U.S. Department of Transportation, Climate Change Center
Climate Strategies that Work

ZONING REFORMS

Updating zoning and other land use codes, regulations, or policies to foster denser mixed-use development promotes livable, connected communities with increased opportunities for transit use, walking, and biking.

Table of Contents

OVERVIEW

Best Suited for:
Long Term
Urban, Suburban, Rural & Tribal

Since the 1950s, conventional land use codes, regulations, and have led to land-use patterns that have significantly increased transportation-related greenhouse gas (GHG) emissions. This has left many individuals entirely reliant on vehicles to make trips to and from home. Zoning codes often require strict separation of uses (e.g., residential and commercial districts) and single-family housing on lots of a required minimum size. This encourages sprawling development with longer distances between homes and destinations. These provisions have resulted in car-dependent communities with limited consumer choice on transportation mode or residence type. In addition, high housing costs and limited supply in areas close to jobs and transit can lead to displacement, with people moving farther away to find affordable housing, leading to longer commutes and more trips made by car.

Traditional zoning codes and associated maps often require strict separation of uses. (Source: The Urban Institute)

Did you know?

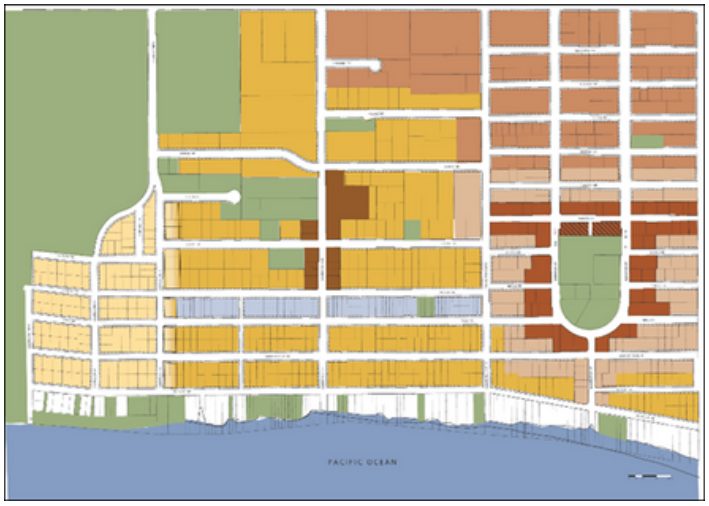
Today, on 75% of all residential land in the US, only a detached single-family house is permitted on each lot (Badger and Bui, 2019).

Updating land use codes, regulations, and policies to increase housing supply and encourage compact, mixed-use, and mixed-income development with convenient access to active transportation and public transit can reverse this trend. Resulting communities would be more inclusive of diverse income levels, supported by convenient transportation options, and would increase location affordability.

Low-density residential developments, separated from other uses, are often less walkable and require personal vehicle travel.

Medium- or high-density residential developments, connected to other uses, are often more walkable and reduce reliance on personal vehicles.

JUMP TO: Overview | GHG Reduction Potential | Co-Benefits | Cost Considerations
Funding Opportunities | Complementary Strategies | Case Studies | What to Read Next | Resources



Performance-based zoning or form-based zoning, and associated maps such as this "regulating plan," focus more on the physical form and characteristics of buildings and their relationship to the surrounding environment rather than strict land use categories. (Source: Form-Based Codes Institute)

States and local communities can craft zoning codes, regulations, and policies to encourage more housing supply in transit-oriented areas and suburban and rural town centers. Zoning is often a local responsibility. However, the **federal government and state governments can encourage local governments to consider policies that support housing production, transit-oriented development (TOD), and walkable communities**. In suburban areas, this would mean easier access to shops and services as a wider variety of uses is woven into existing development. Communities can also support the preservation of existing affordable housing to help current residents stay in their transit-accessible neighborhoods in the face of new development pressures. All of these **policies can help limit the continued growth of distances between destinations by making it easier for people to live and work in locations with more transportation choices, including lower carbon-intensity modes – thereby reducing GHG emissions**. Land use reform that supports density can lead to the protection of natural, undeveloped land, since development growth is focused within a smaller area. Conserving land that would otherwise be developed can support resilience to extreme weather events and other climate impacts, further supporting climate goals.

Promoting density where transit access already exists helps more individuals reach destinations without the need for a personal vehicle. Density is a major factor in creating high-quality public transportation as riders can reach more destinations in less time, resulting in higher ridership and revenue. An increase in frequency and routes can continue to improve ridership, creating positive feedback effects. Protecting and redeveloping small urban cores, main streets, rural downtowns, and other pockets of high density development jointly promotes economic growth and decarbonization where people can take advantage of existing, denser forms of transportation.

Types of zoning amendments that communities can adopt to foster reduced transportation emissions include:

Transit Oriented Development (TOD): Enable and incentivize TOD, such as through overlay districts around public transit stations.

