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MEASURING THE LIVABILITY FRAMEWORK

Prepared by Bolton & Menk

MnDOT's Office of Livability developed the Livability Framework to help guide the planning, programming, and project development processes. It is being piloted in the MnDOT Metro District. The outcomes should result in more people-focused outcomes for the plans, programs, and projects within the district. The Livability Initiative wants each of the Livability Pillars of the Livability Framework to be thoroughly considered and evaluated when planners, project managers, and others make decisions regarding transportation policies, programs, and/or projects.

To support this effort, the Office of Livability is creating a Livability Measurement Tool (or tools) that will help planners, project managers, and others understand and integrate livability considerations, and determine what actions can address these needs. An initial step for this is a summary of current best practices for how to measure livability. This report provides a deep literature analysis of research conducted on measuring livability. The summary covers policy-informed best practices for measuring livability and identifies points of consensus, debates, and gaps in the research on how to measure livability as the MnDOT Office of Livability defines it.

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The Minnesota Department of Transportation (MnDOT) Office of Livability established the Livability Framework to guide transportation policies, programs, and/or projects toward improved, people-focused outcomes. The Livability Framework proposes seven (7) Livability Pillars to be considered as part of the planning and implementation of these activities. These Livability Pillars include Health and Environment, Economic Vitality, Sense of Place, Safety, Connectivity, Equity, and Trust. To support this effort, a Livability Measurement Tool (or tools) will be developed to help planning agencies measure, represent, interpret, evaluate, and track livability considerations, and, thereafter, determine appropriate action to address identified needs. An initial step for this work is a summary identification of current best practices for measuring livability. This report provides a literature analysis of research conducted on measuring livability and identifies points of consensus, debates, and gaps in the research on the measurement of livability as the MnDOT Office of Livability defines the concept. Within the body of research analyzed, there was consensus regarding the effect of the built environment on human health and subjective well-being, and measurements for its assessment. However, there are notable gaps in existing literature for measuring feelings of belonging, the inequitable burden of transportation systems on vulnerable populations, and distrust in government by residents, among other issues.

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Table of Contents

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Introduction

Project Background and Goals

The MnDOT Office of Livability developed the Livability Framework to help deliver projects that not only fix pavement issues but also address broader community goals. The Livability Framework consists of seven pillars: Health and Environment, Sense of Place, Trust, Equity, Economics, Connections, and Safety.

The Livability Pillars cover a wide range of community issues that are linked to transportation. The intent is that the Livability Pillars are thoroughly considered and evaluated when planners, project managers, and others make decisions regarding transportation policies, programs, and/or projects. However, as these are broad concepts, more guidance is needed to effectively assess what action is needed and consistent with the intent. A more specific approach is necessary to ensure a mutual understanding among stakeholders and to promote accountability through effective performance management.

To support this effort, the Office of Livability is creating a Livability Measurement Tool (or tools) that will help planners, project managers, and others understand the livability needs associated with transportation policies, programs, and/or projects, and determine what actions can address these needs. These tools will influence transportation decisions and investments. This current research effort will inform the scoping for the future tool development process.

An initial step to developing supportive tools is a summary of current best practices for how to measure Livability Pillars. This report provides an overview of a literature analysis of research on measuring livability. It covers policy-informed best practices for measuring livability and identifies points of consensus, debates, and gaps in research on how to measure livability as the MnDOT Office of Livability defines it.

Research Methodology

Within the broader research framework, the following research questions were identified, in the context of identifying, defining, and applying livability methods and metrics:

- What are the best practices for measuring livability overall and by subtopic?
- What geographic scope and scale factors should be considered?
- What climate and environmental factors should be considered?
- What community character, form, density, and development factors should be considered?
- What is the most applicable scale of measurements: neighborhood, corridor, region, nation?
- What are the best sources of data, and what is the difficulty level of procuring each of them?
- What connection can be made to community goals like economic development and retention?

The primary focus of this research project was a literature review of articles, summarizing best practices and identifying measurable metrics for each of the seven Livability Pillars. This information is included in the

accompanying matrix (see Appendix A), along with a high-level analysis showing the considerations of the research questions.

The concluding section of the report provides a narrative on the applicability of this database, including recommendations for next steps in the process. This includes both tool development, as well as thoughts on the accompanying needs for data gathering, stakeholder education, and pilot project use cases.

Background

The MnDOT Metro District initiated the Livability Initiative in 2019, recognizing the community's desire for comprehensive consideration and appropriate addressing of community goals and needs in highway project development. The formalized initiative was established in response to feedback gathered during Phase 1 (2016-2018) of the Rethinking I-94 project, revealing community members' interest in broader issues, a preference for early and continuous involvement, the consideration of Livability in the FHWA planning activities, and a desire for accurate and timely information that reflects community goals and desired reflection of their values and vision in project designs.

As defined through both the MnDOT and Federal Highway Administration's (FHWA) Livability Initiatives, livability in transportation is about integrating the quality, location, and type of transportation facilities and services available with other more comprehensive community plans and programs to help achieve broader community goals. Livable transportation networks and facilities:

- Create mobility choice within more balanced multimodal transportation networks
- Provide better access to jobs, community services, affordable housing, and schools
- Support safety for all users of the transportation system
- Reduce energy use and emissions
- Focuses on human scaled considerations and impacts
- Support efficient land use patterns
- Accommodate all abilities and all users
- Recognize and support meaningful engagement by those who have historically been overburdened and underrepresented in public processes

Development of Livability Framework

Following an initial round of livability input from Metro area residents, businesses, and travelers, MnDOT's team conducted Livability workshops in 2021 to provide refinements in the development of the Livability Framework and implementation activities. MnDOT's Livability Initiative not only addresses community needs but also aligns with support from the Federal Highway Administration (FHWA), which advocates for the consideration of livability principles in planning, programming, and project development processes. The FHWA's published principles have played a crucial role in shaping and guiding the formation of the Livability Initiative (see principles here: https://www.fhwa.dot.gov/livability/index.cfm).

Broader Applicability

The Livability Framework developed by MnDOT Metro District holds broader applicability beyond specific projects, extending its impact to various communities and transportation initiatives. By prioritizing aspects such as community engagement, economic opportunities, safety, and environmental considerations, the framework offers a versatile and comprehensive approach that can be adapted to diverse urban and rural settings. Its principles provide a valuable blueprint for transportation planners, programmers, and policy makers aligning with the evolving emphasis on livability in infrastructure development and contributing to the creation of more sustainable, equitable, and people-centric communities across the State of Minnesota.

Guiding Commitments

Concurrent with the development of the Livability Framework, MnDOT staff crafted Guiding Commitments as essential tools to enhance the delivery of projects. The Guiding Commitments inform both MnDOT project and planning folks but also community members and organizations of expectations for MnDOT.

- Vision: Understanding a community's underlying values and issues of importance, now and into the future, to articulate common ground; building toward that vision with each project and demonstrating that commitment to communities over time.
- Co-power: Cultivating joint ownership of each stage of the process; acknowledging that local knowledge is valid and valuable expertise; including communities in identifying criteria for prioritizing decisions and being partners in problem-solving.
- Authenticity and respect: Providing timely, accessible information as well as multiple options for participation; acknowledging issues and constraints communicated by stakeholders.
- Transparency: Communicating realistic timelines, participation impact, funding realities, decision-making processes, and levels of authority; making visible the context of the whole process at each step.
- Inclusivity: Creating inclusive partnerships and teams from vision to construction; ensuring multiple voices are engaged and reflected in decision making.

Livability Pillars

The Pillars of the Livability Framework are broad and cover a wide range of community issues that are linked to transportation. The Livability Framework consists of seven Livability Pillars: Health and Environment, Economic Vitality, Sense of Place, Safety, Connectivity, Equity, and Trust.

Health and environment: Transportation systems and investments that bolster the health and well-being of people who live, work, and play near system corridors. Investments that prioritize delivering benefits to Black,

Indigenous, and people of color (BIPOC) and low-income communities who disproportionately endure the most severe health-related transportation burdens.

Economics: Transportation systems and investments that connect people to jobs, boost local economies, and create wealth-building opportunities for communities, especially in under-resourced communities.

Sense of place: A livable transportation system supports each neighborhood's unique sense of place. A strong sense of place makes people feel at home in their community and connected to their neighbors and culture.

Safety: A livable transportation system ensures that everyone, regardless of their mode of transportation, can travel safely and without risk to their well-being. This goes beyond the prevention of physical accidents; it also includes the protection of personal security and the preservation of people's well-being, keeping them safe from danger, harm or threats while using the transportation system. A livable system invests in mitigating safety issues that disproportionately affect low-income and Black, Indigenous, people of color (BIPOC) communities.

Connectivity: Transportation systems and investments that make it safe, efficient, and affordable to use all modes of travel to access places of social, economic, natural, and cultural significance.

Equity: Transportation investments that ensure the distribution of benefits and burdens of transportation systems and services are fair and just, which historically has not been fair. Transportation equity requires ensuring that underserved communities, especially Black, Indigenous, and people of color (BIPOC), share in the power of decision-making.

Trust: Transportation authorities that build and retain stakeholders' trust through fostering long-term, good-faith relationships.

Identified Challenges

While many tools exist today for measuring livability, they are not currently organized within MnDOT as a self-supporting approach to ensure a human-focused set of outcomes. These include tools like the Census Business Builder, EJScreen, and Bicycle Network Analysis. This has resulted in several challenges in applying Livability guidance to plans and projects. Project managers and other decision makers have requested more clarity in terms of where, when, and how the Livability Pillars apply. They have also requested direction on how to measure and track progress, including defining meaningful metrics, understanding baseline conditions, and determining the impact of a plan or project. There are also questions about data availability and quality, which determine what can be measured and tracked reliably over time. In short, without additional insight and guidance, the Livability Framework risks not being seen as an enhancement to the project and program delivery process.

Summary of Project Findings

Overall Approach

A review of 62 articles pertaining to the seven Livability Pillars was conducted, sourced from MnDOT's library services search (Appendix B). The articles were examined to identify definitions of livability, measurable

indicators for livability, and how livability indicators can be applied across different contexts. A spreadsheet was created with the following criteria to assess each article: title, author, publication year, the seven Livability Pillars, interpretation or measurement method for each pillar, context, key findings or results, a brief article summary, and a general definition of livability. From each article, at least one Livability Pillar was extracted to facilitate categorization. Subsequently, measurable indicators were identified from the articles. Periodic meetings with the Technical Advisory Panel provided guidance and review (Appendix C).

Summary by Livability Pillar

Below is a summary of some of the main themes from the literature review, organized by Livability Pillar. For a more complete documentation of the results of review, see Appendix A. Applying these findings to Minnesota may face limitations due to the region's unique climate, policy landscape, and socio-economic characteristics.

Within each Pillar Summary, Primary Measures and Areas for Additional Research (i.e., gaps) are reported. Primary Measures are those that have higher relative levels of consensus across the collection of articles reviewed. The accompanying spreadsheets include counts of how many reviewed articles cited each measure, providing insight into how often they are being used. It is expected that these may be among the ones used in MnDOT's approach.

Areas for additional research refer to areas where the intended scopes for each Livability Pillar may extend beyond the breadth of existing research and tools, necessitating further study. These areas are measurements that community members and other sources outside this search process have mentioned as important. Some of these may be explored through subsequent work by MnDOT and its partners to holistically account for the impact of transportation on people's lives.

Health and Environment

Health and environment covered many metrics about human and environmental health and well-being. Some overlap was noted between this Pillar and the Equity Pillar since public health disparities can be indicators of equity concerns. To that end, some of the data collected here may be useful for more than one pillar.

- **Active Transportation and Community**: The articles discussed the positive relationship between active transportation and increased community participation, emphasizing potential benefits for physical and mental health, as well as social capital.
- **Assessment of the Built Environment and Physical Surroundings**: The articles explored human and environmental impacts of roadway changes, addressing health, annoyance, while considering environmental factors like air quality, pollution, and habitat damage. The articles also discussed self-reported health outcomes and factors like density, diversity, design, and destination accessibility as crucial for livability.
- **Health Outcomes and Activity**: The research suggested that health outcomes, excluding accidents, are largely influenced by activity levels. Data constraints on accessing health data below the city level are acknowledged, and the detrimental health impact of traffic congestion is highlighted.
- **Urban Forms and Typology Classification**: The articles explore typology classification processes and metrics to compare how different urban forms affect economic, social, and environmental outcomes.

- **Environmental Sustainability**: The discussions on environmental sustainability addresses pollution reduction and use mental health indicators to measure livability, along with other factors such as stability, healthcare, culture, and infrastructure.
- **Transportation's Impact on Human Health**: The research focused on transportation's relationship to human health, emphasizing safety, air quality, and active living opportunities, while also highlighting environmental sustainability in transportation and identifying indicators for livability.

Primary Measures in Research	Areas for Additional Research
• Greenhouse gas emissions related to transportation or development • Air quality • Noise pollution • Tree canopy coverage • Surveys of health	• Cancer • Diabetes • Poor mental health • Childhood obesity • Level of traffic stress

Economic Vitality

Economic vitality is intricately linked to transportation, as economic activity is a primary driver of the need to move people and goods. To that end, there are several metrics that relate to economic activity in the literature. There may need to be more work to look at individual and household level impacts, however.

- **Awareness of Economic Resilience in Transportation Planning**: The findings indicate that while experts are aware of the concept of economic resilience, it may not be consistently applied in transportation planning.
- **Economic Vitality and Roadway Impact:** The texts explored how key financial levers, like road use pricing and parking revenues, can positively impact economic vitality by enabling investment in public transportation and improving public spaces. The text notes that rural roads contribute to income stabilization, income diversification, and improved access to health and education facilities. Quantitative indicators are highlighted for measuring economic health, including direct tourism, retail sales, sales tax revenue, rents, housing prices, and commercial vacancies.
- **Complete Streets**: The economic benefits of Complete Streets are discussed, emphasizing how pedestrian-friendly design can positively influence transportation patterns, consumer behavior, and the overall desirability of an area. Traffic congestion is acknowledged as a significant economic issue, causing delays that restrict economic growth and impact businesses through productivity losses and increased costs.
- **Economic Sustainability in Transport**: Economic sustainability is linked to the reduction of transport costs for trade and distribution operators. The concepts of vitality and viability are used to assess city center health, considering whether the area feels lively to people and has the capacity for commerce.
- **Sustainability Axes and Indicators**: Sustainability is discussed in three essential axes: environmental, social, and economic. Indicators, such as human resource quality and technology prevalence, are highlighted, along with a literature review identifying indexes for livability.

- **Transit-Accessible Economic Opportunities**: The discussion explores the economic benefits of transit-accessible opportunities and mixed-income housing near transit, aligning with social equity principles that measure housing affordability and income diversity. Indicators for assessing job accessibility, considering zonal data on job numbers and level-of-service data for various modes of transportation, are introduced.

Primary Measures in Research	Areas for Additional Research
• Population growth and shifts • Job density • Workers and customers within a specified distance of a study area • Commercial rent rates and vacancy rates	• Job creation from projects • Poverty levels • Business types and tenure • Homeowner/renter balance • Educational attainment • Internet and computer access • Housing affordability over time

Sense of Place

Sense of place is a strongly qualitative measure, and an important one from the perspective of community identity and cohesion. This ranks high among the areas where survey data may be beneficial, to help understand how people perceive their connection to a place and its unique identifiers that make it special.

- **Micro-Level Assessments for Urban Amenities**: Assessments of micro-level characteristics, including pavements, bicycle lanes, and softscape features are utilized to inform recommendations for the installation, rejuvenation, or modification of amenities and facilities. Transit-oriented development, defined as a walkable neighborhood with various travel options and housing choices within a half-mile of a transit station, is highlighted.
- **Urban Environment and Subjective Well-being**: The articles explore pathways between the urban environment (physical and social) and subjective well-being, mediated by life domains such as neighborhood and housing satisfaction.
- **Factors Influencing Livability and Social Interaction**: Factors influencing livability and social interaction are explored, including well-lit and maintained public spaces, driver behavior, and the accessibility of public amenities. The impact of motorized traffic on street livability is noted, with residents on lighter traffic streets reporting better livability.
- **Quality of Life**: Quality of life indicators, efforts to retain community character, and the role of family, work, education, and religious community are considered. Emphasizing the importance of making cities appealing to pedestrians is highlighted. The texts highlight recognizing and meeting community residents' needs and wants, including shelter, energy, water, food, education, entertainment, and transportation.
- **Objective Environment Assessment**: Urban function, residential, commercial, and public uses are calculated using POI data, and the densities of various POI types are determined. Variables such as

building continuity, greenness, openness, and walkability represent the objective environment of a locale, providing insights into the vitality and function of neighborhoods.

Primary Measures in Research	Areas for Additional Research
• Population density • Intersection density (to demonstrate a pedestrian environment) • Job density • Mix and density of land uses	• Defining a sense of place with respect to culture, ethnicity, or history • Feeling of belonging • Feeling of the distinctness of the area • Legacy and tenure of business, cultural hubs, residents, neighborhoods, etc.

Safety

Safety is one of the more intuitive measures, but it has many dimensions. Metrics must cover multimodal traffic safety for all travelers and modes. They must also cover the sense of personal safety for individuals and households navigating their environment, and how that impacts their decision making. There is a lot of research on this topic, but it will be important to discern what is most relevant to a specific context.

- **Benefits of Complete Streets for Safety**: The text highlights that by implementing road modifications to reduce traffic speeds, separate pedestrians and cyclists from vehicles, and enhance visibility, Complete Streets can contribute to a reduction in traffic conflicts and accidents, ultimately improving actual and perceived safety of the road.
- **Social Sustainability and Road Safety**: Social sustainability, including road safety and accessibility, is emphasized as a concern across articles. The evaluation of neighborhood safety is explored through questions regarding crime, violence, discrimination, and drug issues. The overall feeling of safety in the neighborhood is also considered.
- **Cost-Effectiveness of Grade Crossings**: The text suggests there may be more favorable returns from expenditures on improving many grade crossings compared to replacing a select few with grade separations. The community health impacts resulting from traffic jams are acknowledged, emphasizing safety risks.
- **Feeling of Safety:** Livability indicators can assess urban quality, particularly focusing on the feeling of safety. In addition to more general perceptions, the literature touched on the experience of transit riders and how their sense of safety guided their travel choices.
- **Street Repairs Assessments**: Assessments are conducted to determine streets requiring repairs, emphasizing the importance of evaluating and addressing safety aspects in the repair process.

Primary Measures in Research	Areas for Additional Research
• Audits/surveys of feelings of safety • Fatal or serious injury collisions by mode • Violent crimes • Exposure to large vehicles • Exposure to high speeds	• Location-specific research (e.g., tribal communities)

Connectivity

This topic is reasonably well-covered overall, due to the inherent connection to transportation system planning. However, there may be some additional need for research and discernment around individual connections and wayfinding, exploring how well transportation networks connect people with where they want and need to be at multiple scales. This includes understanding the full experience of people moving from point A to point B, rather than just the fact they are able to get from point A to point B.

- **Urban Mobility Challenges and Last-Mile Solutions**: Urban mobility faces challenges from ongoing urbanization, densification, and car-dominated systems, threatening accessibility, safety, sustainability, livability, and efficiency. Traditional solutions involving more transport capacity and sacrificing public space are no longer preferred. Instead, the focus is on sustainable transport, with public transport as a key mode. The 'last-mile problem' hinders public transport attractiveness, emphasizing the need to improve first- and last-mile connectivity.
- **Roads as Lifelines for Rural Communities**: For rural communities, roads are essential lifelines providing new development possibilities by connecting them to economic centers. Research explores multimodal impacts, including changes in modal split, increased walking or biking, alterations in bus travel time, and access to goods and services.
- **Public Transportation and Accessibility Challenges**: Prioritizing public transportation is a common strategy to alleviate traffic congestion, reduce energy consumption, and promote sustainable development. However, accessibility disparities between public and private transportation modes, influenced by operation time and service frequency constraints, pose challenges. Measuring the temporal variations of accessibility dynamically is crucial for establishing livability indicators.
- **Impact of Motorized Traffic on Livability**: High volumes of motorized traffic, combined with a lack of pedestrian-oriented design, negatively impact livability. While traffic can make streets dynamic and interesting, it also poses barriers to accessing jobs, housing, schools, and amenities. Key indicators for livability include connectivity for pedestrians, building density, population density, and district coverage ratio.
- **Factors Influencing Travel Impact**: Factors influencing travel impact are explored, encompassing day-to-day travel time variability, public transportation availability, and the optimization of uses and services around transit stations. The establishment of an Index of Personal Travel Impact (IPTI) is mentioned, focusing on transit-accessible economic opportunities and pedestrian route options.
- **Accessibility for Residents and Maintenance Prioritization**: Accessibility for residents to reach destinations like schools, workplaces, and entertainment venues is emphasized. Maintenance

prioritization for bikeways is discussed, ranking them based on importance, location, maintenance cost, and remaining service life. Desire for transportation to/from accessible and affordable housing, time savings, and access to work are noted considerations.

Primary Measures in Research	Areas for Additional Research
• Pedestrian, bicycle, and vehicle volumes; transit ridership • Vehicle miles traveled (VMT) • Walk Score • Transit route and stop counts	• Individual connections and wayfinding • Degrees to which transportation networks connect people with where they want and need to be via multiple scales/modes

Equity

While there is some research on equity and transportation, its wide-ranging impact means there are considerations beyond how it fits into one Livability Pillar. Because of the historic roots of inequality, an assessment of current conditions and ongoing tracking may not fully consider the factors contributing to equity. Additional work will be needed to build this out further.

Equity in Transportation Planning: Emphasizing the importance of equity in transportation planning, the text underscores the need for equal access to affordable and reliable transportation. It highlights the role of inclusive processes in preventing oversight of the needs of traditionally underserved populations, including low-income communities, minorities, persons with disabilities, the elderly, children, and others.

Indicators for Equity Assessment: Indicators for assessing equity in transportation are discussed, specifically focusing on public transportation availability. The use of the Index of Personal Travel Impact (IPTI) is mentioned as a measure of inequality, reflecting the impact of transportation on individuals. Accessible social and government services are also considered crucial for ensuring equitable transportation.

Challenges and Costs for Underserved Populations: The text acknowledges the increased operating costs for transportation and emphasizes the need for higher public funding. This consideration is particularly important for transit users with low incomes who may struggle to afford higher fares. The self-reporting of transportation costs is noted as a valuable source of information in understanding the financial burdens faced by individuals and communities.

Primary Measures in Research	Areas for Additional Research
• Household poverty • Cost-burdened households (>30% of gross income spent on housing) • Household spending on housing and transportation; resiliency to cost changes • Population shares of cohorts less than 18 years, and 65 years or older • Diversity of neighborhoods by race and income	• Connection to measures of human health • Disproportionate burdens experienced by BIPOC and low-income communities • Cumulative impact of historical decisions on current equity considerations

Trust

Trust is an important measure but can be challenging to quantify. Qualitative data collection like surveys may be needed to gain a picture of how people perceive their relationship with others, including MnDOT, in terms of trust. As with equity, there is also the fact that history matters, and past harm to the community remains in memories and in infrastructure. The literature provides insights into specific circumstances and the cumulative impact of past decisions, but more may be needed to interpret how that impacts trust.

- **Community Strength**: By expanding mobility options for non-motorists, Connected and Automated Mobility (CAM) has the potential to enhance a city's overall community strength and cohesion. This improvement is attributed to various causal mechanisms, including fostering equity in the urban experience, enabling a more multi-functional and diverse city, and enhancing community engagement through the reduction of time burdens associated with less-effective transportation options.
- **Effective Use of Public Funds for Transportation**: The text emphasizes the importance of ensuring that public funds and resources allocated to transportation investments have equitable and worthy impacts. There is a need for responsible spending to address the challenges of transitioning to more sustainable cities. City street experiments are suggested as a low-cost, low-risk approach to exploring potential routes for increased sustainability and livability.
- **Emergency Accessibility Services**: The text discusses the importance of emergency accessibility services, providing continuity during times when transportation networks may be unable to deliver basic services. The research touches on discourse related to transportation's ability to continue functioning during disruptive events.
- **Government Transparency as an Indicator**: The inclusion of government transparency as an indicator for assessing livability underscores the significance of open and accountable governance in enhancing the overall quality of urban life. Transparent government practices contribute to building trust between the authorities and the community, fostering a sense of inclusivity and shared responsibility in decision-making processes related to transportation and urban development. The availability of clear information, open communication channels, and accessible data ensures that citizens can actively participate in shaping their cities, aligning with broader efforts to create sustainable and livable urban environments.

Primary Measures in Research	Areas for Additional Research
• Surveys of subjective well-being, including rates of happiness with family, work, and social relationships; financial and material stability • Voting rates • Infrastructure quality and condition, maintenance programs (as indicators of service dedication to and interest in a neighborhood)	• Impact of past actions or harms on a community • Trust in government • Trust in MnDOT • Impact of vehicle and pedestrian injuries and deaths on community

Overarching Issues

The literature reveals points of consensus across various articles and disciplines. For example, researchers appear to broadly agree on the following points:

- The positive correlation between active transportation and heightened community engagement, recognizing its positive impact on physical health, mental well-being, and social capital
- The complex interplay between the built environment and health outcomes, encompassing factors such as annoyance, air quality, and self-reported health indicators
- Economic vitality discussions showcasing shared recognition of the potential benefits associated with Complete Streets and transit-accessible opportunities

While there is considerable agreement, certain areas lack unanimity or present ambiguity. The consistent awareness of economic resilience in transportation planning does not necessarily translate into its uniform application, suggesting potential disparities in implementation. Disagreements or uncertainties may arise in defining and measuring subjective concepts, such as social interaction, which can vary across communities and contexts. During its tool development process, the MnDOT Metro District Office of Livability will be exploring and testing out the “gap measurements,” the ones not found or agreed upon in the literature review.

As stated above, applying these findings to Minnesota may face limitations due to the region's unique climate, policy landscape, and socio-economic characteristics. The impact of cold climates on active transportation and the specific policy frameworks in Minnesota may necessitate tailored interventions. Cultural and demographic factors, distinct from those in other studied regions, may also influence the applicability of certain strategies.

The literature acknowledges both the wealth of available data and the constraints associated with accessing health data below the city level. Data limitations emerge as a recurring theme, especially in assessing the dynamic aspects of accessibility and health outcomes. The need for more granular data to capture nuanced variations and provide a comprehensive understanding of the intricate relationships discussed remains a shared concern.

Despite the comprehensive insights, there are notable research gaps. These include areas where the intended scopes for each Livability Pillar may extend beyond the breadth of existing research and tools, as identified in the tables above. This includes a significant lack of research and acceptable measures speaking to rural context categories. The dynamics of urban mobility challenges and last-mile solutions, particularly in the context of ongoing urbanization and densification, warrant deeper exploration. In addition, more research is needed to identify the economic impacts of sustainable transportation and its role in fostering community cohesion. Addressing these gaps will contribute to a more holistic understanding of urban livability and inform targeted interventions for sustainable urban development.

Future Applications

The following section provides guidance for how the information gathered here may be used to form tool(s) that support a variety of projects needs and conditions. This does not preclude additional work in any of these areas, which will need further exploration and refinement to ensure a comprehensive and responsive approach.

Managing Potential Conflicts

While the Livability Framework is based on the premise of a harmonious collection of Livability Pillars, the research at times challenged some assumptions on that front. Some of the articles noted that livability goals may sometimes conflict with one another, though there is not comprehensive research on this specific topic. For example, improvements that advance Sense of Place could end up having negative impacts on Equity, such as a situation where beautifying places drives up property values and makes an area less affordable to people of lower incomes. Another example is where improving Connectivity in roadway networks leads to more driving and emissions, negatively impacting Health and Environment.

There is no simple solution. However, at a minimum, these conflicts should surface so that the decision-making processes can prioritize goals, mitigate impacts, and look for common ground. The tool development process can assist by flagging more commonly occurring conflicts as needing additional discussion. In addition to this, once any potential conflicts have surfaced, a tool could suggest an approach to prioritizing Livability Pillars and/or metrics through a public process so that the decision is transparent and accountable.

Application by Project Type

One challenge in application relates to the fact that MnDOT projects and initiatives vary widely, requiring different approaches to measurement and evaluation. This includes applicability from planners working on long range visioning to project managers constructing specific infrastructure projects. In this context, a toolkit of measurement techniques and measurable solutions can be used to assess and address the various aspects of livability depending on the size, complexity, and mode. Below are some thoughts related to several of the most common use cases encountered by MnDOT project managers and planners.

Public Engagement and Surveys

Regardless of project type, many MnDOT projects require some level of public engagement and agency coordination. There is a strong synergy between engagement and the Livability Framework, based in the framework's origins and development. Specific to engagement, these metrics may be used in the following circumstances:

- Project messaging and framing for the engagement effort, to ensure it addresses community issues and concerns beyond project specific details
- Centering issues such as equity and trust, which can be guidelines for how an engagement plan is developed and implemented
- Using identified metrics to track engagement outcomes, to promote accountability toward stated goals and measure results

Part of public engagement may include conducting public surveys, gauging community members' input and collecting other data. Surveys can also be an effective way to ask qualitative questions about preferences, perspectives, and perceptions that would not otherwise be available from quantitative sources. Based on this review, some areas to be covered in qualitative public surveys may include:

- Measuring level of public trust in the transportation system, MnDOT, and other institutions, and contributing factors to that position
- Assessing individual and collective sense of community and place, including understanding the specific historical and cultural contexts that contribute to this
- Measuring qualitative aspects of personal well-being, including happiness, sense of connection and belonging, and measures of stability
- Perceptions of personal and traffic safety, from perspective of different types of multimodal travelers and individual identity

In addition to a stand-alone public survey, questions like these could be curated and made available to ask within the context of a larger public engagement effort.

Policy, Area, and System Plans

MnDOT periodically completes policy, area, and system plans, focused on either broad agency guidance or specific subject areas or modes. As these plans set the stage for future projects, it is important that the Livability Framework be applied at this level to provide additional influence downstream. Specific to this circumstance, metrics may be used for:

- Development of goals and principles follow logically from the Livability Framework's structure, though they frequently will frequently need to be more specific and contextualized to fit a particular plan or project type
- Creation of criteria used for evaluation and prioritization of projects and other implementation actions, especially with qualitative evaluation when metrics are utilized for benchmarking purposes
- Planning for engagement and outreach

Infrastructure Projects: Overall

Specific infrastructure projects are likely the most common use case for MnDOT project managers. As such, the follow sections will get into more specifics by geography, scale and other factors.

- Directing and prioritizing programming and funding of projects consistent with advancing Livability Pillars at a system level
- Adequate project scope, schedule, and budget to ensure enough room to explore and address key issues in the livability framework through existing conditions and alternative development and selection
- Development of goals and evaluation criteria for alternatives that include both directions and metrics consistent with the framework
- Identification of potential project benefits and impacts in terms of meaningful metrics, and reporting this out via project documentation and engagement messaging

Application by Context Categories

The applicability will vary by geography and area character. Below are some general observations about the differences based on an aggregated approach to MnDOT's nine context categories. While all Livability Pillars apply in all circumstances, in some places some may take on more prominence due to an area's distinct features. Future MnDOT conversations with OPMTS and OSPH staff regarding connecting this with the Facility Design Guide will further inform this topic.

Natural and Rural

This group includes the context categories of Natural, Rural, and Rural Crossroad. The fewest articles fell into this category, in part because lower density rural areas tend to have fewer measurable data points per unit of analysis. Due to this issue, the unit of analysis may need to be bigger, to incorporate more data points and account for the fact that rural residents may need to travel further to destinations and amenities. There may also need to be considerations regarding preservation of natural resources, due to a larger concentration of environmentally valuable assets. There are several areas on the outskirts of the Metro District which may be considered Rural, or Rural Crossroads which will require broadened units of analysis for meaningful, appropriate solutions. Due to data limitations in these areas, it may be necessary to supplement data with a more comprehensive or in-depth analysis of the area, and/or with qualitative surveys of stakeholders. It may also be possible to draw conclusions from analysis of similar areas that face similar issues. Unique challenges facing rural areas include longer distances and isolation from jobs, shopping, and essential services that disproportionately impact certain groups.

Suburban

This group includes the context categories of Suburban Commercial and Suburban Residential. This category shares many similarities with urban areas but with a few important differences. One difference in suburban contexts is that recent projects have often focused more heavily on improving connectivity by retrofitting connections into an incomplete or segregated system. Likewise, for projects focused on retrofitting suburban areas, sense of place may be a priority, as many communities were developed without a defined town center or other connected and accessible public spaces. Unique challenges facing these areas may include impacts of

rapid growth and change that may stress infrastructure systems, and/or create systems that are not compatible with viable multimodal transportation options.

Urban and Special Use

This group includes the context categories of Industrial/Warehouse/Port, Urban Commercial, Urban Residential, and Urban Core. As the most intensive land use patterns, the unit of analysis tends to smaller due to a higher degree of fine-grained data availability, and concentrations of activity. While topics of equity are relevant everywhere, they may manifest more directly in places with highly diverse populations and sharp divisions between higher and lower income areas. Economic vitality is also important, particularly as urban areas and special use districts are traditionally job engines for a broader area. Unique challenges may include a mismatch between developed areas and adjacent major infrastructure and managing the transition of redeveloping areas and changing communities.

Application by Scale and Geography

One overall challenge in finding solutions and delivering results on infrastructure projects is a mismatch between the feasible level of involvement and the dimensions of the problems to be addressed. This is frequently seen in situations where projects require crossing jurisdictional boundaries, necessitating close coordination between jurisdictions and navigation of differing expectations.

