage point higher poverty rate, and annual median household incomes that are $5,500 to $13,400 lower, compared to comparable tracts elsewhere. Each of these results is statistically significant in the expected direction in the relevant regression. We find no clear relationships between local population densities and whether a tract had a funded project.

TABLE 9

Pedestrian and Bike Projects Are More Likely to Be Located in Tracts with Higher Shares of People of Color and Higher Poverty Rates

Differences between treated and comparison tracts

	Test	Population density	Percentage of people of color	Poverty rate	Median household income
Comparison A ***(same county)***	Difference in means	259 [163]	9.3% [6.3%]	6% [4.8%]	−13,404 [−13,850]
	Regression	+ ***	+ ***	+ ***	− ***
Comparison B ***(neighboring)***	Difference in means	−284 [−32]	4.4% [2.8%]	2.8% [1.9%]	−5,485 [−5,801]
	Regression	+ **	+ ***	+ ***	− ***
Comparison C ***(similar densities)***	Difference in means	105 [9]	3.3% [0.9%]	3.5% [2.9%]	−7,807 [−5,587]
	Regression	− ***	+ **	+ ***	− ***

Source: The authors, based on an analysis of fiscal year 2022 federal grants and 2016–2020 American Community Survey data.
Note: Median differences are shown in brackets. Table can be read as follows: The average tract with a pedestrian or bicycle project had a population density that was 259 people per square mile higher than the average tract in a comparison group of tracts in the same county. A multivariate regression that controlled for several local characteristics and that included fixed effects for counties where projects were funded showed this difference to be statistically significant in the positive direction. *** $p < 0.001$; ** $p < 0.01$.

In table 10, we demonstrate very similar outcomes for RAISE projects. RAISE grants are allocated to tracts with up to 9 percentage points higher shares of people of color, and up to 5 percent higher poverty rates, than comparable tracts elsewhere in each funded county. This is perhaps unsurprising; many RAISE projects fund pedestrian or cycling improvements; even so, these data again reaffirm that funded projects are located in disproportionately nonwhite and low-income communities. That said, these data also show that RAISE projects are more likely to be in tracts with lower population densities.

TABLE 10

Rebuilding American Infrastructure with Sustainability and Equity (RAISE) Projects May Be More Likely to Be Located in Lower-Density Tracts

Differences between treated and comparison tracts

	Test	Population density	Percentage of people of color	Poverty rate	Median household income
Comparison A ***(same county)***	Difference in means	−741 [13]	9.4% [8.7%]	5.4% [4.8%]	−10,984 [−11,236]
	Regression	+ ***	+ ***	+ ***	− ***
Comparison B ***(neighboring)***	Difference in means	−1174 [−23]	4.8% [3.2%]	2.6% [2.3%]	−6,037 [−7,395]
	Regression	− NA	+ *	+ ***	− ***
Comparison C ***(similar densities)***	Difference in means	72 [6]	3.8% [1.5%]	3.6% [2.7%]	−8,248 [−6,776]
	Regression	− ***	+ NA	+ ***	− ***

Source: The authors, based on an analysis of fiscal year 2022 federal grants and 2016–2020 American Community Survey data.
Note: Median differences are shown in brackets. Table can be read as follows: The average tract with a RAISE project had a population density that was 741 people per square mile lower than the average tract in a comparison group of tracts in the same county. A multivariate regression that controlled for several local characteristics and that included fixed effects for counties where projects were funded showed this difference to be statistically significant in the positive direction. *** $p < 0.001$; * $p < 0.05$. NA = no statistical significance.

We show similar trends, again, when it comes to road capacity expansion projects (table 11). Even so, here, regressions for all but median household income demonstrate less likelihood of statistical significance. But we do find repeated evidence that tracts where such projects are funded have households with lower incomes than those tracts where they are not. This should raise some major concerns since highway expansion is likely to produce increased levels of particulate pollution that could negatively affect the health of populations that are already more likely to suffer from higher rates from disease.

TABLE 11

Road Capacity Projects Are Disproportionately Constructed in Tracts with Lower Incomes

Differences between treated and comparison tracts

	Test	Population density	Percentage of people of color	Poverty rate	Median household income
Comparison A ***(same county)***	Difference in means	−607 [−91]	6.7% [5.7%]	2.8% [1.2%]	−6,303 [−9,069]
	Regression	− NA	+ **	+ ***	− ***
Comparison B ***(neighboring)***	Difference in means	−417 [−80]	2.7% [1.8%]	0.5% [1.7%]	−4,372 [−5,019]
	Regression	− NA	+ NA	+ NA	− **
Comparison C ***(similar densities)***	Difference in means	9 [−1]	6.2% [3.4%]	2.5% [0.5%]	−4,993 [−572]
	Regression	− ***	+ NA	+ NA	− ***

Source: The authors, based on an analysis of fiscal year 2022 federal grants and 2016–2020 American Community Survey data.
Note: Median differences are shown in brackets. Table can be read as follows: The average tract with a Rebuilding American Infrastructure with Sustainability and Equity project had a population density that was 607 people per square mile lower than the average tract in a comparison group of tracts in the same county. A multivariate regression that controlled for several local characteristics and that included fixed effects for counties where projects were funded showed this difference was not statistically significant, but it was in the negative direction. *** $p < 0.001$; ** $p < 0.01$. NA = no statistical significance.

But if highway expansion projects are more likely to be located in low-income tracts, so are projects intended to improve road design (table 12). These sometimes reduce the amount of car travel by replacing travel lanes with improved sidewalks or bus lanes or by installing traffic calming improvements such as crosswalks.

TABLE 12

Road Design Projects Benefit Tracts with Higher Shares of People of Color

Differences between treated and comparison tracts

	Test	Population density	Percentage of people of color	Poverty rate	Median household income
Comparison A ***(same county)***	Difference in means	−511 [−14]	10.3% [6.2%]	5.9% [4.8%]	−12,905 [−13,162]
	Regression	+ ***	+ ***	+ ***	− ***
Comparison B ***(neighboring)***	Difference in means	−866 [−142]	5.7% [3.5%]	3.5% [2%]	−6,921 [−6,544]
	Regression	+ NA	+ ***	+ **	− ***
Comparison C ***(similar densities)***	Difference in means	98 [0]	4.2% [1.3%]	3.5% [2.6%]	−7,466 [−3,921]
	Regression	− ***	+ ***	+ **	− ***

Source: The authors, based on an analysis of fiscal year 2022 federal grants and 2016–2020 American Community Survey data.
Note: Median differences are shown in brackets. Table can be read as follows: The average tract with a road design project had a population density that was 511 people per square mile lower than the average tract in a comparison group of tracts in the same county. A multivariate regression that controlled for several local characteristics and that included fixed effects for counties where projects were funded showed this difference to be statistically significant in the positive direction. *** $p < 0.001$; ** $p < 0.01$. NA = no statistical significance.

Finally, we compare treated and comparison tracts for transit projects (table 13). Here, we make similar findings as above, with the exception of results related to the share of people of color by tract. In fact, our regressions suggest that neighborhoods with higher shares of non-Hispanic white residents may be more likely to have transit projects. This result, however, is statistically insignificant for two of our comparisons and is in the opposite direction of the comparison of means. It may also be a reflection of the larger buffer area we assigned to transit projects, which could bias results toward tracts further from the investments. Future research could clarify the usefulness of different size buffers in conducting this analysis. In addition, it is possible that these results reflect patterns of racial segregation that differ between metropolitan areas; a transit project could serve both tracts with high shares of white residents and tracts with very few white residents.

TABLE 13

Transit Projects Are More Often Located in Tracts with High Poverty Rates

Differences between treated and comparison tracts

	Test	Population density	Percentage of people of color	Poverty rate	Median household income
Comparison A ***(same county)***	Difference in means	1,033 [580]	6.1% [4.6%]	4.9% [3.6%]	−10,083 [−12,103]
	Regression	+ ***	− NA	+ ***	− ***
Comparison B ***(neighboring)***	Difference in means	546 [254]	3.1% [2%]	3.6% [2.3%]	−7,623 [−6,747]
	Regression	+ ***	− NA	+ ***	− ***
Comparison C ***(similar densities)***	Difference in means	221 [68]	2.0% [1.9%]	3.2% [3%]	−3,466 [−3,855]
	Regression	− ***	− ***	+ ***	− ***

Source: The authors, based on an analysis of fiscal year 2022 federal grants and 2016–2020 American Community Survey data.
Note: Median differences are shown in brackets. Table can be read as follows: The average tract with a transit project had a population density that was 1,033 people per square mile higher than the average tract in a comparison group of tracts in the same county. A multivariate regression that controlled for several local characteristics and that included fixed effects for counties where projects were funded showed this difference to be statistically significant in the positive direction. *** $p < 0.001$. NA = no statistical significance.

Housing and Community Development Formula Programs May Be Distributed in a More Equitable Manner than Transportation Investments

We next examined the distributional equity of eight major US housing and community development programs. All such programs that we investigated are allocated by formula except for the COC program, which distributes funding to organizations aimed at ending homelessness. Unlike with transportation formula programs, HUD releases data on how formula program dollars are flowing into counties, so we are able to conduct a county-level analysis for all the agency's programs to get additional granularity. We find, in general, that HUD formula programs are more effectively allocating funding to jurisdictions with higher shares of people of color, as well as to jurisdictions with higher programmatic need, than most transportation formula programs. But there is wide variation in the distribution of funding, with some jurisdictions with high shares of people of color receiving substantially less-than-typical per capita housing funding. Moreover, it is worth considering whether an equitable distribution of federal housing funds will increase *metropolitan* equity. Concentrating these funds in communities of color while continuing to limit spending on subsidized housing in jurisdictions with a population that is disproportionately white could reinforce the exclusionary conditions that exist and may thus contribute to regional racial segregation. In other words, exclusionary towns, cities, and counties may continue to choose to not provide homes affordable to families with low incomes because there is no federal strategy to focus resources therein.

As we did with the transportation programs, we analyze the concentration and high-need equity measures for the major housing and community development programs in our database. We present these results in table 14. Here, the concentration measures show that most programs are distributing more than 25 percent of funds to the counties with the highest shares of people of color (and that house approximately 25 percent of the US population). The Public Housing Operating Fund, has the most funding flowing into counties with high shares of people of color (43 percent), with a concentration measure score of 0.7. Other programs, such as the Continuum of Care, HOME, and Section 202 program (housing for the elderly), are similarly concentrated in communities of color. The Project-Based Section 8 program is the least concentrated in communities of color, distributing just over 25 percent of funding to this high-indicator group of counties.

The median household income concentration measures for housing tell a different story. As with the transportation programs, many HUD programs send less than 25 percent of funding to the lowest–median income counties that house 25 percent of the population. This distribution may be appropriate if these funds are flowing into gentrifying areas with rapidly rising incomes—housing programs should continue distributing funding to those areas in order to preserve affordable housing options. The two public housing programs are the only ones that distribute disproportionately high levels of funding to these counties (40 percent and 37.5 percent, respectively), which aligns with the history of public housing being built in lower-income communities.

TABLE 14

Housing Programs Tend to Concentrate in Areas with Higher Shares of People of Color but Also Higher Incomes

County-level equity measures for major federal housing programs

	Higher Share of People of Color		Lower Median Household Income	
Program	Concentration	High-need equity	Concentration	High-need equity
CDBG	0.5	−0.2	−0.4	−0.1
Continuum of Care	0.6	−0.2	−0.2	−0.2
HOME	0.6	−0.3	−0.2	0.0
Housing Choice Voucher	0.6	−0.2	−0.3	−0.3
Public Housing Capital Fund	0.5	−0.2	0.6	−0.1
Public Housing Operating Fund	0.7	−0.2	0.5	−0.1
Project-Based Section 8	0.1	−0.2	−0.3	−0.2
Section 202	0.6	−0.3	0.0	−0.2

Source: The authors, based on an analysis of fiscal year 2022 federal grants and 2016–2020 American Community Survey data.
Note: CDBG = Community Development Block Grant; HOME = HOME Investment Partnerships Program; Section 202 = Supportive Housing for the Elderly program. Concentration measures fall between −1 and 3, with a score of 0 meaning the highest-indicator counties that constitute approximately 25 percent of the population receive approximately 25 percent of program funds. High-need equity measures fall between −1 and 1, with 0 meaning the median high-indicator county is receiving funding on par with the distribution of the indicator. The high-need equity indicators in this table are computed only for counties that received funding.

Once again, we take this analysis a step further by leveraging the high-need equity measure, which assesses how close funding is to meeting the distribution of a specific indicator. In general, HUD programs are closer to aligning funding levels to county household income than they are to aligning with a county's share of people of color. Many median household income scores hover around −0.1, indicating that the median high-need county is receiving funding that aligns with its relative position nationally in terms of median household income. The high-need equity scores are more strongly negative in terms of share of people of color, meaning that the median high-need county is underfunded compared to what might be expected given its relative level of people of color. As mentioned in the transportation section, a negative high-need equity measure score does not necessarily mean those programs are failing in terms of their equity goals—it simply means even where these programs are sending significant funds to the counties with the highest concentrations of people of color or lowest median household incomes (i.e., those with positive concentration scores), they are still not scaling that funding progressively to align with the county's relative needs according to those demographic characteristics.

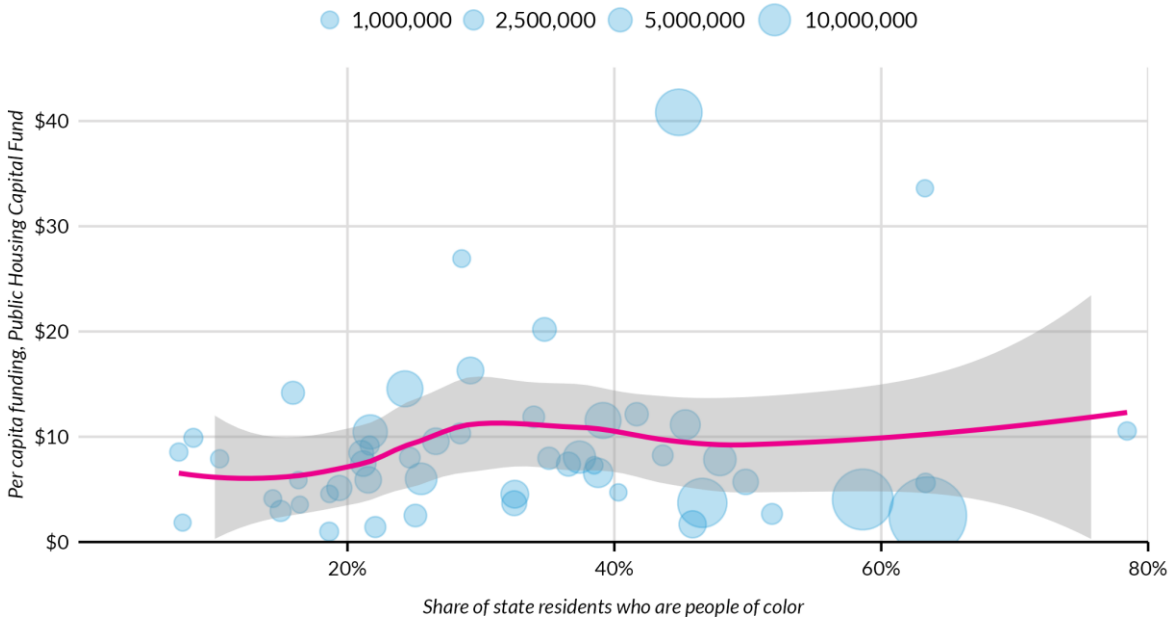
As with the transportation results, the high-need equity scores shown in table 14 were computed using only counties that received funding. When considering all counties, we found that the scores often significantly declined, meaning that those receiving zero funding were relatively high need (except in the case of the Section 8 and public housing programs, where the all-county and funded scores were essentially the same for both indicators). It is also worth noting that, on average, the high-need equity scores for the housing and community development programs are higher than those for the transportation programs; this suggests that HUD's programs are closer to aligning funding levels to counties' relative positions in terms of share of people of color and median household income.