Increased Density and Mixed-Use Zoning: Allow and encourage higher-density development with a mix of residential, commercial, and retail space.

Traditional Neighborhood Development (TND): Enable and incentivize TND, a development strategy designed to mimic neighborhoods built prior to automobile-dependent suburban neighborhoods, such as through the establishment of standards and procedures for large, complex projects or through overlay districts.

Transferable Development Rights (TDR): Implement a voluntary, incentive-based TDR program that allows landowners in one area (i.e., an area targeted for conservation) to sell development rights from their land to another party who then can use these rights to increase the density of development at another designated location (i.e., an area targeted for growth).

Complete Streets Policies: Require streets to accommodate all users, including pedestrians, cyclists, and public transit.

Parking Reforms: Eliminate minimum parking requirements; for example, many conventional zoning codes require minimum parking standards that may be eliminated for most uses.

Pedestrian and Bicycle Oriented Design: Mandate the inclusion of bike lanes, sidewalks, and other pedestrian-friendly amenities in new developments.

Electric Vehicle Infrastructure: Require the installation of electric vehicle charging stations in new developments.

Green Building Standards: Implement green building standards that prioritize energy efficiency and sustainability in transportation-related infrastructure.

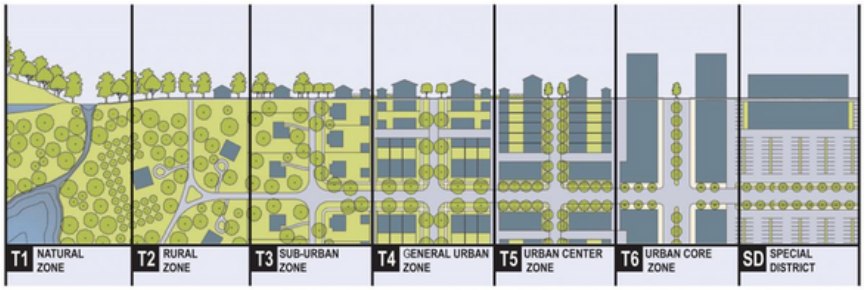
Incentives for Affordable Housing near Transit: Provide incentives for the development of affordable housing near transit hubs.

Transit Corridor Protection: Protect corridors from incompatible development to preserve and enhance transit service viability.

Alternatives to conventional zoning include:

Form-Based Codes

- Whereas conventional zoning codes focus on separation of uses, a form-based code is a land development regulation that fosters predictable built results and a high-quality public realm by using physical form as the organizing principle for the code. A form-based code is a regulation, not a mere guideline, adopted into city, town, or county law.
- More information on Form-Based Codes may be found on the Form-Based Codes Institute website.
- Many form-based codes are organized using the concept of a rural-to-urban "transect," which may be divided into six zones: and natural (T1), rural (T2), sub-urban (T3), general urban (T4), center (T5), and core (T6). The remaining category, Special District, applies to parts of the built environmental with specialty uses that do not fit into neighborhoods. Examples include power plants, airports, college campuses, and big-box power centers.



A version of the original transect diagram (Source: Congress for New Urbanism)

Performance Zoning

Performance zoning, sometimes called "impact zoning" or "flexible zoning," sets specific performance standards or criteria that developments must meet, rather than dictating specific land uses or building types. After these areas are identified and mapped, they are deducted from a site's development potential, and the remaining areas can then be developed at a density permitted by the zoning code. Instead of focusing on what activities are allowed in a particular zone, performance zoning concentrates on the outcomes or impacts of the development, such as traffic congestion, environmental quality, or aesthetic concerns. This approach allows for more flexibility and creativity in land use planning, fostering development strategies that reduce transportation emissions such as TOD (see the TOD page), while ensuring that developments meet certain standards, such as for air quality or pedestrian safety.

GREENHOUSE GAS REDUCTION POTENTIAL

This section provides an overview of greenhouse gas (GHG) emission reductions associated with the strategy. It highlights key findings and relevant metrics from GHG modeling resources, peer-reviewed studies, and real-world applications.

INCREASING DENSITY CAN REDUCE EMISSIONS

A study by the California Air Pollution Control Officers Association (CAPCOA estimates that increasing residential density, job density, or street connectivity through zoning reform can each have up to about a 30% reduction in GHG emissions from vehicle miles traveled (VMT) at the project scale (no greater than a census tract). When combining these land use strategies through zoning reform, the GHG reduction potential can be up to 65% (CAPCOA, 2021).

Nationally, relative to a 2030 baseline, GHG emissions can be reduced by 0.2 to 3.5% through compact development, 0.10 to 0.31% through has the potential to reduce GHG emissions nationally by 0.2 to 3.5% from the 2030 baseline; pedestrian infrastructure improvements, and .009 to 0.28% through bicycle infrastructure improvements. (NASEM, 2012).