The same principle holds true when applying data and metrics to projects. MnDOT planning efforts and project delivery operate at a variety of scales, from local/neighborhood to corridor to regional to statewide. The most relevant data may not be reliably available at the given scale needed. To a large extent, the unit of analysis based on data availability is going to dictate the scale of analysis. While there is no easy solution here, the tool can assist by identifying (where possible) the level of data availability, to provide a guide for the best possible fit. The categories used in this summary include:

- Census tract or neighborhood (CT/N)
- Municipality or city (M/C)
- District or province (D/P)
- Region or state (R/S)
- Country (C)

Data Availability and Gathering

Through a review of the articles, the research team identified several types of data sources, described below. In many cases data sources were not specifically identified, though many can be inferred. A review of data sources and collection methods can provide an opportunity for MnDOT to reflect on data collection and retention overall, and how some sources may have multiple uses. Likewise, the value to the Livability Framework may provide additional justification for enhanced data collection and stewardship.

Standard Public Sources

This includes data sources from governmental agencies that are collected consistently and are publicly available. Examples include US Census data, federal and state labor statistics, and county assessor property records. These were used widely in the articles surveyed and will likely be the basis for many of the standard metrics, especially given the ability to track over time. In Metro District, the Metropolitan Council is an important data source for these types of metrics. The cost for public data is typically free, due to it being in the public domain, though there still may be costs associated with summarizing, formatting, graphing, mapping, and/or interpreting the data for use in this manner.

Variable Public Sources

Many articles used data sources that, while public, are not widely available. The quality, quantity, type, and frequency of data collection varies widely across areas and jurisdictions. These were used frequently in reports but were hard to generalize for broader uses except for projects within the same vicinity. An example may be measures of pedestrian and bicycle activity within a certain area or on a designated facility. However, best practices in data collection in other areas may inspire another place to begin tracking this information more completely and consistently. Associated costs would typically be consistent with standard public sources.

Qualitative Survey Data

Survey data was a commonly used source for many articles, especially those featuring qualitative metrics, such as public perceptions or opinions. While a powerful data tool, these may often be expensive and complicated to collect, especially with either scientific precision or as a consistent time series. Ideally the Livability Measurement Tool could help MnDOT and its partners determine the most cost effective and impactful information to be gathered via survey, and what scale and timing would be optimal. See the public engagement section above for ideas on qualitative survey questions. Unlike public sources, surveys may also include a cost component, based on the cost of developing, implementing, and interpreting a survey.

Other Data Sources

There is a multitude of miscellaneous data sources used, dependent in part on the underlying research methodology. This may include hand-collected data through a research experiment or field observation, or data purchased from a private vendor. As with qualitative survey data, applicability and feasibility will vary greatly, and will need further assessment as to viability. Creative solutions may be needed to assess changes over time, given that methods may not be consistently applied. For private sources, particularly those involving a contractor or vendor, there may be a cost for acquiring the data, over and above the usual costs for collating and formatting data with public sources.

Alignment with Other MnDOT Initiatives

While the livability tool development process will integrate the various existing tools it will also recommend changes to these processes and development of new methodologies. Some existing MnDOT tools that help to measure livability include, but are not limited to, MnDOT's Priority Areas for Walking Score (PAWS) and

MnDOT's Suitability for the Pedestrian and Cycling Environment (SPACE) Tool. Livability measurements will guide both the development of new processes and the modification of existing ones. Pilot projects will augment existing processes to demonstrate how various approaches to measuring and tracking Livability could work in practice. This can provide direct benefits to the plan or project and serve in informing and refining the methodology and approach.

This project will be able to leverage MnDOT's existing in-house data tools as a primary data source. These tools include PAWS, SPACE, the VRUSA high-injury network mapping, the multimodal accessibility tool, and potentially others. The intent would be to efficiently and consistently utilize existing metrics where possible.

This project also bears a close relationship to Rethinking 94 and its various related projects. As such, projects like this may be a testing ground for how a tool works in practice on a complex project. Another upcoming opportunity is some anticipated district and statewide planning processes, which could focus on higher-level policy applications. More projects may be identified based on additional conversation within MnDOT and with partners.

Timeline for Next Steps

At some point after this report is completed, MnDOT will be proceeding to the next stage of tool development. This may include (but not be limited to) the following steps:

- Identify and coordinate with other internal MnDOT offices regarding their level of participation and role in the development of Livability tools.
- Procure a team to assist with supportive research that addresses the areas for additional research listed in this report.
- Evaluate policy-relevant and evidence-informed best practices for measuring each pillar by quantitative and/or qualitative indices.
- Identify a complete set of measurements that appropriately represents the Livability Framework.
    - The final set of measurements should address the challenge that certain indices can represent many Livability Pillars and may overlap. The final set of measurements should aim for a balanced representation of the Livability Pillars, and neither over- nor under-represent any pillar or index.
    - Measurements should be drawn from available and accessible data and include both quantitative and qualitative data. Data that are not available but are desired for an effective tool, should be noted. Within the list of unavailable data, identify data that can be collected via survey questions given through public engagement efforts. If researchers decide a survey would be helpful to fill in livability data gaps, identify a reasonable set of livability questions for such a survey that aims to gather essential livability information. The questions in the survey should be easy for people to answer. For example, if there is no data on how safe people feel walking around their neighborhood, the survey could pose a question such as "How safe do you feel walking in your neighborhood?" to close the data gap on safety.
- Determine proper threshold levels that indicate key livability needs within a neighborhood.

- Configure how data collected through a livability survey can be integrated into the Livability Measurement Tool. Inputting survey data into the tool should be easy for end users of the tool to do.
- Identify and use best practices for clearly communicating indices and thresholds to both internal staff and external stakeholders so that livability needs can be clearly understood. This tool should support end users in making decisions on how and where to make livability improvements.
- Test and refine the tool via early pilot efforts, potentially with a limited number of use cases.
- Develop a process guide for implementing the livability tool, based on project type and status.
- Conduct a staged review and rollout within MnDOT, followed by broader implementation and information sharing.

It is expected that this project will happen over the next couple of years, with an exact timeline to be defined.

APPENDIX A: RESEARCH SUMMARY

Literature Review Matrix

Information				Livability Pillars Mentioned (Article content speaks to one or more of MnDOT's Livability Pillars)							Use / Understanding (How the pillar is understood)	Context (Urban, Suburban, Ex-Urban, Rural) /Neighborhood	Results / Key findings	Summary/Applicability Short Summary (1 - 2 sentences)	General Definition of Livability (if provided)	Notes
Reference Number	Title	Author	Publication year	Health & Environment	Economic Vitality	Sense of Place	Equity	Trust	Connectivity	Safety	Measure / Representation / Interpretation / Evaluation / Tracking					
1	A Proposed Framework for the Incorporation of Economic Resilience into Transportation Decision Making	Davis Chacon-Hurtado	2020	No data	The literature review and survey results have made evident that transportation is neces-sary but not a sufficient factor for economic resilience. Therefore,all other components of resilience should be considered. A keychallenge is identifying measurable outcomes of infrastructuremanagement that could be linked to economic resilience.	No data	No data	No data	No data	No data	Based on previous research focused on the association of trans-portation infrastructure and the economic performance in the region of Indiana (Chacon-Hurtadoetal.2017a, b), two accessibility measures were considered: accessibility to labor and accessibility to markets. The former is represented by the number of people that could be reached within a 40-min drive and the latter by the population within a 180-min drive.	No data	No data	The results of the literature review and expert opinion survey show that although transportation-related factors are positively associated with resilience, they are not the primary factors leading to resilient regions. Factors such as education and industrial diversity were found to be more critical. However, those factors are also as-sociated with infrastructure management because good infrastruc-ture provides access to education opportunities and influences the level of integral specialization of regions	No data	No data
2	A Smart Growth & Equity Framework and Tool for Measuring Underst	Bruce Appleyard, et al.	2020	No data	No data	No data	No data	No data	No data	No data	Data Used in the Smart Growth & Social Equity Calculator Sustainability, Livability, Equity component: VMT per household; housing affordability; Transportation affordability; Pedestrian collisions per 100,000 pedestrians, Walkscore Cardiovascular disease Obesity Urban Form/Livability Opportunities component: Transit jobs accessibility; Population density (population/acre); Jobs density (employees/acre); Pedestrian environment (intersection density)	No data	No data	Dr. Bruce Appleyard, et al., developed an online Smart Growth Equity (SGE) Calculator to measure sustainable, livable, and equitable (SLE) outcomes, understand what SLE performance means in terms of how to respond with policies, and provide guidance on how to enact policies to realize more robust transportation land use integration (smart growth) to achieve SLE outcome for society.	No data	and planning support tools are useful only insofar as they help inform agency decisions about future policies, plans, and investments. In particular, performance measures should be defined and measured in order to help communities understand tradeoffs and benefits involved in providing opportunities for people to achieve sustainability, livability, and equity outcomes. Most regions continue to use transportation system performance measures that are dominated by congestion and mobility measures. Although sustainability, livability, and equity are beginning to enter public debate, there appears to be no
3	Active transportation and social capital: The association between walking or biking for transportation and community participation.	Jessica Stroope	2021	Active transportation may not only promote physical and mental health, but also bolster social capital. The current study assessed several aspects of social capital and showed that active transportation was positively related to greater community participation.	The survey revealed that experts are aware of the concept of economic resilience, but the concept is not necessarily applied in transportation planning	No data	No data	These results align with and extend prior research that found perceived community walkability to be associated with community engagement and social capital... The findings also support and expand research... showing linkages between active transportation and social participation and social trust.	No data	No data	Surveys of health	No data	These findings are important for policy and planning work, as designing supportive environments and removing barriers to active transportation can foster social capital through bolstering community participation. The benefits of active transportation may be broader than previously understood and underscore the need to promote active transportation	This study's findings are important for policy and planning work, as designing supportive environments, removing barriers, and creating policies to increase active trans-portation can foster social capital through bolstering community participation. The benefits of active transportation may be broader than previously understood and underscore the potentially wide-ranging importance of promoting active transportation.	Transportation accessibility also contributes to a region's livability, defined as the level of access to broader oppor-tunities, such as employment centers, affordable housing, qualityof schools, and safer streets and roads (FHWA 2018).	No data
4	Adaptation and testing of a microscale audit tool to assess liveability using google street view: MAPS-liveability.	CL Cleland, et al	2021	No data	No data	MAPS-Liveability enables assessments of micro-level characteristics (such as pavements, bicycle lanes, and softscape features) and active travel. This can inform recommendations for amenity/facility installation, rejuvenation and/or modification.	No data	No data	pressure due to the still ongoing urbanization, urban densification, and car-dominated mobility systems, leading to an increase in mobility demand. This endangers accessibility, safety, sustainability, livability, and efficiency in future cities. Creating more transport capacity, and sacrificing public space, is nowadays no longer the preferred solu-tion as transport policies increasingly focus on stimulating the use of sustainable modes of transport. Public transport (PT) is one of these sustainable modes of transport because of its high capacity and low environmental impacts. However, the attractiveness of public transport in some urban areas is limited. This is	No data	Measures of study area include: Type of residential uses Non-residential destination counts for convenience store, liquore store, big box store, specialty food store, schools/colleges Number of trails Number of transit spots Number of speed limit signs Special speed zones What other street characteristics are present? (specify # of each type) Check all that apply · Traffic calming signs · Traffic calming circles · Traffic calming speed tables · Traffic calming speed humps · Traffic calming curb extension · Roll-over curbs (if whole segment 1) · Drainage ditches	No data	No data	Microscale Audit of Pedestrian Streetscapes (MAPS) has been adapted over time to provide a broad and inclusive method of assessing destinations, land use, streetscapes, aesthetics and social variables at street-level. MAPS-Livability (augmented with safety, sustainability, health, traffic/transport and roads measures) provides a reliable assessment of micro-level liveability features.	Upon review of the differing definitions, it is apparent that although each has been refined to suit the focus of specific applications, all definitions to varying degrees, include the concepts of safety, health, sustainability, inclusivity, education, sense of place, transport (including walkability), amenities and living standards which relate to health and well-being; and align with key elements of the social determinants of health	No data
5	An agent-based model for assessing the financial viability of autonomous mobility on-demand systems used as first and last-mile of public transport trips: A case-study in Rotterdam, the Netherlands	Martjin Stevens, et al.	2022	No data	No data	Transit-oriented development: a walkable neighborhood with a variety of travel options, a mix of uses, and a variety of housing choices – all within a half-mile of a transit station	No data	No data	No data	No data	Measuring waiting time, travel time, and cost for individuals using an Autonomous Mobility on-Demand to travel to/from a transit station	No data	No data	Despite its sustainability, public tranpsort has limited attractiveness, because of first and last mile connections. The combination of autonomous vehicels, ridesharing, and use of wireless fast charging is the most financially viable operation.	No data	No data

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Reference Number	Title	Author	Publication year	Health & Environment	Economic Vitality	Sense of Place	Equity	Trust	Connectivity	Safety	Measure / Representation / Interpretation / Evaluation / Tracking		Results / Key findings		General Definition of Livability (if provided)	Notes	
6	An evaluation of livability in creating transit-enriched communities for improved regional	Wesley E. Marshall	2013	No data	No data	No data	No data	No data	No data	No data	1 Minimize consumption of non-renewable resources for transportation: Fuel used per person per day (gal/pp/pd) 2 Transportation and placemaking system is designed to maximize land use efficiency: Open space within 1-mile of station (square miles), Pavement within 1-mile of station (square miles) 3 Minimize transportation and place making system's impact on ecological systems: Data not available at the TOD level 4 Limit transportation related pollution & wastes: Transportation-relatedCO2 emitted per person per day (g CO2/pp/pd) 5 Transportation meets access needs while consis-tent with human health & safety: Percent of respondents walking or biking to work (%); Fatal or injury crashes per year per 100,000 residents (crashes/year/100,000 pop.); Violent crimes per year per 100,000 residents (crimes/year/100,000 pop.) 6 Planning and management of transportation in-corporates government & community input: Data not available at the TOD level 7 Transportation and placemaking systems promote social equity: Mixed income (degree of evenness ranging from 0 to 1); Mixed race (degree of evenness ranging from 0 to 1) 8 Transportation and placemaking systems meet basic access needs of all individuals: Access to amenities (amenity score based upon number of each use type within 1-mile of transit station); Walkability Index (score based upon local walkability) 9 Transportation is affordable for individuals: Housing+Transportation cost (% of income spent on housing and transportation); Creation of affordable housing (#of units created in the vicinity of each station) 10 Transportation is financed in an equitable manner: Data not available at the TOD level 11 Transportation provides efficient movement of people & goods for economic growth: No. of jobs within 1-mile of TOD; Pedestrian shed (% of half-mile "as-the-crow-flies" walkable zone accessible via the network); Transit score (score); Automobile commute time (% of time to travel to downtown with no traffic vs. with typical morning rush hour traffic) 12 Transportation is resilient to economic fluctuations: Regional access to jobs by transit (% of land area within 1-mile of station with access to n jobs within 60 min via transit); Resiliency to transportation costs increase (% change in H+T costs if gas prices increase by $2 per gallon)	No data	Asking how TOD can address broader, more nuanced yet still measurable community issues, leads to a different set of solutions that may be better suited toward achieving regional benefits and livability.	Using an adaptation of the Transportation Index for Sustainable Transportation (TISP), the research group studied clusters of TODs throughout the Denver metro. The measures asserted within the model are more inclusive of whole community metrics and reaffirm the authors argument that simple goals of congestion management should not be the most critical principle in TOD design or measurements of its success.	"the degreeto whicha place,be it a neighborhood, townor city, sup-ports quality of life, health and wellbeing for the people who live,work, or visit. Citiesconsideredtohaveahighdegreeo flivabilitytendto have a high level of, and widespread accessibility to, amenity"	No data
7	Assessing Mobility Measures for Socially Sustainable Waterfront Redevelopment Projects	Baraah Moutaz Hamdoon	2023	No data	No data	The assessment method relied on an established theoretical framework that defined the principles and indicators of both the mobility morphological measures including Compactness and Density, Mixed-Use Development, Accessibility, and Mobility Networks Connectivity and Integration on the one hand, and the urban design mobility measures including Comfort and Livability, Environmental Quality, Safety and Security on the other hand.	No data	No data	No data	No data	**Morphological mobility-related measures:** Compactness and urban form: population density, floor-area-ratio (FAR) Mixed-use development: breakdown of floor area function (% of floor area dedicated to economic activity : housing : local ammenities) Accessibility: walking catchment distances Connectivity and integration of mobility networks: ease of movement by each transport method **Urban design mobility measures:** Comfort and livability: water feature, green space, tree canopy/shadow coverage Environmental quality Safety and security: standard measures	No data	The research findings proved the validity of the applied assessment method, with its relevant investigation tools, makes it a legitimate revising method for the waterfront urban regeneration designs in the UAE, and in other countries in the region to help significantly enhance the attainment of social sustainability in waterfront urban regeneration projects.	This framework encompasses two sets of the main urban mobility measures, namely, the morphological/urban form mobility measures including Compactness and Density, Mixed-Use Development, Accessibility and Connectivity and Integration of Mobility Networks on the one hand, and the urban design mobility measures including Comfort and Livability, Environmental Quality, Safety and Security. The mix of the qualitative/quantitative investigation tools used in examining these defined mobility measures has succussed in pinpointing the drawbacks of an urban design project/proposal	No data	No data
8	Assessing the influence of connected and automated mobility	Gillian Harrison, et al.	2022	No data	Economic Vitality: Key financial levers, such as road use pricing and parking revenues can drive a virtuous cycle (reinforcing effect with positive outcomes), by enabling investment in improved PT and more attractive public spaces, both of which can improve community cohesion and strength, leading to increased city revenues, driving economic vitality.	Public Space: Connected and Automated Mobility (CAM) risks a continued lock-in of negative effects from privately owned vehicles, as there is likely to be an increase in VMT, leading to more air pollution, noise, and a stronger traffic barrier effect.	No data	Community Cohesion and Strength: By increasing mobility options for non-motorists, CAM has the potential to improve a city's overall community strength and cohesion, through a variety of causal mechanisms, including: improving equity in the urban experience; enabling a more multi-functional and diverse city; and improving community engagement by reducing the time burden of less-effective transportation options	No data	No data	[Qualitative logic/reasoning exercise]	Urban, suburban	Quality of Life (QoL) is a dominant concern for city planners, regardless of how it is achieved; the specifics of new services or technologies (such as CAM) are secondary concerns - which are important only insofar as they support the higher goal of improving QoL.	Using qualitative methods, the reasearch team produced a high level causal loop diagram (CLD) that can be used as a starter for any future research in the area of Connected and Automated Mobility (CAM) and liveability in cities and which may resonate better than previous CAM models have with city planners and policy makers	Liveability in cities relates to the physical, social and cultural factors that can lead to equal access to opportunities, ensuring a sustainable and satisfying quality of life (QoL) for all inhabitants.	No data
9	Assessment of Socio-Economic Impacts of PMGSY Roads Using Fuzzy Multi-Criteria Decision Making Tool	Makrand Wagale	2017	No data	Rural roads have helped in stabilizing income sources and providing different avenues of income diversification, they also have assisted in improving access to health and education facilities.	No data	No data	No data	For rural communities roads are lifelines, they provide new possibilities for development by connecting them to the nearest economic centers (seasonal/regular).	No data	Fuzzy logic reasoning is a best-suited methodology for handling uncertainty and complexity associated with the evaluation of sustainability conditions. Converting data to IF-THEN statements.	Rural	Considering the outcomes, the fuzzy logic reasoning model herein has ability to serve as realistic tool for decision and policy makers. And assist them in implementing the policies and schemes to achieve their goal of sustainable rural development.	This study seeks to understand the socio-economic impacts (SEI) of rural roadway / transportation projects.	No data	No data
10	Beyond Multimodal Metrics Adapting Streets for People and Our Evolving Environment	DeRobertis, Michelle	2022	Humans living on and visiting streets benefit from reduced traffic. London, England, focusing on health and comfort, created a "Healthy Streets" index.9 DeRobertis, studying livability in Italian city centers, classified human impacts-benefits as harm to human health, annoyance to human senses, and attractiveness, and developed 12 indicators Impact on the environment: Numerous environmental impacts from roadway changes have been identified including the following: air quality, street level concentrations of air pollutants, greenhouse gases (GHG), water pollution from roadway runoff, urban heat,	Impact on the economy: Many quantitative indicators measure an aspect of economic health, such as direct tourism, retail sales, sales tax revenue, rents, housing prices, and commercial vacancies. Such indicators can also evaluate impacts of roadway changes.	No data	No data	No data	Impacts on other modes: Multimodal impacts have been the most studied—i.e., change in modal split, increases in walking or biking, change in bus travel time, and access to goods and services.7 Other research focused on a single mode including Risser, who identified dozens of indicators measuring pedestrian safety, comfort, and attractiveness in urban areas.8	No data	CASE STUDIES **New York** Safety: crashes/injuries for motorists, pedestrians, cyclists; vehicle speed; Volume of vehicles, bus passengers, bicycle riders Economic vitality: commercial vacancies, retail sales Public spaces: seated pedestrians at parklets; sales at fronting businesses Transit: bus speeds, ridership user satisfaction survey Environmental: GHG emissions **San Francisco** Improve Safety: Police-reported collisions for all modes; SFMTA-reported municipal incidents; Driver-yielding behavior at crosswalks; Bicyclists' path of travel Improve Perceptions of Safety/Comfort: Bicycle counts; User surveys Improve Transit Performance: Stop-to-stop travel time and variability; Customer surveys; Muni operator feedback; Improve Curb Management; Loading zone demand and compliance Effectively Manage Motor Vehicle Diversion: Stop-to-stop Muni travel time and variability, Compliance with vehicle restrictions and transit-only lanes **Baton Rouge, LA** 1. Crash data before/after using Empirical Bayes Method to account for Regression to the Mean bias (measure of safety); 2. Traffic volume data including all modes to measure mode shift and changes in driving/walking/biking (measure of operations and health); 3. Property values surrounding the project area to measure economic revitalization (measure of economy and quality of life); and 4. Change in impervious surface area to measure stormwater mitigation (measure of environment). **London** To monitor performance, the city measured traffic volume and speed before/after, number of pedestrians and cyclists before/after, and the gender of cyclists as an indication of feeling of safety. Residents, business owners, and visitors were also surveyed about their perceptions of the changes	Urban	This paper outlined four key areas that should be assessed: the impact on transit, bicycling, and walking; impact on safety, community health, and human comfort; environment impacts; and economic impacts. There are numerous indicators within each of these areas; above all, performance metrics should be established at the start of the project development process — this not only helps develop the purpose and need of a project and overall project justification but ensures proper data collection before and after.	Past metrics centered on automobiles such as intersection level of service (LOS), and even new metrics such as vehicle-miles of travel (VMT), fail to capture the full range of benefits of these new strategies to reduce, restrict, or prohibit traffic (e.g., congestion pricing, bus-only lanes, pedestrian streets, green streets, shared spaces, low-emission zones, traffic-restricted zones (ZTL), road diets, bike boulevards, woonerfs, and slow streets. With increased concern for livability and sustainability, policy makers need guidance on new metrics to measure effectiveness of roadway changes that include impacts on other modes, impacts on humans, impacts on the environment, and impacts on the economy.	No data	No data
11	Bicycle and Pedestrian Manual Count Programs: Assessing the Feasibility and Value for Measuring Local Active Transportation Work.	Anastazija F. Ray, et al	2020	No data	No data	No data	No data	No data	No data	No data	User counts	All	Communities described their motivation to conduct counts, management of existing programs, and how they interpreted and used the count data. Among the many uses of the data discussed were documenting use of facilities, allocating resources, assessing efficiency of investments or need for safety interventions, informing or conducting research, and community engagement. It was concluded that counts are a feasible assessment tool for local active transportation (bicycling and walking) promotion efforts.	Bicyclist and pedestrian manual counting programs are used to measure how many people are walking and bicycling in specific locations and their characteristics. The purpose of this study was to understand how communities use this data and assess the potential to use manual count data for assessment and evaluation	No data	No data

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Reference Number	Title	Author	Publication year	Health & Environment	Economic Vitality	Sense of Place	Equity	Trust	Connectivity	Safety	Measure / Representation / Interpretation / Evaluation / Tracking		Results / Key findings	Short Summary (1 - 2 sentences)	General Definition of Livability (if provided)	Notes
12	Causes of Spatial Patterns of Livability in Chinese Cities	Jingjun Hao	2021	No data	No data	No data	No data	No data	No data	No data	[See Indicator system for Didi's "urban development index"]	No data	Relevant government departments should pay full attention to the spatial pattern and spatial dependence of urban livability... and make overall planning and improvement strategies; attention should be paid to the spatial scale difference and the spatial heterogeneity of influencing factors in policy formulation, and the differentiated development policy of livablecities should be put forward according to local conditions	This study explores the spatial distribution and spatial driving factors of urban livability	No data	No data
13	Climate Resilient Urban Mobility by Non-motorized Transport	Joseph, Kigozi	2022	No data	Net present benefits of an improvement	No data	No data	No data	Modality	No data	**Input metrics** **Key input 1: Regional economic data:** Modal split Metro population Economic growth rate Average inflation rate Currency Ugandan GDP/capita Discount rate **Key input 2: Estimated Project Investment Costs:** Construction costs Design costs Evaluation metrics Environmental benefits: Carbon dioxide (CO_2), Nitrogen Oxides (NOX) and Particulatematter (PM) emissions Health benefits: Difference in distance traveled, no. of users, physical activity (minutes), relative risk of mortality, yielding a net present value of physical activity Economic value of accident reduction Savings of user costs Time savings Value Added Tax Revenue (money that will be saved by the users will be spent on other taxable consumables)	No data	All indicators discussed can be monetized and a net present value (NPV) for each indicator can be determined. The sum of the NPVs can be calculated, then, as the Net Present Benefit (NPB). The NPV of the entire project can be calculated by subtracting the Net present Cost (NPC) fro the NPB.	This paper seeks to answer the question whether non-motorized transport (NMT) projects are economically viable and how cities can maximize benefits of NMT for Climate conscious economic growth.	No data	No data
14	Community and Quality of Life-Data Needs for Informed Decision-Making	National Research Council	2002	No data	No data	No data	No data	No data	No data	No data	[No actual metrics]	No data	Many geographic boundaries are arbitrary and affect the collection of geographic data and the measurement of livability. Human settlement landscapes exhibit substantial and complex variability with respect to time as well as place. Recording livability data for a place only at one particular time can misrepresent urban and regional structure and processes. Livability should be analyzed over time as well as space at time scales varying from daily to weekly, monthly, yearly, and over multiple decades.	This report discusses livability metric theory, including but not limited to the importance of place-based indicators and the appropriateness and comprehensiveness, or lack thereof, of both government and private datasets.	Livability is an ensemble concept whose factors include or relate to a number of other complex characteristics or states, including sustainability, quality of both life and place, and healthy communities	No data
15	Commute satisfaction, neighborhood satisfaction, and housing satisfaction as predictors of subjective well-being and indicators of urban livability	Kostas Mouratidis	2020	No data	No data	The pathways between the urban environment – which includes both the physical built environment and the social environment – and subjective well-being can be explained by life domains that mediate this relationship Domain 1: Neighborhood satisfaction; Domain 2: Housing satisfcation	No data	No data	Domain 3: Commute satisfaction	No data	Survey instrument and descriptive statistics	No data	Commute satisfaction was found to be linked to subjective well-being indirectly, mainly via neighborhood satisfaction and job satisfaction. Neighborhood satisfaction was found to relate to subjective well-being directly, but also indirectly via personal relationships satisfaction, housing satisfaction, and leisure satisfaction. Housing satisfaction was found to have a significant direct association with subjective well-being.	Commute satisfaction, neighborhood satisfaction, and housing satisfaction can be used as indicators of urban quality of life and livability due to their potential contribution to subjective well-being. This study aims to uncover whether these three concepts are indeed predictors of subjective well-being and reliable indicators of .livability and quality of life in cities	Livability could be described as "the quality of the person-environment relationship, or how well the built environment and the available services fulfill the residents' needs and expectations"	No data
16	How Do Complete Streets Matter for Communities? The Case of Richfield, Minnesota	Phinney, Robin	2020	Research suggests that any impact on health outcomes, except for injury or death due to accidents with vehicles, occurs largely through an impact on activity. As a result, we would expect to see any relationship with levels of activity emerge before an impact on other outcomes. Second, there are significant data constraints on accessing health data – particularly data that can be disaggregated below the city level	The economic benefits of Complete Streets are widely touted. Proponents argue that designing streets that are more accommodating of pedestrians, public transit users, and bicyclists can lead to changes in transportation patterns, consumer behavior, and the overall desirability of an area. This, in turn, can have a positive impact on business activity, home prices, and public and private investment in an area.	No data	No data	No data	No data	By incorporating modifications to the road designed to reduce traffic speeds, separate pedestrians and cyclists from vehicles, and increase the visibility of pedestrians, cyclists, and public transit users, Complete Streets can lead to a reduction in traffic conflicts and accidents and an improvement in the perceived safety of the road	Livability measure: Difference-in-difference (DID) analysis. The DID analysis is a quasi-experimental research design that allows an estimation of the effects of an intervention (or treatment) over time by comparing to similar groups, only one of which experiences the intervention or treatment Economic vitality measure: semi-structured interviews with owners and/or on-site managers of businesses and nonprofit organizations located along three commercial areas Health & activity: counts via US census and Hennepin County 48-hour count data; qualitative and survey data	No data	At the time of the study, residents and business owners were still adjusting to the changes in street design: business owners expressed uncertainty and apprehension about the impact of the new street design on sales; survey data attest to residents' continuing confusion about using roundabouts; residents also reveal uncertainty about the impact on active living because residents had not yet had the opportunity to experience the roads in summer Residents and business owners are affected by Sweet Street projects even if they do not live on or immediately adjacent to a reconstructed road. This means that spillover effects are likely, as residents and business owners in one part of the city are affected by changes that occur in another part of the city.	In addition to the Complete Streets framework, Richfield Swee Streets include guiding principles for transportation and land use planning, and specific plans for cyclists, pedestrians, and those with physical disabilities. This approach focuses attention on the needs of different types of street users and multiple forms of transportation, aiming to change the experience of the road for all types of users; the reconstructions are also about enhancing the experience of walking, cycling, and transit use throughout the city.	No data	No data
17	Shared automated vehicles could make cities more livable, equitable	Zhi-Li Zhang	2022	No data	No data	No data	No data	No data	No data	No data	[No metrics provided]	No data	No data	No data	No data	[Think piece on shared autonomous vehicles]
18	Do corporate social responsibility ratings have any effect on traffic congestion	Bakare, Bukola, et al.	2022	Traffic Congestion (TC) continues to be a major business operation, community, and environmental health problem. Air pollution resulting from vehicle fumes has been associated with deaths and health issues, such as lung disease, asthma, and stunted lung growth in children.	TC is also an important economic issue: congestion-based delays result in restricted economic growth that directly impacts revenue. Businesses lose money due to delays in shipments, losses of productivity, and wasted fuel.	No data	No data	No data	No data	No data	Using data from the Travel Time Index (TTI) and CSRHub ratings.	No data	Congestion has a strong impact on the environment and that companies, through their employee policies, can impact traffic congestion (TC). The results also highlight the opportunities that companies have in potentially reducing their environmental impact by incorporating congestion reduction strategies as part of their corporate social responsibility (CSR) endeavors, either as a separate measure or as part of their environmental or employee CSR ratings.	Cities can curb congestion by implementing supply or demand side interventions to mitigate traffic congestion (TC) — so can corporations. This study seeks to understand if corporate social responsibility (CSR) ratings relate to traffic congestion.	No data	No data