These data merit additional investigation so as to investigate the variation inherent in these numbers. Unlike in federal transportation programs (table 4), state per capita funding for the Public Housing Capital Fund program is not biased against states with higher shares of the population that are people of color (figure 8). Indeed, we find that the 10 states with the highest share of Black residents receive substantially more per capita public housing funding than those 10 with the lowest shares ($9.30 versus $4.71, respectively). The same is true, though to a lesser degree, in comparing states with the highest and lowest shares of Hispanic residents ($8.74 versus $7.56, respectively).

FIGURE 8

Public Housing Capital Funds Do Not Reflect State Racial Demographics Overall

Share of state residents who are people of color versus per capita Public Housing Capital Fund funding, scaled by state population size



URBAN INSTITUTE

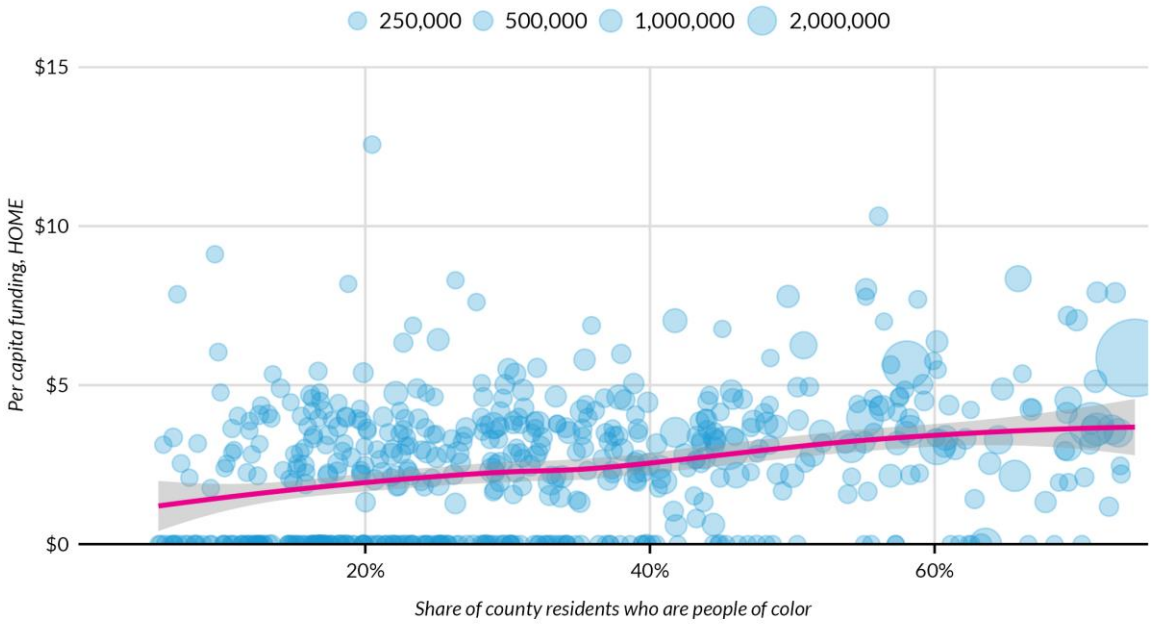
Source: The authors, based on an analysis of fiscal year 2022 federal grants and 2016–2020 American Community Survey data.
Note: Line is a best-fit LOESS curve.

It may be more helpful to consider housing programs at the county level, where we have more fine-grained information about which areas are being funded. Again, we find that the 10 percent of counties with the highest share of people of color receive substantially more Public Housing Capital Fund funds than those with the lowest shares ($12.34 versus $8.04, respectively). In figure 9, we document the distribution of large metropolitan counties in terms of their per capita HOME funding. Here, we show that there is a relationship between a county having a higher share of people of color and it receiving additional per capita funding, in part because a large share of counties with few people of color receives no HOME funding directly.

FIGURE 9

HOME Investment Partnerships Program (HOME) Funding Is Higher in Metropolitan Counties with Higher Shares of People of Color

Share of county residents who are people of color versus per capita HOME funding, scaled by county population size



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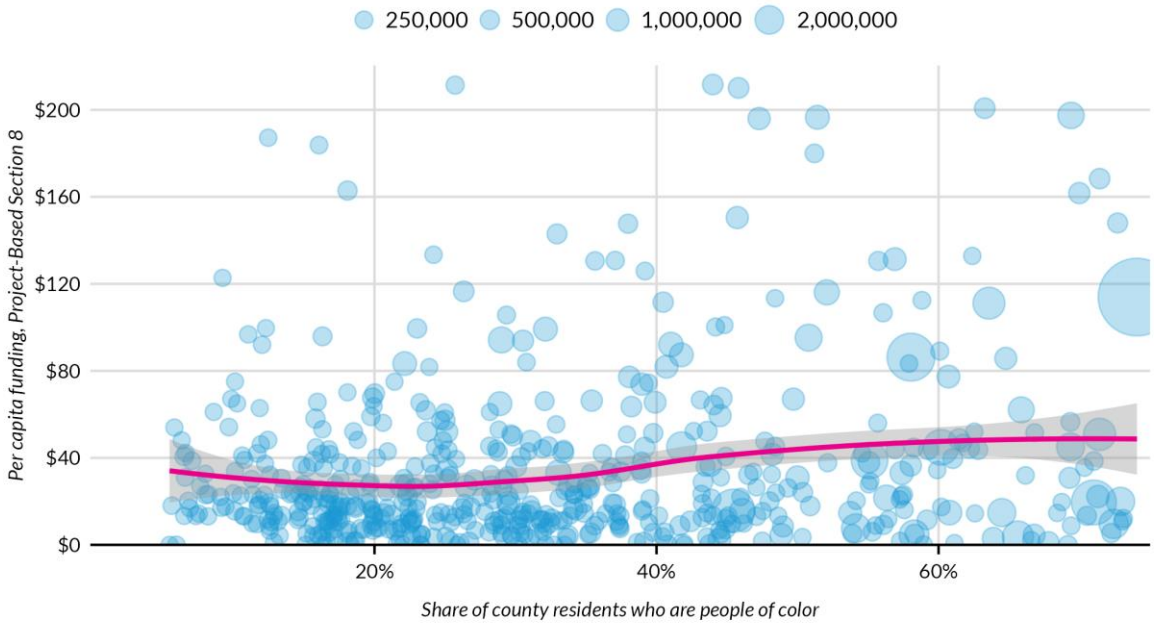
Source: The authors, based on an analysis of fiscal year 2022 federal grants and 2016–2020 American Community Survey data.
Note: Figure illustrates just counties that have more than 100,000 residents and that are located in metropolitan areas. Line is a best-fit LOESS curve. Shows bottom 95 percent of the distribution in terms of people of color.

Finally, we make a similar comparison between county share of people of color and per capita funding for the Project-Based Section 8 program (figure 10). Here, again, we find a clear trend: The median county with a majority of people of color collected higher per capita funding for this program than did the median county whose population is majority white.

FIGURE 10

Project-Based Section 8 Funding Is Somewhat Higher in Metropolitan Counties with Higher Shares of People of Color, on Average

Share of county residents who are people of color versus per capita Project-Based Section 8 funding, scaled by county population size



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Source: The authors, based on an analysis of fiscal year 2022 federal grants and 2016–2020 American Community Survey data.
Note: Figure illustrates just counties that have more than 100,000 residents and that are located in metropolitan areas. Line is a best-fit LOESS curve. Shows bottom 95 percent of the distribution in terms of people of color.

These findings indicate large differences in relationships between local demographics and per capita funding, based on the program evaluated. In each of these cases, however, we see considerable variation in county per capita funding. There are a number of reasonable explanations for this: One is that formula programs' funding distributions have no literal relationship with local demographics. A second is that other local characteristics—such as the local need for additional investment in housing—are important in explaining why federal funding focuses in some areas and not others; we turn to that issue now.

To explore how housing and community development programs are distributing funding in comparison with local housing needs, we measure HUD programs against three housing-related need indicators: share of renters paying more than 30 percent of their income in rent (rent burden), share of households with more than two average occupants per room (overcrowded housing), and housing units

per capita (table 15). All programs had positive concentration scores in terms share of rent-burdened renters and share of households in overcrowded housing, meaning that they distributed more than 25 percent of funding to the highest-need counties in terms of both these indicators. But half of the HUD programs we studied distributed less than 25 percent of funds to counties with the lowest levels of housing units per capita. It is worth noting that most of the funding from HUD does not support new housing construction at all and is largely targeted toward maintenance of existing affordable housing units and community improvements (the major exceptions are HOME grants, which is one of the HUD programs we studied that did distribute more than 25 percent of funds to counties with the fewest housing units per capita).

TABLE 15

Housing Programs Target Counties with Higher Shares of Rent-Burdened and Overcrowded Households but Not Areas with Fewer Per Capita Housing Units

County-level need equity measures for major federal housing programs

	Higher Share of Rent-Burdened Renters		Higher Share of Households in Overcrowded Housing		Fewer Housing Units Per Capita	
Program	Concentration	High-need equity	Concentration	High-need equity	Concentration	High-need equity
Community Development Block Grant	0.2	−0.2	0.3	−0.2	0.1	−0.3
Continuum of Care	0.2	−0.2	0.4	−0.2	0.1	−0.3
HOME	0.3	−0.2	0.5	−0.2	0.2	−0.3
Housing Choice Voucher (Section 8)	0.2	−0.2	0.5	−0.2	0.1	−0.2
Public Housing Capital Fund	0.2	−0.3	0.4	−0.3	−0.3	−0.3
Public Housing Operating Fund	0.2	−0.2	0.4	−0.3	−0.3	−0.3
Section 8 Housing Assistance Payments (Project Based)	0.0	−0.2	0.4	−0.2	−0.2	−0.3
Supportive Housing for the Elderly (Section 202)	0.1	−0.3	0.4	−0.3	−0.1	−0.3

Source: The authors, based on an analysis of fiscal year 2022 federal grants and 2016–2020 American Community Survey data.
Note: HOME = HOME Investment Partnerships Program.

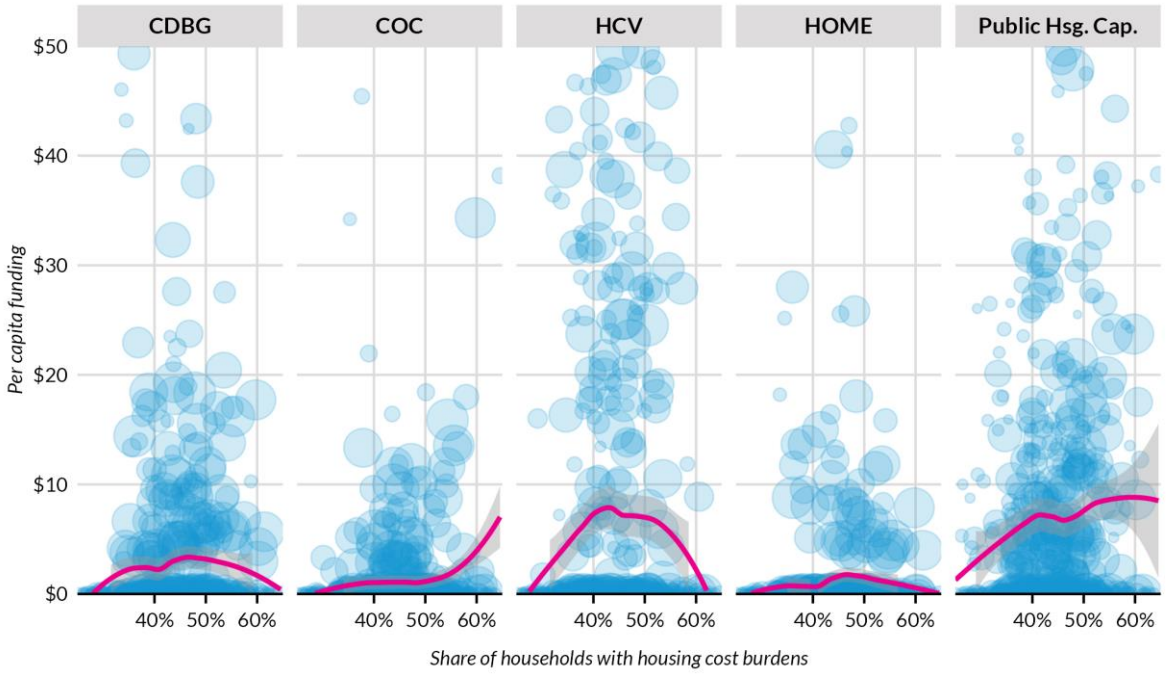
Though many of the programs in table 15 distribute disproportionately higher levels of funding to the highest-need counties, none of them progressively scale funding to fully align with the distribution of the need indicators we selected for consideration. This means that the median high-need county has not received the level of funding that might be expected, given its relative levels of housing needs. Some programs were closer to meeting this distribution than others; for example, funding for Community Development Block Grant (CDBG), COC, HOME, Housing Choice Voucher, and Project-Based Section 8 programs was closer to meeting the distribution of need across all three indicators than other programs (i.e., their high-need equity scores were closer to 0).

Next, we examined county-level housing cost burdens, an important indicator of local housing needs, compared with the distribution of housing program funding (figure 11). We do find that, for the COC and Public Housing Capital Fund programs, funding is generally higher in metropolitan counties with higher housing cost burdens. But that is not the case for CDBG, Housing Choice Voucher, or HOME, whose funding generally concentrates in the center of the national county distribution.

FIGURE 11

Higher Housing Cost Burdens Are Associated with Higher Funding for Only Some Department of Housing and Urban Development Programs

Share of households with housing cost burdens versus per capita funding, scaled by county population size in metropolitan areas



Source: The authors, based on an analysis of fiscal year 2022 federal grants and 2016–2020 American Community Survey data.
Note: Figure illustrates just counties that have more than 100,000 residents and that are located in metropolitan areas. CDBG = Community Development Block Grant (formula); COC = Continuum of Care (competitive); HCV = Housing Choice Voucher (formula); HOME = HOME Investment Partnerships Program; Public Hsg. Cap. = Public Housing capital investments (formula). Shows the central 95 percent of the distribution in terms of share households with housing cost burdens. Line is a best-fit LOESS curve.