ZONING REFORMS DIRECTLY REDUCE EMISSIONS AND VMT

A study of three high-growth U.S. metropolitan areas found that local zoning reforms to accommodate housing growth along public transportation corridors and on underutilized urban land closer to downtown would reduce VMT by up to 13% and GHG emissions by up to 14% (Holland et al., 2023).

In Albuquerque, NM, a modeling study showed that ambitious zoning changes for more compact, infill land development would reduce transportation-related GHG emissions by about 20% in 2040 from the region's 2012 baseline (Tayarani et al., 2018).

CO-BENEFITS

This section outlines the multiple co-benefits associated with the strategy, including safety benefits, local air quality improvements, and improved accessibility. Each co-benefit presents examples that demonstrate how the strategy enhances regional or community well-being while addressing emissions.

SAFETY

By encouraging mixed use development, promoting public transit, and implementing infrastructure for pedestrians and cyclists, zoning codes may be used to help encourage development that reduces the need for car travel, which in turn can decrease the likelihood of vehicle crashes. Additionally, reducing congestion through efficient land use planning can contribute to overall transportation safety by reducing the risk of vehicle-pedestrian collisions on low-speed roads (Retallack & Ostendorf, 2019).

COST SAVINGS

Past suburban and exurban development resulted in families moving further and further from downtowns and urban centers to find affordable housing. In doing so, they often incur higher transportation costs associated with the location of that housing. Shifting toward land use patterns that prioritize compact, mixed-use development easily accessed by public transit and active transportation can reduce transportation costs by reducing the need for car ownership, maintenance, fuel, and parking (Litman, 2024).

property values for residents and businesses, easier travel, reduced pollution, and economic stabilization of neighborhoods (EPA, n.d.).

ACCESSIBILITY AND EQUITY

Zoning reform that expands options for walking, biking, and riding transit increases access to job opportunities, education, and everyday destinations for those who cannot or do not drive, especially the elderly, disabled, youth, and people living in lower-income communities (VTPI, 2023).

AIR QUALITY AND HEALTH

Zoning for compact, mixed-use development that reduces the number of emissions-emitting vehicles on the road (especially in densely-populated areas) will decrease air pollutants that are harmful to human health (Litman, 2024).

Pollution from tailpipe and non-tailpipe emissions contribute to health inequities for communities, especially communities of color, which are disproportionately located near major roadways (EPA, 2014; Jbaily et al., 2022).

RESILIENCE AND ADAPTATION

Adaptation strategies that support community density, like preservation of open green space, using greenways or other trails to mitigate flooding or heat impacts, or using multimodal hubs as evacuation points or heating/cooling centers for vulnerable populations help communities be more resilient to extreme events like floods (Davis et al., 2023; Ciabotti et al., 2023).

Rural communities can reduce emissions through smart zoning reform that is suitable in a rural context.

RURAL COMMUNITIES

Zoning reform can benefit rural communities by allowing for more flexible land use, and supporting efforts to reduce transportation-related GHG emissions. It can enable the development of affordable housing and mixed-use areas, including creating vibrant town centers with improved walkability, bikeability, and the ability for residents to live closer to work and amenities. Overall, it can help promote sustainable growth while preserving the unique character and environment of rural areas (Litman, 2024).

ECONOMIC GROWTH

Zoning reform that encourages compact, mixed-use, transit- oriented development that is conveniently accessed by multiple modes can reduce housing costs while stimulating economic growth by attracting commercial business and visitors (NASEM, 2004; Anagol et al., 2021). This can create jobs and generate revenue for local governments.

COST CONSIDERATIONS

COST EFFECTIVENESS

While there may be upfront costs associated with updating zoning codes and implementing changes, the long-term benefits can outweigh these expenses. For example, promoting compact, mixed-use development can reduce infrastructure costs by minimizing the need for new roads, utilities and other services.

According to one estimate, a shift toward public and active transportation and denser urban development would save $13 trillion throughout the public and private sectors by 2050, due to reduced costs for manufacturing, maintaining, fueling, and operating vehicles and building and maintaining associated infrastructure (Fulton and Reich, 2024).

By reducing air pollution and promoting active transportation, zoning reform can improve public health and reduce health care costs associated with respiratory illnesses and traffic accidents (Frank et al., 2006).

COST OF IMPLEMENTATION

The cost of zoning reform can vary depending on factors such as the scope of the reforms, the size of the community, and the extent of public engagement required. Potential costs to consider include consultant and planning fees, administrative costs, legal costs, and enforcement/compliance costs.