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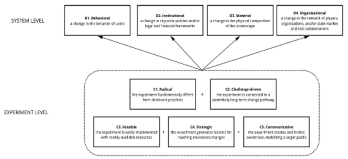
19	Dynamic Modal Accessibility Gap Measurement and Application Using Travel Routes Data	Jinpeng Guan	2020	No data	No data	No data	No data	No data	congestion, reduce energy consumption and emissions, and promote sustainable development, prioritizingpublic transportation is a common strategy. However, many people still choose private vehicles such a scars ,motorcycles, or mopeds for their daily travel. One major reason is the difference of accessibility to destinations, which can often be approximated by points of interest (POIs), via public and private transportation. Public transportation, such as bus and metro, has operation time and service frequency constraints and thus may not provide reliable accessibility to certain POIs at any given time	No data	Data sets: Taxi data collected from onboard devices, metro smart card data and metro station locations, and POI data extracted from maps (including hotels, restaurants, supermarkets, malls, parks, schools, parking lots, pharmacies, hospitals, and banks) (Dyanmic accessibility calculation with the real-travel covered areas by TAXI as travel mode) — (Dyanmic accessibility calculation with the real-travel covered areas by METRO as travel mode) (Dynamic modal accessibility gap (TAXI vs METRO) calculation with real-travel covered areas)	Urban	Taxis are better at getting to POIs in the city center and periphery, generally, the metro gets higher POIs accessibility during mornign and evening peak hours on workdays.	This study proposes a new index called dynamic modal accessi-bility gap (DMAG), which draws upon available data on residents' real travel routes using dif-ferent travel modes, as well as the data on points of interest (POIs), whereas POI accessibility has predominantly been considered via usage of POVs	No data	No data
20	Early Delivery of Equitable and Healthy Transport Options in New Suburbs	Lucy Gunn	2020	No data	No data	No data	No data	No data	No data	No data	2.1 Policy: review of precinct structure planning guidelines 2.2 Place: measuring access to transport and the built environment features in growth areas 2.2.1 Location data (address points) 2.2.2. Destination data (setting up neighborhood boundaries), measurement of the built environment (street connectivity # of clean intersections, dwelling density dph) (location points for community and cultural centres, post offices, convenience stores, supermarkets, parks and open spaces, and fresh food and specialty store), and access to transport (distance to closet bus stop and distance to any public transit stop) 2.3 People: survey evaluation of residents	No data	The analysis presented here of policy, place and people found that adopted guidelines contain many of the key social and transport infrastructure features that support active transport. However, access is reduced when these elements do not exist or are delayed in their delivery to areas	Although planning policies support the development of active transport and healthy, liveable cities they are insufficient for influencing healthy behaviours when not well imple-mented. Early delivery of social and transport infrastructure and services must occur early in the development cycle of new growth areas to support healthier and more sustainable behaviours.	No data	No data
21	Effectiveness of Transportation Funding Mechanisms for Achieving National, State and Metropolitan Economic, Health and Other Livability Goals.	Rebecca Lewis	2018	No data	No data	No data	No data	Ensuring public funds and resources are being effectively/responsibly spent on transportation investments that have equitable, worthy impacts	No data	No data	Pioneer Valley MPO (Massachusettes) Regional Performance Measures and Targets Middle Tennessee Connected, Nashville Area MPO: 1. Number of People Residing within the Region 2. Number of Occupied Jobs Across the Region 3. One-way Trips Per Capita each Day 4. Total Vehicle Miles Traveled per Day 5. Miles Traveled per Capita each Day 6. Time Spent Traveling per Capita each Day 7. Average Speed across all Major Roadways 8. Percent of Miles Traveled on Congested Route 9. Percent of Freight Truck Travel on Congested Routes 10. Daily Transit Ridership (Nashville Area MPO, 2016). Utah Long Range Transportation Plan (2015) 1. Zero Crashes, Injuries, and Fatalities: UDOT is committed to safety and won't rest until a status of zero crashes, zero injuries, and zero fatalities is attained. a. Safety: traffic fatalities, contributing factors, workplace safety incidents (annual workers compensation claims) 2. Optimize Mobility: UDOT continuously strives to make the transportation system work better while quickly and efficiently moving people to their destinations by optimizing operations; improving connections for transit, biking and pedestrians; and increasing capacity. a. Manage System: traveler information distribution, setting and tracking snow removal targets, and tracking incident management. b. Optimize System: signal optimization improvements and managed lanes improvements. c. Capacity: capacity increases, travel-delay forecasts, and Transportation Investment Fund expenditures. 3. Preserve Infrastructure: UDOT believes good roads cost less, and through proactive preservation, UDOT will maximize the value of Utah's infrastructure investment for today and the future. a. Pavement Condition: pavement conditions; ride quality b. Bridge Condition: bridge condition, age distribution, pavement and bridge expenditures. c. Maintenance: Quality Assurance Program	No data	The study covered six case studies states and their multiple, respective MPOs. Phase 1: Planning • Develop performance measures that reflect local priorities. • Plan to achieve desired outcomes cost-effectively. Phase 2: Governance & Finance • Tie sources of funding to desired outcomes. • Provide flexibility to make cost-effective investments. • Delegate investment decisions to policymakers with sufficiently broad authority. Phase 3: Programming • Make cost-effective investments to achieve desired outcomes. Phase 4: Reporting • Analyze outcomes and adjust expectations. • Report returns on investments to taxpayers.	This study sought to understand how effectively do transportation investments deliver desired outcomes: reducing commute times, improving the economy, supporting community development, enhancing public health, providing cleaner air, and advancing other livability goals and how states and MPOs were spending transportation funding in alignment with goals in transportation plans, and how states and MPOs report outcomes to citizens.	No data	No data
22	Equitable-transportation-planning-curriculum Final-Report	Tia Boyd, et al.	2022	No data	No data	No data	Equity in transportation planning helps to ensure equal access to affordable and reliable transportation, as well as fairness in the distribution of its benefits and burdens. Without inclusive processes, transportation planning can overlook the needs of and negatively impact low-income communities, minorities, persons with disabilities, the elderly, children, and other traditionally underserved populations.	No data	No data	No data	Measurement of learning and comprehension through a Learning Outcome Assessment Rubric Learning outcome | Excellent | Good | Poor	No data	This curriculum provides emerging transportation professionals with an education rooted in leveraging a multimodal transportation system for equitable outcomes.	This curriculum will provide emerging professionals with the training and tools needed to successfully integrate equity into transportation decision-making processes. Students taking the course will gain an appreciation for the historic impetus to consider equity and a deeper understanding of related concepts, including accessibility, mobility, affordability, and sustainability	No data	
23	From temporary arrangements to permanent change	Katherine VanHoose	2022	No data	No data	No data	No data	The transition to more sustainable and livable cities is a formidable one: an entire urban mobility system, including user behavior, government policies and market strategies, organizational frameworks, institutional arrangements, and existing infrastructure, must be overhauled. City street experiments offer a low-cost, low-risk way to explore potential routes towards increased sustainability and livability. As "intentional and temporary changes to the street use, regulation and or form, featuring a shift from motorized to non motorized dominance and aimed at exploring systemic change in urban mobility and public life "(Bertolini, 2020), these practices offer a glimpse of "radically different arrangement of the urban mobility system " that look "beyond... mobility itself to reconceive streets as public places for social interaction and conviviality"	No data	No data		No data	City street experiments are increasingly being implemented as ways to explore possible solutions to the challenges and tensions of contemporary urban mobility. The analysis highlighted the following patterns regarding city street experiments and their transitional capacity: • There exists a broad correlation between the cumulative strength of experiment characteristics and overall dimensions of change. • The characteristic radical holds a strong presence, however, appears to have no determining relationship with the dimensions of change. • There is a clear trade-offbetween the characteristics radical and feasible. • The characteristic challenge-driven is weak, however does not appear to have a determining relationship with dimensions of change. • Institutional barriers, both formal (legal frameworks) and informal (automobility as a social norm) major constraints to the feasibility of experiments. • The characteristic strategic is weak and appears to have no determining relationship with the dimensions of change.	This report presents case studies of interim/temporary /experimental urbanism projects. The study investigates how city street experiments may create, build upon and exert their transitional capacity upon the urban mobility system to become a lasting solutions	No data	No data

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24	Quantifying the Sustainability, Livability, and Equity Performance of Urban and Suburban Places in California	Alexander Rijiro Frost	2018	Building on previous typology studies, this paper improves the typology classification processes and expands the performance metrics to holistically compare how different urban forms affect economic, social, and environmental outcomes of all 8,043 census tracts in the state of California.	No data	No data	No data	No data	No data	No data	and these measures continue to expand by including other non-built environment variables such as demography and desirability. These are useful metrics to quantify TOD. From the framework: **Density** Housing (u/ac) Population (pop/ac) Employment (jobs/ac) **Land mix** Service (jobs/ac) Entertainment (jobs/ac) Office (jobs/ac) Industrial (jobs/ac) Retail (jobs/ac) **Diversity** Building diversity Multi-family housing Renters Regional diversity **Design** Street intersection Ped intersection Walkscore **Distance** Transit station distance	Urban/suburban	After an extensive, iterative process, seven major archetypes of California neighborhoods were identified as follows: urban centers, urban places, compact suburbanplaces, suburban places, rural places, employment centers, and special districts. This study found that there were clear trade-offs between urban and suburban living. These include reduced annual VMT, lower transport-related GHG emissions per capita, and savings in annual tmaportation expenses, while consuming less electricity and water per capita. Costs of home ownership are much higher in urban areas, however, despite rents being cheaper. There's less obesity and cardiovascular disease in urban areas but higher rates of athsma.	This paper describes the development of a place typology andsustainability performance measurement framework based on census tracts that will fill the gap in previous research seeking to quantify how urban and suburban place-types affect economic, social, and environmental outcomes at small geographic scales. This analysis and place typology could prove useful in identifying areas with the highest potential for lower-ing vehicle miles traveled and other sustainability, livability, and equity goals	No data	No data
25	International Methods and Local Factors of Walkability	Rui Wang	2022	No data	No data	No data	No data	No data	No data	No data	**Subjective Measures Neighborhood Level Walkability** Neighborhood Environment Walkability Scale (NEWS) International Physical Activity and Environment Network (IPEN) **Objective Measures Neighborhood Level Walkability** Walk Score **Objective Measures Street Level Walkability** Pedestrian Environment Data Scan (PEDS) (1) environment, (2) pedes-trian facilities, (3) road attributes, and (4) walking or cycling Pedestrian Environment Review System (PERS) [See separate tab] Microscale Audit of Pedestrian Streetscapes (MAPS) The street characteristics that were audited consist of four components: (1) overall route (approx-imately 0.4 km from a participant's home toward a predetermined destination); (2) street segments (a section of a street between twocrossings); (3)crossings; and (4) cul-de-sacs, which were recorded at their respective occurrences along the survey route SPOTLIGHT virtual audit tool (S-VAT) Virtual Systematic Tool for Evaluating Pedestrian Streetscapes (Virtual STEPS) Used Google Street View to re-motely evaluate microscale features of the built environment. Thetool contained 40 items that were divided into six sections: (1) pedestrian infrastructure; (2) traffic calming and streets; (3) building characteristics; (4)bicycle infrastructure; (5)transit; and (6) aesthetics or disorder	No data	There were three main types of approaches to measure walkability during the study period: (1) subjective measurement of the neighborhood level walkability; (2) objective measurement of the neighborhood level walkability; and (3) objective measurement of the street level walkability. In addition, this study provided a comprehensive overview of the factors that influence walkability. The widely recognized built environment factors that include accessibility of facilities, safety, and comfort of sidewalks promoted walkability, which was supported by evidence from a variety of countries and pop-ulations. The socioeconomic and sociocultural differences werepotentialreasonsforthedifficultyinconsistentwalkability evalu-ations. For example, residential forms in certain cultural contexts(e.g., gated communities) might lead to barriers or changes in theinfluences on walking behavior. People that live in lower socioe-conomic neighborhoods have a different willingness and fre-quency to walk compared with those in better conditions. These findings could serve as a reminder that researchers should consider local differences and the reasons behind them when conducting walkability assessments.	This report consists of a literature review of studies on walkability as a critical factor in sustainable and livable urban development. It includes a review of neighborhood and street level measurment methods.	No data	No data
26	Investigating Customer Satisfaction Patterns in a Community Livability Context: An Efficiency-Oriented Decision-Making Approach	Golnaz Sarram	2018	No data	No data	No data	No data	No data	No data	No data	Multidimenstional Livability Index (MLI) 1) Phase I - Identifying livability definiton (attitudinal data) a. Livability Index classification analysis in all divisons b. Prioritizing preferences of the users Example preferences/ranks 1 Experiencing negative environmental issues (smog, air pollution, noise, or otherwise) 2 Living in an economically thriving neighborhood 3 Knowing my neighbors 4 Minimal road congestion 5 Quality affordable housing 6 Having a park in my neighborhood 7 How often stuck in traffic due to trains (Response: Occasionally) 8 Feeling safe in my neighborhood 9 Experiencing presence of freight or heavy trucks traffic 10 Living close to school/work 11 Having alternative transportation options (walk, bike, public transit) 2) Phase II - Proxy Settings (Behavioral and Socio-Economic Data) a. Learning the users' mobility, commuting and mode choice patterns as a measure of livability b. Correlating the behaviroal metric to Livability Index 3) Integrating Efficiency-Oriented Decision Making a. The research outcomes provide a practical standard for urban metrics studies to assess their planning performance b. The updated urban modeling procedure can consider residential satisfaction in scenario planning through forecasting project impacts on urban configuations.	No data	No data	The focus of this study is on interpreting a linkage between society stated preferences and quantitative measures of livability by extracting information from survey-based methods and translating it to a quantitative framework using combined service industry and urban computing methodologies. The study covers understanding existing livability patterns, predicting heterogeneous perceptions of quality of life, prioritizing public preferences, and developing a multidimensional livability index (MLI)	[Six principles of livability from FHWA)	No data
27	Livability and Subjective Well-Being Across European Cities	Okulicz-Kozaryn,A. et al.	2019	No data	No data	This paper aims to explore for the first time whether urban livability is correlated to happiness in Europe. Does living in a city with high levels of livability increase happiness? Or is individual happiness independent from the livability of a city? Similarly, is the rela-tionship between livability and happiness consistent throughout Europe or are thereregional differences?	No data	No data	No data	No data	Another definition for livability is quality of place (Burton 2014) and its synonyms: environmental quality or urban quality,defined as the "the physical characteristics of community, the way it is planned, designed, developed, and maintained. Subjective well-being (SWB) is one of the most comprehensive measurements available. Diener and Lucas define it as peo-ple's evaluations of their lives, which include "both cognitive judgments of one's lifesatisfaction in addition to affective evaluations of mood and emotions" Pairwise correlations	Urban, Suburban	Smaller cities score higher on both livability and subjective well-being (SWB). Subjective indicators do not replace, but complement objective indicators (Stiglitz et al. 2009). At the same time subjective indicators are in some ways more useful. Only SWB can be measured completely, while livability and QOL consist of innu-merable items that cannot be measured fully	This study aims to show the correlation between measured livability and subjective well-being (ie happiness), which is self-reported by participants, across european cities.	Livability refers to the quality of life, standard of living, or general well-being of a population in a specific region, area, or city. It is the sum of factors that add up to a community's quality of life (economic prosperity, social equity and stability, educational opportunities, recreation and cultural possibilities, etc.	No data

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28	Livable Streets Livable Arterials Characteristics of Commercial Arterial Roads Associated With Neighborhood Livability	Carolyn McAndrews, et al.	2018	No data	No data	Arterial roads can be neighborhood cultural assets and social places in addition to playing roles as travel corridors	No data	No data	Research consistently finds that high volumes of motorized traffic, combined with a lack of pedestrian-oriented design, have a negative effect on livability. Poor pedestrian environments can limit access to jobs, housing, schools, and neighborhood amenities because streets designed for motorized traffic alone function as barriers to other types of users. Researchers today recognize, however, that traffic can also make certain streets dynamic and interesting, despite being noisy and polluted. Where's the balance?	No data	Measuring six variables using publicly available administrative data for n sites. 1. 24-hr traffic counts 2. Number of lanes 3. Curb-to-curb width (ft) 4. Tree canopy (%) 5. Urban design score (using Ewing and Clemente, 2013 method) **Imageability** (the quality of a place that makes it distinct, recognizable, and memorable): Number of courtyards, plazas, and parks on the block face. Number of major landscape features visible from the block face. Proportion of historic building frontage (both sides). Number of buildings with identiiers (both sides). Number of buildings with nonrectangular shapes (both sides). Presence of outdoor dining (observer side). Number of people (observer side). Noise level. **Enclosure** (the degree to which streets and other public spaces are visually deined by buildings, walls, trees, and other vertical elements). Number of long sight lines visible in three directions. Proportion of street segment with street wall (observer side). Proportion of street segment with street wall (opposite side of street). Proportion of the sky visible straight ahead. Proportion of the sky visible looking across the street. **Human Scale** (refers to a size, texture, and articulation of physical elements that match the size and proportions of humans and, equally important, correspond to the speed at which humans walk). Number of long sight lines visible in three directions. Proportion of street segment with windows (observer side first loor). Average height of buildings weighted by building frontage (observer side). Number of small planters (observer side). Number of pieces of street furniture (observer side) **Transparency** (refers to the degree to which people can see or perceive what lies beyond the edge of a street or other public space and, more specilically, the degree to which people can see or perceive human activity beyond the edge of a street or other public space). Proportion of street segment with windows (observer side irst loor). Proportion of street segment with street wall (observer side). Proportion of street segment with active uses (observer side) **Complexity.** Number of buildings (both sides). Number of basic building colors (both sides). Number of accent building colors (both sides). Presence of outdoor dining (observer side). Number of pieces of public art (both sides). Number of people (observer side) 6. Socioeconomic status (median household income)	No data	Neighbors like arterials that they perceive as a) vibrant with good transit access and b) quiet and clean; they dislike arterials that they perceive as a) unpleasant and b) sketchy. Vibrant arterials contribute to the perceived livability of the surrounding neighborhoods, whereas sketchy arterials are negatively associated with livability, but the same arterials are often simultaneously vibrant and sketchy. Residents clearly value the social functions that arterials provide and seem less aware of traffic volumes; some low-volume arterials are not more livable than those with higher traffic volumes.	This study investigates the positive and negative impacts of commercial arterials with nodes of activity on the livability of surrounding neighborhoods	How happy [residents] were with their neighborhood	No data
29	Liveability and freight transport in urban areas	Maria Rosaria Trecozzia,*, Giuseppe Iiritanoa , Giovanna Petrungaroa	2022	Environmental sustainability concerns the reduction of pollution in all its forms: acoustic, atmospheric, environmental (Waygood et al., 2013; Taniguchi, 2014),	Economic sustainability concerns the reduction of transport costs for trade and distribution operators (Russo and Comi, 2020).	No data	No data	No data	No data	social sustainability concerns, among other things, increasing road safety and accessibility (Taniguchi et al. 2013; Russo and Comi, 2017)	Time windows, access dimensions of fleet vehicles, nearby delivery area and urban distribution centers, pick up point realization, parking network realization, electric fleet vehicles.	Urban	Collaboration between regional and local administrations with distinct roles is essential for achieving more sustainable cities and towns. The regional administration acts as the financier and sets objectives, while the local administration is responsible for execution, management, monitoring, and data reporting. Technical support and training are crucial for enhancing the capabilities of local authorities in addressing urban logistics issues. Recognizing operational results in different cities and towns and assessing the disparity between modeling and implementation is the next step for regional administration	Liveability is used on conjunction with sustainability. In the context of this study, sustainability has three prongs: economic, social, and environmental. Economic sustainability concerns the reduction of transport costs for trade and distribution operators (Russo and Comi, 2020). Environmental sustainability concerns the reduction of pollution in all its forms: acoustic, atmospheric, environmental (Waygood et al., 2013; Taniguchi, 2014), social sustainability concerns, among other things, increasing road safety and accessibility (Taniguchi et al. 2013; Russo and Comi, 2017)	No data	No data
30	Perceived liveability, transport, and mental health: A story of overlying inequalities.	Daniel Oviedo a,* , Orlando Sabogal a , Natalia Villamizar Duarte b , Alexandria Z.W. Chong	2022	Mental Health	No data	No data	No data	No data	No data	That uses questions of how people evaluate the level of crime, violence, discrimination, and drugs of their neighbourhood ranging from "very unsafe" to "very safe". Crime and Security also has the indicator of overall feeling of safety in the neighbourhood (from "bad" to "good").	· Pollution and Sanitation: Incorporating the questions of how bad or good people evaluate the environmental pollution, noise, garbage collection, and sewage system of their neighbourhood. · Leisure Facilities: That has the quality evaluation of culture and recreation facilities and of sport facilities where higher values mean good evaluations. · Urban Design: Incorporating the questions of how bad or good people evaluate the street design, public green space, amount of trees, and street lighting of their neighbourhood. · Crime and Security: That uses questions of how people evaluate the level of crime, violence, discrimination, and drugs of their neighbourhood ranging from "very unsafe" to "very safe". Crime and Security also has the indicator of overall feeling of safety in the neighbourhood (from "bad" to "good").	Urban	Transport investments tend to accomodate already socio-economically advatnaged residents. Inconclusive results for proximity to transit and liveability. Income level, that is a regressor of both Perceived Liveability and Self-reported Mental Health, is having strong effects and in the hypothesised direction.	This paper investigates the relationship between perceived livability and mental health, focusing on the role of transport-related variables and features of the built environment. Using Cali, Colombia as a case study, data from an online participatory planning tool and secondary sources are analyzed through a Structural Equations Model. The results indicate that perceived liveability, treated as a latent variable, influences urban form, environment, transport access, and fear of crime. Higher liveability scores are associated with better mental health, with car users scoring higher in both. The findings suggest that transport investments may benefit already advantaged residents, and the impact of mass transit on liveability is inconclusive.	urban form, the environment, access to transport, and fear of crime, (Pollution and sanitation, Urban design, Leisure facilities, and Crimes and security -	No data
31	Is a liveable city a healthy city? Health impacts of urban and transport planning in Vienna, Austria.	Khomenko Sasha; Nieuwenhuijsen Mark; Ambros Albert; Wegener Sandra; Mueller Natalie	2020	Used indicators like green space, air pollution, physical activity, noise, and heat as ways to measure liveability in addition to stability, healthcare, culture and environment, education, and infrastructure,	No data	No data	No data	No data	No data	No data	Physical activity was assessed using data from the 2014 Austrian Health Survey, estimating minutes per week through the Health Enhancing Physical Activity (HEPA) indicator. Air pollution was measured with annual mean PM2.5 and NO2 concentrations using the ELAPSE Land Use Regression model. Road traffic noise was determined using the EU 24-h day-evening-night indicator (Lden) from the 2012 Austrian Noise Map. Green space was evaluated based on the percentage of green space surface area needed for universal access within a 300 m linear distance, using data from Urban Atlas and the Physical Activity through Sustainable Transport Approaches study. Heat was measured using land surface monthly mean temperatures obtained through Moderate Resolution Imaging Spectroradiometer (MODIS) and ambient daily mean temperatures from the "Hohe-Warte" weather station.	Urban	The study investigates the correlation between liveability, health, and environmental justice in Vienna, Austria, which was ranked as the most liveable city by the Economist Intelligence Unit in 2018 and 2019. Using the Urban and TranspOrt Planning Health Impact Assessment (UTOPHIA) methodology, the researchers estimate the premature mortality burden associated with non-compliance to international exposure level recommendations for various factors. The results reveal that despite Vienna's high liveability standards, 8% of premature mortality is attributable to non-compliance, with 76% linked to PM2.5 exposure and insufficient physical activity. Socioeconomic disparities are observed, with lower SES neighborhoods facing higher mortality risks due to increased exposure to NO2, road traffic noise, heat, and limited green space. The study suggests a need for better alignment between liveability, environmental health, and justice objectives in urban planning.	The study examines Vienna, ranked as the most liveable city, to assess the relationship between liveability, health, and environmental justice. Despite high liveability standards, 8% of premature mortality is linked to non-compliance with exposure recommendations, with socioeconomic disparities in risk observed across neighborhoods.	A liveable and healthy city is a city that provides all residents with equal opportunities (i.e. with respect to service access or environmental quality) health and well-being, as well as the environmental and social justice perspectives to be considered more holistically. stability, healthcare, culture and environment, education, and infrastructure, Greenspace, heat, noise, air pollution, physical activity	No data
32	Measuring Livability at the Neighborhood Scale	H-H Chen and U Dietrich	2019	"Key Indicators" that are decisive for liveability include public space, and building density	No data	No data	No data	No data	"Key" indicators that are decisive for livability: Connectivity for pedestrians, mean distance between two public transport stops, building density, population density,district coverage ratio	No data	Key indicators connectivity for pedestrians, mean distance between two public transport stops, building density, population density, district coverage ratio, public space Indicators: 1. Connectivity for pedestrians, 2. Connectivity for cars, 3. cyclomatic number for pedestrians, 4. cyclomatic number for cars, 5. distance between intersections for average pedestrains, 6. distance between intersections average for cars, 7. number of vehilces per dya for mainstreets 8. number of vehicles for local streets. Noise: proportion of buildings with L(Den) >70dB in % during the day / with L(Den) >50 dB in % during the night. Proportion of buildings with more than 300 m distance to the next public transport stop / the next bicycle rental station Mean distance between two public transport stops Frequency during the day / night / weekend Aspect ratio building height / building distance at main city street / main local street / main neighborhood street. Shadowing (daylight access) at main city street / main local / main neighborhood street. Width of pedestrian sideways at main city street / main local street / main neighborhood street Green space / water space / pedestrian zone, plaza, sport field, private space / semi-public space / public space District coverage ratio Population density Indicators used for sustainable analysis. Building density. Plot ratio Single family / multifamily / hotels, accommodation / civic (government, nursery, school, youth center, hospital, etc., even if in private ownership) / religious, spiritual / commercial (used by public like shopping malls, sport centers, restaurants, etc.) / retail / office, industry / recreational / all others Proportion of buildings with more than 300 m to the next public recycling station for different materials PV potential: percentage of suitable district area / roof area for PV / power demand of district inhabitants which could be covered by PV Modules. Green roof potential: percentage of district / roof area where green roofs could be suitable	Urban	Indicators play a crucial role in guiding long-term planning, identifying areas for improvement, and assessing progress over time. Town-center livability indicators, serving as the primary qualitative and quantitative input for health checks, should be carefully chosen. The article recommends a phased approach, beginning with a collectively agreed set of core indicators that can be expanded upon in subsequent years.	The paper presents a method to assess neighborhood livability by defining 51 indicators across various categories, comparing 36 neighborhoods in Hamburg, Germany. The approach involves selecting the most livable neighborhoods as best practices within the city, converting absolute indicator values into relative ones, and presenting results in radar charts for easy comparison. The method is flexible, allowing users to compare neighborhoods within their own city based on context-dependent ideal values, considering factors like rents, survey feedback, and architectural characteristics. The study emphasizes the importance of context-specific assessments for accurate livability comparisons.	No data	No data

Literature Review Matrix

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Reference Number	Title	Author	Publication year	Health & Environment	Economic Vitality	Sense of Place	Equity	Trust	Connectivity	Safety	Measure / Representation / Interpretation / Evaluation / Tracking		Results / Key findings		General Definition of Livability (if provided)	Notes	
33	Measuringthe livability of anurban centre: an exploratory study of key performance indicators	Carlos J.L.Balsas	2004	No data	the concepts of vitality and viability have been used to assess city centres' health (DoE, 1994). Used together, these two dimensions refer to whether the city centre feels lively to people and whether it has a capacity for commerce to live in it	No data	No data	No data	No data	No data	performance and sales; car parking;footfall; crime safety; cleanliness, tourism and evening economy. Kitchener monitorisation indicators: New housing development Vacancy and residential redevelopment Hotel occupancy rates Downtown construction values Business activity Number of employees downtown Value of fa,cade/interior loan property improvements Population Attendance at downtown events short-term parking revenues Street-front retail vacancy Vacancy and commercial redevelopment Monthly parking revenues Community development initiatives Planning Policy Guidance (PPG)6 indicators: Diversity of uses Shop rents Commercial yield on non-domestic property Accessibility Perception of safety and occurrence of crime Retailer representation and intentions to change representation Proportion of vacant street-level property Pedestrian flows Customer views and behaviour State of town-centre environmental quality	Urban, Downtown	No data	This paper analyses the concept of 'city-centre livability' and how it can be measured through a set of key performance indicators (KPI)s. The article advises that a phased approach is recommended to measure livability of a city center, starting with a collectively agreed set of core indicators that can bebuilt upon year after year.	"...livability has come to mean the ability of a centre to maintain and improve its viability and vitality. These two terms mean the capacity of a city centre to attract investment continuously and to remain alive." "A livable place is safe, clean, beautiful, economically vital, affordable to a diverse population and efficiently administered, with functional infrastructure, interesting cul-tural activities and institutions, ample parks,effective public transportation and broad opportunities for employment. It also connotes asense of community."	Recalls Kevin Lynch's 5 dimensions of performace: vitality, sense, fit, access and control
34	Neighborhood streets as places of older adults' active travel and social interaction – A study in Daokou ancient town	Zhe Wang	2022	No data	No data	Observed social interaction of older adults during weekday	No data	No data	Observed active living on the streets	No data	walkability, environmental maintenance, and street surface evenness, and counted the numbers of restroom, direction sign, street light, and security camera along the streets. percentages of greenery, sky, buildings, and street surfaces, places for sitting/resting to encourage longer walking journeys	urban	, the most popular type of active travel was independent walking (67%). Of their social interaction, the most popular types were staying and chatting (61%), group walking, and chess or card playing. On the street considered more age-friendly to active travel, older adults engaged in more social interaction in the mid-mornings and afternoons	this research observed older adults' active travel and social interaction on two neighborhood streets and investigated the difference in social engagement between older-adult groups on different streets.	No data	No data
35	Outdoor spaces and buildings, transportation, and environmental justice: A qualitative interpretive meta-synthesis of two age-friendly domains	Kristen E. Ravi a,*,1 , Noelle L. Fields a , Holly Dabelko-Schoeny b	2020	No data	No data	Create well lit and maintained public spaces. Drivers to show more care for passengers. Public amenities not accessible because too far	No data	No data	Lack of connectivity to transportation because of affordability and accessibility	No data	Outdoor spaces: clean and pleasant, substantial outdoor seating, well maintained, safe, wheelchair accessible, bike paths separate from pavements, well lit, Transportation: available, affordable, reliable, well marked routes and vehicles, clean, enforced priority seating, specialized transportation to those with disabilities, enough seating and shelter for stops, drivers to wait until passengers board to begin driving, adequate drainage for roads	urban	In sum, the main findings of this QIMS were that older adults faced barriers to accessing outdoor spaces, public buildings, and transportation. The major source of the barriers to outdoor spaces and public buildings was inappropriate infrastructure. Regarding transportation, older adults experienced difficulty accessing transportation due to limited availability and affordability Moreover, the difficulties experienced by the older adults in this study demonstrates a lack of environmental justice.	The main goal of this study is to construct a detailed depiction of how older adults perceive outdoor spaces, buildings, and transportation within the framework of age-friendly assessments. To attain this objective, the researchers utilized a qualitative interpretive meta-synthesis (QIMS) methodology. This approach sought to expand the range of eligible studies by incorporating various existing qualitative studies from different countries. The methodology included systematic sampling, data analysis involving theme extraction and synthesis, and methodological reduction. Additionally, the study emphasized the establishment of credibility for the evidence obtained through these processes.	8 domains of livability: outdoor spaces and buildings, 2) transportation, 3) housing, 4) social participation, 5) respect and social inclusion, 6) civic participation and employment, 7) communication and information, and 8) community and health services	No data
36	Overview of a Framework to Engineer Infrastructure Resilience	Craig A. Davis, Ph.D., P.E., M.ASCE1, et el	2022	No data	No data	No data	No data	emergency accessibility services to provide continuity during the time when the networks are unable to deliver basic services	No data	No data	infrastructure resilience is quantified by the amount of (1) service losses and time to restore, and (2) damage and time to repair	No data	Infrastructure encompasses physical and organizational structures crucial for societal operations. Infrastructure resilience is intertwined with community resilience. The elements include Infrastructure Resilience, Building and Lifeline System Performance, System Service Provision, Continuity of Services, Social and Economic Activity, and Community (wellbeing, livability, equity) Community wellbeing involves social and environmental conditions for flourishing. Element 7 sets community performance targets for resilience, linked with Element 8 defining infrastructure system performance targets. Both are essential for predicting support for community resilience, emphasizing reasonable and affordable objectives for minimizing social and economic losses.	The infrastructure resilience framework presented is a standardized approach to assess and build resilient systems impacted by hazards, emphasizing the connection between infrastructure and community resilience. It quantifies resilience through service losses, restoration time, and damage, addressing collaborative emergency services. Integrating assessment, management, and governance, it considers economic and social losses, offering tools and processes for evaluation, policy formulation, learning, and data-driven resilience actions. This framework marks a crucial step toward engineering systems supporting community resilience.	No data	No data
37	Performance of Smart Growth & Transit-Oriented-Development	Bruce S. Appleyarda,» , Alexander R. Frostb, , Christopher Allenc	2019	No data	Livability principles Provide more transportation choices Promote equitable and affordable housing Enhance economic competitiveness Support existing communities Coordinate and leverage federal policies and investments Value communities and neighborhoods	Quality of life inidcators	No data	No data	No data	No data	Quality of life indicators: Journey to work, Auto ownership, Income, opportunity for civic engagement, access to cultural arts,entertainmentc, obestiy rates, cardiovascular disease, asthma, unemployment, education, poverty, linguistic isolation	Urban	The study evaluates urban quality performance in relation to Transportation Land-use Coordination (TLC), "Smart Growth," and "New Urbanism." Stations with higher livability opportunity access show significant associations with improved quality of life outcomes, including lower rates of obesity, cardiovascular disease, and carbon emissions. However, these high-performing stations lack socio-economic inclusivity. The study recommends coordinated policies to ensure equitable access to opportunities for all, promoting sustainability, livability, health, and equity outcomes.	This paper addresses the lack of research on measuring and understanding the performance of "Smart Growth," Transit-Oriented Development, and "Livability." Evaluating over 350 light rail stations in the US, it utilizes smart growth, livability, and Transportation/Land-use Coordination (TLC) principles. The study reveals that stations with higher livability opportunity access are significantly linked to positive quality-of-life outcomes. However, it highlights a lack of socio-economic inclusivity in these high-performing stations, emphasizing the need for equitable access to livability opportunities for all individuals.	Livability opportunities: (affordable housing, jobs, safe and accessible walkability) health, safety, social inclusion and emissions reductions	No data
38	Planning in Gateway and Natural Amenity Region Communities: Understanding the Unique Challenges Associated with Transportation, Mobility, and Livability	Danya Rumore, Philip Stoker, Zacharia Levine, Lindsey Romaniello	2019	No data	No data	efforts to retain communtiy character	No data	No data	desire to transportation to/from accessible and affordable housing	No data	growth and increased visitation generally correlate with increased opportunity and are likely to increase quality of life and quality of visitor experience,However, once growth and/or visitation exceed a certain level, they may be correlated with decreased quality of life, and even with decreased quality of visitor experience.	GNAR	The study suggests that, despite challenges, the quality of life and visitor experience in many GNARs has generally improved in the last decade. However, some respondents noted declines, and tensions between newcomers and oldtimers, as well as tourists and residents, vary among communities. The research indicates that as GNAR communities experience development and increased visitation pressure, concerns about quality of life, visitor experience, and community tensions may arise. Further analysis will explore the specific challenges faced by different GNAR communities and the impact of planning and transportation issues on their dynamics.	This report investigates transportation and planning challenges in western gateway and amenity region (GNAR) communities facing rapid growth and increased tourism outside major public lands. The study, drawing on interviews, surveys, and observations, reveals that these communities are grappling with issues such as affordable housing, income inequality, and transportation problems, while valuing their small-town character. Despite challenges, most GNAR communities show improved quality of life and visitor experience, though some face significant difficulties. The report suggests that housing, transportation, and land use decisions are interconnected in GNAR communities, requiring further research for appropriate solutions.	No data	No data
39	Prioritization procedure for proposed road-rail grade separation projects along specific rail corridors	National Academies of Sciences, Engineering, and Medicine	2019	Emissions	No data	No data	No data	No data	time savings, access to work	There may be better returns from expenditures made for improving an large number of grade corssings rather than replacing a select few with grade separations	Accident data, emissions, commute time, train speed, large vehicle exposure, highway vehicles speed, presence of hazardous train cars, population density, vunerable populations, emergency response delays	No data	Survey respondents weighed safety and accident data as the most important for making grade separation decisions, while current and future delays to motorists also influence project decisions	more research is needed for the livability module devleoped for this study. Determining criterion to score each crossing appears dependent on organizations and or regional considerations.	quality and location of transportation facilities to broader opportunities such as access to good jobs, affordable housing, quality schools, and safer streets and roads.	No data