Broadband and Water Infrastructure Investments Appear to Be Distributed with Program-Specific Needs in Mind Rather than to Expand Investments in Jurisdictions with High Shares of People of Color or Households with Low Incomes

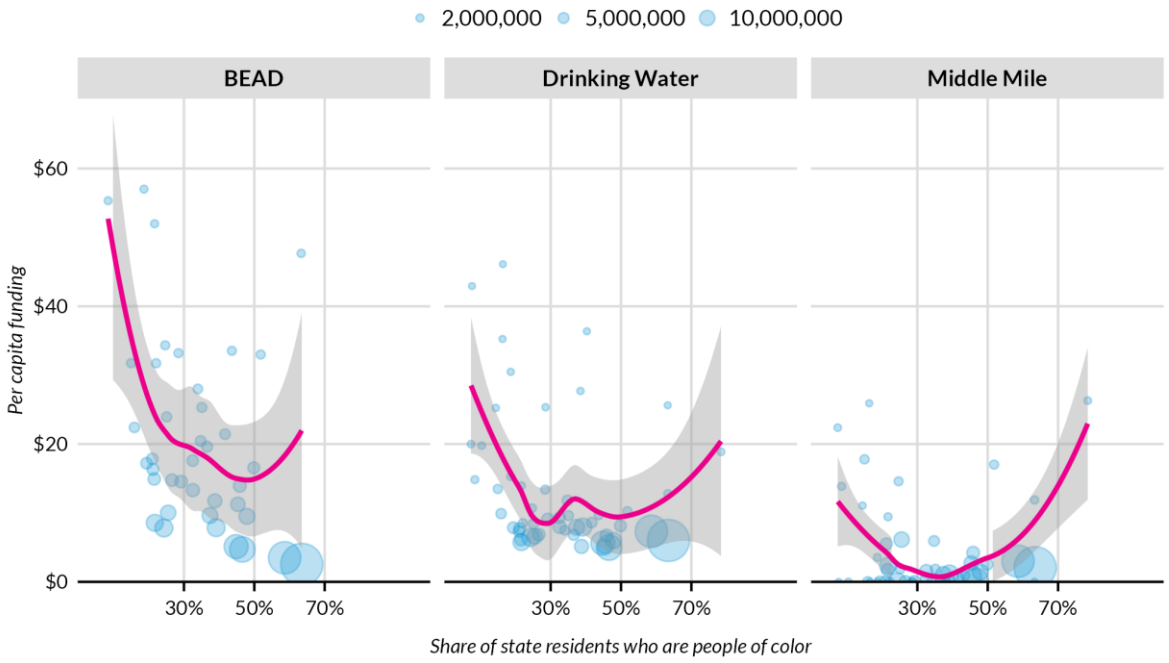
In addition to emphasizing large grants for transportation projects, IIJA emphasized investments in broadband and water infrastructure, mostly distributed to state governments. These programs are designed to improve access to the internet and improve the quality of pipes and other elements of the water supply system. Because the federal government's funding for these programs is mostly allocated to states, we cannot analyze county-level data, which offers more concrete evidence of how funding distribution compares with local demographics.

Nonetheless, we do compare two broadband programs and one water infrastructure program with state share people of color in figure 12. These data point to a U-shaped trend across the programs; states with low and high shares of people of color receive more per capita funding, on average, than those with a middle range of people of color. This outcome does not appear to be an intentional outcome; the Broadband Equity, Access, and Deployment Program, for example, has distributed an initial $100 million to all states.

FIGURE 12

There Are No Steady Associations between a State's Share of People of Color and Per Capita Funding for Broadband and Water Programs

Share of state residents who are people of color versus per capita funding across three programs, scaled by state population size



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Source: The authors, based on an analysis of fiscal year 2022 federal grants and 2016–2020 American Community Survey data.
Notes: Lines are best-fit LOESS curves. BEAD = Broadband Equity, Access, and Deployment Program; Drinking Water = Drinking Water State Revolving Fund; Middle Mile = Enabling Middle Mile Broadband Infrastructure Program.

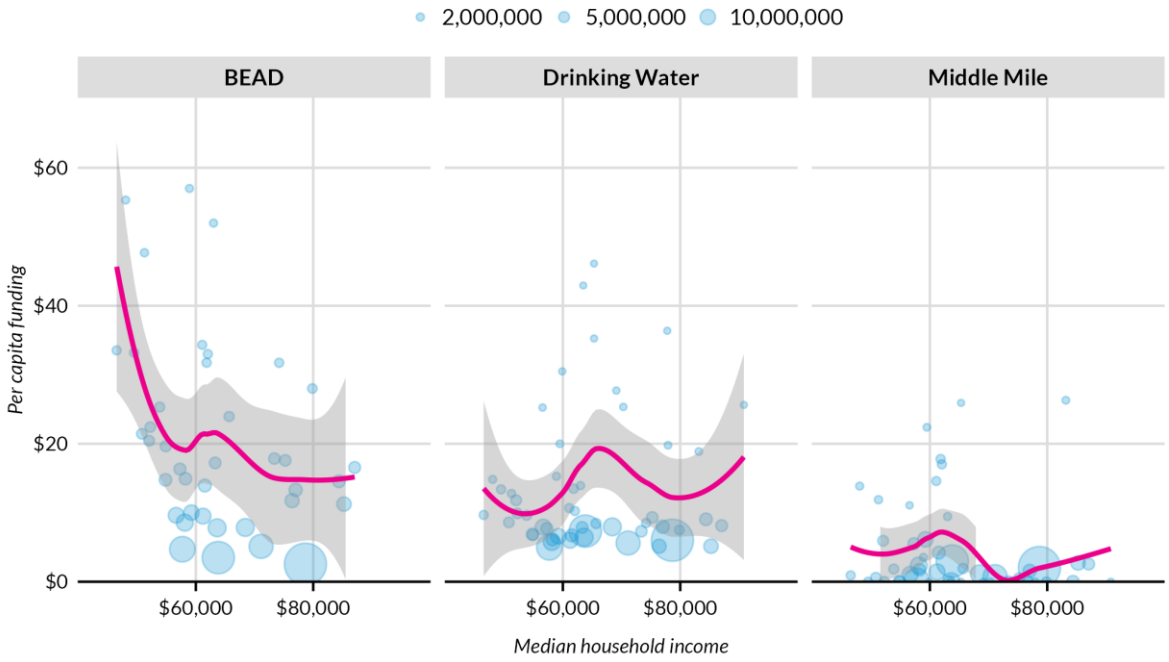
We also compare per capita funding from these programs with state median household incomes (figure 13). Here, we see a relatively straightforward association between increasing state household income and reduced per capita funding for broadband infrastructure. This could, in theory, reasonably reflect the fact that people with higher incomes are in less need of public support to ensure access to

quality internet. But the way the programs—especially the Broadband Equity, Access, and Deployment Program—were designed is arbitrary rather than an intentional effort to address these concerns.

FIGURE 13

Broadband Funding Declines Somewhat for States with Higher Resident Incomes

State median household income versus per capita funding across three programs, scaled by state population size



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Source: The authors, based on an analysis of fiscal year 2022 federal grants and 2016–2020 American Community Survey data.
Note: Lines are best-fit LOESS curves. BEAD = Broadband Equity, Access, and Deployment Program; Drinking Water = Drinking Water State Revolving Fund; Middle Mile = Enabling Middle Mile Broadband Infrastructure Program.

To explore whether broadband programs are distributing funding in comparison with local broadband needs, we measured three competitive broadband programs against two need indicators: average broadband download speed and share of households with internet access (table 16). Generally, these programs distribute large amounts of funding to the highest-need counties that make up 25 percent of the population. The Rural Development Broadband ReConnect Program, for example, distributes 87.5 percent of its funding to the counties with the lowest broadband speeds and 80 percent of its funding to the counties with the lowest shares of households with internet access. The Tribal Broadband Connectivity Program makes similar distributions, while the Enabling Middle Mile Broadband Infrastructure Program is sending 65 percent and 57.5 percent of funding to counties with

low broadband speeds and shares of households with internet access, respectively. This suggests that program administrators are successfully targeting the locations with the greatest need for broadband funding.

TABLE 16

Broadband Programs Target Areas with Lower Broadband Speeds and Internet Access

County-level need equity measures for major federal broadband programs

	Lower Average Broadband Speeds		Lower Share of Households with Internet Access	
Program	Concentration	High-need equity	Concentration	High-need equity
ReConnect Program	2.5	−0.2	2.2	−0.2
Middle Mile	1.6	−0.1	1.3	−0.1
Tribal Broadband Connectivity Program	2.4	−0.2	2.1	−0.2

Source: The authors, based on an analysis of fiscal year 2022 federal grants, 2016–2020 American Community Survey data, and the Federal Communication Commission's Fixed Broadband Deployment Data.
Note: ReConnect Program = Rural Development Broadband ReConnect Program, Middle Mile = Enabling Middle Mile Broadband Infrastructure Program.

Though programs are heavily funding the highest-need counties with 25 percent of the population, they are still not progressively funding counties in a way that aligns with the distribution of the indicators. All programs for both indicators have a negative high-need equity score, which indicates that the median high-need county (i.e., a county in the top half of the indicator distribution) is receiving less funding than might be warranted, given its relative indicator value. That being said, all the high-need equity measures here are quite close to zero, indicating that broadband programs may be closer than many transportation and housing programs to meeting progressive needs related to broadband access.

Local Bureaucratic Capacity in Transportation and Housing and Community Development Is a Major Determinant of whether a County Receives Federal Grants

We have shown that the distribution of federal infrastructure grants to some degree reflects the demographic composition of the counties and states around the country and also that spending is somewhat informed by local need. But there is another issue at play that has a major influence on whether communities receive federal grants: their local capacity. By this, we mean the degree to which

local governments have access to the resources and staff—as well as the background knowledge—to be able to write successful grant applications. This is an important issue from the perspective of competitive grants, which the federal government distributes based on merit, and less important from the perspective of formula grants, which it distributes without judging recipients, other than that they follow federal guidelines in spending them. This is ultimately as much a question of *procedural* equity as it is one of *distributional* equity, since it speaks to the mechanisms by which the federal government is enabling jurisdictions throughout the country to actually apply for grants.

We have already documented some ways by which local capacity may be influencing the ability of localities to win federal grants. We showed in table 8, for example, that, for three major competitive transportation programs, funded counties have significantly higher median incomes than unfunded counties. This indicates that wealthier communities may be better able to plan for new projects and develop applications that win federal approval. In this section, we delve into this issue in more detail by examining staff capacity at the county level. We use US Census of Governments data to calculate the number of people working per capita in the public sector (meaning local government and local agencies) in either transportation or housing and community development, by county. We use this figure as a proxy for a county's ability to assemble the resources to apply for grants.

In table 17, we compare that capacity figure for counties funded by nine federal competitive programs versus the capacity of the equivalent unfunded counties in metropolitan areas. These data raise major concerns. First, for *all* of the programs we studied, the median capacity levels of funded counties were higher than those of unfunded counties. Second, for five of those programs, including RAISE, transit Capital Investment grants, the Low or No Emission Vehicle Program, the Reconnecting Communities Pilot Program, and COC, that difference was statistically significant. This strongly suggests that the federal government's executive departments are preferencing higher-capacity counties when making choices about which should be funded—or at minimum, that those higher-capacity counties are submitting more applications, though we did not have the data available to test whether this was the case. Perhaps surprisingly, we found that counties outside of metropolitan areas, whose data are not shown, generally have higher capacity than those within metropolitan areas.

TABLE 17

Funded Counties across Federal Programs Have Higher Local Staffing Capacity than Unfunded Counties

Differences in local capacity between large funded and unfunded counties in metropolitan areas

Competitive program	Funded counties	Unfunded counties	Median capacity[a] of funded counties	Median capacity[a] of unfunded counties	Significant difference?
RAISE	108	471	1.98	1.63	*
ASAP	19	560	1.69	1.66	—
Transit Capital	44	535	2.31	1.63	*
INFRA	19	560	2.22	1.65	—
Bridge Investment Program	23	556	1.80	1.65	—
Bus Facilities	31	548	1.67	1.66	—
Low or No Emission Vehicle Program	113	466	1.84	1.61	*
Reconnecting Communities Pilot Program	37	542	2.29	1.64	**
COC	427	152	0.92	0.80	*

Source: The authors, based on an analysis of fiscal year 2022 federal grants and 2022 Census of Governments data on county employees by sector.

Note: Includes data only for counties with more than 100,000 residents located in metropolitan areas. Differences in capacity between funded and unfunded counties are statistically significant at the level of *** $p < 0.001$; ** $p < 0.01$; * $p < 0.5$. RAISE = Rebuilding American Infrastructure with Sustainability and Equity; ASAP = All Stations Accessibility Program; Transit Capital = Capital Investment grants for transit; INFRA = Nationally Significant Multimodal Freight and Highway Projects; Bus Facilities = Bus and Bus Facilities Competitive Grants; COC = Continuum of Care.

[a] Capacity is defined as number of local staff per 1,000 residents, either in housing and community development (for COC) or in transportation (for all other listed programs).

We reaffirm these findings by conducting a series of multivariate regressions designed to assess the influence of local capacity on grant awards, in this case considering a set of both competitive and formula grants (table 18). We first explore whether local capacity is associated with a higher likelihood of a county receiving a federal *competitive* grant (among four example programs). We control for three local-level variables that might also influence outcomes: population density, median household income, and the local percentage of population of color. We find that for two of the programs—RAISE and Low or No Emission Vehicle Program—higher capacity is, indeed, statistically associated with a higher likelihood that a county wins a grant. For example, we find that doubling local transportation staff capacity is associated with a 31 percentage-point-higher likelihood of a metropolitan county winning a RAISE grant. This indicates, again, that counties with greater ability to assemble staff to write grants appear to be more successful in actually winning those grants. These regressions provide further

evidence for the possibility that federal policymakers prioritize funding projects in counties based on local demographics. For all of the competitive transportation programs, a county having a higher share of people of color is statistically significantly associated with a higher likelihood of that county winning a grant, even after controlling for capacity, population density, and household incomes.

TABLE 18

Local Staffing Capacity Is Associated with Higher Likelihood of Funding across Several Federal Grant Programs, Even after Controlling for Other Local Characteristics

Multivariate regressions incorporating local demographic characteristics among large counties in metropolitan areas

	Competitive Grants[a]				Formula Grants (among Funded Counties)[b]		
	RAISE	Reconnecting Communities Pilot Program	Low or No Emission Vehicle Program	COC	FTA 5307	HOME	CDBG
Local capacity[c]	30.83 (10.00) **	4.66 (9.47)	25.62 (7.65) ***	30.37 (37.60)	−509.95 (330.68)	2834.30 (768.73) ***	5090.79 (1602.26) **
Population density (log)	0.04 (0.02) *	0.05 (0.01) ***	0.02 (0.02)	0.09 (0.02) ***	1.00 (0.62)	0.59 (0.14) ***	2.65 (0.38) ***
Median household income (log)	−0.13 (0.07) *	−0.07 (0.05)	0.13 (0.07)	−0.10 (0.08)	39.20 (4.46) ***	−1.55 (0.84)	−6.78 (1.81) ***
Percentage of population of people of color	0.24 (0.09) *	0.13 (0.06) *	0.23 (0.10) *	0.10 (0.10)	9.93 (2.79) ***	−1.71 (0.75) *	−2.76 (1.82)
Intercept	1.21 (0.68)	0.50 (0.52)	−1.55 (0.80)	1.20 (0.82)	−422.54 (49.69) ***	15.08 (8.87)	62.80 (18.96) ***
R^2	0.08	0.07	0.05	0.05	0.28	0.36	0.26

Source: The authors, based on an analysis of fiscal year 2022 federal grants, 2016–2020 American Community Survey data, and 2022 Census of Governments data on county employees by sector.