Although zoning reform allowing for more compact development can lower infrastructure costs per capita (accommodating a higher percentage of growth where infrastructure already exists), there may be marginal infrastructure costs of accommodating higher levels of density (e.g., sewer and water system upgrades) that communities need to be aware of. For example, construction costs have been shown to be higher with greater building height (Dong, 2023). However, benefits outweigh the costs of high density development, as less extensive networks are needed (California Planning Roundtable, 2002).

There are often opportunities to leverage funding from grants, partnerships, and other sources to support zoning reform efforts.

FUNDING OPPORTUNITIES

HUD's **Pathways to Removing Obstacles to Housing (PRO Housing)** empowers communities that are actively taking steps to remove barriers to affordable housing and seeking to increase housing production and lower housing costs for families over the long term. With a specific focus on the lacking access to affordable housing which disproportionately affects people of color, this program seeks to alleviate some of the historic zoning pressures that make housing inaccessible to many.

HUD's **Land Use Reforms and Off-Site Construction Research Grant** provides funding for communities to assess the potential for off-site construction methods to increase housing supply and study the impacts of local zoning and other land use regulations that can increase the supply of quality, affordable housing. The increased density associated with greater housing supply is more conducive to high-quality public transit and active transportation networks, which in turn leads to a reduction of VMT.

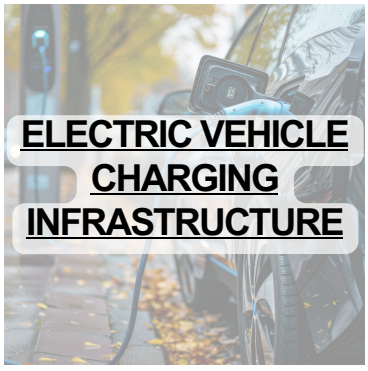
HUD's **Community Development Block Grant (CDBG) Program** supports community development activities to build stronger and more resilient communities. To support community development, activities are identified through an ongoing process. Activities may address needs such as infrastructure, economic development projects, public facilities installation, community centers, housing rehabilitation, public services, clearance/acquisition, microenterprise assistance, code enforcement, homeowner assistance, etc.

FTA's **Areas of Persistent Poverty (AoPP) Program** supports increased transit access for environmental justice (EJ) populations, equity-focused community outreach and public engagement of underserved communities and adoption of equity-focused policies, reducing greenhouse gas emissions, and addressing the effects of climate change.

COMPLEMENTARY STRATEGIES

Zoning codes can influence the design and layout of neighborhoods, including the provision of sidewalks, bike lanes, and pedestrian-friendly infrastructure. By incorporating mixed land uses, reducing distances between destinations, and prioritizing bikeability and walkability, zoning can encourage and support active transportation options such as walking and biking. Additionally, zoning reforms may be needed to enable facilities for bike-sharing and micromobility last mile deliveries.

Zoning codes are a key tool to implement transportation plans by determining land use patterns, densities, and the design of streets and infrastructure. When transportation planning and zoning are coordinated, zoning codes can be aligned with transportation goals to also promote TOD, pedestrian-friendly streetscapes, and mixed-use developments that reduce dependence on personal vehicles and encourage alternative modes of transportation.



Zoning codes can include provisions that require or incentivize the installation of electric vehicle charging stations in new developments, parking facilities, and public spaces. Zoning can also dictate the placement and design of electric vehicle charging infrastructure, and can streamline the permitting process for installing the infrastructure.

Zoning codes typically designate how much parking must be provided for different types of developments, such as residential, commercial, or industrial, as well as which areas may be car-free zones. Coordinating parking reform with zoning reform can improve the efficiency of land designated for parking and encourage ease of access to walking, biking, and public transit.

By shaping land use patterns, densities, and development patterns, zoning can either facilitate or hinder the expansion of public transit infrastructure. Zoning codes that promote mixed-use developments, higher densities, and TOD can create supportive environments for public transit expansion.

Zoning codes may need to be adjusted to encourage or accommodate TOD principles, such as increased density around transit hubs, mixed land uses, and pedestrian-friendly design. Zoning reform can facilitate the development of TOD projects by allowing for higher densities, reduced parking requirements, and streamlined approval processes, ultimately promoting sustainable and transit-friendly communities.