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Reference Number	Title	Author	Publication year	Health & Environment	Economic Vitality	Sense of Place	Equity	Trust	Connectivity	Safety	Measure / Representation / Interpretation / Evaluation / Tracking		Results / Key findings	Short Summary (1 - 2 sentences)		
40	On the promotion of human flourishing	Tyler J. VanderWeele	2017	state of complete physical, mental, and social wellbeing, but also encompassing happiness and life satisfaction, meaning and purpose, character and virtue, and close social relationships	No data	Family, work, education, and religious community	No data	No data	No data	No data	Four pathways to human flourishing - family, work, education, and religious community, unemployment rate, voting rates, rates of religious affiliation. Scale of 1-10 of happiness and life satisfaction, mental/physical health, meaning and purpose, character and virtue, close social relationships, financial and material stability.	No data	No data	The text recommends policy changes, such as eliminating marriage penalties and promoting supportive employment programs, to strengthen marriages and improve the well-being of vulnerable populations. It also emphasizes the positive impact of education, religious community support, and balanced media portrayals in fostering health and human flourishing.	No data	No data
41	Public health impacts of urban traffic jam in Sanandaj, Iran: A case study with mixed-method design.	Nadrian Haidar; Mahmoodi Hassan; Taghdisi Mohammad Hossein; Aghemiri Mehran; Babazadeh Towhid; Ansari Bahjat; Fathipour Asaad	2020	Physcial health, mental health, social determinants of health,	Congestion and delays	No data	No data	No data	Accessibility for mobility impairs groups, aoffrability of public transport, satisfaction of public transport, multimodal integration, opportunity for active mobility	Community health impacts from traffic jams	cardiovascular, pulmonary, neural, gastrointestinal, musculoskeletal and psychosomatic diseases, as well as fatigue and early aging. Indirect impacts were lack of physical activity (like walking and bicycling) due to the residents' reliance on private car use, premature death, disability, and bodily pain due to inner-city accidents, decreasing sleep and rest times as a result of getting stuck in the urban traffic jam, loss of lives and property due to late arrival of emergency vehicles after getting stuck in the urban traffic jam, and poor general health status due to air pollution-associated diseases/ disorders (like asthma/allergy, skin/lung cancer, and older adults' hypertension)	Urban	The study reviewed archival records and identified a slight increase in registered death/hospitalization cases related to diseases linked to air pollution, revealing a concerning trend in both city air quality and fines for traffic violations. Urban traffic jam challenges were categorized into infrastructural, managerial, sociocultural, psychological, and behavioral aspects. Health impacts encompassed physical and family mental health, and social determinants. Community surveys highlighted negative effects on air quality, public services, accessibility, environment, welfare, family circumstances, and social interactions. Identified barriers included insufficient infrastructure, lack of parking, and inadequate traffic education. The study underscores the need for health-oriented plans in low- and middle-income countries grappling with urban traffic issues.	Urban traffic jam challenges were identified across various categories, including infrastructure and sociocultural aspects. Health impacts included effects on physical and mental well-being, with community surveys indicating widespread negative consequences. The study emphasizes the importance of community health-oriented plans, especially in low- and middle-income countries facing issues related to urban traffic.	No data	No data
42	Qualitative and Quantitative Analysis to Advance Transportation	Zachary Elgart	2020	No data	No data	No data	No data	No data	No data	No data		No data	No data	No data	n/a	No data
43	Using Indicators to Assess Sustainable Transportation and Related Concepts	Tara Ramani	2018	Discourse organized around transportation's relationship to human health, especially in relation to four key elements – safety, air quality, active living opportunities, and access to critical destinations.. Discussions of sustainability in transportation that are centered on long-term environmental and ecological considerations, most notably climate change.	No data	No data	No data	Discourse related to transportation's ability to continue functioning when faced with disruptive events.	No data	No data	Livability: Employment–population balance Proximity to bicycle routes Proximity to transit facilities Proximity to parks and recreation Health: Traffic density Safety Proximity to clinics and hospitals Proximity to parks and recreation	urban	Observations indicate that regions with favorable livability and health scores are typically situated nearer to downtown and urbanized zones, contrasting with sustainability performance, which appears to be more broadly distributed across various areas. The results indicate significant correlations over different years within the same index—such as sustainability, with correlation coefficients of 0.93, 0.89, and 0.87 between the 2010 and 2020, 2030, and 2040 values, respectively. Similar high correlations exist for livability and health indices across various years. However, within a specific analysis year, the correlations between sustainability, livability, and health indices are notably low.	This study assesses the connection between sustainability, health, and livability in transportation planning for the El Paso metropolitan area. Using indicator-based case studies, the research develops indices for each concept over a 30-year planning horizon, revealing little correlation among them. The findings suggest that, despite theoretical overlaps, livability and health may not effectively represent sustainability in practical implementation, emphasizing the challenges and broader influences in achieving meaningful changes over time.	Discourse that is generally concerned with transportation as it relates to community-scale impacts, primarily on human well-being.	No data
44	Ranking Sustainable Urban Mobility Indicators and Their Matching Transport Policies to Support Liveable City Futures: A MICMAC Approach	Ioannis Chatziioannou a , Alexandros Nikitas b,* , Panagiotis G. Tzouras a , Efthimios Bakogiannis a , Luis Alvarez-Icaza c , Luis Chias-Becerril d , Christos Karolemeas a , Stefanos Tsigdinos a , Pontus Wallgren e , Oskar Rexfelt e	2023	Environmental sustainability	Sustainability has three essential axes: the environmental, the social and the economic one and all of them are linked with transport	No data	No data	No data	No data	No data	affordability of public transport for the poorest, accessibility of public transport for mobility impaired groups, air pollutions emissions, noise hinderance, road deaths, acces to mobility service, greenhouse gasses, congestions and delays, energy effifiency, opportunity for active mobility, multimodal integration, satisfactoin with public transport, traffic safety	urban	The most crucial group of strategies for sustainable urban mobility is urban design, with Transit Oriented Development (TOD) being the most influential, linking transport investment with land use planning. The next significant group focuses on alternative transport modes, including Bus Rapid Transit (BRT), public transit systems, and bike lanes, promoting non-motorized mobility. Strategies related to parking supply come next, emphasizing parking charges and minimum parking requirements to control car usage. The sustainable mobility framework also considers strategies associated with vehicles movement, efficient automobile usage, and ownership, without completely banning cars. The last group addresses no-mobility strategies, utilizing technological innovations, wireless connectivity, and teleworking to reduce actual travel, with an emphasis on flexible work schedules and telecommuting/teleworking, highlighted by the impact of the COVID-19 pandemic.	The study emphasizes the critical importance of understanding, promoting, and managing sustainable urban mobility in the face of the climate crisis. Through a qualitative approach involving literature review and discussions with experts, Sustainable Urban Mobility Indicators (SUMIs) were identified, with traffic congestion, affordability of public transport, energy efficiency, access to mobility service, and multimodal integration identified as the most impactful. The analysis also ranked strategies to support sustainable mobility, including Transit Oriented Development, public and active transport enhancement, parking policies, vehicle circulation and ownership measures, and telecommuting and car-pooling.	No data	No data
45	Re-Working Appleyard in a Low Density Environment: An Exploration of the Impacts of Motorised Traffic Volume on Street Livability in Christchurch, New Zealand	Wiki J., Kingham S., and Banwell K.	2018	No data	No data	Those on lighter and moderate trafficked streets reported better liveability motorised traffic acts as a barrier to street liveability and social interaction There was a significant relationship, indicating that as motorised traffic volumes rose residents were increasingly aware of the impact it was having on the liveability of their street	No data	No data	No data	No data	larger living space, more frequent interactions with community members, community severance or sense of belonging, light traffic 0-500 vpd, moderate 1,400 - 2,500, and heavy 8,400 - 13,720	suburban	In a study involving 52 respondents from different traffic areas, it was found that residents on light and moderately trafficked streets had larger local home areas, positive perceptions, more neighborhood connections, and frequent community interactions, indicating better street liveability. In contrast, heavy trafficked streets had smaller local home areas, negative perceptions, fewer neighborhood connections, less frequent community interactions, and increased community annoyance, suggesting negative impacts on liveability and community severance. The research emphasizes the role of motorized traffic volumes in shaping residents' perceptions and interactions within their communities.	The research in Christchurch shows that residents on light to moderate trafficked streets perceive their neighborhoods as more livable with increased community interactions, while those on heavily trafficked streets have a negative perception, smaller local home areas, and reduced community belonging, affirming the impact of motorized traffic on street livability and community wellbeing.	No data	No data
46	Ridership dynamics and characteristics of potential riders of a transit system	Mehmet Baran Ulak a,* , Eren Erman Ozguven b , Mark W. Horner c , Lindsay Weaver d , Jorge Puente d , Jeremy Crute d , Dennis J. Smith d , Michael Duncan d , Elizabeth Whitton e	2021	sustainable and eco-friendly modes of transport such as rail transit and by reducing the commuting trips made by personal cars	No data	No data	No data	No data	No data	No data	number of commuting trips	Urban	The findings of the study show that the assessment of factors which are influential for a transit system to thrive is a complex task and not very straightforward. For example, Debary station is one of the stations that produce the largest ridership and analysis show that large passenger flows occur during AM and PM peak period between Debary and urban/urban core stations. However, we cannot pinpoint a specific cause for this large ridership.	This study investigates the SunRail transit system in Greater Orlando, Florida, emphasizing the importance of sustainable transportation for urban accessibility and livability. By analyzing ridership dynamics and socio-demographic characteristics around SunRail stations, the research aims to offer insights to urban and transport planners for developing strategies to enhance ridership and promote a less car-dependent multimodal transportation system.	No data	No data
47	Smart and Equitable Parks: Quantifying Returns on Investments Based on Probabilistic Mobility-Dependent Correlates of Park Usage Using Cyber-Physical System Technologies	Katherine A. Flanigan	2022	No data	No data	No data	No data	No data	day to day travel time variability	safety risks	Poverty, youth and seniors, neighborhood condition, resident health, site condition, investmtnet need, black carbon, tree canopy, air quality	Urban	The study evaluates the proposed framework's flexibility by comparing accessibility for the same origin-destination pair in four cases. Cases involve variations in available transportation modes and different traveler preferences, considering factors like cost and reliability. Results highlight the potential of shared micromobility modes in reducing travel costs, the impact of removing certain modes on accessibility for specific population groups, and the influence of traveler sensitivity to reliability, emphasizing the importance of considering diverse factors in urban transportation planning.	Parks play a crucial role in urban vitality, contributing to economic growth, public health, and social interactions. In Pittsburgh, financial constraints have led to underinvestment in its 165 parks, creating challenges for equitable distribution of benefits. This study aims to explore urban park use and its correlations with time-dependent accessibility, providing data-driven insights for city officials and planners to enhance the equitable distribution of benefits related to parks and mobility services.	No data	No data

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48	Study on Building a Smart Sustainable City Assessment Framework Using Big Data and Analytic Network Process	Wann-Ming Wey and Ti-Ching Peng	2021	indicators include: GHG emissions, Air and noise pollution, domestic water use,	Indicators include: human resource quality and prevalence of technology	Indicators include: living environment quality	Iidicators include: public transportation availability	Indicator includes: government transparency	Indicators include: public transportation availability	No data	GHG emissions: reduce greenhouse gas emissions to mitigate the impact of climate change on ecological environment Air pollution and noise: Provide basic data for air quality and noise monitoring and reduce air pollution and noise by controlling the sources of pollution Domestic water use: monitor and control the use and quality of water in the city Public transportation availability: Completion and high availability of public transportation systems increase the number of public transportation users, reduce the number of private vehicle users, lower CO2 emissions Living Environment quality: Sufficient open spaces, green fields, living spaces, and pedestrian spaces Human resources quality: Train advanced researchers with high research and development capacities, interdisciplinary thinking, and abilities to analyze and plan policies Government transparency: Disclose the city government's administrative information to the public	urban	The results of the questionnaire survey used the FDM (Fuzzy Delphi Method) to identify key principles of smart growth. The consensus values were ranked, and a threshold value was determined. The top 10 critical indicators, in descending order, included greenhouse gas emissions, living environment, public transportation availability, decision making, air pollution and noise, prevalence of technology, government transparency, innovation and internationalization, human resource quality, and domestic water use.	This study aims to bridge the gap between sustainable cities and smart cities by identifying and integrating indicators into a unified concept. Using a static evaluation system and big data techniques, the research develops a dynamic model that assesses the impact of factors on urban sustainability and smartness under changing conditions. The proposed model, demonstrated through case studies in Taipei City and Singapore, evaluates indicators such as public transportation availability, technology prevalence, and greenhouse gas emissions, revealing specific weights and scores that contribute to the overall assessment of smart sustainable cities.	No data	No data
49	The indicators and methods used for measuring urban liveability: a scoping review	Zahra Khorrami, Tingting Ye, Ali Sadatmoosavi, moghaddameh mirzaee, Mohammad Mehdi Fadakar Davarani, Narges Khanjani	Under peer review	Conducted literature review and identified indexes for livability	Conducted literature review and identified indexes for livability	No data	No data	Conducted literature review and identified indexes for livability	No data	Conducted literature review and identified indexes for livability	Economic Vitality: Economic development; Employment and income; Retail vacancy; Tourism and evening economy; Social Well-being: Safety (including crime safety); Health and healthcare; Cultural environment richness; Degree of social harmony; Urban Infrastructure: Public services; Convenience (including transportation and amenities); Infrastructure quality; Natural and Cultural Environment: Natural environment comfort level; Cultural environment comfort level; Community Livability: Community convenience; Community environment; Community management	n/a	five main domains of indicators for measuring urban liveability. These domains include: Economic, Environmental, Domestic Security, Socio-Cultural and Political/Governance domains.	The study aimed to systematically review indicators and methods for evaluating urban livability by employing a five-stage methodological framework. A comprehensive search of electronic databases and other sources identified 67 relevant papers out of 3599. The review identified five key domains crucial for livability: Economical, Environmental, Institutional, Social, and Governance. The most frequently applied indices included Environmental friendliness and Sustainability, Socio-Cultural Conditions, and Economic Vibrancy and Competitiveness, with the study recognizing 10 different methodologies used for assessing urban livability. The findings provide valuable insights for future research in systematically measuring urban livability.	A liveable urban environment refers to a place where the built structure promotes quality of life by supporting the basic needs of its residents. The founding premise is that the urban form and environment, the economic values, and social sustainability are interconnected and that cities should be comprised of a built landscape that encourages, rather than impedes healthy and sustainable living	No data
50	The 15-minute city: interpreting the model to bring out urban resiliencies.	Lamia Abdelfattaha , Diego Depontea , Giovanna Fossa	2021	Building volume densification around stations, suggested by the TOD approach in combination with land saving, now constitutes a health risk due to the clustering of people	No data	General Theory of Walkability focuses on the importance of making cities appealing to pedestrians	No data	No data	we should better optimize uses and services around transit stations	No data	Service proximity, travel time, population density, destinations: food/grocery stores, commercial stores (including clothes shops, electronics shops, etc.), cultural venues, educational facilities, parks and green spaces, restaurants, health facilities, sports facilities and other (post offices, banks, etc.), block length, intersection density	urban	The analysis of population density and workplace distribution in Milan reveals distinct urban characteristics at different time scales, as illustrated by isochrone maps. The 15-minute accessibility analysis highlights microclusters of local centralities, with the Duomo district being a prominent center. The examination of service compresence demonstrates variations in service accessibility within the city, indicating the need for service diversity within a walkable distance. The Walk Score analysis at a 15-minute radius confirms service density but also identifies less walkable areas in the north, emphasizing the importance of urban structure for comfortable walking trips. Additionally, a walkability analysis based on neighborhood conditions shows a correlation between proximity to the city center and high walkability levels, although this does not consistently align with population distribution trends. Areas with high population accessibility but low walkability scores require intervention to ensure equitable access to daily amenities.	In the context of a globally connected world and smart cities, the concept of the 15-minute city responds to a growing desire for local, walkable neighborhoods that enhance community and place identity. This model, emphasizing proximity and minimizing daily commutes, gained significance during the COVID-19 pandemic, highlighting the value of outdoor movement and social life within neighborhoods. The paper explores the 15-minute city theory theoretically and practically, focusing on Milan as a case study, mapping its potential for inclusive, walkable living environments and emphasizing the role of soft mobility in achieving this vision.	No data	No data
51	Tools for addressing transport inequality	Tom Cohen	2020	No data	No data	No data	IPTI to measure inequality	No data	Establishes a IPTI (Index of Personaly Travel Impact)	No data	Travel time, door to door time, travel costs based on income	urban	The process involves assigning transportation modes based on respondent information, trip details, and an evaluation of time and financial costs for both private and collective transport options. Crow-flies distance is determined using online calculators, and financial cost and journey time are estimated using publicly-accessible journey planning tools, considering factors such as time of travel, vehicle type (if applicable), and route preferences.	This paper introduces the Index of Personal Travel Impact (IPTI) as a novel measure for assessing transport inequality in the context of creating livable cities. Unlike conventional accessibility metrics, IPTI focuses on individual-level estimates, considering desired travel and accounting for factors such as time, financial impact, and personal characteristics. The IPTI is designed to offer decision-makers a more accurate and straightforward representation of the relative ease or difficulty of traveling for individuals, potentially aiding in addressing mobility barriers and informing the appraisal process for urban development schemes. The paper concludes with suggestions for further research on IPTI's applications and implications.	No data	No data
52	Toward a Guide for Smart Mobility Corridors Frameworks and Tools	Bruce Appleyard, Jonathan Stanton, and Chris Allen	2020	No data	Transit-accessible economic opportunities, Mixed income housing near transit (this currently supports the social equity principle, which measures housing affordability and income diversity	Vibrant & accessible community, cultural & recreational opportunities	Accessible social & government services	No data	Transit-accessible economic opportunities	Livability Calculator currently assesses urban quality by operationalizing the Six HUD/EPA/ USDOT principles: 2. Healthy, safe & walkable transit corridor neighborhoods,	Transit jobs accessibility, Transit service coverage (aggregate frequency of transit service per sq. mile), Housing unaffordability (percent of income spent for housing), Income diversity (variance from regional median household income), Jobs density (employees/acre), Retail jobs density (retail employees/acre), Transit ridership balance of flows, Health care opportunities (health care employees/acre), Population density (population/ acre), Access to culture & arts (# corridor entertainment employees/acre), Pedestrian environment (intersection density), Pedestrian collisions per 100,000 pedestrians	urban	The Smart Mobility Calculator offers valuable functionality for assessing Daily VMT (Vehicle Miles Traveled) metrics, aiding Climate Action Planning and evaluating environmental impacts of development projects under SB 743. Utilizing official VMT data from Caltrans, it helps guide policies by indicating areas above or below regional averages, facilitating SB 743 CEQA project analysis. The tool includes various urban quality metrics related to environmental impacts, affordability, health, and social equity, making it versatile for climate action planning, new housing initiatives, and addressing community planning in disadvantaged areas.	This report addresses the challenge of achieving coordination between transportation and land use at the corridor level, exploring sustainability, livability, and equity (SLE) principles. Utilizing Caltrans' Corridor Planning Process Guide and Smart Mobility Framework, the report reviews literature, practices, and planning support tools, aiming to serve as a comprehensive guide for agency staff. It highlights the Smart Mobility Calculator as a novel online tool, incorporating statewide datasets for urban quality and livability, offering a practical resource for decision-makers in achieving balance and coordination in corridor planning.	Transportation an dland use coordination, with smart growth	No data
53	Towards an enriched framework of service evaluation for pedestrian and bicyclist infrastructure: acknowledging the power of users' perceptions	Alvaro Rodriguez-Valencia · Jose Agustin Vallejo-Borda · German A. Barrero · Hernan Alberto Ortiz-Ramirez	2021	No data	No data	Experiences, unlike services, are related to individuals' sensory events, revealed over the duration, which are memorable	No data	No data	No data	Feeling of safety contributes to overall riding experience.	Survey respondents preceptions: Street vendor presence, pavements, streetlights, traffic pollution, street trees, street attaractiveness, noise pollution, presences of other cyclists or pedestrians, avoids vehicles lane, avoids sidewalks, pleasure, overcrowded infrastructure, personal safety, heavy vehicles, facades, order, surface condition, enjoyment, road safety, signage, pedestrian/bike presences, facades preception, cleanliness, furniture	No data	perceptional variables appear in both models as significant: surface condition, enjoyment, signage, and road safety. Regarding only the four common variables, we found that enjoyment has the second highest coefcient, which is about 0.38 times the magnitude of the surface condition's coefcient. Similarly, the signage coefcient is almost 1.5 times that of road safety	This study aims to enhance active transportation by proposing and validating a framework that integrates user-oriented inputs with traditional supply-oriented variables to explain the Quality of Service (QoS) for pedestrians and bicyclists in urban environments. The framework considers individual perceptions alongside operational and geometry variables, as tested in two independent surveys. The results highlight the superior explanatory power of perception variables in understanding individuals' perceived QoS, justifying the effectiveness of the proposed framework for both pedestrians and bicyclists.	No data	No data

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54	Transport policy for liveability - Valuing the impacts on movement, place, and society.	Paulo Anciaes» , Peter Jones	2020	No data	Economic activity generated by those in public spaces	Trip quality, street audit tools, surveys	No data	No data	Pedestrian route options	Data collecte dby govts	Trip quality 'level opf service' survey reponses, place quality movement and place functions of streets and people's experiences, time use in places economic activity generated, personal security saefty audits done by govt, health and wellbeing mortality risk, are all already monetized.	No data	A potential solution to address the complexity of assessing impacts is to assume some overlap, allowing impacts to be replaced or included as attributes of others. The multidimensional nature of impacts, difficulty in describing them with single indicators, and the subjective experience of liveability pose challenges in monetization. The political aspect of prioritizing preferences for different policies, limited transferability across cities or regions, and uncertainty in forecasting future impacts further complicate the appraisal process. Additionally, evolving policy concerns, urban pressures, new technologies, and changing socio-economic factors may require a broader perspective, considering the joint optimization of transport and other goods and services.	This paper explores the challenges in translating priorities for healthy, equitable, and sustainable transport systems into compelling economic cases for funding agencies. The focus is on appraising nine impacts related to liveability, including trip quality, time use in transport, place quality, personal security, visual blight, and health/wellbeing. The review assesses the current appraisal methods and proposes alternatives, noting robust methods for some impacts but challenges in areas like monetizing time use in transport and visual blight without further methodological developments.	No data	No data
55	Tribal Transit Study: Demographic Needs Indicators, Funding Needs and Livability	Elvis Ndembe Ranjit Godavarthy Jeremy Mattson Jill Hough, Ph.D	2021	No data	rural transit is more expensive to provide per trip compared to urban transit, and the costs of operating tribal transit could be even higher due to low population densities and longer travel distances.	recognizing and meeting community residents' needs and wants, including shelter, energy, water and food, education, entertainment, and transportation. Second, the built and natural environment of community embodied in its architecture, water bodies, green space, local climate, and air regulation, play a central role in determining livability of a place	The increased operating costs underscore the need for higher public funding, particularly considering that many tribal transit users have low incomes and may not afford higher fares.	No data	No data	No data	Cost per trip, knowledge of public transit, access to transit, destinations of importance	Rural/Tribal	The research examines travel behavior in tribal areas, which often face unique demographic and geographic challenges such as higher concentrations of low-income households and lower population densities. The study analyzes 2017 Local Area Transportation Characteristics for Households (LATCH) data, comparing census tracts with high Native American populations to other rural tracts. Results indicate that households in Native American tracts have fewer daily person miles, person trips, vehicle miles, and vehicle trips, suggesting a mobility gap, particularly due to a higher percentage of these households lacking vehicle access. The study emphasizes the necessity of transit provision to address transportation disadvantages in tribal areas, where gaps in service still exist despite an increase in tribal transit systems over the past decade. About 66% of those living on reservations with tribal transit have access to such systems, highlighting potential areas for improvement in transit services.	The research aims to investigate demographic indicators of tribal communities related to transportation needs, assess existing tribal transit operations and funding, and explore the impact of transit on livability and quality of life in U.S. tribal communities. The study identified small urban and rural Indian tribes/reservations with significant transit needs based on indicators like population demographics. Case studies of Standing Rock Reservation (North and South Dakota) and Makah Indian Reservation (Washington) revealed that tribal areas, often rural with lower population densities, face mobility challenges, especially among transit-dependent groups with limited resources, highlighting the potential role of transit in improving community quality of life.	Livability means being able to take your kids to school, go to work, see a doctor, drop by the grocery or post office, go out to dinner and a movie, and play with your kids at the park — all without having to get in your car, Livability is about tying the quality and location of transportation facilities to broader opportunities such as access to good jobs, affordable housing, quality schools, and safe streets. This includes addressing safety and capacity issues on all roads through better planning and design, maximizing and expanding new technologies such as ITS and the use of quiet pavements, using Travel Demand Management approaches to system planning and operations, etc. set of sustainability impacts with direct impact to residentsof a local community ranging from economic development, environmental quality, equity,affordability, public safety and health, and community interconnectivity	No data
56	The TROLLEY Study: Assessing Travel, Health, and Equity Impacts of a New Light Rail Transit Investment During the COVID-19 Pandemic	Katie Crist , Tarik Benmarhnia , Lawrence D. Frank , Dana Song , Elizabeth Zunshine and James F. Sallis	2021	Self reporting of health outcomes, Density (population, employment, housing, etc.); Diversity (mixture of uses, incomes, etc.); Design (walkability/intersection density), and Destination Accessibility (number of jobs accessible by transit and auto). Proximity to the trolley line of residential and occupational addresses will be calculated using GIS from geocoded locations	No data	No data	Self reporting of transportation costs	No data	No data	No data	measure of the percentage of new employees using LRT as their primary commute method, PQoL-20 scale asking satisfaction with various life aspects.	urban	quantify changes in travel, health, and equity outcomes for a diverse cohort of adult workers following the opening of a new light rail transit (LRT) line nearly two years into the COVID-19 pandemic. It addresses the decline in transit ridership during the pandemic, with a focus on understanding how behaviors and health outcomes vary based on socioeconomic and built environment factors. The research, uniquely generalizable within the post-pandemic period, advances prior LRT evaluations by including participants who both live and work near rail stations.	The TROLLEY study aims to prospectively investigate the impact of a new light rail transit (LRT) line and the easing of COVID-19 restrictions on the mobility and health of a diverse cohort of university employees. Participants, distributed across economic and racial/ethnic strata and living at varying distances from the LRT, will be monitored for changes in physical activity, travel mode, vehicle miles traveled, and health outcomes using accelerometer, GPS devices, and self-report measures. The study will span 2 years, with measurements taken at three intervals, and employ multilevel mixed-effects models to assess longitudinal changes and potential modifiers of outcomes.	No data	No data
57	Use of Geographical Accessibility Indicators in Policy Making	Barry Zondag Significance Eric Molenwijk Rijkswaterstaat -WVL	2020	No data	These indicators, developed for various purposes such as job accessibility, consider zonal data on job numbers and level-of-service data for car, public transport, and bicycle. The goal is to calculate the potential number of jobs reachable within an acceptable travel time. This travel time should be reasonable, avoiding excessive lengths and hard barriers, and is mode-specific, reflecting observed behavior from empirical travel survey data.	No data	No data	No data	Proximity and density of jobs/destinations	No data	Congestion Indicator (Network Indicator): This commonly used indicator measures travel time losses on the network compared to free-flow travel time. population or employment as a measure of destination attractiveness, coupled with a distance decay function. The decay function may consider factors like travel times, generalized time (including waiting times), or generalized costs (including travel costs). Economic-Geographical Indicators (Logsum Indicator): These indicators measure changes in land use and travel Level-of-Service by assessing the utility for travelers.	Urban and rural	The study introduces segmentations based on functions/goals, modes, geographical scale, and trip length, facilitating a top-down approach that identifies challenges and opportunities across different fields. The main communication challenge was transitioning from a network-centric approach to a broader geographical perspective, a shift that gained acceptance among policymakers over the study years. The accessibility dashboard and a strategy linking accessibility developments with policy options played crucial roles in supporting policymakers in this paradigm shift.	Geographical accessibility indicators, considering changes in land use and transport systems, have been part of academic literature but play a minor role in practical policy making due to a sectoral focus on specific networks. The Netherlands aims to adopt a more integrated approach to transport and land use, especially in urban areas, driven by climate and livability concerns. The study explores the use of geographical accessibility indicators in policy making, focusing on the forthcoming national transport market and capacity analyses (NMCA) 2020/21, providing an opportunity to integrate these indicators into policy discussions.	No data	No data
58	Using street view images to examine the association between human perceptions of locale and urban vitality in Shenzhen, China.	Wu Chao; Ye Yu; Gao Fanzong; Ye Xinyue	2023	No data	No data	the residential, commercial, and public uses of an area, which can be calculated using POI data. POI data are obtained from AMap. The most common POI types within a local neighbourhood can be used to determine the function of the locale and assess the vitality of the neighbourhood. The densities of six types of POIs, residential type, public administration and services, business services, industry, transportation and green spaces, are determined. variables of building continuity, greenness, openness and walkability are used to represent the objective	No data	No data	Accessibility is important for residents to reach certain destinations, such as schools, workplaces and leisure and entertainment venues	No data	The likelihood of passing through a space. The suitability of a space as a destination to attract arriving traffic, namely, centrality The proportion of the total area of urban roads to the total area. The ratio of the total distance of the road network to the area. The number of business POIs in a 500 m grid. The number of green space-related POIs in a 500 m grid. The number of industrial POIs in a 500 m grid. The number of public facility-related POIs in a 500 m grid. The number of residential POIs in a 500 m grid. The number of traffic POIs in a 500 m grid. POI-based mixed use measured by Shannon entropy. The proportion of the total floor area characterizing the spatial density of building floors The proportion of the coverage area characterizing the percentage of occupied by buildings. The standard deviation of the proportion of buildings in a grid representing building continuity The visibility of greenery based on SVIs. The proportion of visible sky based on SVIs. The proportion of sidewalk to road. Residents' perception of the beauty of a locale Residents' perception of whether a locale is boring. Residents' perception of whether a locale is lively. Residents' perception of the safety of a locale. Residents' perception of the affluence of a locale.	Urban	The findings provide decision-making support for comprehensive locale evaluations and improvements in urban vitality, emphasizing the importance of human-centered urban planning and management. The study concludes that daytime and nighttime vitality is influenced by different factors, with urban function playing a prominent role. The integration of comprehensive factors for assessing locale environments yields novel insights, highlighting the need for policymakers and planners to conduct research at the human scale and fine spatiotemporal scales based on geotagged data from multiple sources to promote urban vitality and optimize urban areas.	The study investigates daytime and nighttime vitality in Shenzhen, China, using EasyGo data from Tencent. Subjective and objective variables derived from street view images are employed to reflect human perceptions of locale. Random forest and spatial lag regressions reveal that unbalanced urban function allocation, accessibility, building form, and human perceptions are key drivers of urban vitality. Urban function emerges as the dominant variable category, with distinct variations observed between daytime and nighttime vitality, highlighting the increasing importance of human perception in nighttime vitality. The findings offer insights into the relationship between human perceptions and urban vitality, informing recommendations for urban micro-renewal and the creation of high-quality, livable communities.	No data	No data