Notes: Regressions were performed only on counties that have more than 100,000 residents and that are located in metropolitan areas. Robust standard errors are in parentheses. RAISE = Rebuilding American Infrastructure with Sustainability and Equity; COC = Continuum of Care; FTA 5307 = Urbanized Area formula grants program for transit; HOME = HOME Investment Partnerships Program; CDBG = Community Development Block Grant. *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

[a] Binary dependent variable: Whether a county is funded; [b] Continuous dependent variable: How much a county is funded; [c] Housing and community development staff per capita for housing programs; transportation staff per capita for all other listed programs.

Perhaps surprisingly, we also find that higher local capacity is associated with higher program funding under two of the *formula* programs that we analyze in table 18, HOME and CDBG. This does not mean that these formulas are integrating capacity into their allocations; in neither case are counties

rewarded specifically for having more staff working in housing and community development. Yet in this case, the relationship may be reversed: It may be possible that higher federal support from these programs (which is distributed to local governments year in and year out, unlike the competitive funds) helps enable counties to hire more staff working in this sector. In other words, federal grantmaking becomes the *generator* of increased local capacity. It is worth emphasizing, however, that table 18 examines conditions only in large metropolitan counties. Many smaller counties do not meet the minimum thresholds to receive direct HOME or CDBG funding—for example, counties are qualified to receive CDBG funding only if they are considered urban and have a population of at least 200,000 (though some cities within smaller counties may be eligible to receive direct funding on their own).[22] While some smaller or rural counties may receive transit, CDBG, or HOME funds that are passed down by their states, they are limited in their ability to collect federal funding directly and thus build their local capacities. Some of these counties, such as those in rural areas, have high shares of people of color and families with low incomes and are in need of additional federal support.

Conclusion: Implications and Policy Recommendations

In our research, we find that federal funding is being distributed in ways that could support racial and economic equity goals. Some programs—particularly those distributed through competitive processes—are directing disproportionately high amounts of funding to communities with higher shares of residents who are people of color. This could be good news for these communities, many of which may have experienced historical underinvestment. We remain concerned, however, that many of the grant programs we examine—particularly those distributed by formula—are weighted *against* communities of color. Further, most grants are generally flowing to counties and states with higher bureaucratic capacity and higher household incomes. Based on these findings, we make the following recommendations:

- Federal government agencies should conduct ongoing tracking of the degree to which federal funds are flowing into communities of color and lower-income communities. They need to keep account of how these funds—particularly formula grants—are being used in receiving communities and whether those uses are aligned with the local needs of communities of color and low-income households. The federal government should consider not just the distribution of funds, but also conduct an evaluation of the potential positive and negative externalities emanating from the funded projects themselves.
- Congress and federal agencies should review program formulas to align funding flows to communities based on current conditions. Because formula grants are "sticky," meaning they are rarely changed and often reflect decisions made decades ago, they tend to reinforce existing conditions. For some housing programs, for example, concentrating funding in areas that already have federally subsidized affordable housing means little momentum to encourage more integrated communities by funding subsidized housing in exclusionary communities. For some of the largest transportation programs, funding is disproportionately focused on states with higher automobile dependence, which limits the ability of other states—typically those with a higher share of people of color—to provide their residents good access to transit. We find that many formula programs continue to underfund areas of high need, both in terms of local demographics and in terms of indicators directly related to program purpose. Congress and federal agencies should take the goal of distributional equity seriously by throwing out dated, rarely refreshed formulas and population thresholds that no longer meet the country's

needs. One key opportunity is linking the distribution of federal funding to local affirmatively furthering fair housing requirements. For example, agencies could specifically target affordable housing resources to communities that have historically excluded residents of color, but that now are required to show how they will desegregate.

- While the federal government's distribution of competitively funded grants appears to be supporting communities of color, in many cases, we find that they are biased toward counties with higher median household incomes. Federal agencies should address this gap to meet the needs of lower-income counties.
- Federal agencies should consider developing approaches to measure the equity impacts of funded projects in communities of color and lower-income communities. We find that road expansion projects are disproportionately located in areas with a higher share of people of color and with more households with low incomes, both of which have historically been exposed to higher levels of air and noise pollution emanating from nearby highways. The federal government should evaluate the holistic impacts of the projects it funds to guarantee the economic vitality and public health of people living near those projects. Where federal agencies are not already doing so, they should require project promoters to show how they will mitigate negative externalities for communities of color.
- Ensuring that jurisdictions are able to engage in the application process is the first step toward equitable grant distribution. We demonstrate that local capacity remains an obstacle to winning federal competitive grants. The federal government should work to reduce the burden of application processes, particularly for counties with high shares of people of color, with lower household incomes, and with limited direct access to federal formula funds from programs like CDBG. At the same time, it should work to increase investment in low-capacity communities to ensure they are able to pursue federal funds successfully. Many low-capacity communities both face challenges in applying for competitive grants and have smaller populations and therefore receive less federal funding via direct formula appropriations. These compounded disadvantages necessitate greater federal funding support to expand the capacity of local governments to shape equitable development in their communities. Changing grant application processes is essential to increasing procedural equity.

Limitations

As should be expected for a project of this magnitude, our research has several limitations that should be kept in mind when interpreting the results. For one, our analysis leaves out a number of federally funded programs, specifically those administering fewer than $1 billion (in fiscal year 2022 for HUD programs, and through 2026 for IIJA programs). While our analysis still captures 66 major programs, our omission of programs that do not meet this fiduciary threshold means that our data may not capture the full scope of federal infrastructure spending.

Furthermore, of the programs that we ultimately do analyze in this report, we were not able to identify the jurisdiction receiving downstream funds for each IIJA project; as previously noted, IIJA-funded formula programs are administered at the state level (excluding the formula public transportation investments). It is presently unclear how state and local governments allocated the federal funding that they received and to what extent those further allocations, if any, were equitable. There were also several individual competitively awarded projects that we could not locate, meaning that a small share of funded projects was left out of the data analysis. In particular, projects intended for interjurisdictional transportation improvements, such as the Ferry Service for Rural Communities Program, presented these challenges.

Our analysis was also limited in that it does not compare the differences in funding approaches of urban and rural jurisdictions. While we base our findings on per capita metrics in an effort to analyze different-size jurisdictions along the same scale, we do not evaluate the specific needs of rural communities. Yet in many cases, rural communities face unique challenges that could necessitate greater funding. Programs also vary in terms of how they define eligibility, such as in terms of whether they are considered "rural"; this can impact the distribution of funding across programs. The interactive website accompanying this report, which allows users to view the funding differences of urban and rural communities, may be useful in filling this gap.

Finally, our analysis explores only one year of federal funding. While some programs have released allocations for fiscal year 2023, award data for the year are incomplete and as such are not included in this report. Moreover, IIJA will continue to administer funds to states and communities through 2026. While this work is valuable in its own right and can, we hope, serve as a resource to inform future funding decisions over the course of the program, our work should not be misinterpreted as a conclusive assessment of IIJA in its entirety. We also do not examine any additional funding sources that jurisdictions may leverage to supplement IIJA or HUD funds on projects, such as local matches,

private-sector investment, or other federal funding streams such as those distributed through the American Rescue Plan.

Opportunities for Future Research

Additional research is needed to overcome several limitations of this study. Every formula program follows its own specific rules, for example, which here we only examine lightly, but future work could explore how specific elements of each program's formulas may produce inequitable outcomes. Our work further raises important questions about the degree to which the federal government's grants are fairly allocated given differences in local capacity. We need better information about understanding and increasing local capacity. The federal government has begun to attempt to address this issue through programs like DOT's Thriving Communities Program grants, but the degree to which they result in a better local ability to submit effective grant applications is currently unclear.

Future research would supplement our analysis by analyzing future years of formula and competitive infrastructure investments, in turn providing a more holistic analysis of the equity of grant distribution across multiple departments, agencies, and programs under IIJA and HUD. This work could complement our research by expanding our approach to other significant federal spending bills passed by Congress, including the 2022 Inflation Reduction Act and the fiscal year 2023 omnibus, both of which included significant funding commitments to new infrastructure programs. This would allow researchers to evaluate the full spectrum of federal programs that are of interest to communities and even examine how jurisdictions may leverage multiple federal funding streams to carry out important project work. Like IIJA, the Inflation Reduction Act will dedicate funds to programs with local economic and environmental implications over the course of several years and as such provides an opportunity for researchers to conduct a longitudinal study of the impacts of federal spending.

Our research has focused on the *distribution* of funds, but it has told us very little about how those funds are being used. We need better information about how state and county formula funds are used on specific projects and in what locations. Finally, we need to understand whether the projects funded by infrastructure grants are actually benefiting the communities impacted. Ultimately, improving the equitable distribution of federal infrastructure spending is just the first step toward a more just society.

Appendix A. Methods

Data Cataloguing

Our research began with months of data cataloguing. We collected funding information on all major IIJA and HUD programs from the websites of the various departments and agencies that administered these programs. We defined major programs as those expected to distribute at least $1 billion in fiscal year 2022 (for HUD) or at least $1 billion in fiscal years 2022–2026 (for IIJA, over the course of that law's lifetime). We identified a total of 66 programs that met these criteria. We reviewed legislation and agency grantmaking documents to summarize what is currently known about each program's approach to funding.

We did not analyze programs that had not received awards for fiscal year 2022 as of the date of our analysis nor those that had incomplete data for any other reason. Finally, we chose not to include IIJA programs that primarily funded private entities and projects; we determined that the movement of these funds to communities and their resultant equity impacts could not be tracked. For a full list of programs that we did not include in our analysis, see appendix C: "Unstudied Programs."

For formula programs, we identified the jurisdictions or entities within jurisdictions that received funds in fiscal year 2022. HUD already identifies county-level funding distribution for these funds, which are typically allocated to local jurisdictions and housing providers. Most formula funds from IIJA, such as those distributed by DOT and the Department of Energy, are distributed at the state level. For these programs, we were unable to identify the county where the money was eventually spent (e.g., by a state funding a highway project in a specific city) because this would require analyzing each state's project-level expenditures. However, IIJA formula funds distributed for public transportation investments are allocated by urbanized area. We assigned these funds by county in each relevant urbanized area using areal interpolation; this may not exactly reflect funding distribution but is an approximation reflecting county boundaries.

For each competitive program, where data were available, we compiled a list of every individual project funded in fiscal year 2022 through departmental press releases. We captured a range of descriptive data for each project, including the following:

- funding amount
- county (or counties) where funds are expected to be used

- a project description

For competitive programs funded through IIJA, we also assigned "project types" to each project to further classify what IIJA funds are being used for. Each project was assigned a primary project type and up to three secondary project types. The 29 project types we created include "airports," "broadband," "road design," and "road capacity." When possible, we collected project specifics, typically from local sources, and mapped the projects using geospatial software to identify their location. This allowed us to assign projects to specific counties and specific locations within those counties. In circumstances in which projects spanned multiple counties, we listed multiple counties and assumed that funds were distributed evenly across counties.

Through this cataloguing, we sought to understand the mechanisms by which grants are distributed from federal departments to programs and from programs to jurisdictions or projects. A summary of the programs we evaluated is in table A.1.

TABLE A.1
Summary of Programs Evaluated

Agency	Bureau	Program	Share of US states funded	Total state funding	Total state funding per 1,000 people	Median state funding	Median state funding per 1,000 people
USDA	USFS	Community Wildfire Defense Grant Program for At-Risk Communities	42%	$175 m	$30,612	$0	$0
USDA	RUS	Rural Development Broadband ReConnect Program	56%	$1.6 b	$715,849	$8.0 m	$1,905
DOC	NTIA	Broadband Equity, Access, and Deployment Program	100%	$5.2 b	$2.2 m	$1.0 m	$23,178
DOC	NTIA	Middle Mile	65%	$915 m	$345,400	$ 10.2 m	$1,496
DOC	NTIA	Tribal Broadband Connectivity Program	46%	$1.0 b	$695,616	$0	$0
USACE	CECW	US Army Corps of Engineers IIJA Construction Projects	63%	$7.2 b	$2.1 m	$3.9 m	$1,415
DOE	EERE	Weatherization Assistance Program	98%	$281 m	$63,416	$3.3 m	$1,101
DOE	NE	Civil Nuclear Credit Program	2%	$1.1 b	$27,957	$0	$0
HUD	NA	Community Development Block Grant	100%	$3.3 b	$514,404	$39.1 m	$9,118
HUD	NA	Continuum of Care	100%	$2.8 b	$413,277	$27.5 m	$6,789

Agency	Bureau	Program	Share of US states funded	Total state funding	Total state funding per 1,000 people	Median state funding	Median state funding per 1,000 people
HUD	NA	Supportive Housing for the Elderly (Section 202)	100%	$585 m	$82,067	$5.2 m	$1,106
HUD	NA	Housing Choice Voucher (Section 8)	100%	$24.7 b	$3.6 m	$225 m	$54,033
HUD	NA	HOME Investment Partnerships Program	100%	$1.5 b	$239,682	$19.6 m	$4,434
HUD	NA	Public Housing Operating Fund	100%	$5.0 b	$805,424	$44.6 m	$10,009
HUD	NA	Public Housing Capital Fund	100%	$3.2 b	$505,324	$31.3 m	$7,645
HUD	NA	Section 8 Housing Assistance Payments (Project Based)	100%	$17.7 b	$2.8 m	$182 m	$41,786
DOI	BIA	Indian Water Rights Settlements	12%	$2.1 m	$1,502	$0	$0
DOI	USBR	Aging Infrastructure Account	23%	$596 m	$283,350	$0	$0
DOI	USBR	Rural Water Projects	12%	$388 m	$280,074	$0	$0
DOI	USBR	Large-Scale Water Recycling Program	12%	$310 m	$15,186	$0	$0
DOI	USBR	Water Storage, Groundwater Storage, and Conveyance projects	10%	$210 m	$18,224	$0	$0
DOT	FAA	Airport Infrastructure Grants	35%	$20 m	$4,819	$0	$0
DOT	FAA	Airport Terminal Program	81%	$969 m	$185,626	$10.6 m	$2,371
DOT	FHA	Bridge Investment Program	48%	$2.1 b	$381,094	$0	$0
DOT	FHA	Appalachian Development Highway System	21%	$246 m	$54,378	$0	$0
DOT	FHA	Bridge Formula Program	100%	$5.3 b	$1.4 m	$57.6 m	$18,685
DOT	FHA	Carbon Reduction Program	98%	$1.2 b	$267,991	$17.4 m	$4,216
DOT	FHA	Congestion Mitigation and Air Quality Improvement Program	98%	$2.5 b	$452,654	$15.9 m	$7,914
DOT	FHA	National Electric Vehicle Infrastructure Formula Program	100%	$615 m	$132,410	$8.8 m	$2,021
DOT	FHA	National Highway Freight Program	98%	$1.4 b	$295,392	$19.8 m	$4,530
DOT	FHA	Metropolitan Planning	98%	$438 m	$79,265	$4.3 m	$1,264
DOT	FHA	National Highway Performance Program	98%	$28.4 b	$6.2 m	$400 m	$97,188