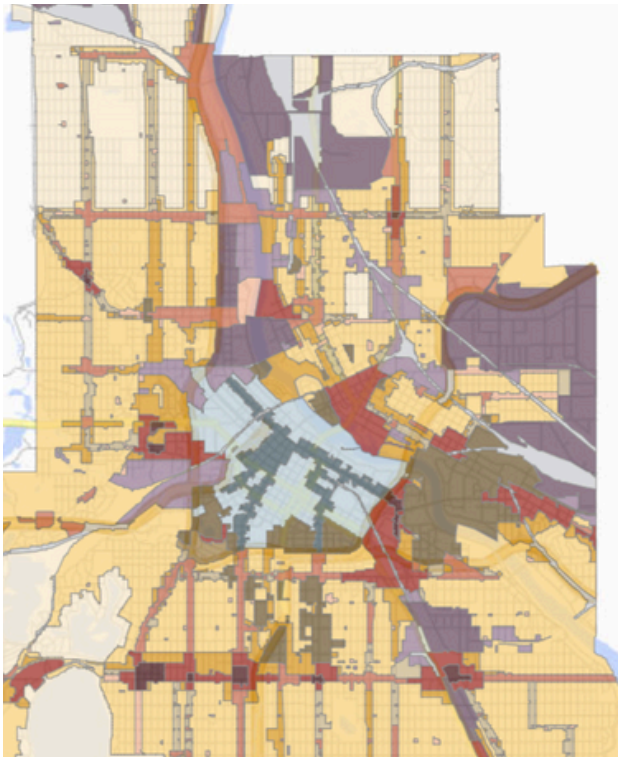
View All Strategies

JUMP TO: Overview | GHG Reduction Potential | Co-Benefits | Cost Considerations
Funding Opportunities | Complementary Strategies | Case Studies | What to Read Next | Resources

CASE STUDIES

BUFFALO, NY UNIFIED DEVELOPMENT ORDINANCE "GREEN CODE"

Buffalo, NY became the first major U.S. city to abolish parking requirements in 2017 when it formally adopted its Unified Development Ordinance (UDO) "Green Code" zoning ordinance, which included the elimination of off-street parking minimums. The elimination of off-street parking minimums helps to promote citywide development, density, and the use of alternative transportation modes.



Updated Minneapolis, MN primary zoning district map (Source: Minneapolis 2040).

MINNEAPOLIS, MN 2040 COMPREHENSIVE PLAN

As required by state law, Minneapolis updated its zoning rules to match the development guidelines that the City Council approved in the Minneapolis 2040 comprehensive plan. Since 2020, the City has worked to meet this requirement by adopting inclusionary zoning, eliminating areas exclusively zoned for single-family, adopting new built form districts and regulations, and eliminating minimum parking requirements. The Land Use Rezoning Study, adopted in 2023, is the next major update to zoning regulations that creates consistency between the zoning code and the comprehensive plan.

PORTLAND, OR RESIDENTIAL INFILL PROJECT

Portland, OR became the largest modern U.S. city to end so-called "single-family zoning" in 2021 with its "Residential Infill Project" (RIP) and associated zoning reforms. The zoning reforms allow new forms of housing on residential parcels previously zoned for a single-family detached house. The new rules also permit new types of housing, and set new, more flexible rules for how the homes can be configured and how large they can be. The overall purpose of the RIP is to provide more density, allowing more housing without increasing Portland's existing footprint.

WASHINGTON STATE, MIDDLE HOUSING

The Washington State Legislature put into effect House Bill 1110, requiring several cities in Washington to include a range of housing types, known as middle housing, in areas previously zoned for detached homes. Middle housing refers to buildings that are compatible with the scale of detached single family housing, in terms of bulk and form, such as duplexes and triplexes, townhouses, and courtyard apartments In Seattle, multi-unit housing types are required in Neighborhood Residential and Residential Small Lot zones by a deadline of June 30, 2025, with some flexibility for addressing issues such as displacement risk and development standards that may create further barriers.

IMPLEMENTING ZONING REFORMS: **WHAT TO READ NEXT**

Implementing zoning projects involves several steps:

1. **Coordinated Transportation Planning**: One of the first steps before reforming zoning codes to reduce greenhouse gas emissions is to perform coordinated transportation planning. Working with partners and stakeholders, develop a comprehensive plan that outlines specific goals and strategies for reducing emissions, including through zoning.
2. **Zoning audit**: Conduct a thorough assessment of current zoning codes and regulations to identify areas for improvement for reducing greenhouse gas emissions.
3. **Stakeholder engagement**: Engage with various stakeholders including local governments, community members, businesses, and environmental organizations to gather input, build support, and ensure that the zoning projects align with community needs and priorities.
4. **Code development**: Draft zoning codes and other land use regulations that incorporate measures to reduce greenhouse gas emissions, such as promoting transit-oriented development.
5. **Public review and approval**: Present the proposed zoning changes to the public for review and feedback. Make adjustments based on public input and seek approval from relevant governing bodies or planning commissions.
6. **Implementation and enforcement**: Once approved, implement the zoning changes by updating official zoning maps and codes. Establish mechanisms for enforcement to ensure compliance with the new regulations, such as permit requirements and inspections.
7. **Monitoring and evaluation**: Continuously monitor the effectiveness of the zoning updates in reducing greenhouse gas emissions. Evaluate progress towards goals and make adjustments to the codes and regulations as needed to improve outcomes.
8. **Education and outreach**: Provide educational resources and outreach efforts to inform the public and stakeholders about the benefits of the zoning projects and how they can contribute to reducing greenhouse gas emissions in their communities.