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Reference Number	Title	Author	Publication year	Health & Environment	Economic Vitality	Sense of Place	Equity	Trust	Connectivity	Safety	Measure / Representation / Interpretation / Evaluation / Tracking		Results / Key findings	Short Summary (1 - 2 sentences)	General Definition of Livability (if provided)	Notes
59	Incorporating Livability into Transportation Asset Management Practices through Bikeway Quality Networks	Marketa Vavrova and Carlos M. Chang	2019	No data	No data	No data	No data	No data	bikeways that are identified as needing maintenance in the assessment are ranked based on their importance, location, cost of the maintenance, and remaining service life.	Assesments are carreid to determine the streets for repairs	agency expenditures, level of non-motorized investment, bikeway pavement condition, bikeway pavement marking condition, and jobs created. Two street purpose categories are considered: Priority: bicyclist movement prioritized; includes roadway sections with bikeways identified in applicable local, regional, and state bicycle plans. General: all other roadway sections.	Urban	This paper underscores the importance of incorporating livability principles into Transportation Asset Management (TAM) practices, particularly due to financial constraints faced by transportation agencies. The Bikeway Quality TAM Framework is introduced as a valuable contribution, offering a step-by-step process for local agencies managing multimodal assets to enhance decision-making. The framework includes elements such as condition assessment, prioritization, scenarios, and reporting. It proposes a prioritization ratio, the bikeway weighted effectiveness ratio (WERBIK), considering factors like asset importance, location, cost, and remaining service life. The framework encourages coordinated maintenance and construction activities and was applied to a case study, revealing non-linear relationships between agency costs and new bikeways implemented, as well as bikeway network improvement.	This paper introduces a framework for integrating livability into transportation asset management, with a specific focus on enhancing bikeway networks. The Bikeway Quality Framework is delineated in a step-by-step manner, offering guidance for assessment, prioritization, scenarios, and reporting. The assessment phase involves aligning existing and planned assets with local plans and pavement resurfacing projects for optimal cost efficiency. Prioritization considers factors like asset importance, location, maintenance cost, and remaining service life. Scenarios analyses, encompassing constrained and unconstrained budgets, are conducted, and results are reported through various performance measures. The framework's application to 70 block-long sections in San Francisco, California, is illustrated as an example.	A livable neighborhood is one which people can depend on for safe, economical transportation choices that promote public heath, reduce oil dependency and greenhouse gases, and improve air quality while enhancing the unique characteristics of the community (2). Livability in its principles refers to physical community design and land use together with multimodal transportation choice and opportunities for its residents, and is correlated with quality of life and sometimes even used synonymously (3). There is also a connection between livability, which is more localized and place-based (4), and sustainability, which seeks to "meet the needs of the present generation, without compromising the ability of future generations to meet their own needs" (5) in three dimensions including environment, economy, and social equity.	No data
60	A review of quality of life (QOL) assessments and indicators: Towards a "QOL-Climate" assessment framework, Estoque etal QoL Frame work 2019	Ronald C. Estoque, et al.	2018	No data	No data	No data	No data	No data	No data	No data	Proposes a categorization of variables/measures across four distinct qualities of life: **Q1 Livability of the environment**; included any indicator that is related to the qualityofthe social and physical environment, such as housingconditions, as well as the quantity and quality of urbanfacilities, water, air, and green spaces. **Q2 Life-ability of a person**; indicators associated with human and personal attributes, such as those related to health and education. **Q3 Utility of life**; included any indicator that is related to one's (or thecommunity's) contribution to society and the environment,such as civic involvement, ecological footprint, sustain-ability-related programs, and efforts toward environmentalconservation and art and culture preservation. **Q4 Enjoyment of life**: comprised indicators or dimensions such assubjective well-being, life satisfaction, happiness, and life expectancy. Categorizes literature based on five different units of analysis: census tract or neighborhood (CT/N), municipality or city (M/C), district or province (D/P), region or state (R/S), or country (C)	Urban	The study finds that (i) Quality of Life (QOL) assessments vary in terms of conceptual foundations, dimensions, indicators, and units ofanalysis, (ii)social indicators are consistently used across assessments, (iii) most assessments consider indicators that pertain to the livability of the environment, and (iv) QOL can be based on objective indicators and/or subjective well-being, and on a composite index or unaggregatedtdimensions and indicators	This study found that most Quality of Life (QOL) assessments are insufficiently connected to climate-related issues, an important research gap. t proposes an augmented "QOL-Climate" assessment framework, designed to capture the social-ecological impacts of climate change and variability.	No data	No data
61	Victimsoftheirown(definitionof) success:Urbandiscoursesand expertknowledgeproduction intheLiveableCity, McArthur_Robin 2019	Jenny McArthur, et al.	2019	No data	No data	No data	No data	No data	No data	No data	For policymakers, liveability discourse creates a demand for expert knowledge, to measure the various tangible and intangible characteristics that qualify whether a city is 'liveable'. Liveability discourse and the knowledge that supports itpresents a distinct and partial model of the world, which spurs specific forms of action (or inaction) by the state. The widespread adoption of the 'fuzzy' concept enables an illusory consensus to form, which is politically useful as it avoids direct confrontations with voters or interest groups. Liveability discourse also allays possible tensions between the needs of current and future residents: existing residents are assured thatquality of life is prioritised, while liveability also operates as a way of appealing to future residents, to attract a talented, high-skilled workforce	Urban	The article calls for an alternative to livability, one that "can build power through alternative forms of knowledge, and ways of knowing, that are compelling to urban practitioners, politicians and the public."	The useof aggregate metrics and reliance on indices generated from undisclosed data sources and 'expert judgement' obscures the differentiated quality of life and everyday experience for urban populations. Therefore, liveability discourse has exerted and maintained stronger discursive power toundermine urban livelihoods than to improve them, due to the phenomena and qualities that itconceals.	No data	Metaanalysis/critique of livability as a concept and measuring it as an exercise
62	Livability for whom?: Planning for livability and the gentrification of memory in Vancouver, Tofo Doucet 2022	Giuseppe Tolfo, et al.	2022	No data	No data	Livability discourses facilitate and justify dispossession through the gentrification of memory – selectively omitting the past to build more productive narratives in the present	No data	No data	No data	No data	No metrics are provided, but consider: Livability as aesthetics, amenities and design Livability as affordability	Urban	In the Case 1, livability is associated with improving the lives of low-income residents, who are "supported and engaged." In Case 2, livability is an aesthetic and design concept that aims to create a neighbourhood where (middle-class) residents can "work, play, and shop" and "enjoy a vibrant street life". Displacement is likely to follow. In this way, livability discourse requires the marginalized communities' histories, in service of capital accumulation and dominant class interests. Through its assumptions of emptiness, the discourse of livability justifies gentrification and reinforces the pro-cesses' connections to settler colonialism and racial capitalism (McClintock, 2018; Toews, 2018). It measures progress by the erasure of unwanted uses and bodies, and protects against the potential for conflict by silencing the history of those excluded. Framing livability from an inclusive or equitable lens must consider movements demanding the universal right to housing, racial justice, public transportation and infrastructure, education, social infrastructure, food security, fair representation and democracy, and health services.	No data	Livability is meant as a shorthand for resident quality-of-life, itself influenced by policies that govern ownership and tenure, services and amenities, affordability, habitability, accessibility, location, and cultural adequacy of living conditions. Because of its vagueness, livability can also be a nebulous concept. The primary approach to livability centres on aesthetics and the built environment; more comprehensive critiques include subjective experiences. But this incompletely speaks to inequities... this is part of the "livability paradox": most residents never experience the qualities that make their city "livable."... "Livability" – as it currently manifests itself in international discourses – similarly glosses over in-equalities and injustices, thereby failing to cater to the diverse needs of urban population.	Metaanalysis/critique of livability as a concept and measuring it as an exercise
End of worksheet																

Health & Environment Measures			
Concept/Issue/Goal	**Measure**	**Data Source (if available)**	**Consensus (Reference Number)**
Access	Access to active transport	No data	44
Activity	Active living	No data	41
Activity	Physical activity	No data	31, 41
Activity	Δ in # of active transport users	No data	13, 16
Activity	Δ in distance traveled	No data	13, 16
Activity	Δ in minutes of physical activity	No data	13, 16
Activity	Δ in relative risk of mortality	No data	13, 16
Cleanliness	Surveys of garbage collection	No data	30
Climate and environs	Air quality	No data	31, 41, 44, 47
Climate and environs	Climate change	No data	43
Climate and environs	Drainage ditches	No data	4
Climate and environs	Environmental sustainability	No data	44
Climate and environs	Urban Heat Island Effect	No data	31
Climate and environs	surveys of sanitiation	No data	30
Climate and environs	Adeqaute drainage for roads	No data	35
Comfort	Audit of greenspace	No data	7, 30, 31
Comfort	Noise pollution	No data	31, 44, 48, 53
Comfort	Tree canopy/shadow coverage	No data	7, 28, 47
Consumption	Fuel used per person per day (gal/pp/pd)	No data	6
Consumption	The increase in the amount of energy consumed by buildings and transportation based upon the assumed development types and travel forecasts.	No data	21
Consumption	Water use	No data	48
Emissions	Audits of polluted areas	No data	30, 39
Emissions	Greenhouse gas emissions related to transportation or development, including CO2, Nitrogen Oxides (NOX), and Particulatematter emitted per person per day (g of emission/pp/pd); other volatile organic compounds	No data	6,13, 21, 22, 44, 47, 48
Impervious surface	Building density	No data	32
Impervious surface	Change in impervious surface area to measure stormwater mitigation (measure of environment)	No data	10
Physical health	Disability	No data	41
Physical health	Environmental Health Hazard Index	No data	22
Physical health	Fatigue	No data	41
Physical health	Food access	No data	22
Physical health	Gastrointestinal	No data	41
Physical health	musculoskeletal health	No data	41

Health & Environment Measures			
Concept/Issue/Goal	**Measure**	**Data Source (if available)**	**Consensus (Reference Number)**
Physical health	Pulmonary health	No data	41
Physical health	Rates of cardiovascular disease	No data	2, 37, 41
Physical health	Rates of obesity	No data	2, 37
Physical health	Sleep	No data	41
Physical health	Audit of recreation facilities	No data	30
Physical health	Transportation related health distressed populations	No data	22
Physical, mental health	Surveys of health	County health survey	3, 16, 20
End of workheet			

Gaps in Health & Environment Measures	
Concept/Issue/Goal	**Measure**
Physical health	Cancer
Physical health	Diabetes
Mental health	Poor mental health
Physical health	Childhood obesity
Physical, mental health	Level of traffic stress
End of workheet	

Economic Vitality Measures			
Concept/Issue/Goal	**Measure**	**Data Source (if available)**	**Consensus (Reference Number)**
Access to labor	# downtown employees	No data	33, 57
Access to labor	# of people within a n-minute drive of study area	U.S. Census	1, 21, 24
Access to labor	Job density (employees/acre)	Administrative	2, 6, 24
Access to labor	No. of jobs within 1-mile of TOD	Administrative	2, 6
Access to labor	Percent of all regional employment and higher education opportunities accessible within 20 minutes of the average household.	No data	21
Access to labor	Percent of all regional employment and higher education opportunities accessible within a 20 minute transit ride on rail or BRT for the average household.	No data	21
Access to labor, transit richness	Regional access to jobs by transit (% of land area within 1-mile of station with access to n jobs within 60 min via transit)	No data	6
Access to markets	# attendees at downtown events	No data	33
Access to markets	# of people within a n-minute drive of study area	U.S. Census	1, 21
Access to markets	Attendance at downtown events	No data	33
Access to markets	Commercial vacancy	No data	10, 33, 49
Access to markets	Hotel occupancy	No data	33
Access to markets	Pedestrian flows	No data	33
Access to markets	Retail sales	No data	10, 33
Affordability	Socioeconomic status (median HH income)	No data	28, 49
Cost efficiency	Construction costs of roads in the Draft Preferred RTP divided by the increase in total job and college enrollment opportunities within 20 minute drive as compared to if no RTP projects were built by 2040.	No data	21
Cost efficiency	Construction costs of transit in the Draft Preferred RTP divided by the forecasted annual system ridership in 2040 multiplied by 30 to represent a generalized transit project lifespan.	No data	21
Firm effects	Semi-structured interviews with owners and/or on-site managers of businesses and nonprofit organizations locate	No data	16
Performance and revenues	Community development initiatives	No data	33
Performance and revenues	Downtown construction values	No data	33
Performance and revenues	Monthly parking revenues	No data	33
Performance and revenues	New housing development	No data	33
Performance and revenues	Property values surrounding the project area to measure economic revitalization (measure of economy and quality of life)	No data	10
Performance and revenues	Shop rents	No data	33
Performance and revenues	short-term parking revenues	No data	33
Performance and revenues	Street-front retail vacancy	No data	33
Performance and revenues	Value of façade to interior loan property improvements	No data	33

Economic Vitality Measures			
Concept/Issue/Goal	**Measure**	**Data Source (if available)**	**Consensus (Reference Number)**
Cost savings	Economic value of accident reduction	No data	13, 16
Cost savings	Savings of user costs	No data	13, 16
Cost savings	Time savings	No data	13, 16
Cost savings	Value Added Tax Revenue (money that will be saved by the users will be spent on other taxable consumables)	No data	13, 16
Regional management	# occupied jobs in region	No data	21, 57
Regional management	Average inflation rate	No data	12
Regional management	Discount rate	No data	12
Regional management	Economic growth rate	No data	12
Regional management	GDP/capita	No data	12
Regional management	Metro population	No data	12, 21, 33, 57
Regional management	Modal split	No data	12
Access to markets	Evening economy	No data	33, 49
Access to markets	Tourism	No data	33, 49
Access to markets	Visits to town center	No data	33
Access to labor, access to markets	Rates of growth	No data	38
Access to markets	Time use in space (economic activity generated)	No data	54
Access to labor	Employee travel patterns	No data	56
End of worksheet			

Gaps in Economic Vitality Measures	
Concept/Issue/Goal	**Measure**
Business support	Business tenure
Business support	Mix of industries
Affordability	Rates of home ownership
Access to labor	Educational attainment
Access to markets	Internet and computer access
End of workheet	

Sense of Place Measures			
Concept/Issue/Goal	**Measure**	**Data Source (if available)**	**Consensus (Reference Number)**
Access	access to arts, entertainment	No data	37
Access	Centrality of the site	GIS	58
Access	Cultural environment richness	No data	49
Accessibility	wheelchair accessible	No data	35
Comfort	# pieces of street furniture	No data	53
Comfort	# public restrooms	No data	34
Comfort	# seated pedestrians at parklets	No data	10
Comfort	# water features	No data	7
Comfort	Crowdedness	No data	53
Comfort	Outdoor seating	No data	35
Comfort	percentages of greenery	No data	34
Comfort	Places for sitting/resting	No data	34
Comfort	Public realm maintenance and cleanliness	No data	33, 35
Comfort	Public space	No data	32, 50
Comfort	Shelter for stops	No data	35
Comfort	Size of living space	No data	45
Comfort	Street lighting	No data	35, 53
Comfort	Street trees	No data	53
Compactness	District coverage ratio	No data	32
Compactness	floor-area-ratio (FAR)	No data	7
Compactness	Pedestrian environment (intersection density)	GIS	2, 20, 50, 52
Compactness	Population density (population/acre)	Administrative	2, 7, 20, 24, 32, 50, 52, 57
Compactness	Residential dwelling unit density	No data	24, 32
Complete street	Pedestrian/bike presence	No data	53
Complexity (visual richness of a place)	Number of accent building colors (both sides)	No data	28
Complexity (visual richness of a place)	Number of basic building colors (both sides)	No data	28
Complexity (visual richness of a place)	Number of buildings (both sides)	No data	28
Complexity (visual richness of a place)	Number of people (observer side)	No data	28
Complexity (visual richness of a place)	Number of pieces of public art (both sides)	No data	28
Complexity (visual richness of a place)	Presence of outdoor dining (observer side)	No data	28

Sense of Place Measures			
Concept/Issue/Goal	**Measure**	**Data Source (if available)**	**Consensus (Reference Number)**
Enclosure (the degree to which streets and other public spaces are visually deined by buildings, walls, trees, and other vertical elements)	Number of long sight lines visible in three directions	No data	28
Enclosure (the degree to which streets and other public spaces are visually deined by buildings, walls, trees, and other vertical elements)	Proportion of street segment with street wall (opposite side of street)	No data	28
Enclosure (the degree to which streets and other public spaces are visually deined by buildings, walls, trees, and other vertical elements)	Proportion of the sky visible looking across the street	No data	28
Enclosure (the degree to which streets and other public spaces are visually deined by buildings, walls, trees, and other vertical elements)	Proportion of the sky visible straight ahead	No data	28
Hospitality	Street vendor presence	No data	53
Hospitality	Visitor experience	Survey	38
Human Scale (refers to a size, texture, and articulation of physical elements that match the size and proportions of humans and, equally important, correspond to the speed at which humans walk)	Average height of buildings weighted by building frontage (observer side)	No data	28
Human Scale (refers to a size, texture, and articulation of physical elements that match the size and proportions of humans and, equally important, correspond to the speed at which humans walk)	Number of long sight lines visible in three directions	No data	28
Human Scale (refers to a size, texture, and articulation of physical elements that match the size and proportions of humans and, equally important, correspond to the speed at which humans walk)	Number of pieces of street furniture (observer side)	No data	28

Sense of Place Measures			
Concept/Issue/Goal	**Measure**	**Data Source (if available)**	**Consensus (Reference Number)**
Human Scale (refers to a size, texture, and articulation of physical elements that match the size and proportions of humans and, equally important, correspond to the speed at which humans walk)	Number of small planters (observer side)	No data	28
Imageability (the quality of a place that makes it distinct, recognizable, and memorable)	Exterior facing materials, colors	No data	53
Imageability (the quality of a place that makes it distinct, recognizable, and memorable)	Noise level	No data	28
Imageability (the quality of a place that makes it distinct, recognizable, and memorable)	Number of buildings with identiiers (both sides)	No data	28
Imageability (the quality of a place that makes it distinct, recognizable, and memorable)	Number of buildings with nonrectangular shapes (both sides)	No data	28
Imageability (the quality of a place that makes it distinct, recognizable, and memorable)	Number of courtyards, plazas, and parks on the block face	No data	28
Imageability (the quality of a place that makes it distinct, recognizable, and memorable)	Number of major landscape features visible from the block face	No data	28
Imageability (the quality of a place that makes it distinct, recognizable, and memorable)	Number of people (observer side)	No data	28
Imageability (the quality of a place that makes it distinct, recognizable, and memorable)	Presence of outdoor dining (observer side)	No data	28
Imageability (the quality of a place that makes it distinct, recognizable, and memorable)	Proportion of historic building frontage (both sides)	No data	28
Imageability (the quality of a place that makes it distinct, recognizable, and memorable)	Resident perception of locale	Survey	58
Land use mix and efficiency	# of businesses or POIs in the study area	GIS	58

Sense of Place Measures			
Concept/Issue/Goal	**Measure**	**Data Source (if available)**	**Consensus (Reference Number)**
Land use mix and efficiency	# of greenspace POIs in the study area	GIS	58
Land use mix and efficiency	# of residences in the study area	GIS	58
Land use mix and efficiency	Counts by residential types	No data	2, 24, 50
Land use mix and efficiency	Entertainment (jobs/ac)	No data	2, 20, 24, 50, 52
Land use mix and efficiency	Healthcare facilities and jobs (jobs/ac)	No data	50, 52
Land use mix and efficiency	Industrial (jobs/ac)	No data	2, 20, 24, 50, 52
Land use mix and efficiency	Mixed-use development: breakdown of floor area function (% of floor area	No data	7, 58
Land use mix and efficiency	Non-residential destination counts for convenience store, liquore store, bic	No data	2, 20, 24, 50, 52
Land use mix and efficiency	Office (jobs/ac)	No data	2, 20, 24, 50, 52
Land use mix and efficiency	Open space within 1-mile of station (square miles)	No data	6
Land use mix and efficiency	Pavement within 1-mile of station (square miles)	No data	6
Land use mix and efficiency	Proportion of ROW area to total land area	GIS	58
Land use mix and efficiency	Proportion of sidewalk to road	GIS	58
Land use mix and efficiency	Retail (jobs/ac)	No data	2, 20, 24, 50, 52
Land use mix and efficiency	Service (jobs/ac)	No data	2, 20, 24, 50, 52
Land use mix and efficiency	Visibility of greenery based on SVIs.	GIS	58
Transparency (refers to the degree to which people can see or perceive what lies beyond the edge of a street or other public space and, more speciically, the degree to which people can see or perceive human activity beyond the edge of a street or other public space)	Proportion of street segment with street wall (observer side)	No data	28
Transparency (refers to the degree to which people can see or perceive what lies beyond the edge of a street or other public space and, more speciically, the degree to which people can see or perceive human activity beyond the edge of a street or other public space)	Proportion of street segment with windows (observer side first loor)	No data	28

Sense of Place Measures			
Concept/Issue/Goal	**Measure**	**Data Source (if available)**	**Consensus (Reference Number)**
Transparency (refers to the degree to which people can see or perceive what lies beyond the edge of a street or other public space and, more speciically, the degree to which people can see or perceive human activity beyond the edge of a street or other public space)	Proportion of street segment with active uses (observer side)	No data	28
Wayfinding	directional signs	No data	34
Wayfinding	Signage design	No data	53
End of workheet			

Gaps in Sense of Place Measures	
Concept/Issue/Goal	**Measure**
Imageability (the quality of a place that makes it distinct, recognizable, and memorable)	Feeling of belonging
Imageability (the quality of a place that makes it distinct, recognizable, and memorable)	Feeling of the distinctness of the area
Imageability (the quality of a place that makes it distinct, recognizable, and memorable)	Legacy and tenure of business, cultural hub, residents, homes, etc.
End of workheet	

Equity Measures			
Concept/Issue/Goal	**Measure**	**Data Source (if available)**	**Consensus (Reference Number)**
Accessibility	Accessible for impaired groups	No data	44
Accessibility	Percent disabled fulltime workers	No data	22
Accessibility	Percent limited English proficiency	No data	22
Accessibility	Percent population <18 years old	No data	22, 47
Accessibility	Percent population ≥65 years old more	No data	22, 47
Affordability	Affordability for poorest	No data	44
Affordability	Creation of affordable housing (#of units created in the vicinity of each sta	No data	6
Affordability	Housing Choice Vouchers by Tract	Count	22
Affordability	Housing+Transportation cost (% of income spent on housing and transpo	No data	6, 51
Affordability	Location Affordability Index	No data	22
Affordability	Low Income Housing Tax Credit Properties	Count	22
Affordability	Low Transportation Cost Index	No data	22
Affordability	Multifamily Properties Assisted	Count	22
Affordability	Percent households in neighborhoods with low to medium home values*	No data	22
Affordability	Percent households receiving food stamps	No data	22
Affordability	Percent households where the head has no high school education	No data	22
Affordability	Percent minority population	No data	22
Affordability	Percent of households below poverty	No data	22, 47
Affordability	Percent of zero-vehicle households	No data	22
Affordability	Public Housing Buildings	Count	22
Affordability	Cost-burdened households (>30% of gross income spent on housing)	Administrative	22, 52
Comfort	Enforced priority seating for disabled visitors	No data	35
Comfort	Signage for groups in linguistic isolation	No data	37
Diverse neighborhoods	Mixed income (degree of evenness ranging from 0 to 1);	No data	6, 50
Diverse neighborhoods	Mixed race (degree of evenness ranging from 0 to 1)	No data	6
Affordability	Resiliency to transportation costs increase (% change in H+T costs if gas p	No data	6, 22
End of worksheet			

Gaps in Equity Measures	
Concept/Issue/Goal	**Measure**
Health equity	Connection to measures of human health
Diverse neighborhoods	Disproportionate burdens experienced by BIPOC and low-income communities
End of workheet	

Trust Measures			
Concept/Issue/Goal	**Measure**	**Data Source (if available)**	**Consensus (Reference Number)**
Emergency management	Time to restore services	No data	36
Emergency management	Amount of service losses	No data	36
Emergency management	Function with disruptive events	No data	43
Emergency management	Emergency response time	No data	39
Maintenance	Infrastructure quality	No data	33, 49
Maintenance	Bicycle facility condition index	No data	21
Maintenance	Bridge condition	No data	21
Maintenance	Overall condition index (OCI)	No data	21
Maintenance	Pavement condition	No data	21
Maintenance	Pavement surface condition/evenness	No data	34, 53, 59
Subjective well-being	# interactions with community members	No data	45
Subjective well-being	Community severance or sense of belonging	No data	45
Subjective well-being	Opportunity for civic engagement	No data	37
Subjective well-being	Rates of happiness with family	No data	37, 40
Subjective well-being	Rates of happiness with social relationships	No data	37, 40
Subjective well-being	Rates of happiness with work	No data	37, 40
Subjective well-being	Rates of religious affiliation	No data	37, 40
Subjective well-being	Voting rates	No data	37, 40
Subjective well-being	Degrees of social harmony	No data	37, 40
Subjective well-being	Financial and material stability	No data	37, 40
Subjective well-being	Scale of happiness	No data	37, 40
End of workheet			

Gaps in Trust Measures	
Concept/Issue/Goal	**Measure**
Collective trauma	Impact of past actions or harms
Institutional trust	Trust in government
Institutional trust	Trust in MnDOT
Collective trauma	Impact of vehicle and pedestrian injuries and deaths on community
End of workheet	

Connectivity Measures			
Concept/Issue/Goal	**Measure**	**Data Source (if available)**	**Consensus (Reference Number)**
Access	Dyanmic accessibility calculation with the real-travel covered areas by TAXI as travel mode) — (Dyanmic accessibility calculation with the real-travel covered areas by METRO as travel mode) (Dynamic modal accessibility gap (TAXI vs METRO) calculation with real-travel covered areas)	Taxi data collected from onboard devices, metro smart card data and metro station locations, and POI data extracted from maps	19
Access	Access to critcal destinations	No data	43
Access	access to transit from affordable housing	No data	38
Access	Access to work	No data	39
Access	Amenity score based upon number of each use type within 1-mile of trans	No data	6
Access	Modal choice (# options)	No data	37
Accessibility	Accessibility incident counts	No data	21
Accessibility	Snow removal	No data	21
Affordability	Affordability of transit	No data	41
Affordability	Affordable transit routes	No data	35
Affordability	Cost of using a shared service	No data	5
Affordability	Cost per trip	No data	55
Bikability	# trails	GIS	5, 22
Bikability	Percent of respondents biking to work (%)	No data	6
Bikability	Volume bicyclists	Count	10, 11, 21, 22, 48
Bikability	designated bike path	No data	35
Congestion	Bottlenecks	No data	21
Congestion	Corporate Social Responsibility (CSR) for congestion	CSR Hub	18
Congestion	Miles Traveled per Capita each Day	No data	21
Congestion	One-way trips per capita per day	No data	21, 46
Congestion	Person throughput	No data	21
Congestion	Time Spent Traveling per Capita each Day	No data	21, 22
Congestion	Total Vehicle Miles Traveled per Day	No data	21
Congestion	Travel Time Index (TTI)	Travel Time Index (TTI)	18, 51
Congestion	General delay	No data	41, 44
Curb management	Loading zone demand and compliance	Ticketing/fine data	10
Mitigation	Person hours delay	No data	21
Mitigation	time savings	No data	39
Network integration	Ease of movement by and between each transport method	No data	7
Quality	Audit of trip quality	survey response	54
Quality	Agency expenditures by mode	Audit	59
ROW management	# travel lanes	No data	28, 32
ROW management	Curb-to-curb width	No data	28, 32

Connectivity Measures			
Concept/Issue/Goal	**Measure**	**Data Source (if available)**	**Consensus (Reference Number)**
Shared mobility	Attraction of population	No data	12
Shared mobility	Degree of integration	No data	12
Shared mobility	Driver cancellation rate after response	No data	12
Shared mobility	Night order proportion for shared service trips	No data	12
Shared mobility	Passenger cancellation rate after response	No data	12
Shared mobility	Passenger complaint rate for shared service	No data	12
Shared mobility	Penetration rate of users	No data	12
Shared mobility	Per capita travel consumption	No data	12
Shared mobility	Response rate of driver for a shared service	No data	12
Shared mobility	Total number of shared service trips	No data	12
Shared mobility	Travel time for a shared service	No data	5, 12
Shared mobility	Waiting time for a shared service	No data	5, 12
Traffic calming	# roll-over curbs	No data	5
Traffic calming	# speed limit signs	No data	5
Traffic calming	# traffic calming circles	No data	5
Traffic calming	# traffic calming curb extension	No data	5
Traffic calming	# traffic calming signs	No data	5
Traffic calming	# traffic calming speed hump	No data	5
Traffic calming	# traffic calming speed tables	No data	5
Transit richness	# transit routes	No data	22, 33, 52
Transit richness	# transit stops	GIS	5, 32, 33, 52
Transit richness	# transit transfers	No data	22, 52
Transit richness	Distance between transit stops	No data	20, 24, 32
Transit richness	Stop frequency	No data	24
Transit richness	Stop-to-stop travel time and variability	No data	10, 50
Transit richness	Transit rider survey	Survey	10
Transit richness	Transit score (score)	No data	6
Transit richness	Volume bus riders	Count	10, 11, 21, 22, 48
Transit richness	Knowledge of public transit	No data	55
Transit richness	Access to public transit	No data	55
Transit richness	Access to destinations of importances via transit	No data	55
Vehicular travel	AADT	Count	10, 11, 28, 48
Vehicular travel	Automobile commute time (% of time to travel to downtown with no traffi	No data	6, 10
Vehicular travel	Average passage time	No data	12
Vehicular travel	Average speed	No data	12
Vehicular travel	Average travel distance	No data	12
Vehicular travel	VMT	No data	21, 22, 48

Connectivity Measures			
Concept/Issue/Goal	**Measure**	**Data Source (if available)**	**Consensus (Reference Number)**
Walkability	International Physical Activity and Environment Network (IPEN)	No data	25
Walkability	Neighborhood Environment Walkability Score (NEWS)	No data	25
Walkability	Network density in terms of facility miles of pedestrian-oriented links per s	No data	22
Walkability	Volume pedestrians	No data	22, 48
Walkability	Pedestrian Environment Data Scan (PEDS)	No data	25
Walkability	Pedestrian Environment Review System (PERS)	No data	25
Walkability	Pedestrian shed (% of half-mile "as-the-crow-flies" walkable zone accessib	No data	6
Walkability	Percent of respondents walking to work (%)	No data	6
Walkability	SPOTLIGHT virtual audit tool (S-VAT)	No data	25
Walkability	Virtual Systematic Tool for Evaluating Pedestrian Streetscapes (Virtual STEI	No data	25
Walkability	Walkability Index (score based upon local walkability)	No data	6
Walkability	Walking catchment distances	GIS	7
Walkability	Walkscore	Walkscore	2, 22, 24, 25
End of workheet			

Gaps in Connectivity Measures	
Concept/Issue/Goal	**Measure**
No data	No data
End of workheet	

Safety Measures			
Concept/Issue/Goal	**Measure**	**Data Source (if available)**	**Consensus (Reference Number)**
Accessibility	Vulnerable populations	No data	39
Personal safety	Audit of feeling of safety, crime	No data	10, 30, 33, 53, 54
Personal safety	Audits of instances of discrimination	No data	30
Personal safety	Violent crimes per year per 100,000 residents (crimes/year/100,000 pop.)	No data	6, 30, 49, 54
Traffic safety	Feeling of safe from collision	No data	53
Traffic safety	Large vehicle exposure	No data	39
Traffic safety	Vehicle speed	No data	39
Traffic safety	Hazardous train cars	No data	39
Traffic safety	Fatal or injury crashes by mode per year per 100,000 residents (crashes/yea	KSI crash data	6, 10, 21, 22, 30, 44, 52
Traffic safety	Driver yielding, behavior at intersections	No data	10
Traffic safety	Mortality risk	No data	54
End of workheet			

Gaps in Safety Measure	
Concept/Issue/Goal	**Measure**
Culturally-competent safety	Location-specific research (e.g., tribal communities)
End of workheet	

APPENDIX B: RESEARCH ABSTRACTS

APPENDIX B: RESEARCH ABSTRACTS

Title: Effectiveness of Transportation Funding Mechanisms for Achieving National, State and Metropolitan Economic, Health and Other Livability Goals.
Authors: Lewis Rebecca; Zako Robert; Biddle Alexis; Isbell Rory
Publication Date: 2018
Abstract: Federal, state and local governments spent approximately $320 billion on transportation in 2012. These public monies buy outputs: facilities and services for highways, transit, air, water, rail and pipelines (BTS, 2016, 110-114, table 5-5). But how effectively do these investments deliver desired outcomes: reducing commute times, improving the economy, supporting community development, enhancing public health, providing cleaner air, and advancing other livability goals? The Moving Ahead for Progress in the 21st Century Act (MAP-21), adopted in 2012, established national performance goals, called for the development of performance measures and targets, required that targets be incorporated into plans and programs, and required reporting on progress in meeting targets (FHWA, 2013a). MAP-21 directs states and MPOs to use performance measures and targets. But little has been written about how to integrate performance measures, especially outcomes measures, into all phases of transportation decision-making. In particular, little attention has been given to how existing governance and finance structures can frustrate efforts to achieve desired outcomes cost effectively. States and MPOs have different mechanisms for allocating funding from various sources to transportation projects and programs: the Federal Highway Trust Fund, state gas and sales taxes, etc. Many funding sources are dedicated to particular uses. For example, 27 states limit the use of gas and other motor vehicle taxes to just investments in roads. In some states, transportation commissions allocate funding; in others, the legislature or governor decides bridges (AASHTO, 2016, 52-69). Though performance measures are becoming more pervasive because of federal policy, and each state has goals in long-range plans, the authors sought to understand how planning, governance and finance, programming and reporting on performance were integrated. Essentially, the authors sought to understand how states and MPOs were spending transportation funding in alignment with goals in transportation plans, and how states and MPOs report outcomes to citizens. The authors looked closely at six case study states, as well as a selected MPO in each state. While the authors found good practices in some states, the authors found little evidence of states clearly linking planning, governance and finance, and programming systematically. Further, the authors found that states report outputs rather than outcomes. The authors provide recommendations for better linking planning, governance and finance, programming, and reporting to improve accountability and transparency.