Agency	Bureau	Program	Share of US states funded	Total state funding	Total state funding per 1,000 people	Median state funding	Median state funding per 1,000 people
DOT	FHA	Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation—Formula	98%	$1.4 b	$304,725	$19.7 m	$4,794
DOT	FHA	Railway-Highway Crossings Program	98%	$245 m	$57,283	$3.9 m	$897
DOT	FHA	Highway Safety Improvement Program	98%	$3.0 b	$643,241	$42.2 m	$10,008
DOT	FHA	Surface Transportation Block Grant Program	98%	$13.8 b	$3.0 m	$195 m	$47,281
DOT	FHA	Tribal Transportation Program	71%	$461 m	$216,736	$1.2 m	$262
DOT	FHA	Reconnecting Communities Pilot Program	62%	$185 m	$17,341	$850,000	$116
DOT	FMCSA	Motor Carrier Safety Assistance Program	100%	$292 m	$62,747	$4.4 m	$1,023
DOT	FRA	Railroad Crossing Elimination Grants	62%	$571 m	$131,986	$1.4 m	$312
DOT	FTA	All Stations Accessibility Program	17%	$686 m	$59,954	$0	$0
DOT	FTA	Bus and Bus Facilities Competitive Grants	58%	$551 m	$126,741	$2.3 m	$740
DOT	FTA	Capital Investment Grants	42%	$3.7 b	$394,950	$0	$0
DOT	FTA	Ferry Service for Rural Communities Program	8%	$252 m	$329,423	$0	$0
DOT	FTA	FTA Metropolitan, Statewide, and Non-Metropolitan Planning	100%	$184 m	$30,265	$1.9 m	$542
DOT	FTA	Urbanized Area Formula Grants	100%	$6.9 b	$933,276	$61.9 m	$12,927
DOT	FTA	Enhanced Mobility of Seniors and Individuals with Disabilities	100%	$253 m	$32,075	$2.8 m	$605
DOT	FTA	Formula Grants for Rural Areas, Growing State Apportionments, Growing States and High-Density States Formula	98%	$41.1 m	$8,654	$288,478	$ 88
DOT	FTA	FTA State Safety Oversight Program	58%	$49.0 m	$10,835	$509,857	$87
DOT	FTA	State of Good Repair Formula Grants	85%	$4.1 b	$474,866	$12.7 m	$3,270
DOT	FTA	Bus and Bus Facilities Formula Grants	100%	$597 m	$135,381	$7.9 m	$ 1,944

Agency	Bureau	Program	Share of US states funded	Total state funding	Total state funding per 1,000 people	Median state funding	Median state funding per 1,000 people
DOT	FTA	Rail Vehicle Replacement Grants	12%	$703 m	$74,174	$0	$0
DOT	FTA	Low or No Emission Vehicle Program	81%	$1.1 b	$195,628	$8.5 m	$2,046
DOT	MARAD	Port Infrastructure Development Program Grants	42%	$701 m	$255,197	$0	$0
DOT	NHTSA	Highway Safety Programs, National Priority Safety Programs	100%	$857 m	$207,759	$12.2 m	$2,948
DOT	OST	Nationally Significant Freight and Highway Projects	44%	$1.5 b	$332,038	$0	$0
DOT	OST	RAISE Grant Program	100%	$2.2 b	$678,548	$39.8 m	$7,773
DOT	OST	Rural Surface Transportation Grant Program	23%	$273 m	$102,731	$0	$0
DOT	OST	Safe Streets and Roads for All	96%	$802 m	$137,091	$4.9 m	$1,081
DOT	PHMSA	Natural Gas Distribution Infrastructure Safety and Modernization Grants	37%	$195 m	$40,119	$0	$0
EPA	STAG	Clean School Bus Program	100%	$933 m	$183,969	$9.7 m	$2,980
EPA	STAG	Clean Water State Revolving Fund-Emerging Contaminants	100%	$183 m	$36,878	$2.1 m	$628
EPA	STAG	Clean Water State Revolving Fund	100%	$2.6 b	$526,190	$29.8 m	$8,901
EPA	STAG	Drinking Water State Revolving Fund Emerging Contaminants	100%	$1.4 b	$390,598	$22.7 m	$4,975
EPA	STAG	Drinking Water State Revolving Fund	100%	$2.6 b	$699,539	$40.2 m	$8,827
EPA	STAG	Drinking Water State Revolving Fund Lead Service Lines Replacement	100%	$4.1 b	$1.1 m	$63.4 m	$13,908

Source: The authors, based on an analysis of fiscal year 2022 federal grants and 2022 Census of Governments data on county employees by sector.

Note: USDA = US Department of Agriculture; DOC = Department of Commerce; Middle Mile = Enabling Middle Broadband Infrastructure Program; USACE = Department of Defense Army Corps of Engineers; DOE = Department of Energy; HUD = Department of Housing and Urban Development; DOI = Department of the Interior; DOT = Department of Transportation; EPA = Environmental Protection Agency; USFS = US Forest Service; RUS = Rural Utilities Service; NTIA = National Telecommunications

and Information Administration; CECW = Corps of Civil Engineers Civil Works; EERE = Office of Energy Efficiency and Renewable Energy; NE = Office of Nuclear Energy; NA = Funds were administered directly from the agency, not a bureau; BIA = Bureau of Indian Affairs; USBR = US Bureau of Reclamation; FAA = Federal Aviation Administration; FHA = Federal Highway Administration; FMCSA = Federal Motor Carrier Safety Administration; FRA = Federal Railroad Administration; FTA = Federal Transit Administration; MARAD = Maritime Administration; NHTSA = National Highway Traffic Safety Administration; OST = Department of Transportation Office of the Secretary; PHMSA = Pipeline and Hazardous Materials Safety Administration; STAG = State and Tribal Assistance Grants; IIJA = Infrastructure Investment and Jobs Act; RAISE = Rebuilding American Infrastructure with Sustainability and Equity.

Demographic and Need Indicators

The key goal of our analysis was to explore the degree to which federal infrastructure program funding is being distributed in a manner that advances racial and economic equity. In order to undertake this analysis, we had to understand the conditions in which these funds were being distributed as well as the way that each type of project could impact those conditions. We began by considering the extent to which different types of projects may produce positive and negative externalities; for example, a transportation project could increase access to employment but also spur pollution in the surrounding areas. We scanned the literature to identify the degree to which these externalities are disproportionately concentrated in communities with certain demographic characteristics compared to others (see appendix B: "Table of Project-Related Externalities").

We first sought to understand the degree to which program funds were distributed compared to local demographics. This can help tell us whether federal funding is supporting increased allocations to historically underinvested communities—or reinforcing historic disinvestment. We collected the following key data for each jurisdiction we analyzed (counties and states) from the US Census 2016–2020 American Community Survey. These are what we refer to as our **demographic indicators:**

- share of residents who are people of color, defined as people who are not non-Hispanic white
- share of residents who are living under the federal poverty line
- median household income in dollars

We also calculated population density in terms of residents per square mile as a useful mechanism to compare states and counties. This metric can be used as a proxy for the degree to which a jurisdiction is rural or urban.

Next, we sought to compare funding distributions with local characteristics reflective of need for investment, relative to each of the individual programs. We refer to these characteristics as **need indicators.** Using these indicators, we could identify whether counties were receiving funds proportionate to what data indicate they necessitate. Using the table of externalities we developed, we

established indicators for each program (based on what we know about what types of need might be relevant to a programmatic investment), organized into a series of categories, assigned to the relevant program. For each category of need indicators, we collected detailed data across a number of points (see the full list in appendix D). These categories included the following:

- **broadband access**, containing measures of internet access and connectivity (e.g., broadband speed, households with internet access)
- **mobility,** highlighting the ability of individuals to move around their local environments, such as by walking, driving, biking, or using public transportation (e.g., commute time, car access, frequency of fatal accidents)
- **environmental safety**, including measures of local environmental conditions that can impact public health (e.g., superfund site, diesel particulate matter level, drinking water system violations)
- **housing affordability and stability**, containing measures of vacancy and access to stable housing (e.g., housing cost burden, homelessness)
- **housing quality**, measuring housing conditions (e.g., complete plumbing, complete kitchen)
- **housing supply**, including measures of overall housing access and production (e.g., housing units per capita, permits per capita)
- **local bureaucratic capacity**, measuring staff levels per capita in transportation, housing/community development, or environmental sectors
- **program-specific data**, meaning information relevant to a specific program (e.g., the number of public housing units in a county is relevant to the amount of funding a county receives from HUD's public housing program)

We created a large matrix linking each of the programs with the demographic and need indicators; we did not compare all programs to all indicators, since that would not appropriately reflect the differences between the individual programs. This formed the basis for our calculations of equity metrics that follow.

We acknowledge that the list of indicators we developed is limited and may not fully reflect programmatic specifics. We believe, however, that the indicators we chose offer a rounded view of the characteristics of the communities where federal infrastructure funds have been distributed and enable us to assess the equity of that distribution.

Calculating Equity Metrics at the State and County Levels

After establishing the categories, we began to analyze the data. The first component of the analysis involved understanding how funds have been distributed across state and county geographies. We examined the amount of per capita funding received by every state and county for every program in our dataset.

We began by running a set of analyses to determine whether funds are more likely to support communities with certain characteristics by comparing the distribution of funds across states and counties with the **demographic indicators** and **need indicators** that we defined in the preceding sections. This required us to begin by calculating the percentile rankings for both the per capita funding and all of the indicators in each state and county for each program. We did this by gathering all funding and indicator data and normalizing the indicators into percentile measures. In other words, the least-funded county on a per capita basis would be at the 0 percentile; the most-funded county would be at the 100th percentile. For example, for the share of population in poverty, the county with the smallest share of residents living in poverty would be at the 0 percentile and the county with the highest share would be at the 100th percentile.

For each county and state, and for each program, we make the following calculation:

$$E_{jp} = F_{jp} - I_{jp},$$

where E is the equity metric for jurisdiction j (e.g., state or county) and program p; F is the per capita funding percentile; and I is the indicator percentile. This equity metric ranges from −1 to +1. A score of 0 means that the jurisdiction's funding is proportional to this indicator. A negative score means the jurisdiction is getting less funding than the indicator would imply; a positive score means the jurisdiction is getting more funding than the indicator would imply.

We then make the following **high-need** equity calculation for each program and indicator, which is the median equity indicator for jurisdictions j that are above the 50th percentile in terms of that indicator.

$$E_p = median_{J_{ip50\%}}^{J_{ip100\%}}(F_{jp} - I_{jp}),$$

where E is the equity measure for program p across all jurisdictions evaluated j (we conducted this analysis two times, both for all jurisdictions and for just those jurisdictions that were funded). This score ranges from −1 to +1. A score of 0 means that the program is, for the typical jurisdiction among the top half of the distribution of the indicator, responding to the national distribution of this indicator. A

negative score means that the program is, for the typical high-indicator jurisdiction, underfunding those counties; a positive score means the program is overfunding them.

Consider the example of a program designed to fund affordable housing units, compared with a related indicator, such as share of residents living under the federal poverty line. If the equity metric for this program were close to 0, it would mean fund distribution for affordable housing is proportional to the level of local poverty among jurisdictions with above-national-median poverty levels. On the other hand, if the metric were higher than 1, it would mean that these high-poverty counties are receiving a higher-than-expected share of funding.

For each program, we make the following calculation of **concentration** in the top group of jurisdictions by that indicator:

$$C_p = \left(\left\{\sum_{I_{jpX\%}}^{I_{jp100\%}} D_{jp} \;/\; \sum_1^j D_{jp}\right\} \cdot \frac{1}{1-X}\right) - 1,$$

where C is the concentration measure for program p for all jurisdictions evaluated j, I is the indicator percentile for jurisdiction j for program p, and D is the total funding in jurisdiction j for program p. To conduct this calculation, we order the counties in terms of their indicator scores and select the top jurisdictions whose populations account for approximately 25 percent of the national total in terms of jurisdictions evaluated. (For example, if there were 10 counties evaluated and the 3 counties that had the highest proportion of people living below the poverty level accounted for approximately 25 percent of the population, we would assess the share of national funding going to those 3 counties.) However, since jurisdictional populations do not divide evenly at that 75 percent cut point, we allow some leeway for jurisdictions that overrun that (e.g., in the previous example, if the 3 counties actually accounted for 28 percent of the national population, we would still take all 3, because only 2 counties, in this example, would account for 20 percent of the population). X is the share of the population closest to this percentile, in theory meaning ~0.75 (but in our example 0.72). This score ranges from −1 to +3. A score of 0 means that the top 25 percent of high-need populations in the country, according to a given indicator, receive 25 percent of the funding. A higher score means that these jurisdictions receive more than 25 percent of the funding. Using our previous example, if this score were 1, it would mean that the 25 percent of jurisdictions with the highest poverty rates receive 50 percent of the funding, suggesting they are being disproportionately funded.

Finally, we make the following calculation of **variability** for each *formula* program. This score represents the degree to which a specific program is meeting the goal of equitable funding across the country, on a per capita basis:

$$V_p = \frac{\overline{(abs[K_{jp} - K_{np}])^j_1}}{K_{np}},$$

where V is a metric of average variability for each program p for all jurisdictions evaluated j (we evaluate funding only at the state level here). K is the per capita funding for a program, either for a jurisdiction j or for the nation n. A score closer to 0 means the program hews closely to jurisdictional population. A higher score means the program's funding is far from reflecting the national distribution of funding.

Tract-Level Analysis

We completed a local analysis of several of the programs we studied by examining funded projects at the census tract level. We first developed a method to compare tracts where projects were funded with a set of reasonably comparable tracts where projects were *not* funded. Using the project-specific mapping data that we collected previously, we then examined whether the US government is disproportionately awarding projects in certain types of neighborhoods and not others. The goal of this analysis was to assess infrastructure funding decisions in terms of their local effects, not in terms of their distribution by jurisdiction, as we undertake above.