See the Resources section below for sources that can provide more information on each of these steps.

RESOURCES

GENERAL RESOURCES

APA Equity in Zoning Policy Guide: The zoning policy guide provides zoning tools to position planners to lead the way on zoning for equity at the local, state, and federal level.

Congress for the New Urbanism's Enabling Better Places: Users' Guide to Zoning Code Reform: This guide serves as a resource for Michigan's local governments to implement zoning code changes.

TOOLKITS AND MODELLING APPROACHES

National level

Argonne National Laboratory Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) Model: The model provides life-cycle emissions assessment for different vehicle technologies and futures.

EPA Motor Vehicle Emission Simulator (MOVES): The MOVES model provides vehicle emission rates and mobile-source inventories.

Transportation Pooled Fund VisionEval: The project and associated tools (i.e., Energy Emissions Reduction and Policy Analysis Tool; EERPAT) are designed to evaluate many alternative futures and policies to help state and metropolitan area governments address pressing issues, despite uncertainty.

FTA Transit Greenhouse Gas Emissions Estimator: The estimator is a spreadsheet-based tool that allows users to estimate the partial lifecycle GHG emissions generated from the construction, operation, and maintenance phases of a project across select transit modes. Users input general information about a project, and the Estimator calculates annual GHG emissions generated in each phase.

Infrastructure Carbon Estimator (ICE): ICE is a spreadsheet tool that estimates the lifecycle energy and GHG emissions from the construction and maintenance of transportation facilities. ICE is intended to inform planning and other pre-engineering analysis such as those conducted during the NEPA process.

Mobility Energy Productivity Tool (MEP): This tool evaluates the ability of a transportation system to connect individuals to goods, services, employment opportunities, and others while accounting for time, cost, and energy. This tool also includes a separate metric to evaluate freight connectivity, called Freight MEP.

The Argonne Laboratory POLARIS Transportation System Simulation Tool: This is an open-source simulation tool that allows users to simultaneously model all aspects of travel decisions through a network-demand model. This tool can be used to understand impacts of transportation decisions across several key metrics, which includes congestion, accessibility, cost, emissions, energy, and environmental justice, that can be integrated into land use planning.

DOE Behavior, Energy, Autonomy, and Mobility Comprehensive Regional Evaluator (BEAM CORE): This is an open-source, integrative modeling tool that can capture and analyze a wide set of transportation system components. The tool produces various metrics such as aggregate vehicle and person miles traveled, congestion, energy consumption, and accessibility metrics, for insight on the interconnected impacts between transportation and land use decisions.

DOE and National Renewal Energy Laboratory (NREL) Mobility Energy Productivity (MEP): This metric is used to measure the existing and potential impact of changes in mobility options across transportation modes at the community or regional level. The MEP metric takes into account travel time, energy, and affordability.

DOE's Lawrence Berkely National Laboratory (LBNL) developed the Individual Experienced Utility-Based Synthesis (INEXUS): INEXUS is a suite of accessibility metrics that measure agent-trip level accessibility. These metrics can be used to identify and measure individual travelers who benefit from improved mobility under different simulation scenarios. Tools such as these can be used to design improved operational efficiency in existing and future transportation systems.

State level

APA Michigan Chapter Zoning Reform Toolkit: This toolkit aims to provide urban leaders with tools needed for updating and modernizing zoning and development review regulations to develop more housing types. It also includes case studies on the application of the strategies recommended. This toolkit explains elements of the affordable housing crisis and how zoning reform can act as an intervention. It also provides 15 zoning tools that can be used to address housing supply and affordability.

Massachusetts Housing Toolbox: This toolbox provides strategies and best practices, including zoning and land use tools, for the creation and preservation of affordable housing, with guides, tools and resources for local boards &

committees, planners, municipal staff, developers, and volunteers.

California Quantifying the Effect of Local Government Actions on Vehicle Miles Traveled (VMT): This research resulted in a Vehicle Miles Traveled (VMT) Impact spreadsheet tool, which lets users easily see impacts for any census tract, city, or region in California.

California Emissions Estimator Model (CalEEMod): CalEEMOD is a statewide land use emissions computer model designed to provide a uniform platform for government agencies, land use planners, and environmental professionals to quantify potential criteria pollutant and greenhouse gas (GHG) emissions associated with both construction and operations from a variety of land use projects.

WORKING WITH COMMUNITIES

U.S. Department of Energy's Clean Cities Coalition Network: This network supports communities in achieving cleaner air and reducing dependence on fossil fuels by promoting alternative transportation options.

EPA's Smart Growth: This website provides resources and technical assistance to help communities integrate active transportation into their development plans, promoting compact, walkable neighborhoods.