Title: Qualitative and Quantitative Analysis to Advance Transportation
Authors: Zachary Elgart, Todd Hansen, Ipek Sener, James Cardenas, Ben Ettelman, and Ahmadreza Mahmoudzadeh
URL: https://mdl.mndot.gov/items/202314
Abstract: On July 1, 2020, the Texas A&M Transportation Institute (TTI) initiated a research project, on behalf of the Minnesota Department of Transportation (MnDOT), titled Qualitative and Quantitative Analysis to Advance Transportation Equity. The project objectives were:
Establish a detailed understanding of equity-related challenges and needs related to transportation performance measures throughout Minnesota.
Identify or develop performance measures and equity-focused strategic actions1 that could improve the ability for transportation equity in Minnesota to be assessed at the state level in a manner that achieves context-sensitive outcomes representative of the communities served.

Facilitate the adoption of identified or developed equity performance measures and complementary strategic actions through a training program designed specifically for MnDOT that includes information detailing the appropriate use cases, data requirements, and other relevant considerations.
This research project synthesized previous research investigating equity assessments and equity-focused guidance or regulations, assessed MnDOT's current performance measures from an equity-first perspective, and leveraged directly collected community and staff expertise to achieve three outcomes: 1) new or updated performance measures; 2) creation of strategic actions designed to help MnDOT address issues of inequity discovered via the new or updated measure; and 3) a training program to assist with implementation of research findings.

Title: On the promotion of human flourishing
Author: Tyler J. VanderWeele
Citation: Proceedings of the National Academy of Sciences (PNAS) 114 (31) 8148-8156
Abstract: Many empirical studies throughout the social and biomedical sciences focus only on very narrow outcomes such as income, or a single specific disease state, or a measure of positive affect. Human well-being or flourishing, however, consists in a much broader range of states and outcomes, certainly including mental and physical health, but also encompassing happiness and life satisfaction, meaning and purpose, character and virtue, and close social relationships. The empirical literature from longitudinal, experimental, and quasiexperimental studies is reviewed in attempt to identify major determinants of human flourishing, broadly conceived. Measures of human flourishing are proposed. Discussion is given to the implications of a broader conception of human flourishing, and of the research reviewed, for policy, and for future research in the biomedical and social sciences.

Title: Liveability transitioning: Results of a pilot study of walking, accessibility, and social connection strengths weaknesses in established suburbs in Adelaide.
Authors: McGreevy Michael; Musolino Connie; Baum Fran
Citation: Cities & Health. 2023. 7(3) p433-462
Abstract: Population health is profoundly affected by the livability of the urban environments where people live. In Australia today most people live in suburbs which fall well short of the form and function required for livability, which is adversely affecting population health and health equity. The authors produced the Healthy Urban Neighborhood Transition Tool (HUNTT) to analyze the existing livability strengths and weaknesses of neighborhoods with the objective of assessing their potential for, and pathways required, for a livability transition. This paper presents a summary of the findings of the application of the HUNTT in 22 suburbs of Adelaide, South Australia, looking at the livability determinant of walkability. The study showed that there were walkability strengths and weaknesses in all surveyed suburbs, and weaknesses tended to proliferate more in middle and all outer suburbs and those with lower median incomes. It also showed that a walkability transition is possible in all the suburbs surveyed. However, it would require coordination between multiple stakeholders, government regulatory changes and intervention, and significant public funding.

Title: Community and Quality of Life: Data Needs for Informed Decision-Making
Corporate Author: National Research Council, 2002
URL: https://nap.nationalacademies.org/catalog/10262/community-and-quality-of-life-data-needs-for-informed-decision

Abstract: "Quality of life"..."livability"..."sense of place." Communities across America are striving to define these terms and to bring them to life, as they make decisions about transportation systems and other aspects of planning and development.
Community and Quality of Life discusses important concepts that undergird community life and offers recommendations for collaborative planning across space and time. The book explores: Livability as an ensemble concept, embracing notions such as quality of place and sustainability. It discusses how to measure the "three legs" of livability (social, economic, ecological) while accounting for politics and personal values. And the book examines how to translate broad ideas about livability into guidelines for policymaking. Place as more than location, including the natural, human-built, and social environments. The book discusses the impact of population changes over time, the links between regional and local identity, and other issues. Tools for decision making in transportation and community planning. It reviews a variety of decision models and tools such as geographic information systems (GIS)—as well as public and private sources of relevant data. Including several case examples, this book will be important to planners, planning decision makers, planning educators and students, social scientists, community activists, and interested individuals.

Title: An evaluation of livability in creating transit-enriched communities for improved regional benefits
Author: Wesley E. Marshall
Citation: Research in Transportation Business & Management, Volume 7, July 2013, Pages 54-68
Abstract: To improve a long history of misguided transportation performance measures and associated investment/policy decisions, this research explores concepts of livability with respect to transportation in an effort to impart a quantifiable framework for assessing performance of transportation in general and for the purposes of this paper, transit-oriented developments (TODs) in Denver, Colorado. One advantage of the proposed methodology is that the framework links broad sustainability and livability goals with transportation objectives as well as to associated livability indicators and variables. Such a comprehensive framework facilitates a better understanding of what can be done to improve regional performance of transportation and transit infrastructure. For illustrative purposes, this paper then assesses the extent to which TODs in Denver are satisfying livability concerns and begins to characterize the policies and planning that have led to these differing outcomes. Denver is an advantageous case study because it represents a second-generation mass transit system in a region that is fighting intense auto-dependence. The analysis presents the performance of the Denver system with its associated TODs from a broader and more comprehensive perspective that facilitates insight into how transportation goals can be better understood and realized by transportation managers.

Title: Livability and Subjective Well-Being Across European Cities.
Author: Okulicz-Kozaryn, A., Valente, R.R.
Citation: Applied Research Quality Life 14, 197–220 (2019).
URL: https://doi.org/10.1007/s11482-017-9587-7
Abstract: This study documents for the first time the correlation between livability and subjective well-being (SWB) across European cities. Livability is measured with the popular Mercer Quality of Living Survey and correlates considerably with SWB, measured as place and life satisfactions. There are outliers, for instance: the “unlivable” but “happy” Belfast (fool’s paradise) and the “livable,” but “unhappy” Paris (fool’s hell). In addition, we find geographic patterns: while the Mercer index ranks higher Western cities, subjective well-being is higher in Northern cities. Smaller cities score higher on both livability and SWB, confirming thus the urban sociological theory of urban malaise while contradicting urban economic theory of city triumph.

Title: Measuring the livability of an urban centre: an exploratory study of key performance indicators
Author: Carlos J.L. Balsas
Citation: Planning Practice & Research, 19:1, 101-110, (2004)
URL: https://www.tandfonline.com/doi/full/10.1080/0269745042000246603?needAccess=true
Abstract: N/A

Web Resource: Technical Reports | Transportation Research Center for Livable Communities | Western Michigan University (wmich.edu)

Title: The indicators and methods used for measuring urban liveability: a scoping review.
Authors: Khorrami Z, Ye T, Sadatmoosavi A, Mirzaee M, Fadakar Davarani MM, Khanjani N.
Citation: Rev Environ Health. 2020 Dec 18;36(3):397-441
Abstract: Objectives: Liveability is a multi-dimensional and hierarchical concept which consists of various criteria and sub-criteria and may be evaluated in different ways. The aim of this study was to systematically review indicators and methods used for the evaluation of urban liveability in literature.
Content: The five-stage methodological framework of Arksey and O'Malley was used to conduct this scoping review. A systematic search of electronic databases, including Scopus, Medline (via PubMed), Embase, Web of Science and EBSCO was done until May 29, 2019. Web searching, searching reference lists and hand searching was also conducted to retrieve more relevant articles. Two reviewers screened the papers for eligibility based on the inclusion criteria and extracted their key data and reported them descriptively.
Summary: Sixty seven (67) out of 3,599 papers met the selection criteria. This review showed five distinct domains considered to be important components of liveability. These were Economical, Environmental, Institutional, Social, and Governance (Political) domains. The most important subdomains (indices) which were frequently applied in various studies were Environmental friendliness and Sustainability, Socio-Cultural Conditions and Economic Vibrancy and Competitiveness. We also identified seven different methodologies and six ranking tools used for assessing urban liveability. Among the quantitative methods, three methods accounted for 89.6% of the articles. These methods were the Analytical hierarchy process and entropy (AHP; n=24; 50%), Factor analysis & Principle Component Analysis (FA & PCA; n=12; 25%) and Spatial Multi-criteria Decision-making Method (Spatial; n=7; 14.6%). Among the ranking tools used, three ranking tools accounted for 65.4% of the articles. These tools were the Livable City Scientific Evaluation Standards (LCSES; n=9; 34.6%), The Global Liveable Cities Index (GLCI; n=4; 15.4%) and the Economist Intelligence Unit (EIU; n=4; 15.4%).
Outlook: This paper discusses and summarizes the latest indicators and methods used for determining urban liveability. The information offered in the review can help future investigators to decide which method suits their purpose and situation better and measure urban liveability more systematically than before.

Title: Measuring Livability at the Neighborhood Scale –Development of Indicators and Methods for the Comparison between Neighborhoods and Best Practice within the Chosen City
Authors: H-H Chen and U Dietrich
Citation: IOP Conf. Ser.: Earth Environ. Sci. 290 012121, 2019.
URL: https://iopscience.iop.org/article/10.1088/1755-1315/290/1/012121/pdf
Abstract: A method that allows an assessment of the livability by comparing different neighborhoods with each other as well as with the best practice was developed in this paper. First of all, a set of 51 indicators comprising the categories of connectivity, traffic, public transportation and bicycle infrastructure, urban form, density, land use, open space coverage

ratio, potential for PV, green roof and materials were defined. The values for these indicators were investigated for 36 neighborhoods in the city of Hamburg, Germany. Secondly, some neighborhoods were chosen as the most livable neighborhoods and the average of their results was used for indicating the best practice in Hamburg. This approach allows users to compare their chosen neighborhoods with the best practice of their own city. Thirdly, each absolute indicator value was transferred into a relative one, where 0 % represents the lowest found value and 100 % the highest one. Fourthly, each indicator was assigned with a character. If the smaller percentage the better, like percentage of buildings near a noisy street, this character is "S". If the bigger percentage the better, like frequency of public travel, the character is "B". If the closer to the best practice the better, like inhabitants per hectare, the character is "R". Thus, the ideal neighborhood would show 0 % for character S, 100 % for B and the best practice for R. Finally, the results are presented in the radar charts in order to facilitate the comparison.

Title: Ranking Sustainable Urban Mobility Indicators and Their Matching Transport Policies to Support Liveable City Futures: A MICMAC Approach.
Authors: Chatziioannou Ioannis; Nikitas Alexandros; Tzouras Panagiotis G; Bakogiannis Efthimios; Alvarez Icaza Luis; Chias Becerril Luis; Karolemeas Christos; Tsigdinos Stefanos; Wallgren Pontus; Rexfelt Oskar
Citation: Transportation Research Interdisciplinary Perspectives. 2023. 18(0) p100788
Abstract: Understanding, promoting and managing sustainable urban mobility better is very critical in the midst of an unprecedented climate crisis. Identifying, evaluating, benchmarking and prioritizing its key indicators is a way to ensure that policy-makers will develop those transport strategies and measures necessary to facilitate a more effective transition to livable futures. After identifying from the literature and the European Commission (EC) directives the indicators that are underpinning the powerful scheme of Sustainable Urban Mobility Plans (SUMPs) that each municipality in Europe may implement to elevate the wellbeing of its population, the authors adopt a Cross Impact Matrix Multiplication Applied to Classification (MICMAC) approach to assess, contextualize and rank them. Through conducting a qualitative study that involved a narrative literature review and more importantly in-depth discussions with 28 elite participants, each of them with expertise in sustainable development, the authors are able to designate the Sustainable Urban Mobility Indicators (SUMIs) that are the most (and least) impactful. According to the analysis the most powerful indicator is traffic congestion, followed by affordability of public transport for the poorest, energy efficiency, access to mobility service and multimodal integration. This analysis allows us to then match them with the most applicable strategies that may ensure a holistic approach towards supporting in practical terms sustainable mobility in the city level. These are in ranking order: Transit Oriented Development (TOD); public and active transport enhancement; parking policies, vehicle circulation and ownership measures; telecommuting and car-pooling.

Title: Perceived liveability, transport, and mental health: A story of overlying inequalities.
Authors: Oviedo Daniel; Sabogal Orlando; Duarte Natalia Villamizar; Chong Alexandria Z W
Citation: Journal of Transport & Health. 2022.27(0) p101513
Abstract: This paper examines the links between perceived livability and mental health, questioning the role transport-related variables and features of the built environment play in the relationship between the two concepts. By exploring a topic not often tackled from the perspective of transport and health studies, the paper positions the concept of perceived livability as a mechanism to capture the subjective interpretations of the built environment by residents of different socioeconomic backgrounds and mobility behaviors. The paper uses Cali, Colombia as an example of a rapidly growing city in the global

South. The authors analyze data collected from an online participatory planning instrument where over 300 participants responded to questions on their mental health and their perceptions of the built environment, urban design, access to leisure facilities, and so forth. The authors use a Structural Equations Model that incorporates mental health and perceived livability as latent variables. The paper also draws from secondary data to map both the spatial distribution of the various determinants of perceived livability as well as the scores of the two latent constructs analyzed. The authors demonstrate that perceived livability can be expressed as a latent variable, causing scores and correlations in measured variables associated with the urban form, the environment, access to transport, and fear of crime. On the whole, higher livability scores are linked with higher mental health scores, and car users tend to score higher in both perceived livability and mental health scores. There are meaningful links between perceived livability and mental health influenced by transport-related drivers such as mode choice. Findings concerning car users suggest that transport investments in cities like Cali tend to accommodate already socio-economically advantaged residents. When testing the hypothesis that proximity to mass transit infrastructure could increase livability, the results were inconclusive, which suggests a limited "livability footprint" of public transport infrastructure.

Title: Investigating Customer Satisfaction Patterns in a Community Livability Context: An Efficiency-Oriented Decision-Making Approach.
Authors: Sarram Golnaz; Ivey Stephanie S
Editors: Wang Yinhai; McNerney Michael T
Citation: International Conference on Transportation and Development 2018. American Society of Civil Engineers. p191-201
Abstract: A comprehensive understanding of neighborhood facilities distribution and functions along with residential quality of life satisfaction is a key asset for relating livability management to transportation networks. Due to the simultaneous involvement of varied factors with an individual's perception of livability, this concept is difficult to measure. Therefore, a more objective means of quantifying livability is needed. The service industry has demonstrated the intersection of machine learning classifiers and survey domain knowledge for evaluating users' quality of experiences; however, this process of inquiry-based learning has never been considered for solving the communication difficulties between community stakeholders and transportation agencies. Another area of overlap is that of urban computing, which integrates computing technology in the traditional context of urban areas, connecting ubiquitous sensing technologies, computational power, and data about the urban environment to promote quality of life for people living in a particular community. To this aim, the focus of this study is on interpreting a linkage between society stated preferences and quantitative measures of livability by extracting information from survey-based methods and translating it to a quantitative framework using combined service industry and urban computing methodologies. This work focuses on four transportation planning-related research questions in this blended framework: understanding existing livability patterns, predicting heterogeneous perceptions of quality of life, prioritizing public preferences, and developing a multidimensional livability index (MLI).

Title: Adaptation and testing of a microscale audit tool to assess liveability using google street view: MAPS-liveability.
Authors: Cleland Claire; Ferguson Sara; Kee Frank; Kelly Paul; Williams Andrew James; Nightingale Glenna; Cope Andy; Foster Charlie; Milton K; Kelly M P; Jepson Ruth; Hunter Ruth F
Citation: Journal of Transport & Health. 2021.22(0)
Abstract: Livability is a complex, multifaceted concept with various definitions, but with an agreed core set of features (e.g., safety, walkability). Typically, livability is measured at the macro-level (city or

regional-level), and has been used in advocacy by local populations. However, micro-level (street-level) livability measurements could also/alternatively be used to identify modifiable environmental features impacting health and well-being. To date, no micro-level livability tools exist. This study investigates the reliability and rater agreement of a new micro-level audit tool designed for use with Google Street View (GSV). MAPS-Livability (GSV), was adapted from the Microscale Audit of Pedestrian Streetscapes (MAPS). This study had two phases: 1) MAPS-Liveability development (rapid literature review identifying core livability concepts, focus groups confirming livability concepts and tool adaptation); 2) reliability investigation (researcher agreement). Assessment was made of: total livability; nine livability sub-characteristics (e.g., safety, health); and 12 proxy measures of behavior including active travel (e.g., bicycle racks, presence of bicycles in racks). Inter-rater reliability and sensitivity to change were assessed by percentage agreement, inter-class correlation coefficients (ICC) and Wilcoxon signed-ranked tests ($p < 0.05$). Inter-rater reliability was excellent (ICC 0.905-0.968) for total livability, parked cars and total number of cars (moving/parked); good (ICC 0.754-0.885) for health, sustainability, places, number of bicycle racks, bicycle rack capacity, number of bicycles in the racks (time-point 2), cyclists (time-point 2), moving cars (time-point 2) and pedestrians; and moderate (ICC 0.550-0.742) for safety, inclusivity, education, traffic/transport, pavements, roads, cyclists (time-point 1), number of bicycles in the racks (time-point 1) and moving cars (time-point 1). MAPS-Livability provides a reliable assessment of micro-level livability features. MAPS-Livability has excellent inter-rater reliability for total livability and moderate-excellent inter-rater reliability for livability attributes and behavioral indicators. GSV at street-level supports safe, large-scale objective data collection, and collection of historical data where primary data is unavailable.

Title: Bicycle and Pedestrian Manual Count Programs: Assessing the Feasibility and Value for Measuring Local Active Transportation Work.
Authors: Ray Anastazjia F; Pelletier Jennifer E; Zukoski Ann P
Citation: Journal of Transport & Health. 2020.16(0)
Abstract: Promoting walking and bicycling has been a major focus in the US in recent years. Bicyclist and pedestrian manual counting programs are used to measure how many people are walking and bicycling in specific locations and their characteristics. The purpose of this study was to understand how communities use this data and assess the potential to use manual count data for assessment and evaluation. Six communities in Minnesota were selected to participate in this study. One semi-structured interview per community was conducted with local public health staff who participated in manual counts in 2012, 2014, and 2016. Interviews were transcribed and analyzed using a thematic analysis approach. Communities described their motivation to conduct counts, management of existing programs, and how they interpreted and used the count data. Among the many uses of the data discussed were documenting use of facilities, allocating resources, assessing efficiency of investments or need for safety interventions, informing or conducting research, and community engagement. Communities also described how the setting and circumstances that exist in the community affect both data interpretation and implications of the data as well as barriers, facilitators, and technical assistance needs for collecting and using count data effectively. Communities may need technical assistance to know how to use data collected through bicyclist and pedestrian manual counting. However, with appropriate instruction and assistance, counts are a feasible assessment tool for local active transportation (bicycling and walking) promotion efforts. However, contextual information about the setting and circumstances that exist in local communities is necessary to properly interpret and use count data and therefore is also necessary when using counts for assessment or evaluation. This method supports equity as manual counts do not require expensive equipment, and are relatively easy to implement.

Title: Transport policy for liveability - Valuing the impacts on movement, place, and society.
Authors: Anciaes Paulo; Jones Peter
Citation: Transportation Research Part A: Policy and Practice. 2020. copyright 2019. 132(0) p157-173
Abstract: In many countries, there is a movement away from 'car-centred' policies and a stronger interest in developing healthy, equitable, and sustainable transport systems that enhance liveability. However, the translation of these new priorities into convincing 'economic cases' for funding agencies requires changes in appraisal methods. This paper reviews the state of the art in the appraisal of nine impacts of transport related to liveability: trip quality, time use in transport, place quality, time use in places, personal security, visual blight, community severance, equity/social inclusion, and health/wellbeing. The authors look at whether and how these impacts are currently appraised in practice and propose alternative methods based on a review of the literature and the authors' suggestions. The authors found that there are robust methods to measure and monetise some of the impacts, but those methods tend to be integrated in national guidelines and are not always suitable at the city or regional level. Research on stated and revealed preferences methods has moved fast but application faces issues of complexity, transferability, and double counting. It is still difficult to monetise impacts such as time use in transport and visual blight without further methodological developments.

Title: Are All Transit Stations Equal and Equitable? Calculating Sustainability, Livability, Health, & Equity Performance of Smart Growth & Transit-Oriented-Development (TOD).
Authors: Appleyard Bruce S; Frost Alexander R; Allen Christopher
Citation: Journal of Transport & Health. 2019. 14(0) p100584
Abstract: While "Smart Growth", Transit-Oriented-Development, and "Livability" have been around for years, little research has provided a framework to measure and understand their performance so transit planners can realize key sustainability, livability, health, and equity outcomes. In response, this paper builds on literature and practice to evaluate over 350 light rail stations throughout the US, using smart growth, livability, and Transportation/Land-use Coordination (TLC) principles. Using recently developed Livability and Smart Growth Equity calculators (http://bit.ly/SmartGrowthEquity), and a smart growth/livability place-typology framework, this research assesses and grades "livability opportunity access" performance of these station areas along such key dimensions as regional/local access to jobs, services, transit, walkability. Using analysis of variance (ANOVA) methods, the authors show the significant associations between this livability access and the potential for realizing key quality-of-life benefits important for both individuals and society. But are all people able to equitably access these livability opportunities around transit so they can work towards realizing their desired quality of life? This study provides a unique evaluation of urban quality performance related to Transportation Land-use Coordination (TLC), "Smart Growth" and "New Urbanism. The authors find stations with higher levels of livability opportunity access to be significantly associated with key quality of life outcomes for individuals and society, such as lower rates of obesity, cardiovascular disease, asthma, driving, carbon emissions, and even lower poverty and unemployment. These higher-performing stations also have higher rates of walking, bicycling, transit use associated with lower household transportation costs which offset higher housing costs. Unfortunately, these stations are not socio-economically inclusive - in sum, all stations are not equal, or equitable. Using livability-opportunity-access-assessments with livability ethics, the authors recommend transportation and land-use agencies coordinate policies to provide equitable access to opportunities so all people can pursue and realize sustainability, livability, health, and equity outcomes for themselves and society.

Title: Livable Streets, Livable Arterials? Characteristics of Commercial Arterial Roads Associated With Neighborhood Livability.
Authors: McAndrews Carolyn; Marshall Wesley
Citation: Journal of the American Planning Association. 2018.84(1) p33-44
Abstract: Problem, research strategy, and findings: Planners and engineers traditionally consolidate motorized traffic onto arterial roads that pose challenges for surrounding neighborhoods. The authors investigate the positive and negative impacts of commercial arterials with nodes of activity on the livability of surrounding neighborhoods. They examine 10 arterials in Denver (CO) and survey respondents in adjacent neighborhoods, asking how they view those arterials. They use factor analysis to create a typology of neighbors' perceptions of these arterials. Neighbors like arterials that they perceive as a) vibrant with good transit access and b) quiet and clean; they dislike arterials that they perceive as a) unpleasant and b) sketchy. Vibrant arterials contribute to the perceived livability of the surrounding neighborhoods, whereas sketchy arterials are negatively associated with livability, but the same arterials are often simultaneously vibrant and sketchy. Residents clearly value the social functions that arterials provide and seem less aware of traffic volumes; some low-volume arterials are not more livable than those with higher traffic volumes. The findings are limited by the small sample size; the authors do not try to validate objective measures of livability with residents' perceptions. Takeaway for practice: Arterials can be good places for surrounding neighborhoods while still serving as major traffic corridors; accessibility and mobility do not always conflict. Planners should develop economic development plans for affected neighborhoods and enhance neighborhood livability by encouraging active land uses on arterials, maintaining the safety and cleanliness of arterials, and enhancing the pedestrian environment along those arterials.

Title: Assessing the influence of connected and automated mobility on the liveability of cities.
Authors: Harrison Gillian; Stanford Joseph; Rakoff Hannah; Smith Scott; Shepherd Simon; Barnard Yvonne; Innamaa Satu
Citation: Journal of Urban Mobility. 2022. 2(0) p100034
Abstract: In this work the authors are concerned with how the introduction of connected and automated mobility (CAM) will influence liveability in cities. The authors engaged with city and transport planners from both Europe and the U.S. and adopted a system dynamics approach to capturing the discussions and exploring potential outcomes. There are two aims in doing this: (1) to identify the concerns of city planners and how they differ from the traditional focus of transport researchers; but also (2) to develop a causal loop diagram (CLD) that can both explore the potential systemic effects of CAM and help to communicate those effects and the underlying mental models. Addressing these aims can inform policy design related to both CAM specifically and urban mobility more generally. In a change from previous related studies, the authors allowed the participants to establish their concept of liveability in cities and did not define a specific CAM scenario. This broad scope was critical in capturing the high-level view of what really matters to city stakeholders. The authors have established that a focus on a more holistic understanding of interactions related to sustainability is required rather than on specific transport modes or technology. A key insight that emerged was that quality of life (QoL) was the dominant concern of city planners, regardless of how it is achieved. The specifics of new services or technologies (such as CAM) are secondary concerns - which are important only insofar as they support the higher goal of improving QoL. As a result, the authors have produced a high level CLD that can be used as a starter for any future research in the area of CAM and liveability in cities and which may resonate better than previous CAM models have with city planners and policy makers--those who will ultimately play a key role in recommending and then implementing changes affecting QoL.

Title: Active transportation and social capital: The association between walking or biking for transportation and community participation.
Author: Stroope Jessica
Citation: Preventive Medicine. 2021.150(0) p106666
Abstract: Active transportation provides benefits to communities and individuals, yet little is known about its relationship with social capital. This study examined relationships between active transportation behavior and three indices of social capital (community participation, sense of community, and sociopolitical control). Linear regression was used to assess cross-sectional data (N = 1700) from the Survey of the Health of Wisconsin, a population-based representative sample collected in 2014, 2015, and 2016. Active transportation was associated with greater levels of community participation (p = 0.012). The association between active transportation and community participation was the third largest in terms of standardized coefficient (beta = 0.07), following only age and college degree or greater educational attainment. Active transportation was not significantly associated with sense of community or sociopolitical control. All models controlled for confounding background characteristics. These findings are important for policy and planning work, as designing supportive environments and removing barriers to active transportation can foster social capital through bolstering community participation. The benefits of active transportation may be broader than previously understood and underscore the need to promote active transportation.
Publisher

Title: Is a liveable city a healthy city? Health impacts of urban and transport planning in Vienna, Austria.
Authors: Khomenko Sasha; Nieuwenhuijsen Mark; Ambros Albert; Wegener Sandra; Mueller Natalie
Citation: Environmental Research. 2020. 183 p109238
Abstract: Each year, The Economist Intelligence Unit (EIU) computes the Global Liveability Index and determines the most livable cities around the world. Vienna, Austria, was ranked by the EIU as the most livable city worldwide in 2018 and 2019. However, the relationship between a livable as well as healthy and environmentally-just city has not been previously explored. To explore whether the most livable city is also a healthy and environmentally-just one, the authors estimated the premature mortality burden related to non-compliance with international exposure level recommendations for physical activity (PA), air pollution (PM2.5 and NO2), road traffic noise, green space and heat for Vienna, as well as its distribution by socioeconomic status (SES). The authors applied the Urban and TranspOrt Planning Health Impact Assessment (UTOPHIA) methodology and estimated the annual mortality, life expectancy (LE) and economic impact of non-compliance with exposure guidelines for the Viennese adult population >= 20 years. The authors compared current with recommended exposure levels, quantified the association between exposures and mortality and calculated attributable health impact fractions. Eight percent of premature mortality (i.e., 1239 deaths, 95% CI: 679-1784) was estimated to be attributable to non-compliance with the recommended exposure levels. Seventy-six percent of the attributable premature mortality was due to PM2.5 exposure and insufficient PA. Non-compliance also resulted in an average of 199 days of LE lost for the adult population (95% CI: 111-280) and an economic impact of 4.6 (95% CI: 2.5-6.7) billion 2015 annually. Overall, residents of lower SES neighborhoods faced higher risk of premature mortality due to higher exposure to NO2, road traffic noise, heat and less green space. Despite high livability standards according to EIU definition, a considerable premature mortality burden was attributable to non-compliance with exposure recommendations, and socioeconomic inequalities were estimated. Although the exposure attributable mortality burden was lower than in other European cities and local Viennese policies favor the reduction of motorized traffic, alongside the promotion of active and public transport and urban greening, there is room for further alignment of livability, environmental health and justice objectives.

Title: Outdoor spaces and buildings, transportation, and environmental justice: A qualitative interpretive meta-synthesis of two age-friendly domains.
Authors: Ravi Kristen E; Fields Noelle L; Dabelko Schoeny Holly
Citation: Journal of Transport & Health. 2021. 20(0) p100977
Abstract: Age-friendly environments promote healthy and active aging by building and maintaining capacity across the life course and allowing people who have a loss of capacity to continue engaging in activities that they value. Existing research demonstrates that municipalities are conducting age-friendly assessments worldwide. The current study aims to create a rich description of older adults' experiences with outdoor spaces, buildings, and transportation as part of an age-friendly assessment. A qualitative interpretive meta-synthesis (QIMS) was conducted to increase the number of studies eligible for analysis by allowing the inclusion of several existing qualitative studies from several countries. The QIMS included a systematic sampling and data analysis (i.e., theme extraction, theme synthesis, and methodological reduction) procedures and establishment of evidence credibility. The themes that emerged regarding older adults' experiences with outdoor space and buildings included 1) accessibility and 2) appropriate infrastructure. Regarding transportation, the theme of accessibility included subthemes of 1) availability and 2) affordability. Further reduction indicated that age-friendliness could be conceptualized as an environmental justice (EJ) issue. The three areas of EJ (i.e., distributional justice, procedural justice, and recognition) provide a helpful framework to guide the systematic documentation and evaluation of age-friendly community efforts. Moreover, interprofessional collaborations are needed to address transportation equity and inclusion better.

Title: Tools for addressing transport inequality: A novel variant of accessibility measurement.
Author: Cohen Tom
Citation: Journal of Transport Geography. 2020. Crown .88(0) p102863
Abstract: Accessibility is widely thought the most appropriate reference point when assessing transport inequality, a fundamental consideration of the liveable city. But definitions of accessibility vary and often either trivialise or overcomplicate the concept, with the result that decision makers lack a representation of it that is sufficiently accurate and at the same time sufficiently straightforward. A response is offered in this paper: the Index of Personal Travel Impact (IPTI). IPTI is an estimate at the individual level of the relative impact of desired travel, reflecting the time taken and real financial effect, and is expressed as an amount per unit distance. It is calculated using the journeys an individual would like to make (as opposed to those they actually make or those that an authority might assume "important") and reflects the specific characteristics of the individual (e.g. car availability or mobility impairment) and of the journey (e.g. the need to arrive by a given time). It therefore serves as a good individual-level representation of the relative ease/difficulty of travelling.The rationale for IPTI's formulation is described in detail and the measure's strengths and weaknesses discussed. The practical feasibility of calculating IPTI is explored through description of a small pilot which produced encouraging results, and through a discussion of the potential efficiencies offered by the increasing availability of large data sources and online journey-planning tools. IPTI's potential applications are then discussed: first, it could provide an intelligible way of demonstrating the differing extent to which people face mobility barriers, which could be useful where an attempt is being made to address inequality. Second, IPTI could inform the appraisal process by showing the distributional effects of a given scheme upon individuals' relative capacity to travel. The paper concludes with recommendations for further research.

Title: Public health impacts of urban traffic jam in Sanandaj, Iran: A case study with mixed-method design.

Authors: Nadrian Haidar; Mahmoodi Hassan; Taghdisi Mohammad Hossein; Aghemiri Mehran; Babazadeh Towhid; Ansari Bahjat; Fathipour Asaad
Citation: Journal of Transport & Health. 2020. 19(0) p100923
Abstract: The aim was to conduct a health impact assessment (HIA) on Sanandaj urban traffic jam, as a consequence of current urban traffic and transport initiatives conducted by Sanandaj urban traffic and transport system. Incorporating practice standards into the methodology, and applying a single mixed-method case study, the authors collected four sources of data through profiling community (archival records/documentations), interviews/focus group discussions, field notes, and community survey in Sanandaj, Iran. Integration of data was conducted at interpretation level (data synthesis). Reviewing archival records, a slight increase was found in the registered death/hospitalization cases due to diseases associated to air pollution. An aggravating trend was found in both air quality of city and fines for traffic violations. Challenges of urban traffic jam from residents' viewpoints were grouped into infrastructural, managerial, sociocultural, psychological and behavioral categories. Essential themes for the health impacts of urban traffic jam included physical and family mental health, and social determinants of health. Community survey showed high levels of negative impacts of urban traffic jam on air quality, public services delivery and accessibility, physical environment, public welfare services, family circumstances, social environment, and tobacco/substance use. The following barriers of urban traffic and transport initiatives were identified as the high priorities for revisiting plans: lack of enough streets/highways, lack of enough underpass/overpass, lack of parking lots in crowded areas and poor traffic education/acculturation. The team of assessors, based on findings, established the priority impacts and recommended justify options for action. Performing the HIA, the authors portrayed the contribution of a various range of urban-traffic related determinants to public health in a low- and middle-income country (LMIC) setting. This study may recall and familiarize policy and decision makers outside health sector on the ways to provide community health-oriented plans/projects. The findings are particularly informative for the LMICs, where urban traffic jam is mostly due to poor urban traffic and transport initiatives within urban areas.