As a team, we chose to select a series of project types with known local impacts and that we had been able to map successfully based on information collected from the federal government. We specifically chose among programs for which funds are distributed competitively; as noted, this means that localities and states submit project ideas and federal departments select among them. Most programs are substantially oversubscribed, meaning that federal officials have substantial range in making choices between the projects they want to fund (this decisionmaking process is not "subjective" per se insofar as it requires officials to score proposals on a number of predefined criteria). The project types we chose included the following:

- **pedestrian or bicycling infrastructure**, meaning any investment that improves accessibility and/or safety for pedestrians and/or bikers
- **RAISE projects**, or all projects funded by the RAISE program, which supports a wide range of multimodal surface transportation projects
- **road capacity increases**, meaning projects that add lanes to existing roadways or create new roadways

- **road design improvements**, meaning any investment or construction on roads that does not include adding lanes or creating new roadways
- **transit projects**, which include any project designed to expand transit systems with new fixed-guideway investments, whether rail or bus

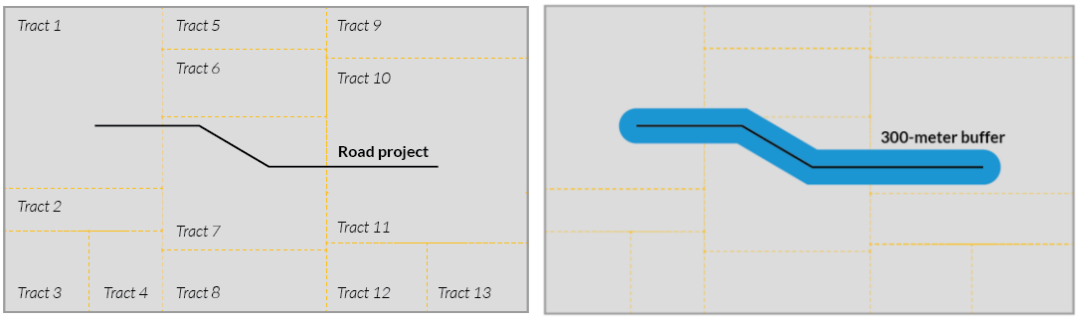
Note that the project types are sometimes overlapping (e.g., some RAISE projects funded were in the form of bicycling infrastructure). For each of these project types, we conducted detailed tract-level analyses independently as the impacted areas—and the types of impacts—vary. That said, results were similar across the project types (as we note in the main body of the paper), pointing to a general federal strategy to invest in tracts whose residents are disproportionately people of color and relatively lower income. We worked as a team to identify reasonable "buffer areas" based on a review of extant scholarship for project impacts, either positive or negative, choosing the following buffers for each project type:

- **Pedestrian or bicycling infrastructure***:* 300 meters. Vehicular air pollution is most likely to persist within 300 meters of a major roadway (Samuels and Freemark 2022).[23] By increasing mobility for bikes and pedestrians along certain corridors, it can be assumed that road traffic in this area will decrease, and with it, particulate matter concentrations.
- **RAISE projects***:* 300 meters. RAISE projects are likely to have impacts across this distance, as they fund moderate-scale surface transportation projects.
- **Road capacity increases***:* 300 meters. Adding new lanes to roadways is likely to increase traffic Weingart 2023), therefore leading to higher concentrations of particulate matter near projects.[24]
- **Road design improvements***:* 300 meters. By making roads safer for bikes and pedestrians along certain corridors, it can be assumed that road traffic in this area will decrease, and with it, particulate matter concentrations.
- **Transit projects***:* 800 meters, equivalent to one-half mile, the generally accepted distance for a transit project to be considered "adjacent" to where people live Guerra, Cervero and Tischler 2011), meaning it is close enough for people to access by walking or other nonmotorized means.

We map a prototypical road project in a county, as well as its buffer, in figure A.1.

FIGURE A.1

Prototypical Road Project Mapped against Tracts in a County



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Source: Framework developed by the authors.

We collected data nationwide at the census tract level, used by many scholars to reflect neighborhood-level data. Our data source was the US Census 2016–2020 American Community Survey. For each tract, we assembled information about its population density per square mile, the share of its residents who describe themselves as *not* non-Hispanic white, the share of its residents in poverty, its median household income, and the county in which the tract is located. These baseline data reflect details about individual affected communities and allow us to compare them with their surroundings.

We drew buffers for each of the project types, as described above, using a geospatial analysis program, and identified any tracts that intersected with the buffer. We thus defined being "treated" by a project relatively broadly, encompassing not only the neighborhood exactly where a new investment is made but also those neighborhoods that are nearby. Because we include tracts that have any intersection at all with each project type's buffer, in some cases, treated neighborhoods include portions that are relatively far from the actual investments (but differences depend on local conditions since the physical size of tracts varies around the country). We chose not to use areal interpolation for this analysis due to the fact that doing so would imply having greater certainty about the distribution of inhabitants in tracts than we realistically can have.

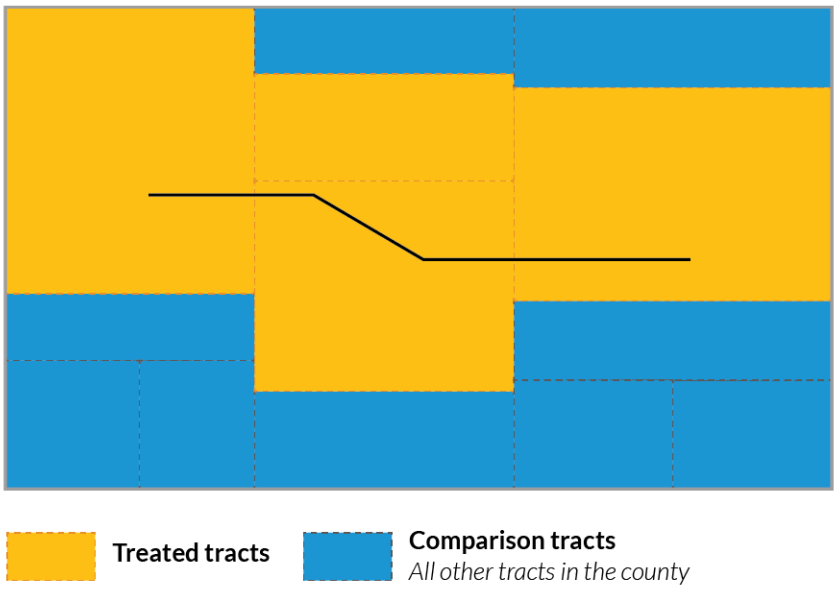
To evaluate the demographics of the tracts where funded projects are located, we established a set of three sometimes-overlapping comparison groups. These three comparisons allow us to make more confident claims about the distribution of projects around the country, since each comparison group has its own limitations.

Comparison group A (figure A.2) represents all tracts outside of the treatment buffer within the same county. This comparison group has the benefit of being the largest of the three, but it may be

biased. For example, consider a large county with both rural and urban populations. If the funded project is in the county's largely urban section, a comparison with group A could imply that such projects are disproportionately located in urban areas, but this may not reflect the reality that a large share of the county's population lives in urban areas.

FIGURE A.2

Comparison A: Impacted Tracts versus All Other Tracts in County



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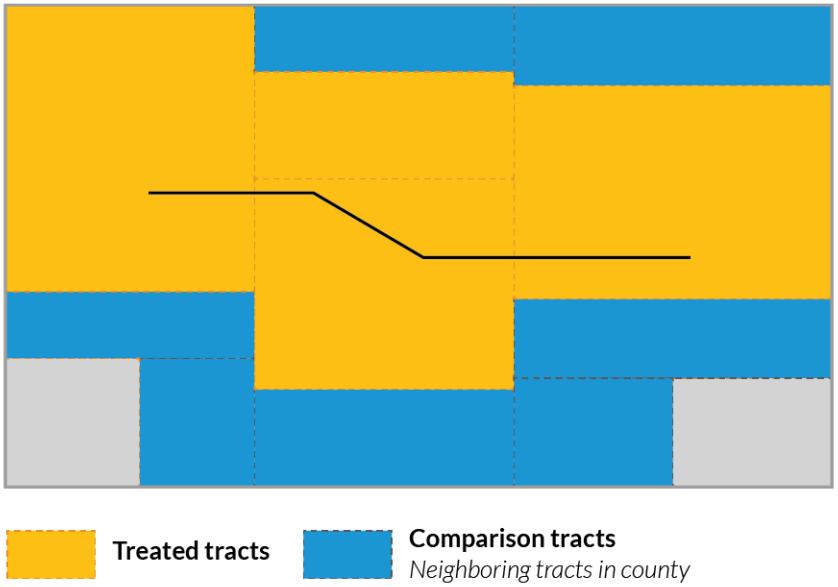
Source: Framework developed by the authors.

Comparison group B (figure A.3) is a group of all tracts that neighbor the treated tracts. This group has the benefit of being located in areas close to the treated areas and thus may be relatively similar in geography. That said, because they are located nearby, this comparison group suffers its own limitations. Namely, it is possible that the neighboring tracts are quite likely to benefit from or suffer the consequences of being located near the funded project, as they may be just outside the buffer.

FIGURE A.3

Comparison B: Impacted Tracts versus Neighboring Tracts



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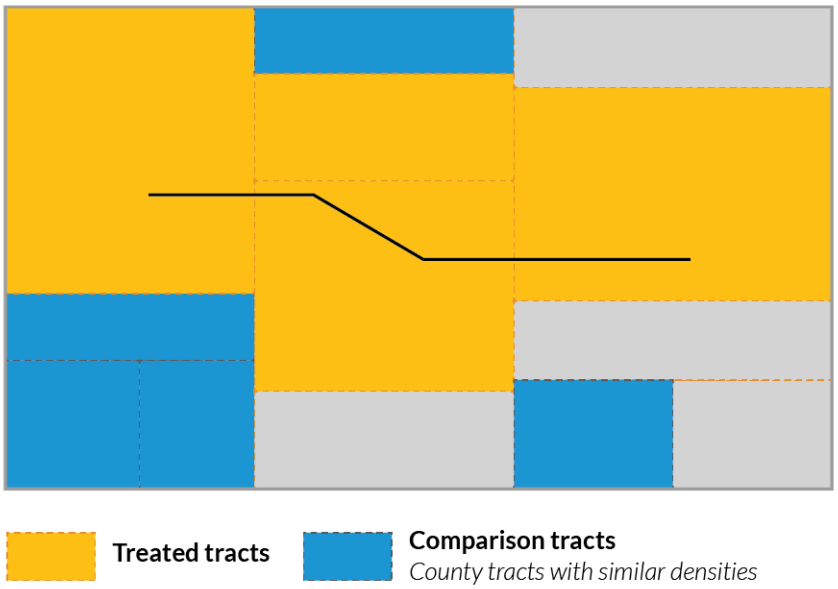
Source: Framework developed by the authors.

Comparison group C includes tracts with similar population densities as the treated tracts (figure A.4). In each county where a project was funded, we select only the tracts that have a population density that is at most 25 percent higher or 25 percent lower than the average of treated tracts in that county. This comparison has the advantage of comparing tracts based on a meaningful underlying data point but may inappropriately exclude some tracts that could be comparable based on different data.

FIGURE A.4

Comparison C: Impacted Tracts versus Similar Tracts



Source: Framework developed by the authors.

Because of the limitations inherent in each of these comparison groups, we choose to run all of our analyses on all three groups. We believe that doing so increases the robustness of our results and enables us to feel more confident about our findings by emphasizing only the analyses where we find compelling results across all three comparison groups.

Once we developed our database of treated and comparison tracts, we conducted a series of analyses designed to compare the demographic characteristics of both. First, across each of the three comparison groups and for each county where a project was awarded, we compared the mean population density, percentage of people of color, poverty rate, and median household income of treatment and comparison groups. (We also used a series of t-tests of means to evaluate county-level data on this indicator, but we do not report those results in our report as we have individual data for hundreds of counties.) Then, we took the mean and median of those differences. This allows us to tell whether awarded projects were more likely to be located in certain types of neighborhoods than others, on average.

Second, we conducted a series of multivariate linear probability model regressions, with robust standard errors, designed to control for local characteristics and assess the significance of these comparisons nationwide. We first evaluated the correlations between each of the four neighborhood-

level demographic indicators among tracts nationwide in order to avoid multicollinearity in our regressions. We found that only one correlation—between poverty rate and median household income—was higher than 0.41 or lower than −0.23 (the correlation was −0.64). As such, we did not include both of those characteristics together in any individual regression. We used the following general form for our regressions:

$$T_t = \beta_0 + \beta_1 \log(D_t) + \beta_2 C_t + \beta_3 P_t + \beta_4 \log(I_t) + F_t + \varepsilon,$$

where T is a binary variable representing whether or not a tract t is treated. As independent variables, we evaluate population density (D), percentage of people of color (C), poverty rate (P), median household income (I), and county-level fixed effects reflecting other local conditions for which we did not assemble data, such as local political differences. In regressions to evaluate the impacts of local poverty rate, we replaced median household income with poverty rate.

Appendix B. Table of Project-Related Externalities

An externality is an outcome, effect, or consequence of some project, whether positive or negative. While positive externalities are the planned or unplanned beneficial outcomes of some effort, a negative externality is an outcome and/or byproduct of some phenomena that causes harm (often referred to as a "cost"). In the context of infrastructure work, negative externalities are undesired byproducts of construction and development, such as the air pollution and traffic noise nuisances associated with highway development. Each project reviewed in this study is likely to generate some level of negative externalities that affect nearby communities. Although some of these effects are inevitable (e.g., short-term traffic increases following lane closures for repairs), research offers evidence-based measures to mitigate the harms of more longitudinal negative externalities (e.g., increased air pollution impacting childhood respiratory health) in development work.

Understanding negative externality considerations in infrastructure development is important when seeking to assess racial equity across a community. Those with a disproportionate share of low-income and/or nonwhite residents disproportionately face negative externalities such as air pollution, water contamination, and the division of neighborhoods due to highway or major roadway construction.

Other scholars have developed recommendations to address negative infrastructure externalities. For example, governments of various jurisdictions can set new regulations related to air pollutions and gas emissions and encourage the use of public transportation and hybrid and electric vehicles (Sofia et al. 2020). Alternatively, action has been taken to address the ways highway construction has broken apart communities; the construction of cap parks in some cities reconnects communities divided by construction, reduces air pollution, and increases urban green space (Houston and Zuñiga 2019). While this is a start, more action needs to be taken on city, county, and state levels to mitigate infrastructure project-related harms, especially those that disproportionately affect communities of color.

Table B.1 details a select number of externalities associated with the various infrastructure projects involved in IIJA- and HUD-funded projects, including increases in road capacity, bridge construction, bus infrastructure, freight rail, and transit-oriented development. These externalities are split into those affecting the surrounding community and those affecting the broader region. We have also elaborated on how the impacts of infrastructure projects are tied to racial equity.