American Planning Association (APA) Working to Address the Nation's Housing Crisis: The APA provides resources on planning-led zoning reform to address housing supply issues and explore ways planners can work with states to enable reform.

Smart Growth America: Smart Growth America empowers communities through technical assistance, advocacy and thought leadership to create livable places, healthy people, and shared prosperity. Smart Growth America also provides a variety of resources on their website to support community planning efforts and zoning reform.

Center for Neighborhood Technology: The Center for Neighborhood Technology delivers innovative analysis and solutions that support community-based organizations and local governments to create neighborhoods that are equitable, sustainable, and resilient. The Center for Neighborhood Technology provides tools and publications that support planning and zoning reform initiatives on their website.

RURAL SPECIFIC

FTA National Rural Transit Assistance Program (RTAP): This FTA program provides technical resources, toolkits, training, webinars, a resource library, news updates, and information on Tribal transit and State RTAP programs.

AARP Livable Communities Transportation and Mobility: This website includes resources such as policy briefs and a rural transportation toolkit for rural communities on the topics of livability, funding opportunities, health care, and transportation options available in rural areas.

Community Transportation Association for America Transit Planning 4 All: This program, in partnership with several organizations, supports older adults and people with disabilities in getting involved in coordinated transportation system development. The members are involved in surveys, research activities, grants, and creating a knowledge sharing network.

Some rural planning and zoning tools that can help preserve rural character while reducing transportation emissions, adapted from EPA's Essential Smart Growth Fixes for Rural Planning, Zoning, and Development Codes, include:

- **Determine Areas for Growth and for Preservation:** After engaging a community-driven process to plan for which areas shall be targeted for growth and which for preservation, communities may adopt zoning amendments or other development standards and procedures that establish requirements and incentives for focusing growth in designated areas while prohibiting or disincentivizing it in others.
- **Incorporate Fiscal Impact Analysis in Development Reviews:** Rural communities can require fiscal impact analysis within the project development review process to determine how best to allocate their resources and make development decisions that benefit residents.
- **Reform Rural Planned Unit Developments (PUDs):** To provide more control regarding where and how larger scale development may be permitted, rural communities can adopt zoning and subdivision provisions that allow or incentivize new village-scaled development within designated areas where the community has decided it makes sense to grow.

- **Use Wastewater Infrastructure Practices that Meet Development Goals:** Communities may align local zoning and development regulations with wastewater treatment standards to promote development in designated areas that helps reduce transportation emissions while protecting water resources and public health.
- **Right-size rural roads:** Right-sizing rural roads can support reducing transportation emissions by making roads more walkable and bikeable while providing streetscapes that foster mixed-use, compact development where it makes sense such as in town centers.
- **Encourage Appropriate Densities in the Periphery:** Rural communities can develop design regulations that require street connectivity with adjacent neighborhoods, and create land use district transitions to adjacent agricultural or undeveloped areas.
- **Use Cluster Development to Transition from Town to Countryside:** Rural communities can adopt zoning and subdivision provisions that allow cluster development only at the periphery of towns, which helps provide a smooth transition between town-scaled development and open lands (EPA, 2012).

REFERENCES

Anagol, S., Ferreira, F. V., & Rexer, J. M. (2021). Estimating the economic value of zoning reform (No. w29440). National Bureau of Economic Research. https://www.nber.org/papers/w29440

Badger, E., & Bui, Q. (2019). Cities start to question an American ideal: A house with a yard on every lot. The New York Times, 18. https://www.nytimes.com/interactive/2019/06/18/upshot/cities-across-america-question-single-family-zoning.html

Bashmakov, I. A., Nilsson, L. J., Acquaye, A., Bataille, C., Cullen, J. M., Fischedick, M., ... & Tanaka, K. (2022). Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, Chapter 11. https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_FullReport.pdf

Boutros, A., Field, S., & Resler, K. (2023). Integrating Equity into Transportation: An Overview of USDOT Efforts. Public Roads, 87(1). https://highways.dot.gov/public-roads/spring-2023.

California Planning Roundtable. (2002). Myths Facts About Affordable & High Density and Housing: A Report by California Planning Roundtable California Department of Housing & Community Development. https://cproundtable.org/static/media/uploads/publications/mythsnfacts__.pdf.

California Air Pollution Control Officers Association (CAPCOA). (2021). Handbook for Analyzing Greenhouse Gas Emissions Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. https://www.caleemod.com/handbook/index.html

Ciabotti, J., Kelly, Q., Lauderdale, E., Lohse, K., Weyer, S., Hintze, M., ... & Systematics, C. (2023). Trails as Resilient Infrastructure Guidebook (No. FHWA-HEP-24-007). United States. Department of Transportation. Federal Highway Administration. Office of Human Environment. https://www.fhwa.dot.gov/environment/recreational_trails/publications/trails-resilient-infrastructure-guidebook.pdf.