Title: Early Delivery of Equitable and Healthy Transport Options in New Suburbs: Policy, Place and People.
Authors: Gunn Lucy; Kroen Annette; De Gruyter Chris; Higgs Carl; Saghapour Tayebeh; Davern Melanie
Citation: Journal of Transport & Health. 2020.18(0) p100870
Abstract: Planning policies support the development of healthy, livable cities. Yet, recent research suggests they may not offer enough detail to provide on-the-ground delivery of social and transport infrastructure that supports and impacts healthy, active behaviors and the subjective wellbeing of residents in new developments and growth areas. Three analyses were conducted. First, planning policies were reviewed using a content analysis to identify environmental features known to support healthy and active behaviors. Then, for two growth area estates located in Melbourne, Australia (Allura and Selandra Rise), the on-the-ground delivery of these planning policies were evaluated using spatial data of key destinations (e.g., shops, schools, and transport) and geographic information systems analysis. Finally, the health and subjective wellbeing of adult residents from these two estates combined (n = 352) was assessed using survey methodology. This included asking residents about the importance and satisfaction with access to transport and key destinations. The authors found that many built environment features were mentioned in the policy documents; however, policy standards for dwelling density remain low at 15 dph and distances for accessing activity centers too long at 1 km to adequately support the walkability of new growth areas. The authors found generally, that average distances to key destinations were longer and more variable in growth areas in comparison to inner city areas and Greater Melbourne overall. For residents, satisfaction with access to destinations differed between the

two case study areas. Residents in Allura, where destination and transport access was generally poorer were less satisfied, whilst those in the more walkable and established Selandra Rise area were more satisfied. Although planning policies support the development of active transport and healthy, livable cities they are insufficient for influencing healthy behaviors when not well implemented. Early delivery of social and transport infrastructure and services must occur early in the development cycle of new growth areas to support healthier and more sustainable behaviors.

Title: Re-Working Appleyard in a Low Density Environment: An Exploration of the Impacts of Motorised Traffic Volume on Street Livability in Christchurch, New Zealand.
Authors: Wiki J; Kingham S; Banwell K
Citation: World Transport Policy & Practice. 2018. 24(1) p60-68
Abstract: Street space was once an essential element of urban environments and provided a place for community interaction and engagement. This role however is increasingly being subverted by vehicular dominance. As a result, street space no longer acts as a driver for social interaction in many places, which has significant impacts on the liveability of streets and the wellbeing of their residents. This study sought to assess the extent to which motorized traffic volumes impact street liveability and community severance in Christchurch, a relatively low density city in New Zealand. Based on Appleyard's work of the late 1970s, data was collected from six streets, in two areas, categorized into three motorized traffic volume classifications. Results showed that residents on light trafficked streets have more neighborhood connections and community interactions and perceive their street to be more liveable. Furthermore, residents on heavy trafficked streets had a negative perception of their street environment, smaller local home areas and a decreased sense of belonging to their community. This affirms relationships found in previous research and raises questions about what and whom the residential street spaces of Christchurch are, and should be, designed for.

Title: Using street view images to examine the association between human perceptions of locale and urban vitality in Shenzhen, China.
Authors: Wu Chao; Ye Yu; Gao Fanzong; Ye Xinyue
Citation: Sustainable Cities and Society. 2023. 88(0) p104291
Abstract: There is a high correlation between the physical environment, human perception, and urban vitality. However, fine-scale variations in urban vitality are complex, and human perceptions of locale are difficult to measure. In this study, EasyGo data provided by Tencent, are used to distinguish differences in daytime and nighttime vitality in Shenzhen, China. Then, a series of subjective and objective variables is calculated to reflect human perceptions of locale based on street view images (SVIs). Finally, random forest and spatial lag regressions are adopted to analyze the driving forces of urban vitality. The results suggest that differences in urban vitality are manifestations of the unbalanced allocation of urban function, accessibility, building form, and human perceptions. The dominant variable category is urban function. There are obvious distinctions between daytime and nighttime vitality, particularly because the human perception category is increasingly important to nighttime vitality. This work sheds light on the relationships between human perceptions and urban vitality, providing suggestions for urban microrenewal and the construction of high-quality streets and liveable communities.

Title: Assessing Mobility Measures for Socially Sustainable Waterfront Redevelopment Projects: A Case Study in United Arab Emirates.
Authors: Hamdoon Barah Moutaz; Ahmed Khaled Galal
Citation: International Journal of Transport Development and Integration. 2023. WITPress..7(1) p55-65

Abstract: Mobility measures have an influential impact on urban social sustainability. This has not been investigated enough in the recent urban waterfront redevelopment projects in United Arab Emirates (UAE). This research aims at first initiating an assessment method for the mobility measures on both the morphological/urban form and urban design levels. Then, it aims at applying this assessment method on Mina Zayed (Zayed Port) waterfront urban regeneration project in Abu Dhabi, as a selected case study. The assessment method relied on an established theoretical framework that defined the principles and indicators of both the mobility morphological measures including Compactness and Density, Mixed-Use Development, Accessibility, and Mobility Networks Connectivity and Integration on the one hand, and the urban design mobility measures including Comfort and Livability, Environmental Quality, Safety and Security on the other hand. The utilized qualitative/quantitative tools of the adopted Case Study method encompassed the expert analysis of the CAD design drawings, Space Syntax Theory application through the DepthmapX simulation variables of Step Depth, Choice and Integration. The initiated assessment method managed to reveal the challenges and potentials of the investigated mobility measures in the analyzed case study. Based on these outcomes, a set of enhancement strategies for mobility measures on both morphological scale and urban design scale has been recommended. These included, among other measures, improving the infrastructure for non-motorized modes of mobility, enhancing mixed land-use of the design, having a more integrated mobility grid and improving accessibility. The research findings proved the validity of the applied assessment method, with its relevant investigation tools, makes it a legitimate revising method for the waterfront urban regeneration designs in the UAE, and in other countries in the region to help significantly enhance the attainment of social sustainability in waterfront urban regeneration projects.

Title: The 15-minute city: interpreting the model to bring out urban resiliencies.
Authors: Abdelfattah Lamia; Deponte Diego; Fossa Giovanna
Citation: XXV International Conference Living and Walking in Cities (LWC 2021). 2022. copyright 2021. 60(0) p330-337
Abstract: In a globally connected world and increasingly smart cities, the demand for living in a physical neighborhood where one can walk and cycle among familiar people and a variety of services is always alive. It is a quality of life which meets the deep desire of community and place identity. In this regard, the 15-minutes city is the contemporary version of the classical "human measure". The model offers a refreshing chrono-centric vision for the city that prioritizes people's time, energy and physio-psychological health by relieving their daily commutes. The recent pandemic clearly showed this potential; the daily outdoor movement by soft mobility allowed for social life even during lockdown periods. The paper is subdivided into two main components: a theoretical discussion of the 15-minute city model as part of a broader sustainable urban planning narrative, and a practical application mapping the potentials of Milan as a 15-minute city, focusing on population distribution and urban fabric structure as a measure of performance evaluation. The emergence of the 15-minute model rebalances the building volume concentration of the consolidated Transit Oriented Development paradigm; suggesting an innovative and more articulated vision. The 15-minute approach, rooted in the organic planning of the '60, is pushed by the covid-19 emergency, making treasure of the experience of urban regeneration masterplans of the last decade. The approach falls in line with real estate strategies for place making, which aim to create new sustainable urban districts that are pedestrian oriented and carbon free. After interpreting the international framework of urbanism trends with respect to the 15-minute model, the paper focuses on the Milan case. The potentials for neighborhoods across the city of Milan is investigated to conform to an inclusive 15-minute city model, using fully-fledged and innovative mapping of proximity. This analysis aims to explore the resilience of urban resources to support walkable living environments with a guaranteed basic level of accessibility to daily needs by walking. The

support to this model offered by soft mobility modes and micro-mobility devices is also raised. The results show, in a number of urban neighborhoods, a limited level of walkability although related to a spatial city structure which is able to be regenerated as a dense and effective network of 15-minute neighborhoods through tactical urbanism actions on existing open spaces and soft mobility policies, combined with long term strategies (infrastructure capacity and digital upgrading). It is a first methodological test which opens up the research towards a new inclusive concept of accessibility.

Title: Liveability and freight transport in urban areas: the example of the Calabria Region for City Logistics.
Authors: Trecozzi Maria Rosaria; Iiritano Giuseppe; Petrungaro Giovanna
Citation: XXV International Conference Living and Walking in Cities (LWC 2021). 2022.60(0) p116-123
Abstract: The freight transport in urban areas is a central theme in the studies of the last 20 years due to the increase of expenditure that influences the freight demand and the number of vehicles for their distribution. Notwithstanding its negative impact on city sustainability and livability is usually overlooked by policy-makers. The Calabria Region has created a virtuous way for the freight distribution in urban areas, as part of the Regional Transportation Plan (RTP) by means of the dedicated measure 2.5 City Logistics. This measure indicates how to make freight distribution more efficient by specific interventions. The aim is to increase livability and to obtain convergence of different interests of the actors involved, as citizens, public sector, retailers, and couriers, oriented to UN and EU targets and according to the RTP. This paper presents the experience of the Calabria Region related to City Logistics, as a prototypal process from planning, to programming and executing. This process includes a technical-administrative path developed with specific training activities involving all stakeholders realizing an integrated approach between different administrations with different roles in urban logistics projects. The process aims to create special urban areas where freight vehicles traffic is controlled through regulatory, management and infrastructural interventions, as time windows, upgrading fleets with environmentally vehicles, ICT/ITS, Urban Distribution Centers, Nearby Delivery Areas. The traffic control and management support the measures for COVID 19 emergency to ensure social distancing.

Title: Ridership dynamics and characteristics of potential riders of a transit system: The SunRail of Central Florida
Authors: Ulak, Mehmet Baran; Ozguven, Eren Erman; Horner, Mark W; Weaver, Lindsay; Puente, Jorge; Crute, Jeremy; Smith, Dennis J; Duncan, Michael; Whitton, Elizabeth
Citation: Transportation Research Interdisciplinary Perspectives, 2022. Elsevier. 16(0). P100720
Abstract: Accessibility, livability, and public health in urban areas can be improved by promoting sustainable and eco-friendly modes of transport such as rail transit. The success and feasibility of a rail transit system, however, rely on maintaining sufficient ridership depending on several factors. This study focuses on two of these factors in examining the SunRail transit system: 1) the ridership dynamics in terms of passenger flows between transit stations, and 2) the socio-demographic characteristics of the population living around and travelling between these stations. The SunRail system is the flagship commuter rail line of Greater Orlando, Florida, encouraging denser and more walkable development and promoting a less car-dependent multimodal transportation system. For this purpose, the authors utilized an instantaneous-balance Bayesian model estimating the origin–destination passenger flows and conducted a comprehensive assessment of the characteristics of residents living within each SunRail station area. The analyses help provide a more detailed understanding of the travel dynamics of SunRail riders as well as who lives and works in all 12 SunRail station areas. Consequently, the findings and insights obtained from the analyses aim to serve urban and transport planners in devising strategies to influence ridership based on the passenger flows and unique characteristics of the station areas.

Title: An agent-based model for assessing the financial viability of autonomous mobility on-demand systems used as first and last-mile of public transport trips: A case-study in Rotterdam, the Netherlands
Authors: Stevens, Martijn; Correia, Gonçalo Homem de Almeida; Scheltes, Arthur; van Arem, Bart
Citation: Research in Transportation Business & Management, 2022. Elsevier, 45(0). P100875
Abstract: The continuing urbanization and corresponding increase in transport demand are putting pressure on the accessibility, safety, sustainability, livability, and efficiency of urbanized regions. Public transport is regarded as a sustainable mode of transport for these regions and therefore transport policies aim to increase its attractiveness. However, public transport is facing last-mile connectivity problems. The application of Autonomous Mobility on-Demand (AMoD) as a feeder service for public transport hubs can potentially improve the first and last-mile trip leg which increases the attractivity of public transport. However, will such a system be financially viable when applied in an urban area? and what kind of operation will lead to the highest system performance? In this research, this question is addressed by proposing a method that connects macro transport modeling and agent-based modeling (ABM). An existing gravity-based travel demand estimation model built in a macro simulation tool is used to predict passenger demand across all the OD pairs of a city. For those OD pairs that can use the AMoD as first /last mile this is modeled using an agent-based rationale to be able to simulate the behavior of passengers and vehicles within that specific area of the city. The simulation model is applied to the case study area of the south of Rotterdam, in The Netherlands, where metro Station Zuidplein and the rail Station Lombardijen function as two AMoD hubs. Using the case study, the impact of relocation, ridesharing, and charging strategy is assessed in regards to financial viability. Among other insights, results show that the AMoD service leads to a profit on a typical business day for the operating companies despite the high-quality level of the service (very low average waiting time for a vehicle). If this particular system would not consist of automated vehicles and one would have to pay a salary to drivers, it would not be possible to make a profit on a typical business day. Moreover, results show that activating dynamic ridesharing and using wireless fast chargers at the stations results in the most financially viable operation. Activating automatic relocations results in the most costly operation.

Title: From temporary arrangements to permanent change: Assessing the transitional capacity of city street experiments
Authors: VanHoose, Katherine; de Gante, Ana Rivas; Bertolini, Luca; Kinigadner, Julia; Büttner, Benjamin
Citation: Journal of Urban Mobility, 2022. Elsevier. 2(0). P100015.
Abstract: In response to acute urban mobility and livability challenges, city street experiments have emerged as a way to explore possible solutions for alternative futures. While the added value of these experiments to improve urban living conditions is widely acknowledged, their potential to stimulate larger system change remains unknown. This paper uses the defining characteristics of transition experiments and a multi-level perspective of transitions in order to assess the transitional capacity of city street experiments. The authors devise an assessment framework to systematically assess six case studies in Amsterdam and Munich, revealing emerging patterns of experimentation within urban mobility systems.

Title: Do corporate social responsibility ratings have any effect on traffic congestion?
Authors: Bakare, Bukola; Motuba, Diomo; Szmerekovsky, Joseph
Citation: Transportation Research Part A: Policy and Practice, 2022. 165(0). P98119
Abstract: Traffic congestion (TC) is a complex issue that has an adverse impact on the environment, business operations, livability, and health of a community. Supply-side TC mitigation measures increase transportation capacities while demand-side measures attempt to modify travel behavior so that the

travel demand is reduced. As part of the demand-side, some corporations are investing in TC reduction through actions that contribute to improved walkability, reduced peak travel demand, and active commuting. While beneficial for their local communities, TC reduction efforts are not specifically tagged as a part of corporate social responsibility (CSR) endeavors. CSR involves reporting of a company's stewardship towards its community and environmental impact. Research reflecting on the impact of CSR on TC has not been conducted. This study aims to fill this gap. Using corporations headquartered in the top traffic-congested cities in the United States, this study examines the relationship between TC and CSR. This research employed a hierarchical linear model with two datasets, Travel Time Index (TTI) and CSRHub ratings. Of the four CSR categories studied, community, employees, and environment ratings are significantly related to TTI, with employees and environment ratings having an inverse relationship to TTI. This shows that congestion has a strong impact on the environment and that companies, through their employee policies, can impact TC. The results also highlight the opportunities that companies have in potentially reducing their environmental impact by incorporating congestion reduction strategies as part of their CSR, either as a separate measure or as part of their environmental or employee CSR ratings. The authors' results are also a starting point for new tools/strategies that transportation policymakers and analysts can use to engage companies to help mitigate TC. A further study on other cities with major traffic problems may shed more light on CSR and TC.

Title: Smart and Equitable Parks: Quantifying Returns on Investments Based on Probabilistic Mobility-Dependent Correlates of Park Usage Using Cyber-Physical System Technologies

Authors: Flanigan, Katherine A; Lightman, Karen; Graff, Lindsay; Lin, Cheyu; Qian, Sean

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Abstract: Parks are integral to the success of any vibrant city and have long been touted as engines of economic growth that also improve public health, clean the air, manage stormwater, and enable patrons to commune with nature while enjoying a rich set of social experiences within their community. Today, 165 parks are maintained in Pittsburgh ranging from small neighborhood parks to large greenways. Unfortunately, the financial constraints of the city have challenged its ability to maintain its parks; Pittsburgh parks are underinvested in comparison to both regional and aspirational peers. A key challenge for local governments is to develop and maintain parks and other public goods in ways that equitably distribute benefits to health, well-being, livability, accessibility to essential services, and the economy. This is critical because in areas where essential services are unevenly distributed across a community, parks and greenways often lead to a bifurcation: they either serve as barriers that result in social polarization, or serve as enabling public facilities that connect citizens in under-resourced areas to their wider communities and services; the polarizing or unifying nature of parks is heavily dependent on the configuration and health of surrounding mobility services. The overarching goal of this work is to explore urban park use and correlates of use (measured by time-dependent accessibility) in order to bring to light ways in which city officials and planners can quantify data-driven returns on potential

investments to parks and mobility services and implement changes that will more equitably distribute these benefits.

Title: Beyond Multimodal Metrics: Adapting Streets for People and Our Evolving Environment
Authors: DeRobertis, Michelle; Renard, April
Citation: ITE Journal, Institute of Transportation Engineers (ITE), 2022. 92(6). P44-50.
Abstract: Many cities across the world are implementing strategies that reduce, restrict, or prohibit automobile traffic either directly or indirectly. These include congestion pricing, bus-only lanes, pedestrian streets, green streets, shared spaces, low-emission zones, traffic-restricted zones (ZTL), road diets, bike boulevards, woonerfs, and slow streets. Assessing the effectiveness of these strategies is still in its infancy, perhaps due to lack of professional guidance. What is recognized is that past metrics centered on automobiles such as intersection level of service (LOS), and even new metrics such as vehicle-miles of travel (VMT), fail to capture the full range of benefits of these new strategies. Multimodal LOS metrics have started to address the fact that streets serve multiple modes, not only automobiles. But road redesign has impacts beyond transportation including social, economic, and environmental. With increased concern for livability and sustainability, policy makers need guidance on new metrics to measure effectiveness of roadway changes. In this paper, the authors present four U.S. and Canadian case studies, which show that measuring success includes these other considerations. It concludes with recommendations on assessing the full gamut of benefits and impacts on cities' built environment.

Title: Climate Resilient Urban Mobility by Non-motorized Transport
Author: Joseph, Kigozi
Editors: Amin Akhnoukh, Kamil Kaloush, Magid Elabyad, Brendan Halleman, Nihal Erian, Samuel Enmon
Citation: Advances in Road Infrastructure and Mobility: Proceedings of the 18th International Road Federation World Meeting & Exhibition, Dubai 2021. Sustainable Civil Infrastructures, p1225-1236. Edition: 1, Ch.: 86.
Abstract: African cities have begun to suffer climate change effects. In most African cities, populations are increasing rapidly and the reliance on Non-Motorized transport (NMT) is high, but dedicated NMT infrastructure remains underdeveloped. In all cities and towns across Uganda, the use of private vehicles has risen steadily over the years and has congested these cities, poisoned the air and killed NMT users at exceptionally high rates. This paper seeks to answer the question whether NMT projects are economically viable and how cities can maximize benefits of NMT for Climate conscious economic growth. This paper presents an economic analysis of the NMT pilot project in Kampala using the Non-Motorized Transport Project Assessment Tool (NMT-PAT) to quantitatively and qualitatively analyze the expected impacts (benefits and costs) with focus on Environmental and Health Benefits. The results of the analysis indicate that considering a design life of 15 years, Kampala city will experience reductions in emissions to the tune of 675,000 tons for carbon dioxide, 13.81 tons of particulate matter and 2536 tons of nitrogen dioxide. The health benefits in terms of reduction in accidents valued at Uganda shillings 4,163,611,405,517.35 (USD 1,134,499,020) will also be realized. A general improvement in journey quality, security and livability will also be achieved as well as a reduction in the noise levels by about 3.75 dB. To encapsulate by implementing the proposed NMT infrastructure, a net present value of 14 trillion shillings (USD 3 Billion) shall be realized thus demonstrating that NMT investment is viable.

Title: Neighborhood streets as places of older adults' active travel and social interaction – A study in Daokou ancient town

Authors: Wang, Zhe; Zhang, Hua; Yang, Xiaolin; Li, Guoxiang
Citation: Journal of Transport & Health, Elsevier 24(0). P101309
Abstract: Neighborhood streets are convenient places for older adults to engage in behaviors for active living, such as walking (active travel) and chatting with neighbors (social interaction). Street environments and older adults' active living in ancient towns need investigation. Taking Daokou ancient town in China as an example, this research observed older adults' active travel and social interaction on two neighborhood streets and investigated the difference in social engagement between older-adult groups on different streets. On-site non-participant observation was conducted for four weekdays with seven 30-min sections per day. Data of 350 older adults' active travel and social interaction on these streets were collected. Street environmental factors were measured and classified into four categories in terms of active-travel promotion: typology, motivators, functionality, and safety. To identify the differences in social engagement between the groups by street, one-way ANOVA tests were conducted after controlling for a significant confounding variable (daypart). Among the older adults, the most popular type of active travel was independent walking (67%). Of their social interaction, the most popular types were staying and chatting (61%), group walking, and chess or card playing. On the street considered more age-friendly to active travel, older adults engaged in more social interaction in the mid-mornings and afternoons ($p < 0.05$). This study highlighted older adults' active living on neighborhood streets in ancient towns. The findings can be used to create street affordances for older adults' active travel and social interaction, and produce healthy outcomes through the refinement of design and transportation policies and practice on street intervention.

Title: The TROLLEY Study: Assessing Travel, Health, and Equity Impacts of a New Light Rail Transit Investment During the COVID-19 Pandemic
Authors: Crist, Katie; Benmarhnia, Tarik; Frank, Lawrence D; Song, Dana; Zunshine, Elizabeth; Sallis, James F
Citation: BMC Public Health, BioMed Central, 2022. 22(1). P1475
Abstract: The COVID-19 pandemic disrupted life in extraordinary ways impacting health and daily mobility. Public transit provides a strategy to improve individual and population health through increased active travel and reduced vehicle dependency, while ensuring equitable access to jobs, healthcare, education, and mitigating climate change. However, health safety concerns during the COVID-19 pandemic eroded ridership, which could have longstanding negative consequences. Research is needed to understand how mobility and health change as the pandemic recedes and how transit investments impact health and equity outcomes. The TROLLEY (TRansit Opportunities for HeaLth, Livability, Exercise and EquitY) study will prospectively investigate a diverse cohort of university employees after the opening of a new light rail transit (LRT) line and the easing of campus COVID-19 restrictions. Participants are current staff who live either < 1 mile, 1-2 miles, or > 2 miles from LRT, with equal distribution across economic and racial/ethnic strata. The primary aim is to assess change in physical activity, travel mode, and vehicle miles travelled using accelerometer and GPS devices. Equity outcomes include household transportation and health-related expenditures. Change in health outcomes, including depressive symptoms, stress, quality of life, body mass index and behavior change constructs related to transit use will be assessed via self-report. Pre-pandemic variables will be retrospectively collected. Participants will be measured at 3 times over 2 years of follow up. Longitudinal changes in outcomes will be assessed using multilevel mixed effects models. Analyses will evaluate whether proximity to LRT, sociodemographic, and environmental factors modify change in outcomes over time. The TROLLEY study will utilize rigorous methods to advance the understanding of health, well-being, and equity-oriented outcomes of new LRT infrastructure through the COVID-19 recovery period, in a sample of demographically diverse adult workers whose employment location is accessed by

new transit. Results will inform land use, transportation and health investments, and workplace interventions. Findings have the potential to elevate LRT as a public health priority and provide insight on how to ensure public transit meets the needs of vulnerable users and is more resilient in the face of future health pandemics. The TROLLEY study was registered at ClinicalTrials.gov (NCT04940481) June 17, 2021, and OSF Registries (https://doi.org/10.17605/OSF.IO/PGEHU) June 24, 2021, prior to participant enrollment.

Title: Towards an enriched framework of service evaluation for pedestrian and bicyclist infrastructure: acknowledging the power of users' perceptions
Authors: Rodriguez-Valencia, Alvaro; Vallejo-Borda, Jose Agustin; Barrero, German A; Ortiz-Ramirez, Hernan Alberto
Citation: Transportation. Springer, 2022. 49(3), p791-814
URL: https://link.springer.com/article/10.1007/s11116-021-10194-4
Abstract: More and more cities worldwide are striving for sustainability and livability. Measuring the service or performance of local-scale spaces for pedestrians and bicyclists to better understand how to provide "walkable" and "bikeable" environments is key in this endeavor to enhance active transportation. These pedestrian and bicycle service or performance indicators, such as Level of Traffic Stress or Level of Service, relate measurable characteristics with a perceived proxy of the performance or service, such as comfort, satisfaction, or quality of service (QoS). The purpose of this study is to propose and validate a framework that integrates user-oriented inputs to the existing traditional supply-oriented variables to explain the QoS in segment roadways in urban environments for active modes. The conceptual framework underlying this study considers the contribution of individual perceptions, in addition to the traditionally considered operational and geometry variables, to explain the perceived QoS of pedestrian and bicyclist infrastructure. The framework is tested via two separate and independent surveys for pedestrians and bicyclists. Evidence determined the relative importance of these supply-oriented and user-oriented factors to explain the QoS. The superior explanatory power of the perception variables and in terms of the variables that explain the individuals' perceived QoS justify the framework for both pedestrians and bicyclists.

Title: Enhancing Equitable Access to Opportunities Using Traveler Behavior Data
URL: https://nicr.usf.edu/2021/05/17/2-4-enhancing-equitable-access-to-opportunities-using-traveler-behavior-data/
Project Contract Numbers: 69A3551947136; 79075-00-B
Status: Active
Funding Amount: 150000
Sponsor Organizations:
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Start Date: 2021-04-15
Expected Completion Date: 2022-09-30
USDOT Program: University Transportation Centers Program
Abstract: The goal of integrating accessibility into transportation planning is to ensure that congestion mitigation measures encourage transportation equity and urban space livability. Traditional methods of estimating travel time, travel time reliability, and trip length information to power accessibility measures have largely focused on modeling and/or estimation procedures, displaying a hypothetical universe of access — not where travel actually occurs. This research project will develop a suite of measures to assess accessibility, taking advantage of available crowdsourced origin-destination data to identify accessibility from real data rather than a modeled approach. The measures (e.g., travel time to/from destinations, trip length, access to jobs, etc.) will be estimated for cities of varying size and U.S. geographic distribution to inform congestion-mitigation decision-making based on actual travel behaviors. The results of this work will help transportation planners and policy makers understand locations where access is (or is not) adequately provided to identify appropriate and innovative solutions for shifting travel behavior to more sustainable approaches. The 2021 Urban Mobility Report website will include the results of the accessibility analysis and new performance measures. In subsequent years, the methods will be honed with feedback from academic and practitioner peer review, after the release of the information on the UMR website, and with the availability of more data. NICR will be shown as a 2021 Urban Mobility Report sponsor on the UMR website.

Title: Tribal Transit Study: Demographic Needs Indicators, Funding Needs and Livability
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Pagination: 211p
Publication Date: 2021-04-00
URL: https://www.ugpti.org/resources/reports/details.php?id=1031
Abstract: The objectives of this research are to study the demographic indicators of tribal communities that relate to transportation needs, describe and evaluate existing tribal transit operations and funding,

and examine the role of transit in livability and quality of life in tribal communities in the United States. This study identified small urban and rural Indian tribes and reservations that have the most significant transit needs. The basis for this determination was an examination of traditional mobility need indicators such as population of older adults, people with disabilities, those with low income, school-age youth, and households with no vehicles. The study evaluated existing tribal transit operations and funding. Finally, this study conducted case studies in two selected Indian reservations to understand the role of transit and other factors in livability and improving quality of life in tribal communities. The case studies were conducted with Standing Rock Reservation in North Dakota and South Dakota and Makah Indian Reservation in Washington, and they involved surveys of community residents and transit riders. The study shows that tribal lands are mostly rural with lower population densities. Moreover, the share of the population often described as transit dependent, particularly those with low income, households with no vehicles, and youth, is often higher for tribal areas compared with the general U.S. population. Additionally, tribal areas often lack resources and are dependent on federal support to meet mobility challenges on reservations. The case studies identified several factors that could be improved to enhance quality of life in the communities, and they showed that transit can play a role.

Title: Equitable Transportation Planning Curriculum for Urban Planning and Transportation Programs
Abstract: Transportation is needed to access jobs, food, health care, recreational and open spaces, and other important destinations. Equity in transportation planning processes ensures equal access to affordable and reliable transportation while ensuring that vulnerable groups don't receive disproportionate benefits or burdens. Without inclusive processes, transportation planning can negatively impact low-income communities, minorities, persons with disabilities, the elderly, children, and other traditionally underserved populations. Many agencies and communities across the nation are seeking to address equity concerns and encourage livability, economic growth, and active transportation. Planning and transportation professionals must understand how to successfully plan for equity by identifying and addressing a broad range of transportation needs. It is also important that transportation professionals have a clear understanding of their roles as advocates for and partners with disadvantaged communities. This curriculum proposal seeks to provide emerging professionals with the training and tools needed to successfully integrate equity into transportation decision-making processes. Students taking the course will gain an appreciation for the historic impetus to consider equity and a deeper understanding of related concepts, including accessibility, mobility, affordability, and sustainability. Beyond this foundational knowledge, emerging professionals will acquire skills that can be put into practice and propel equity to the forefront of the transportation planning profession. This foundational knowledge and skillset will launch the use of innovative transportation planning approaches to identify and address the unique needs of various population groups, particularly traditionally underserved populations. Emerging planners and transportation professionals are the next group of professionals to shape the transportation system. Funding from CTEDD would enable the development of an expanded curriculum with service-learning and community engagement experience for planning and transportation students across the nation. This curriculum will provide those emerging professionals with the foundation and tools needed to successfully advance equity in transportation decision-making for years to come.
Project Contract Numbers: CTEDD 021-03; USDOT - 69A3551747134
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Expected Completion Date: 2022-02-28
USDOT Program: University Transportation Centers Program

Title: Toward a Guide for Smart Mobility Corridors: Frameworks and Tools for Measuring, Understanding, and Realizing Transportation Land Use Coordination
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Report/Paper Numbers: 20-54; CA-MTI-1805
Abstract: The coordination of transportation and land use (also known as “smart growth”) has been a long-standing goal for planning and engineering professionals, but to this day it remains an elusive concept to realize. Leaving us with this central question -- how can we best achieve transportation and land use coordination at the corridor level? In response, this report provides a review of literature and practice related to sustainability, livability, and equity (SLE) with a focus on corridor-level planning. Using Caltrans’ Corridor Planning Process Guide and Smart Mobility Framework as guideposts, this report also reviews various principles, performance measures, and place typology frameworks, along with current mapping and planning support tools (PSTs). The aim being to serve as a guidebook that agency staff can use for reference, synergizing planning insights from various data sources that had not previously been brought together in a practical frame. With this knowledge and understanding, a key section provides a discussion of tools and metrics and how they can be used in corridor planning. For illustration purposes, this report uses the Smart Mobility Calculator (https://smartmobilitycalculator. netlify.app/), a novel online tool designed to make key data easily available for all stakeholders to make better decisions. For more information on this tool, see https://transweb.sjsu.edu/research/1899-Smart-Growth-Equity-Framework-Tool. The Smart Mobility Calculator is unique in that it incorporates statewide datasets on urban quality and livability which are then communicated through a straightforward visualization planners can readily use. Core sections of this report cover the framework and concepts upon which the Smart Mobility Calculator is built and provides examples of its functionality and implementation capabilities. The Calculator is designed to complement policies to help a variety of agencies (metropolitan planning organizations (MPOs), state departments of transportation (DOTs), and local land use authorities) achieve coordination and balance between transportation and land use at the corridor level.

Title: Commute satisfaction, neighborhood satisfaction, and housing satisfaction as predictors of subjective well-being and indicators of urban livability
Author: Mouratidis, Kostas
Citation: Travel Behaviour and Society, Elsevier, Oct. 2020. 21(0). P265-278
URL: https://doi.org/10.1016/j.tbs.2020.07.006;
http://www.sciencedirect.com/science/article/pii/S2214367X20301988
Abstract: Commute satisfaction, neighborhood satisfaction, and housing satisfaction can be used as indicators of urban quality of life and livability due to their potential contribution to subjective well-being. This study aims to uncover whether these three concepts are indeed predictors of subjective well-being and reliable indicators of livability and quality of life in cities. The study presents and tests a model that examines the pathways between commute satisfaction, neighborhood satisfaction, and housing satisfaction, satisfaction with other life domains, and subjective well-being components – life

satisfaction, affect, and eudaimonia. Data are obtained through a survey in the city region of Oslo, Norway and are analyzed with structural equation modeling. Findings show that commute satisfaction, neighborhood satisfaction, and housing satisfaction are all significantly associated with subjective well-being. Commute satisfaction was found to be linked to subjective well-being indirectly, mainly via neighborhood satisfaction and job satisfaction. Neighborhood satisfaction was found to relate to subjective well-being directly, but also indirectly via personal relationships satisfaction, housing satisfaction, and leisure satisfaction. Housing satisfaction was found to have a significant direct association with subjective well-being. These findings suggest that commute satisfaction, neighborhood satisfaction, and housing satisfaction are reliable indicators of urban livability. Consolidating these indicators provides a platform for future measurements of urban quality of life for research as well as public policy purposes.