TABLE B.1

Infrastructure Project-Related Externalities

Potential positive externalities	Potential negative externalities	Racial inequity	Sources
Road capacity increase			
<u>Surrounding community:</u> ▪ Roadways increase accessibility for the surrounding community, potentially contributing to increased property values. <u>Region</u>: ▪ Roadways increase scale and interconnectedness of transportation network, potentially increasing economic efficiency and expanding potential areas for development. ▪ Creating new roads to connect cities and communities increases accessibility for residents, making it easier for them to commute to work, for example. ▪ It could also give residents more access to higher-paying jobs if they can travel farther to places to work. ▪ Local businesses could also attract qualified and hardworking employees from outside the given community. This could improve productivity and the quality of their products/services.	<u>Surrounding community:</u> ▪ Presence of highways/major roadways, particularly with high levels of slow-moving or stopped traffic, produces air pollutants (ultrafine particulates, black carbon, carbon monoxide, etc.). ▪ Children who live near major highways are more likely to develop asthma/wheezing or reduced lung function. ▪ Particulate matter in the air increases cardiac and pulmonary deaths and lung cancer. ▪ When exposed to black carbon (air pollutant), males experienced less sleep compared to females, and people of lower socioeconomic status experienced less sleep compared to people of higher socioeconomic status. If air pollutants affect sleep health and duration, it appears individuals and communities may be affected differently depending on certain demographics (including socioeconomic status). ▪ Highways/major roadways are loud and often produce significant ambient noise. Continued exposure to loud, unwanted sounds can lead to hearing loss. ▪ Noise interference can threaten healthy sleep and relaxation (e.g., insomnia) or simply cause people to lose concentration. Continued loud noises can also be associated with stress, depression, and annoyance.	Highways have historically been disproportionately built through neighborhoods with more minority (and low-income) residents. These individuals are thus disproportionately affected by air and noise pollution, both of which can lead to health challenges.	Brugge, Durant, and Rioux (2007); Fang et al. (2015); Karas (2015); Levkovich, Rouwendal, and van Marwijk (2016); Matos and Lobo 2023; Welde and Tveter (2022); Vernez Moudon (2009)

Potential positive externalities	Potential negative externalities	Racial inequity	Sources
	▪ Highway/major roadway construction typically requires demolishing portions of existing neighborhoods, breaking up neighborhood blocks. This construction often creates a separation between white and black communities, for example. ▪ Adjacency to highways is associated with poor conditions for pedestrians. This can lead to a reduction in foot traffic despite a potentially growing population. ▪ Because of the air and noise pollution impacts of highways, property values near roads can go down. <u>Region</u>: ▪ Increased availability of highways shifts modal choice away from transit, walking, and biking and toward car use, which increases carbon emissions. ▪ Availability of highway road capacity increases suburban and exurban development, destroying natural and agricultural land while diminishing development in central areas. ▪ It could reduce success of local (and small) businesses, especially in rural areas. Constructing new roads improves access to rural areas by larger external firms, which may encourage them to move in and disrupt the local economy.		
Road design (e.g., streetscapes, repaving)			
<u>Surrounding community</u>: ▪ Improving road design can prevent accidents (e.g., redesign right-of-way, repave, create medians, add street lighting). ▪ Adding bright streetlights leads to a reduction in crashes. ▪ Improved streetscapes designed for pedestrians and cyclists can improve quality	<u>Surrounding community:</u> ▪ If streets are in better shape, residents in the community may become more likely to drive than to walk or bike. This reduction in exercise could have negative health impacts. ▪ Improved streetscapes could result in increased property values in the	Roads tend to be improved (e.g., repaved) more often and at faster rates in more white, affluent neighborhoods compared to those with more minority residents. Thus, neighborhoods with more minority residents could be	Cain et al. (2014); Duncan (2022); Eves (2009); Jackett and Frith (2013); Raifman and Choma (2022); Sallis et al. (2015)

Potential positive externalities	Potential negative externalities	Racial inequity	Sources
of life, increasing willingness to walk and bike through a neighborhood. ▪ Improvements can increase nearby property values and increase customers patronizing surrounding businesses.	surrounding areas, which could displace or increase the costs of living for nearby residents.	disproportionately affected by the issues road improvements aim to fix (e.g., more accidents).	
Bridges			
Region: ▪ Building more bridges may shorten commutes for residents who previously had to travel on long, less direct routes. ▪ By providing a faster route from point A to point B, bridges may give individuals access to better education or employment. Surrounding community: ▪ Bridges with allocated space for pedestrians and bikes also increase the amount of foot and bike traffic in a city by making it easier for bikers and pedestrians to get around.	Surrounding community: ▪ The construction of bridges can cause water pollution and impact or potentially threaten marine ecosystems. ▪ Bridge construction can (like road expansion) require using eminent domain to acquire surrounding parcels. Region: ▪ The construction of new bridges for cars can serve as a mechanism to increase highway/road capacity and produce the negative externalities associated with roadway capacity noted above.		McCartney et al. (2012); Moore, Berejikian, and Tezak (2013)
Bus infrastructure (e.g., new buses, bus depots, bus stations)			
Surrounding community: ▪ Better bus infrastructure gives residents the opportunity to travel farther to work if they do not own cars. This could ultimately increase the incomes of residents, which would then improve the local economy. ▪ Improved bus infrastructure gives people without cars better access to jobs, educational opportunities, and health care services they may not have been able to reach otherwise. Region: ▪ Improved bus facilities encourage mode shift away from cars and onto public transit, which can (a) reduce carbon emissions, (b) encourage more infill development rather than suburban/exurban sprawl, and (c)	Surrounding community: ▪ Diesel buses and bus depots emit significant air pollution, and that has the potential to encourage health problems. ▪ Construction of new bus operations facilities can also emit various forms of pollution including air, water, noise, and landfill.	Compared to white people, people of color are less likely to have personal cars on average and therefore may rely more heavily on public transportation including buses.	Forbes et al. (2012); Fu, Ramos, and Axelrod (2022); Jain, Gupta, and Pandey (2016); Stacy et al. (2020)

Potential positive externalities	Potential negative externalities	Racial inequity	Sources
support greater investment in existing communities. ▪ Constructing new operations facilities also has the power to strengthen the local economy by creating new jobs.			
Freight rail			
Surrounding community: ▪ Compared to roads where trucks drive near other cars and potentially pedestrians, freight rail is separate from roads and cars/pedestrians. This can reduce exposure to truck-generated air pollution. Region: ▪ Freight rail removes trucks from roads, reducing traffic throughout a region. Compared to trucks, which produce significant carbon dioxide and other forms of particulate pollution, freight rail produces significantly lower levels of air pollution.	Surrounding community: ▪ Construction of freight rail facilities can require large land acquisitions from surrounding areas; low-income residents are more likely to live in such communities. ▪ Though freight rail is less polluting than trucks, it can still expose nearby residents to high levels of particulate pollution, causing lung disease.	Railroads often create a racial divide in communities, separating the more low-income neighborhoods of color from the economic centers of communities.	Ananat (2011); Mahmudi and Flynn (2006); Pinto et al. (2018)
Passenger rail (urban)			
Surrounding community: ▪ Urban rail stations can support considerable urban development projects, creating the opportunity to invest in mixed-use, dense neighborhood developments. ▪ Rail stations are associated with increased property values, increasing the value of development. Region: ▪ Urban rail has the capacity to reduce traffic congestion because residents of the community are encouraged to ride trains rather than driving their individual vehicles. ▪ Urban rail reduces energy consumption and air pollution, especially if electric.	Surrounding community: ▪ Urban rail stations are associated with increasing property values and higher rents, each of which can be associated with gentrification and displacement.	Compared to white people, people of color may be less likely to have personal cars and therefore may rely more on public transportation including urban rail.	Ewing et al. (2014); Grass (1992); Hess and Almeida (2007); Tehrani, Wu, and Roberts (2019); Zhu et al. (2022)
Passenger rail (intercity)			

Potential positive externalities	Potential negative externalities	Racial inequity	Sources
Surrounding community: ▪ Communities located along the routes of intercity passenger rail systems can also experience economic growth as rail passengers disembark and purchase goods and services in their communities. ▪ Residents living near intercity rail services gain access to travel destinations, improving their quality of life and connections with the rest of the country. Region: ▪ Intercity rail has the capacity to move people between different cities, whether for work, education, or to purchase goods and services. ▪ Through connecting people and businesses across cities, intercity rail can integrate separate city/community economies into a larger regional economy. ▪ If intercity rail results in a mode shift away from car or air travel, it can reduce overall carbon emissions.		Railroads often create a racial divide in communities, separating the more low-income neighborhoods of color from the economic centers of communities.	Ananat (2011); Kasu and Chi (2018); Sperry, Taylor, and Roach (2013)
Pedestrian and cycling infrastructure (e.g., cycle tracks, sidewalks)			
Surrounding community: ▪ More opportunities to bike and walk give people more exposure to daylight and fresh air, which can improve physical and mental health. ▪ This encourages people to walk/bike and can lead to many health benefits including reducing rates of chronic disease. Health benefits also lead to decreased health costs for individuals down the line. ▪ Installing separate bike lanes on roads can reduce the frequency and severity of collisions between cars and bicycles. The location and characteristics of bike lanes impact perceptions of safety.		White, more affluent neighborhoods may be more likely to have parks and outdoor communal spaces. Thus, there could be a greater need for the construction of promenades for pedestrians in neighborhoods with more minority residents.	Lee and Buchner (2008); Márquez, Cantillo, and Arellana (2021); Marshall and Ferenchak (2019); van den Berg (2005)

Potential positive externalities	Potential negative externalities	Racial inequity	Sources
Region: ▪ A connected bike and pedestrian network can make it feasible to travel throughout a region without a car in a fashion that is impossible if sidewalks or bike paths abruptly end.			
Vehicle emissions reduction or electrification			
Surrounding community: ▪ This reduces air particulate and noise pollution and the detrimental health impacts associated with it. Region: ▪ This reduces carbon dioxide emissions.	Region: ▪ This could provide incentives for people to travel by car if the government is investing in subsidies specifically directed at them rather than other types of projects, like those that support transit, pedestrian, or cycling facilities.	More individuals of color and those earning lower incomes tend to live near highways and large, busy roads compared to white people. Thus, minorities are likely more affected by the air pollution from highways and roads. Vehicle electrification is vitally important for these communities and would greatly reduce the amount of air pollution to which they are exposed.	Peters et al. (2020)
Ports			
Surrounding community: ▪ Ports can be associated with the creation of local jobs. Region: ▪ Ports promote economic development in a region by facilitating the purchasing, trade, and movement of goods and services. ▪ If integrated into a multimodal freight system, ports can help facilitate more efficient and less carbon-intensive transportation options.	Surrounding community: ▪ Ports are often associated with significant traffic of large trucks (e.g., dieselized containers), which are transporting goods to and from ships at the port. This can increase air pollution in the surrounding community.	Residents living near port facilities have historically been more likely to be people of color and people with low incomes.	Kozawa, Fruin, and Winer (2009); Rodrigue and Notteboom (2022)
Airports			
Region: ▪ Airports increase tourism in a region, thus promoting regional economic development.	Surrounding community: ▪ Airports produce significant noise pollution, with planes landing and taking		Doerr et al. (2020); Sadr et al. (2014);

Potential positive externalities	Potential negative externalities	Racial inequity	Sources
Expanded airport facilities can offer new travel options for local residents, increasing quality of life.	off all through the day and night. This can cause significant disruptions to the residents living nearby, especially during the night. ▪ When planes at airports spend time idling on the runway, they produce air pollution in the surrounding community that affects the health of nearby residents. ▪ Airports also significantly increase traffic in nearby communities, which can cause inconveniences like increased commute times for local residents.		Schlenker and Walker (2016)
New affordable housing <u>Surrounding community:</u> ▪ Affordable housing has been variously associated with a small but statistically significant increase in property values or no effect on property values at all. ▪ As residential stability is improved by affordable housing, schools can experience improved educational outcomes because of reduced student mobility. ▪ This residential stability also increases spending and produces a larger labor market, which can support local economies. <u>Region:</u> ▪ Availability of affordable housing can reduce overall housing costs in a metropolitan area.	<u>Surrounding community:</u> ▪ The construction of affordable housing developments can create disruptions for pedestrian and car traffic in communities as well as produce temporary air and noise pollution.	Families of color are more likely to be extremely low income than white families, thus making them more likely to rely on affordable housing in their communities.	Jain, Gupta, and Pandey (2016); Lubell, Crain, and Cohen (2007); National Low Income Housing Coalition (2019); Stacy and Davis (2022)
Homelessness response and related services <u>Surrounding community:</u> ▪ Approaches to reduce homelessness can benefit the surrounding community by reducing the number of people living on the streets. ▪ While severe homelessness may discourage people from visiting a city or community, reductions in homelessness caused by		Compared to white people, people of color tend to be more affected by homelessness. Thus, local and regional policies to reduce homelessness would provide significant benefits to	Burt (2017); Olivet et al. (2021); Seo, Choi, and Shin (2021)

Potential positive externalities	Potential negative externalities	Racial inequity	Sources
various services could encourage tourism and boost local economies. Region: ▪ Services responding to homelessness can improve regional economies because homelessness is expensive. For example, services that aim to reduce homelessness may reduce the amount of taxes people in the region have to pay to fund medical and social services for people who are homeless.		minority individuals and families.	
Transit-oriented development			
Surrounding community: ▪ Residents living near transit stations are more likely to walk and take public transit as opposed to driving personal vehicles. ▪ Walking more (and driving less) can provide personal health benefits for these residents as well as reduced air pollution for all members of the community. ▪ Property values also tend to increase near transit stations, where it is more appealing for people to live. This can increase tax revenue of local municipalities as property taxes increase. Region: ▪ Transit-oriented development can boost regional economies because it increases the number of commuters travelling through the area and purchasing goods and services. ▪ Transit-oriented development can also increase the use of nonautomobile transportation modes, which can reduce environmental pollutants.	Region: ▪ By increasing property values and drawing new residents, transit-oriented development can contribute to residential segregation and gentrification as well as and the displacement of low-income families and families of color.	Public transit development and revitalization is more common in white communities, while communities mainly comprised of people of color often lack those developments. Thus, white people may receive more benefits from transit-oriented development than nonwhite individuals do.	Marshall and Ferenchak (2019); Purifoye (2020); Tehrani, Wu, and Roberts (2019)
Broadband access			
Surrounding community: ▪ Broadband access expands opportunities (see below) for small businesses and		People of color tend to have lower access to stable and reliable internet compared to	Chen et al. (2022); Pant and Hambly Odame (2017)

Potential positive externalities	Potential negative externalities	Racial inequity	Sources
community organizations, especially in rural areas. ▪ Broadband access enhances productivity (e.g., stable Wi-Fi, wireless credit card transactions, online planning and bookkeeping). ▪ Broadband access expands reach of businesses (e.g., videoconference with businesses/customers outside of the local community, create/improve website design, enhance digital advertising presence such as through customer attraction on social media) ▪ Broadband access provides an opportunity for residents to save money on goods and services by purchasing them online from vendors outside their local, geographic community. <u>Region:</u> ▪ Broadband access throughout a region can better connect small businesses with other businesses and organizations. ▪ Greater connectivity between businesses and organizations across a region could lead to more socially responsible outcomes (e.g., a group of small businesses across a region coming together in philanthropy or events for the broader community)		their white counterparts. This "digital divide" was exacerbated during the COVID-19 pandemic, when most schools and businesses transitioned online.	
Electricity transmission infrastructure			
<u>Surrounding community:</u> ▪ Provides more stable, reliable electricity to households and businesses in the local community	<u>Surrounding community:</u> ▪ This could cause adverse environmental impacts (e.g., pollution during construction, potential wildfire risk if overhead lines cut through trees). ▪ This could cause health risks (e.g., pollution during construction, exposure to electromagnetic fields can increase childhood cancer risks).	People of color (including Black, Hispanic, and Native American households) have significantly higher energy burdens than their white counterparts. Communities of color are more likely to be affected by power outages and their consequences (e.g.,	Cotton and Devine-Wright (2015); Tobiasson and Jamasb (2016); Welton (2022)

Potential positive externalities	Potential negative externalities	Racial inequity	Sources
	▪ This could increase road closures/traffic during construction and maintenance. ▪ This could cause visual intrusion of electric transmission lines into rural/suburban landscapes. <u>Region:</u> ▪ Electricity transmission infrastructure (e.g., overhead lines) can worsen an area's "amenity" and property values.	loss of food, medical challenges due to lack of electricity).	