Davis, S., McAlear, Z., Plovnick, A., & Wilkerson, A. (2023). Trails and Resilience: Review of the Role of Trails in Climate Resilience and Emergency Response. https://www.fhwa.dot.gov/environment/recreational_trails/publications/fhwahep23017.pdf.

Dong, H. (2023). Higher density development for lower cost housing? Understanding the multifamily housing market and the role of density in multifamily home prices. Journal of Planning Education and Research, 43(3), 617-636. https://journals.sagepub.com/doi/abs/10.1177/0739456X20912829.

Frank, L., Kavage, S., & Litman, T. (2006). Promoting public health through smart growth: Building healthier communities through transportation and land use policies and practices. https://trid.trb.org/View/798593.

Fulton, Lewis, and D. Taylor Reich. Compact Cities Electrified: United States. Institute for Transportation & Development Policy and UC Davis Institute of Transportation Studies, Jan. 2024, https://www.itdp.org/wp-content/uploads/2024/01/CCities_USA_Brief-for-Policymakers_Download.pdf.

Holland, B. (2023). Urban Land Use Reform: The Missing Key to Climate Action Strategies for Lowering Emissions, Increasing Housing Supply, and Conserving Land. RMI, Cities, 2023. https://rmi.org/insight/urban-land-use-reform/

Jbaily, A., Zhou, X., Liu, J., Lee, T. H., Kamareddine, L., Verguet, S., & Dominici, F. (2022). Air pollution exposure disparities across US population and income groups. Nature, 601(7892), 228-233. https://doi.org/10.1038/s41586-021-04190-y.

Litman, T. (2015). Understanding smart growth savings. Victoria, BC, Canada: Victoria Transport Policy Institute. https://vtpi.org/sg_save.pdf

Litman, T. (2024). Win-Win Transportation Emission Reduction Strategies. Victoria Transport Policy Institute. https://www.vtpi.org/wwclimate.pdf

National Academies of Sciences, Engineering, and Medicine (NASEM). (2004). Transit-Oriented Development in the United States: Experiences, Challenges, and Prospects. Washington, DC: The National Academies Press. https://doi.org/10.17226/23360 /

National Academies of Sciences, Engineering, and Medicine (NASEM). (2012) . Incorporating Greenhouse Gas Emissions into the Collaborative Decision-Making Process. Washington, DC: The National Academies Press. https://doi.org/10.17226/22805.

Retallack, A. E., & Ostendorf, B. (2019). Current understanding of the effects of congestion on traffic accidents. International journal of environmental research and public health, 16(18), 3400. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6766193

Tayarani, M., Poorfakhraei, A., Nadafianshahamabadi, R., & Rowangould, G. (2018). Can regional transportation and land-use planning achieve deep reductions in GHG emissions from vehicles?. Transportation Research Part D: Transport and Environment, 63, 222-235. https://www.sciencedirect.com/science/article/pii/S1361920917308192

The Urban Institute. (2022). Cracking the Zoning Code. https://apps.urban.org/features/advancing-equity-affordability-through-zoning/#home

US Environmental Protection Agency (EPA). (2007). Measuring the Air Quality and Transportation Impacts of Infill Development. EPA 231-R-07-001 https://www.epa.gov/sites/default/files/201401/documents/transp_impacts_infill.pdf.

US Environmental Protection Agency (EPA). (2012). Essential Smart Growth Fixes for Rural Planning, Zoning, and Development Codes. https://www.epa.gov/sites/default/files/documents/essential_smart_growth_fixes_rural_0.pdf.

US Environmental Protection Agency (EPA). (2014). Office of Transportation and Air Quality. Near Roadway Air Pollution and Health: Frequently Asked Questions. FAQ, https://www.epa.gov/sites/default/files/2015-1/documents/420f14044_0.pdf

US Environmental Protection Agency (EPA). (n.d.). Attracting Infill Development in Distressed Communities: 30 Strategies. https://www.epa.gov/smartgrowth/attracting-infill-development-distressed-communities-30-strategies

Victoria Transport Policy Institute (VTPI). (2023). Community Cohesion as a Transport Planning Objective. https://www.vtpi.org/cohesion.pdf

Washington State Legislature. (2023). HB 1110 - 2023-24: Increasing middle housing in areas traditionally dedicated to single-family detached housing. https://app.leg.wa.gov/billsummary?BillNumber=1110&Initiative=false&Year=2023.

Williams, A. J., McHale, C., & Chow, C. (2022). Final report on loneliness and transport systematic review. School of Medicine. https://www.sustrans.org.uk/media/11359/sustrans-loneliness-and-transport-systematic-review-final-report-21-06-30.pdf.

For more information visit the DOT Climate Change Center, https://www.transportation.gov/priorities/climate-and-sustainability/dot-climate-change-center