Source: The authors, based on review of the literature cited above in the Sources column.

Appendix C. Unstudied Programs

TABLE C1

Programs Excluded from Our Analysis

Programs that were eligible for our analysis but were not included due to incomplete funding data.

Program	Granting agency
State Digital Equity Capacity Grant	NTIA
State Digital Equity Competitive Grant	NTIA
Power Marketing Administration Transmission Borrowing Authority	DOE
Regional Clean Hydrogen Hubs	DOE
Preventing Outages and Enhancing the Resilience of the Electric Grid/Hazard Hardening	DOE
Program Upgrading Our Electric Grid and Ensuring Reliability and Resiliency	DOE
Four Regional Clean Direct Air Capture Hubs	DOE
Battery Manufacturing and Recycling Grants	DOE
Battery Materials Processing Grants	DOE
Smart Grid Investment Matching Program	DOE
Carbon Capture Demonstration Projects Program	DOE
Carbon Storage Validation and Testing	DOE
Transmission Facilitation Program	DOE
Advanced Reactor Demonstration Program	DOE
Carbon Dioxide Transportation Infrastructure Finance and Innovation Program	DOE
Clean Hydrogen Electrolysis Program	DOE
Energy Improvement in Rural or Remote Areas	DOE
Indian Health Service Sanitation Facilities Construction Program	EPA
Flood Mitigation Assistance Grants (National Flood Insurance Act Section 1366)	FEMA
State and Local Cybersecurity Grant Program	FEMA
Building Resilient Infrastructure and Communities (Robert T Stafford Act Section 203[I])	FEMA
Abandoned Mine Reclamation Fund	DOI
Federal-State Partnership for Intercity Passenger Rail Grants	FRA
Amtrak National Network Grants	FRA

Program	Granting agency
Amtrak Northeast Corridor Grants	FRA
Consolidated Rail Infrastructure and Safety Improvement Grants	FRA
Facilities and Equipment	FAA
National Infrastructure Project Assistance (Megaprojects)	DOT
Motor Carrier Safety Operations and Programs	FMSCA
Federal Lands Transportation Program (Funds for National Park Service)	FHWA
Federal Lands Access Program	FHWA
Charging and Fueling Infrastructure Grants (Community Charging)	FHWA
Charging and Fueling Infrastructure Grants (Corridor Charging)	FHWA
Transportation Infrastructure Finance and Innovation Act	DOT
National Culvert Removal, Replacement, and Restoration Grant	FHWA
Superfund	EPA
Brownfields Projects	EPA
Geographic Programs—Great Lakes Restoration Initiative	EPA
Affordable Connectivity Program	FCC
Real Property Activities	GSA
Water Infrastructure Improvements for the Nation, Small and Underserved Communities Emerging Contaminants Grant Program	EPA
Orphaned Well Site Plugging, Remediation, and Restoration	DOE
Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation—Discretionary	FHWA

Notes: NTIA = National Telecommunications and Information Administration; DOE = Department of Energy; EPA = Environmental Protection Agency; FEMA = Federal Emergency Management Agency; DOI = Department of the Interior; FRA = Federal Railroad Administration; DOT = Department of Transportation; FMSCA = Federal Motor Carrier Safety Association; FHWA = Federal Highway Administration; FCC = Federal Communications Commission; GSA = General Services Administration.

Appendix D. List of Indicators and Data Sources

TABLE D1

Indicators and Data Sources

Indicator category	Indicator	Definition	Data source
Baseline	Share of residents who are people of color	The share of all residents who are nonwhite and Hispanic	2016–2020 American Community Survey
	Share of residents who are living under the federal poverty line	The share of all residents under the federal poverty line	2016–2020 American Community Survey
	Population density	Population of the jurisdiction divided by its land area (in people/square mile)	2016–2020 American Community Survey
	Median household income	Median household income in the jurisdiction (in US dollars)	2016–2020 American Community Survey
Need (Broadband Access)	Broadband speed	Average maximum downstream bandwidth/speed offered by providers for consumer service in the jurisdiction (in MBPs)	2023 FCC Form 477
	Households with internet access	Share of households with internet access	2016–2020 American Community Survey
Need (Mobility)	Transportation costs	Transportation costs as share of income for the regional typical household	2020 Housing and Transportation Affordability Index
	Annual vehicle miles traveled per household	Annual vehicle miles traveled per household for the regional typical household	2020 Housing and Transportation Affordability Index
	Employment access index	A weighted measure developed by Center for Neighborhood Technology to estimate both the quantity of and residents' access to the jobs in a region (in jobs/square mile)	2020 Housing and Transportation Affordability Index

Indicator category	Indicator	Definition	Data source
	Commute time	Share of population with commutes that are 30 minutes or longer	2016–2020 American Community Survey
	Fatal accidents	Fatal crashes per capita in 2020 (in crash/person)	2020 National Highway Traffic Safety Administration Fatality and Injury Reporting System Tool
	Public transit commutes	Share of commuting population that uses public transit	2016–2020 American Community Survey
	Green commutes	Share of commuting population that uses public transit, walking, or biking	2016–2020 American Community Survey
	Train use	Share of population that uses a train at least weekly	2017 National Household Transit Survey, Federal Highway Administration
	Bus use	Share of population that uses a bus at least weekly	2017 National Household Transit Survey, Federal Highway Administration
	Public transit stops	Number of public transit stops per person	2023 National Transit Map Stops, Bureau of Transportation Statistics
	Average weekday household person trips	Average number of person trips for two-person households with one vehicle available	2017 Local Area Transportation Characteristics, Bureau of Transportation Statistics
	Car access	Share of households with at least one car	2016–2020 American Community Survey
	Major roads and highways	Miles of major roads and highways per capita per square mile (in miles/person/square mile)	2022 North American Roads, Bureau of Transportation Statistics
Need (Environmental Safety)	Greenhouse gas per acre	Annual greenhouse gas emissions from household auto users per acre (in tonnes)	2020 Housing and Transportation Affordability Index

Indicator category	Indicator	Definition	Data source
	Ozone level	Ozone annual mean top 10 of daily maximum eight-hour concentration in air—average of all census tract values	2023 EJScreen, US Environmental Protection Agency
	Particulate matter 2.5 level	Annual average concentration of inhalable particles that are 2.5 micrometers or smaller in air measured—average of all census tract values (micrograms/cubic meter)	2023 EJScreen, US Environmental Protection Agency
	Diesel particulate matter level	The estimated concentration of diesel particulate matter as provided by the 2017 Air Toxics update—average of all census tract values (in $\mu g/m^3$)	2023 EJScreen, US Environmental Protection Agency
	Contaminated sites	Number of known contaminated sites, potentially contaminated sites, or brownfields in a jurisdiction per capita (in sites/person)	2023 Facility Registry Service, US Environmental Protection Agency
	Superfund site	Number of proposed or confirmed sites on the National Priorities List of superfunds per capita (in sites/person)	2023, Superfund Enterprise Management System database, US Environmental Protection Agency
	Drinking water system violations	Water system violations (in violations/person served)	2020 Safe Drinking Water Information System, US Environmental Protection Agency
Need (Energy Access)	Energy costs	Average household annual energy cost as a share of household income	2020 Low-Income Energy Affordability Data Tool, Department of Energy
	Energy grid disturbances	Grid disturbances per capita (in disturbances/person)	2020 Department of Energy
	Electric power generation	Power generation per capita (in thousand megawatt hours/person)	2020 US Energy Administration
Need (Housing)	Housing cost burden	Share of renters paying more than 30 percent of income in rent	2016–2020 American Community Survey

Indicator category	Indicator	Definition	Data source
	Overcrowded housing	Share of households with an average of two or more occupants per room	2016–2020 American Community Survey
	Vacancy rate	Share of housing units that are vacant	2016–2020 American Community Survey
	Homelessness	Number of individuals experiencing homelessness per capita (in individuals/total people)	2020 Point-in-Time estimates, US Department of Housing and Urban Development
Need (Housing Quality)	Complete plumbing	Share of population lacking complete plumbing facilities	2016–2020 American Community Survey
	Complete kitchen	Share of population lacking complete kitchen facilities	2016–2020 American Community Survey
Need (Housing Supply)	Housing units	Housing units per capita (in units/person)	2016–2020 American Community Survey
	Permits per capita	Average annual units permitted per capita from 2010 to 2020 (in units/person)	2010–2020 housingdata.app, Building Permits Survey
Need (Capacity)	Public employees, housing	Full-time equivalent government personnel working in housing, per capita	2022 Census of Governments
	Public employees, environment	Full-time equivalent government personnel working in environment, per capita	2022 Census of Governments
	Public employees, transportation	Full-time equivalent government personnel working in transportation, per capita	2022 Census of Governments
Program Specific	Airports	Number of primary and commercial airports per capita (in airports/person)	2023 County Transportation Profiles, US Bureau of Transportation Statistics
	Bridges	Number of bridges per capita (in bridges/person)	2023 County Transportation Profiles, US Bureau of Transportation Statistics

Indicator category	Indicator	Definition	Data source
	Bridges in poor condition	Share of bridges in poor condition	2023 County Transportation Profiles, US Bureau of Transportation Statistics
	Child population	Share of population under 18	2016–2020 American Community Survey
	Docks	Number of docks per capita (in docks/person)	2023 County Transportation Profiles, US Bureau of Transportation Statistics
	Elevated rail stations	Number of elevated rail transit stations (excluding streetcar) per capita (in stations/person)	Transit Explorer, as of June 22, 2023
	Fatal highway–rail grade crossing incidents	Number of people killed in highway–rail crossings incidents (2010–2023) per capita (in deaths/person)	2023 Highway–Rail Crossing Incidents, US Bureau of Transportation Statistics
	Freight railroad	Number of freight railroad passenger miles per capita (in miles/person)	2023 County Transportation Profiles, US Bureau of Transportation Statistics
	Highway–rail grade crossing incidents	Number of highway–rail crossings incidents (2010–2023) per capita (in incidents/person)	2023 Highway–Rail Crossing Incidents, US Bureau of Transportation Statistics
	Jobs in transportation and trade	Jobs in transportation or trade per capita (in jobs/person)	Q2 2021 Longitudinal Employer-Household Dynamics, US Census Bureau
	Passenger railroad and rail transit	Number of passenger railroad and rail transit passenger miles per capita (in miles/person)	2023 County Transportation Profiles, US Bureau of Transportation Statistics
	Project-based Section 8 units	Number of project-based Section 8 units per capita (in units/person)	2022 A Picture of Subsidized Households, US Department of Housing and Urban Development
	Proximity to inland waterways	Share of land area that is 500 feet from navigable waters	2020 Commercially Navigable Waterway data, US Department of Transportation

Indicator category	Indicator	Definition	Data source
	Public housing units	Number of public housing units per capita (in units/person)	2022 A Picture of Subsidized Households, US Department of Housing and Urban Development
	Rail transit miles	Kilometers of urban rail transit in per capita (in kilometers/person)	2023 Transit Explorer, Chicago Cityscape
	Section 202 contracts	Number of Section 202 (elderly) units per capita (in units/person)	2022 A Picture of Subsidized Households, US Department of Housing and Urban Development
	Section 8 housing choice voucher contracts	Number of housing choice voucher–subsidized voucher households per capita (in vouchers/person)	2022 A Picture of Subsidized Households, US Department of Housing and Urban Development
	Senior population	Share of population older than 64	2016–2020 American Community Survey
	Subway rail stations	Number of subway rail transit stations (excluding streetcar) per capita (in stations/person)	2023 Transit Explorer, Chicago Cityscape

Notes: MBPS = Megabits per second; FCC = Federal Communications Commission

Notes

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grants across the country, while researchers at Brookings Institution are tracking all programs funded under IIJA. "Investing in America," White House, updated July 26, 2023, https://www.whitehouse.gov/invest/; "Bipartisan Infrastructure Law (BIL) Maps Dashboard," GSA Data to Decisions, updated July 7, 2023, https://d2d.gsa.gov/report/bipartisan-infrastructure-law-bil-maps-dashboard; "Brookings Federal Infrastructure Hub," Brookings, accessed August 7, 2023, https://www.brookings.edu/articles/brookings-federal-infrastructure-hub/.

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About the Authors

Yonah Freemark (he/him). Yonah Freemark is a senior research associate in the Metropolitan Housing and Communities Policy Center at the Urban Institute. He is the research director of the Land Use Lab at Urban. His research focuses on the intersection of land use, affordable housing, transportation, and governance. He has published peer-reviewed scholarship in numerous journals, including *Urban Affairs Review*, *Politics & Society*, *Housing Policy Debate*, and *Journal of the American Planning Association*. Freemark previously worked for Chicago's Metropolitan Planning Council and has written for the *New York Times*, *Next City*, and *CityLab*, among other publications. He holds master's degrees in city planning and in transportation, as well as a PhD in urban studies from the Massachusetts Institute of Technology. He lives along the U Street Corridor in Washington, DC.

Mel Langness (they/them). Mel Langness is a research analyst in the Metropolitan Housing and Communities Policy Center and a current master of urban planning and policy student at the University of Illinois Chicago. Their interdisciplinary research focuses on understanding connections between the built environment, structural disparities, and experiences of violence. Langness is a mixed-methods researcher with extensive quantitative and qualitative experience, including in surveying and interviewing, and is a core member of the community-engaged research methods team at Urban. Langness completed their undergraduate degree in political science at the University of North Carolina at Chapel Hill with highest distinction and honors as a Morehead-Cain scholar.

Amanda Hermans (she/her). Amanda Hermans is a research analyst in the Metropolitan Housing and Communities Policy Center. Her research interests include community development, housing affordability, public transit access, and economic equity. She previously worked as a research assistant at The Lab @ DC, a scientific research team in the District of Columbia mayor's administration, where she used evidence-based research and civic design practices to evaluate and improve the district's housing and transit programs. Hermans has a bachelor's degree in journalism and international studies from Northwestern University and a master of public policy degree from American University, where she focused on urban and environmental policy analysis.

Gabe Samuels (he/him). Gabe Samuels is a research assistant in the Metropolitan Housing and Communities Policy Center. His research focuses on fair housing, land use, transportation, and environmental justice. Before joining Urban, Samuels was a student at Emory University, where he

conducted research on international rebel group dynamics and affordable housing along Atlanta's Buford Highway. He received his BA in international studies and environmental sciences in 2022.

Tomi Rajninger (she/her). Tomi Rajninger is a research assistant in the Metropolitan Housing and Communities Policy Center. Her research interests include community development, homelessness, affordable housing, and educational and economic equity. Rajninger graduated from the University of California, Los Angeles, with a BS in statistics and a minor in public affairs. While at the University of California, Los Angeles, she conducted research aiming to accelerate equity in computing and technology, focusing on educational pathways.

David Blount (he/him). David Blount is a research associate in the Metropolitan Housing and Communities Policy Center at the Urban Institute. His work focuses on developing systemic solutions in housing and community development that create more livable, sustainable, and equitable communities. Blount was previously a senior policy analyst at the Center for the Study of Social Policy. He is a former Bill Emerson National Hunger Fellow with the Congressional Hunger Center. Blount holds a BA in sociology and international studies from Loyola University Chicago and an MSW from the Brown School at Washington University in St. Louis.

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