Title: Early Delivery of Equitable and Healthy Transport Options in New Suburbs: Policy, Place and People
Authors; Gunn, Lucy; Kroen, Annette; De Gruyter, Chris; Higgs, Carl; Saghapour, Tayebeh; Davern, Melanie
Citation: Journal of Transport & Health, Elsevier, Sept. 2020. 18(0).
URL: https://doi.org/10.1016/j.jth.2020.100870
http://www.sciencedirect.com/science/article/pii/S2214140520300748
Abstract: Planning policies support the development of healthy, livable cities. Yet, recent research suggests they may not offer enough detail to provide on-the-ground delivery of social and transport infrastructure that supports and impacts healthy, active behaviors and the subjective wellbeing of residents in new developments and growth areas. Three analyses were conducted. First, planning policies were reviewed using a content analysis to identify environmental features known to support healthy and active behaviors. Then, for two growth area estates located in Melbourne, Australia (Allura and Selandra Rise), the on-the-ground delivery of these planning policies were evaluated using spatial data of key destinations (e.g., shops, schools, and transport) and geographic information systems analysis. Finally, the health and subjective wellbeing of adult residents from these two estates combined (n = 352) was assessed using survey methodology. This included asking residents about the importance and satisfaction with access to transport and key destinations. The authors found that many built environment features were mentioned in the policy documents; however, policy standards for dwelling density remain low at 15 dph and distances for accessing activity centers too long at 1 km to adequately support the walkability of new growth areas. The authors found generally, that average distances to key destinations were longer and more variable in growth areas in comparison to inner city areas and Greater Melbourne overall. For residents, satisfaction with access to destinations differed between the two case study areas. Residents in Allura, where destination and transport access was generally poorer were less satisfied, whilst those in the more walkable and established Selandra Rise area were more satisfied. Although planning policies support the development of active transport and healthy, livable cities they are insufficient for influencing healthy behaviors when not well implemented. Early delivery of social and transport infrastructure and services must occur early in the development cycle of new growth areas to support healthier and more sustainable behaviors.

Title: How Do Complete Streets Matter for Communities? The Case of Richfield, Minnesota
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Edition: Final Report
Report/Paper Numbers: MN 2020-22; CTS#2019007
Abstract: Municipalities across Minnesota have turned to Complete Streets in an attempt to develop more usable roads for their residents. This report investigates how Complete Streets are reshaping one Minnesota community. In 2013, Richfield, a suburb of Minneapolis, enacted a particularly innovative Complete Streets policy. Known locally as "Richfield Sweet Streets," the program has led to the reconstruction of several major roads across the city. Richfield's Sweet Streets program is unique in that it incorporates a modal hierarchy in which users are prioritized differently in road redesign and reconstruction. It relies on extensive community engagement, aiming to improve outcomes for individuals and the community as a whole. This research presents a baseline analysis of how Richfield's Sweet Streets projects are affecting the local community, while identifying a set of methods and measures for future research. The analysis draws on multiple sources of data to better understand the nature and consequences of Richfield's Sweet Streets for user experience and livability, economic vitality, transportation and safety, and individual and community health. The research aims to illustrate Richfield's innovative approach to transforming its transportation infrastructure while providing a roadmap for future analyses of the impacts of Richfield's Sweet Streets.

Title: Dynamic Modal Accessibility Gap: Measurement and Application Using Travel Routes Data
Authors: Guan, Jinping; Zhang, Kai; Shen, Qing; He, Ying
Citation: Transportation Research Part D: Transport and Environment, Elsevier, Apr. 2020. 81(0)
URL: https://doi.org/10.1016/j.trd.2020.102272
http://www.sciencedirect.com/science/article/pii/S1361920919313033

Abstract: Accessibility is a key concept in transportation research and an important indicator of people's quality of life. With the development of big data analytics, dynamic accessibility that captures the temporal variations of accessibility becomes an important research focus. Few prior studies focus on comparative measures of dynamic accessibility to Points of Interest (POIs) by alternative travel modes. To fill this research gap, the authors propose a new index called dynamic modal accessibility gap (DMAG), which draws upon available data on residents' real travel routes using different travel modes, as well as the data on POIs. The authors study the DMAG in the real-travel covered area, assuming POIs are only useful if it is within someone's real-travel covered area. The authors then apply this DMAG methodology to Shanghai's central city and peripheral area. In both cases, the authors measure the accessibility for public and private travel modes. As an example, one-week taxi GPS and metro smart card data, and POIs data are used to generate the DMAG index for 30-minute and 60-minute trip durations for weekdays and holidays. Results show that DMAG can reflect the pattern of temporal variations. The proposed DMAG analytical framework, which can be applied at both the user and the system levels, can support urban and transportation planning, and promote social equity and livability.

Title: A Smart Growth & Equity Framework and Tool for Measuring, Understanding, and Realizing Transportation Land Use Coordination for Sustainability, Livability, and Equity

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Abstract: The coordination and integration of transportation and land use (also known as “smart growth”) has been a long-standing goal for planning and engineering professionals, but to this day remains an elusive concept to realize. As this approach is a widely recognized as key to achieving sustainable, livable, and equitable (SLE) outcomes for individuals and society, a key aim of this report is to instill the coordination of transportation and land use into practice by the collection of key actors and agents (MPOs, DOTs, and local land use authorities, etc.) through new measurement and policy guidance frameworks and tools. A fundamental assumption of this report is that frameworks are needed first to help guide the use of tools to measure and understand urban quality, and then inform policy decisions toward realizing SLE outcomes. Along these lines, this report provides a review of current literature and practice related to measuring and understanding the integration of transportation and land use through the lenses of sustainability, livability, and equity (SLE), specifically focusing on efforts to operationalize the Livability Principles of the 2009 HUD/DOT/EPA Partnership for Sustainable Communities and Caltrans’ Smart Mobility Framework. Specifically, this report builds on the use of various principles, performance measures, and place typology frameworks, along with current mapping and Planning Support Tools (PSTs) in order to develop a framework to: a) Measure SLE urban quality performance urban places b) Understand what this SLE performance means in terms of how to respond with policies c) Provide guidance on how to enact policies to realize more robust transportation land use integration (smart growth) to achieve SLE outcome for society. With this knowledge and understanding then authors then go into a discussion of tools and metrics and how they can be used. For illustration purposes, this report uses the Smart Growth & Social Equity Calculator (https://smartgrowthcalculator.netlify.com/) – an online tool designed to make key data easily available to all stakeholders so they can more readily make coordinated decisions to that will lead to a more robust integration between transportation and land use. Specifically, the SGE Calculator can help with: climate action planning, VMT analysis related to new CEQA regulations under SB 743 that move us away from LOS, and how to coordinate transportation & land use across the spectrum, from community NIMBY discourses to regional and state transportation planning.

Title: Evaluations of FHWA Research & Technology Program Projects
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Sponsor Organizations:
American Association of State Highway and Transportation Officials (AASHTO)
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Start Date: 2020-01-29
Expected Completion Date: 2024-06-30
URL: http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=4860
Abstract: The Federal Highway Administration (FHWA) "provides stewardship over the construction, maintenance and preservation of the Nation's highways, bridges and tunnels. FHWA also conducts research and provides technical assistance to state and local agencies in an effort to improve safety, mobility, and livability, and to encourage innovation" (https://www.fhwa.dot.gov/). A significant portion of FHWA's research activities, evolved over many years in response to successive legislative initiatives, is managed by agency research and technology (R&T) program staff housed at the Turner-Fairbank Highway Research Center (TFHRC) in McLean, VA, and other locations. The current objectives and priorities of FHWA's R&T activities are described in the FHWA Research and Technology Agenda. (The Agenda and other documents cited here are available on the Web.) The ultimate aim of R&T activities is to support FHWA's mission through deployment of innovations spawned by FHWA research. To ensure that R&T activities are effectively and efficiently contributing to FHWA's mission, R&T staff apply leading practices in research management and, from time to time, undertake formal evaluations of particular activities, projects, or programs. The Corporate Master Plan for Research and Deployment of Technology & Innovation presents the strategic management framework that FHWA leadership applies to improve the effectiveness and efficiency of R&T activities generally. In addition, FHWA's R&T staff solicit advice from the Transportation Research Board (TRB), particularly the Research and Technology Coordinating Committee (RTCC). The RTCC issues annual reports commenting on R&T programs generally and suggesting adjustments to program strategies and approaches to improve program relevance, effectiveness, and impact. Within this context, FHWA in 2014 initiated the "R&T Evaluation Program" to assess and communicate the effectiveness of selected projects within the R&T portfolio. A

total of 16 such projects initially were designated for evaluation; these evaluations have been conducted by the Volpe National Transportation Systems Center. For the next stage of the R&T Evaluation Program, FHWA asked TRB to take a more active role in managing evaluations of selected projects. The objective of this project is to conduct evaluations of specific projects within the FHWA R&T program. These evaluations will be quantitative and indicative of observable contributions of research results to FHWA's mission and returns on investments of public funds. The reporting of evaluation results is intended to inform FHWA R&T program management and facilitate stakeholder understanding of the value of the R&T program. The project currently entails evaluation of as many as 5 particular projects designated by FHWA and TRB. Each specific project evaluation is conducted by the evaluation contractor and guided by an oversight panel of five to seven members selected to represent technical expertise and the concerns of likely users of the results of the R&T project being evaluated. Each evaluation includes the following milestones and deliverable products: (1) Evaluation Scoping Report presenting the objectives, evaluation plan, and likely measures of effectiveness for evaluation of the designated FHWA R&T project, (2) Evaluation Plan describing the evaluation strategy and specific tasks to be performed, calendar schedule, evaluation team personnel, and intermediate evaluation products, (3) Interim Report describing the evaluation team's progress on the Evaluation Plan, difficulties encountered in conducting the work, and any preliminary assessment of research project outcomes supported by work so far accomplished, (4) Project Evaluation Report documenting the evaluation and presenting the results.

Title: Use of Geographical Accessibility Indicators in Policy Making
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Citation: European Transport Conference 2020, Date: 2020-09-09 to 2020-09-11, 15p.
URL: https://aetransport.org/past-etc-papers/conference-papers-2020
Abstract: Geographical accessibility indicators are accessibility indicators that account for both changes in land use (activities) as well as for changes in the transport system (e.g. travel times). These indicators are already for a long-time part of the academic literature on accessibility (Geurs K. and Ritsema van Eck 2001 and 2003, Schreurer and Curtis 2007, Bath et al. 2000). In practice however these indicators still play a minor role in the actual policy making in most countries and cities (Hull et al, 2012, Papa E et al, 2005). A reason for this is the sectoral set up of the government which results in a focus on mostly domain specific (rail or road) network indicators. Over the last years this rigid sector approach is changing driven by a combination of climate and livability concern, especially for the urban areas, and decreasing support for road investments. Both the Ministry of Infrastructure and Water management as well as the Ministry of Interior in the Netherlands have called in their vision statements for a more integrated approach towards transport and land use. Up to now this ambition was stated at a more abstract level and it is the challenge to include this in the actual policy making process. The forthcoming national transport market and capacity analyses (NMCA) 2020/21 offers a good opportunity for this. This study is executed by the Ministry of Infrastructure and Water Management, in general with intervals of four years, to inform the newly elected government about the future accessibility challenges. This paper reports on the findings of two pre-studies in 2018 and 2019 for the NMCA to explore the use of geographical accessibility indicators in policy making in the Netherlands. The studies have focused on two main policy making tasks, identifying future challenges and evaluating the impacts of policy measures. In the study various geographical indicators were tested on their potential contribution to

these two policy tasks. The geographical indicators tested in the study vary by type of indicator, like use of fixed time intervals or functions for acceptable travel times estimated on observed behavior and the inclusion of competition for activities or not (e.g. size and location of labor force in case of accessibility of jobs). These indicators have been calculated for scenario developments, to identify future challenges, and to calculate accessibility impacts of land use or transport policy measures at a national and regional scale level. The accessibility indicators have been applied for various policy domains, such as individual and/or economic development, and their relevant travel purposes like accessibility of jobs (for workforce), of employees (for firms), education, shopping and healthcare. Findings of this study on the use of geographical indicators for identifying future policy challenges are: • Interpretation of geographical accessibility maps and results works out differently and does not present a direct map with bottlenecks like for the traditional network indicators; • A successful use of these indicators requires a shift in focus from a traditional bottlenecks (congestion) approach to a broader opportunity focused approach. The challenges and goals should therefore be formulated in close interaction with exogenous scenario developments and vary by region. In this approach the added value is in realizing opportunities that are offered by future developments and how undesirable developments can be mitigated; • The indicator offers additional insight in how accessibility is influenced by exogenous developments (e.g. international migration or economic growth), spatial developments (e.g. housing or office development sites) and changes in the transport system (e.g. road infrastructure of PT service levels); • The future accessibility challenges can be formulated region specific tailored to regional developments. The possible policy strategy to improve accessibility is now much broader and includes besides traditional infrastructure measures also land use options and guidance on the coordination with other policy fields.

Title: Planning in Gateway and Natural Amenity Region Communities: Understanding the Unique Challenges Associated with Transportation, Mobility, and Livability
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https://rosap.ntl.bts.gov/view/dot/41701
Abstract: Communities outside of major public lands and other natural amenities throughout the western United States face a variety of transportation and planning-related concerns associated with

rapid growth and increases in tourism. Surprisingly, while the unique transportation and planning-related challenges of these western gateway and amenity region (GNAR) communities have, to some extent, been documented in recreation and tourism research, these concerns have largely been overlooked in planning scholarship. To begin to address this gap, this report presents key descriptive findings from a study aimed at examining the unique transportation, mobility, and access to opportunity-related challenges being experienced by GNAR communities throughout the western U.S. It draws on findings from in-depth interviews with 31 planners and other key public officials from 25 western GNAR communities, an online survey of planners and other key public officials in GNAR communities throughout the west, and observation of planning efforts in the regions around Zion National Park and Moab, UT, and Sandpoint, ID. The results provide empirical evidence that many western GNAR communities are experiencing significant increases in growth and visitation pressures along with a number of related "big-city" problems, such as lack of affordable housing, income inequality, and transportation issues. These changes contrast against the fact that these communities value their small town character and related community characteristics. The data suggest that despite these pressures, most GNAR communities are experiencing improved quality of life and visitor experience. However, some communities report declining quality of life and visitor experience, as well as extreme challenges associated with housing, transportation, and other planning concerns, raising the question of whether GNAR communities reach a tipping point at which visitation and development pressures result in overall impacts on community wellbeing. The results also show that GNAR communities throughout the west are experimenting with innovative and promising approaches for tackling their housing and transportation issues. Further analysis is needed to better understand what kinds of GNAR communities are experiencing what kinds of challenges, as well as to assess the effectiveness of different kinds of strategies for addressing these challenges; the authors will explore those topics in future publications. One key takeaway from this study is that housing, transportation, and land use decisions are highly interwoven in GNAR communities throughout the west; further research is needed to better understand this connectivity and what it means for appropriate housing and access solutions.

Title: Incorporating Livability into Transportation Asset Management Practices through Bikeway Quality Networks
Authors: Vavrova, Marketa; Chang, Carlos M
URL: https://doi.org/10.1177/0361198119840610
Citation: Transportation Research Record: Journal of the Transportation Research Board, 2019 Volume: 2673(4), p 407-414
Report/Paper Numbers: 19-00644
Abstract: This paper describes a framework for implementing livability into transportation asset management practices. The framework focuses on improving the quality of bikeway networks as an important factor to enhance livability. The Bikeway Quality Framework is explained step by step and provides ideas for assessment, prioritization, scenarios, and reporting. In the assessment phase, existing and planned assets according to applicable local plans are coordinated with pavement resurfacing projects for maximum cost efficiency. During the prioritization phase, assets in need of maintenance are ranked based on their importance, location, cost of the maintenance, and remaining service life. Scenarios analyses include both constrained and unconstrained budgets. Results of the analysis are reported using several performance measures: agency expenditures, level of non-motorized investment, bikeway pavement condition, bikeway pavement marking condition, and jobs created. The framework is applied in an example with 70 block-long sections in San Francisco, California.

Title: Quantifying the Sustainability, Livability, and Equity Performance of Urban and Suburban Places in California
Authors: Frost, Alexander Rijiro; Appleyard, Bruce; Gibbons, Joseph; Ryan, Sherry
Citation: Transportation Research Record: Journal of the Transportation Research Board, 2018. 2672(3) p 130-144
Report/Paper Numbers: 18-06140
URL: https://doi.org/10.1177/0361198118791382
Abstract: For years, researchers and practitioners have worked toward measuring urban form, but a gap still remains in the research to quantify how urban and suburban place-types affect economic, social, and environmental outcomes at small geographic scales. To provide such analysis, this paper describes the development of a place typology and sustainability performance measurement framework for all census tracts in California. This study found there were clear trade-offs between urban and suburban living. Compared with suburbs, the households in urban places benefited from a 57.9% reduction in annual vehicle miles traveled, 37.2% lower transport-related greenhouse gas emissions per capita, and saved more than US$2,675 in annual transportation costs, while consuming less electricity (39.9%) and water per capita (63.8%). However, the cost of urban homeownership was 40% higher, despite rents being 18.5% cheaper. And although obesity and cardiovascular disease rates were 10.3% and 8.9% lower in urban places, asthma rates were 7.5% higher. From 1970 to 2015, urban housing decreased from 34% to 21%, whereas statewide it dropped 7.5%. Despite ambitious climate action and smart growth goals, the majority of growth in California continues to be in low-density suburban/rural areas, responsible for 80% of the state's total household carbon emissions. This analysis and place typology could prove useful in identifying areas with the highest potential for lowering vehicle miles traveled and other sustainability, livability, and equity goals. This is made even more significant given California's recent move to abolish level of service analysis for traffic impact studies.

Title: Using Indicators to Assess Sustainable Transportation and Related Concepts
Author: Ramani, Tara
Citation: Transportation Research Record: Journal of the Transportation Research Board, 2018. 2672(3) p 92-103
URL: https://doi.org/10.1177/0361198118794543
Report/Paper Numbers: 18-03007
Abstract: The overall goal of this study is to assess the concept of sustainability in relation to the related concepts of "health" and "livability" that have emerged in transportation planning discourse. This study achieves the goal using an indicator-based case study, conducted for the El Paso metropolitan area in the United States. Data from the regional travel demand model and other sources were used to quantify a sustainability index, livability index, and health index for individual traffic analysis zones in the region, for four analysis years over a 30-year planning horizon. Each index was comprised of representative indicators, which were normalized and aggregated in accordance with common multi-criteria decision-making methods. The analysis results demonstrated little correlation between the quantified livability, sustainability, and health indices developed for the El Paso region. The indices also showed relatively low levels of change over time for a location. That is, the relative performance of a traffic analysis zone tended to stay the same, despite the modeled changes to the transportation system, demographics, and land use. The main implication of the research findings is that despite overlaps at a theoretical level, concepts such as livability and health cannot necessarily serve as proxies for sustainability when implemented in practice. The study also provides insight into the challenges of making meaningful change in the area of sustainability over time and highlights the influence of factors beyond transportation, such as land use and socio-economic issues.

Title: Building Active Communities Technical Support
URL: https://westerntransportationinstitute.org/research_projects/building-active-communities-technical-support/
Project Status: Active
Funding Amount: 60000
Sponsor Organizations:
Office of the Assistant Secretary for Research and Technology
University Transportation Centers Program
Department of Transportation
Washington, DC 20590 United States
Managing Organizations:
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Start Date: 2018-11-01
Expected Completion Date: 2019-12-31
USDOT Program: University Transportation Centers Program
Source Agency: Western Transportation Institute
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Abstract: The Montana Nutrition and Physical Activity (NAPA) Program's Building Active Communities Initiative (BACI) is a project of the Montana Department of Public Health and Human Services in cooperation with Montana State University's Office of Rural Health. With in-depth, interactive training, mentoring and ongoing technical assistance, NAPA's Building Active Communities Initiative supports community-led approaches to develop active and healthy communities. The overarching goal of the Initiative is to provide communities the tools and technical assistance they need to develop policies, plans, and projects that support safer, connected, and walkable communities. WTI's Small Urban and Rural Livability Center provided funding support for several of BACI's Action Institutes. This project will build on the momentum created by the Building Active Communities Initiative Program by extending WTI's technical support efforts. Many of the small rural communities that have participated over the years have an ongoing need for technical assistance. At the BACI Action Institutes, these communities gathered information and developed ideas for policies, programs, and projects to implement in their

communities. Many of these communities lack the technical knowledge to fully implement their ideas. WTI's Small Urban, Rural, and Tribal Center on Mobility (SURTCOM) staff have been involved with the BACI program from the beginning and have long standing relationships with NAPA, DPHHS, MDT, and Department of Commerce staff that have also been involved with providing technical assistance to BACI Action Institute and the BACI communities.

Title: Assessing Navigatability and Livability of Public Transportation Systems
URL: http://utc.mit.edu/
Project Contract Numbers: DTRT13-G-UTC13
Status: Completed
Funding Amount: 200000
Sponsor Organizations:
Office of the Assistant Secretary for Research and Technology
University Transportation Centers Program
Department of Transportation
Washington, DC 20590 United States
Managing Organizations:
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Start Date: 2018-09-01
Expected Completion Date: 2019-09-30
Actual Completion Date: 2019-12-31
USDOT Program: University Transportation Centers Program
Supplemental Notes: Project MITR25-3 (no Final Report was issued for this project)
Source Agency: New England University Transportation Center
Massachusetts Institute of Technology
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Cambridge, MA 01239 United States
Abstract: (N/A)

Title: Understanding Relationships Between the Built Environment, Physical Activity, Public Health, Urban Mobility, and Traffic Congestion: Graduate Curriculum Development (Project L2)

Supplemental Notes: The draft final report related to this project is currently out on peer review. We expect this process to be completed by Sept 2022.
Project Contract Numbers: 69A3551747104
Status: Active
Funding Amount: 22687
Sponsor Organizations:
Office of the Assistant Secretary for Research and Technology
University Transportation Centers Program
Department of Transportation
Washington, DC 20590 United States
Managing Organizations:
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Start Date: 2018-08-15
Expected Completion Date: 2022-05-30
USDOT Program: University Transportation Centers Program
Source Agency: Southeastern Transportation Research, Innovation, Development and Education Center (STRIDE)
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URL: https://stride.ce.ufl.edu/wp-content/uploads/2018/08/L2-**Abstract:** pdf
Abstract: Evidence-based research from the public health profession has determined adverse factors associated with the built environment, transportation network, urban land use patterns, and travel mode choices are contributing to declining public health and rising healthcare costs in U.S. metropolitan areas. The objective of this project is to develop a multidisciplinary graduate-level course addressing the intersection between public health, transportation and the built environment. The methodology of this course will focus on establishing basis of need for and potential benefits from implementation of optimal solutions to the challenging dilemma of how the built environment impacts urban mobility,

transportation infrastructure, network connectivity, sustainability, livability, and public health. Interconnections between the fields of physical activity, public health, public policy and engineering planning and design will be identified. The goal is for students with diverse backgrounds, in a variety of academic fields, to be able to evaluate urban, suburban communities, and neighborhoods to identify positive and adverse effects of the built environment on levels of physical activity and measures of public health, with an emphasis on adoption of polices and approaches for improving desirable outcomes supporting healthier communities. Currently, there is recognition of the need for physical activity, public health, and transportation professionals to work collaboratively. However, these three disparate fields have distinct methods and languages that often inhibit meaningful collaboration. To the best of our knowledge, this course will is the first of its kind. As such, it will bring together content from physical activity, public health, civil engineering, and transportation planning and community design. Anticipated result of this course will be education of professionals who will have requisite skills, knowledge, and abilities to facilitate collaborative efforts across multiple disciplines to improve physical activity, public health, built environment, and traffic congestion outcomes.

Title: Transportation, Land Use, and Environmental Planning
Author: Deakin, Elizabeth.
Citation: S.I.: Elssevier Science, 2019. 652p.
Source: cloudLibrary, MnDOT Library Catalog
Abstract: Transportation, Land Use, and Environmental Planning examines the practices and policies linking transportation, land use and environmental planning needed to achieve a healthy environment, thriving economy, and more equitable and inclusive society. It assesses best practices for improving the performance of city and regional transportation systems, looking at such issues as public transit and non-motorized travel investments, mixed use and higher density urban development, radically transformed vehicles, and transportation systems. The book lays out the growing need for greater integration of transportation, land use, and environmental planning, looking closely at changing demographic needs, public health concerns, housing affordability, equity, and livability. In addition, strategies for achieving these desired outcomes are presented, including urban design and land use planning, regional and corridor-level transit plans, bike and pedestrian improvements, demand management strategies, and emerging technologies and services. The final part of the book examines implementation challenges, considering lessons from the US and around the globe at both local and regional levels. Introduces never-before-published research Offers best practices for transit, cycling, urban design and housing provision Assesses emerging developments, such as smart cities, new vehicle technologies, automated highways and transportation sharing Examines the institutional and political dimensions of sustainability planning at the urban and regional levels Utilizes case studies from around the world that show alternative ways forward.

Title: Turning point : shared automated vehicles could make cities more livable, equitable
Alt. Title: Shared automated vehicles could make cities more livable, equitable
Author: Zhang, Zhi-Li.
Citation: CTS 22-07. Minneapolis, Minn. : University of Minnesota; Center for Transportation Studies, 2022.
URL: https://conservancy.umn.edu/bitstream/handle/11299/242958/CTS-22-07.pdf?sequence=1&isAllowed=y
Abstract: This report gives highlights of findings related to the potential of shared automated vehicles (SAVs), along with recommendations for policymakers, in these key areas: technological backbone for SAVs; SAV operations and revenues; jobs and prosperity; public transit; social equity; land use and

streetscapes. This research was funded as part of a National Science Foundation (NSF) Smart and Connected Communities grant (award no. CMMI-1831140), Leveraging Autonomous Shared Vehicles for Greater Community Health, Equity, Livability, and Prosperity (HELP). Support also came from Dayton Hudson Foundation funds at the University of Minnesota Foundation.

Title: Prioritization procedure for proposed road-rail grade separation projects along specific rail corridors
Author: TRB NCHRP Research Report, 2019 ; 901, 2572-3766.
Abstract: Prioritization Procedure for Proposed Road-Rail Grade Separation Projects Along Specific Rail Corridors is designed to assist state and local planners in making prioritization and investment decisions for road-rail at-grade crossing separations. The report provides a comprehensive means of comparing similar project alternatives within a specific rail corridor. Planning factors include economic, environmental, and community livability factors to support a robust decision process for making grade separation decisions. NCHRP Report 901 also includes railroad crossing assessment tool (RCAT), a multicriteria evaluation tool that considers safety, economic, environmental, and community livability factors in a set of linked Microsoft Excel spreadsheets. The report also includes a communications toolkit to help inform and convey to stakeholders and decision makers the relative objective merits of individual road-rail separation projects within corridors.

Title: Assessment of Socio-Economic Impacts of PMGSY Roads Using Fuzzy Multi-Criteria Decision Making Tool
Citation: Urbanization Challenges in Emerging Economies: Resilience and Sustainability of Infrastructure(71 - 79)
Abstract: Rural roads are one of the significant aspects which contribute to the social and economic well-being of rural households. They assist in overall development and welfare of the rural inhabitants. Pradhan Mantri Gram Sadak Yojana (PMGSY) is one such initiative taken by Government of India with a view of developing rural regions. It has been launched to enhance rural connectivity with a viewpoint of producing better economic and social prospects for rural inhabitants. The current study is an attempt to assess the impacts incurred by the construction of PMGSY roads on the socio-economic status of rural habitants. The study develops a novel model to assess the socio-economic impacts of rural roads constructed under PMGSY scheme, by employing Mamdani fuzzy interference system. A case study of Jhunjhunu District of Rajasthan State, India, is considered to validate the effectiveness of the model. Total of 33 sub-criteria under five main criteria have been considered as significant indicators to assess the change in socio-economic status of the habitations. The developed model foresees the change in socio-economic status of the selected habitations before and after the construction of PMGSY roads. Moreover, the percentage change occurred in the socio-economic status of the habitations provides an insight and clarity to the decision makers in employing different schemes to enhance the lives of the rural population. And also will assist to devise appropriate strategies for sustainable planning of rural road infrastructure.

Title: Study on Building a Smart Sustainable City Assessment Framework Using Big Data and Analytic Network Process
Authors: Wann-Ming Wey and Ti-Ching Peng
Citation: Journal of Urban Planning and Development. Volume 147, Issue 3
Abstract: This study identifies indicators of urban sustainability and smart cities and then integrates them into a unified concept. Its aim is to reduce the gap in the literature between sustainable cities and smart cities with respect to urban development guidelines. Moreover, development directions for

smart, sustainable, and inclusive urban environmental planning and design strategies are evaluated. To achieve these goals, a static evaluation system was developed and big data technique was used to construct a dynamic model. This model identifies factors that affect sustainable and smart cities and simulates changes in urban built environments under dynamic conditions, such as changes in regional development policies or space structures. Our proposed model is applied to examine the effects of both economic development and environmental issues on urban built environments. Moreover, changes in urban land intensification use mean that this model can be used to identify a set of management strategies that can meet planning targets and yield a sustainable urban built environment. Our proposed model is illustrated through case studies that demonstrate both the state of the art and the state of current practice to planners and decision makers. Our study revealed that the dependency weights of 10 indicators (listed in descending order) were “public transportation availability” (weights being 0.310), “prevalence of technology” (0.175), “greenhouse gas emission” (0.103), “domestic water use” (0.092), “living environment quality” (0.082), “decision making” (0.060), “innovation and internationalization” (0.050), “human resource quality” (0.048), “air pollution and noise” (0.048), and “government transparency” (0.032). Taipei City scored a total of 96 points on its performance as a smart sustainable city, which was weighted as 10.3919 and Singapore scored 105 points, which was weighted as 10.7528 according to the evaluation model, respectively.

Title: Overview of a Framework to Engineer Infrastructure Resilience through Assessment, Management, and Governance
Citation: Lifelines 2022: 1971 San Fernando Earthquake and Lifeline Infrastructure(901 - 913)
Abstract: Infrastructure system resilience prior to or following disruptions due to natural or technological hazards is intimately linked with and supports community resilience. This paper presents a framework, consisting of eight key elements, connecting processes and tools for assessment, management and governance related decisions, and the community outcomes. It recognizes infrastructure as interdependent socio-technical systems capable of achieving resilience through optimized flow and provision of services to users that satisfy community-level objectives by reducing social and economic losses while enhancing community wellbeing. In this paper, an overview of the framework is provided.

Title: International Methods and Local Factors of Walkability: A Bibliometric Analysis and Review
Authors: Rui Wang, Yanhui Wang and Yu Zhang
Citation: Journal of Urban Planning and DevelopmentVolume 148, Issue 4
Abstract: Improving walkability is critical for sustainable and livable urban development. Although numerous measures for walkability have been developed by researchers from different fields, systematic classification and comparisons are lacking. Few studies have discussed the inconsistency in the factors that influence walkability in different social contexts. To address these gaps, this study identified the significant researchers, keywords, and citations from papers that were collected between 2014 and 2021 through a bibliometric analysis to provide a basic understanding of walkability research. Then, subjective and objective, and neighborhood and street level measurement methods were distinguished for targeted use. Finally, the built environment factors and social factors that were found in the existing studies that influenced walkability were discussed separately. The findings of this study could help researchers from different fields to select the appropriate methods and factors and remind them that the sociocultural and socioeconomic causes of local differences should be fully considered in walkability assessments. In addition, due to the advantages of low cost and high efficiency, the automatic virtual audit should be recommended for future walkability studies.

Title: Causes of Spatial Patterns of Livability in Chinese Cities: MGWRL Analysis Based on Didi's Big Data
Authors: Jingjun Hao, Peng Zhang, Wei Yu and Xiaoqing Mou
Citation: Journal of Urban Planning and DevelopmentVolume 147, Issue 3
Abstract: Continuous expansion results in urban problems such as congestion, pollution, and crime that seriously threaten the sustainable development of Chinese cities. How to promote the development of efficient and livable cities in China is of great significance in easing the pressure of urban development and promoting healthy urban development. Based on Didi's “urban development index,” this study explores the spatial distribution and spatial driving factors of urban livability in China through Theil index decomposition, standard deviation ellipse analysis, global and local spatial autocorrelation analysis, and multiscale geographically weighted regression with lagged dependent variables (MGWRL) model analysis. The results reveal the following three points. First, China's urban livability presents a spatial pattern of “east-west-middle” decreasing, with large spatial distribution differences and significant spatial dependence. Second, the effects of urban livability influencing factors have spatial scale differences. The impact of global variables such as human capital, fixed assets investment, medical level, and greening degree on urban livability is consistent at the global level. Local variables such as finance, urbanization, advanced industrial structure, and foreign trade only have consistent impacts on urban livability in local regions, and the scope of these regions varies with different variables. Third, it is further found that the effects of some local variables on urban livability have spatial heterogeneity. The effects of finance on urban livability shows a decreasing trend from east to west and from north to south in space; the effects of advanced industrial structure on urban livability are spatially characterized by outward radiation attenuation along the Yellow River and the middle reaches of the Yangtze River; only less than one-third of the local regression coefficients of variables such as spatial lag, urbanization, and foreign trade passed the significance test. Relevant government departments should pay full attention to the spatial pattern and spatial dependence of urban livability in China, and make overall planning and improvement strategies; attention should be paid to the spatial scale difference and the spatial heterogeneity of influencing factors in policy formulation, and the differentiated development policy of livable cities should be put forward according to local conditions.

Title: A Proposed Framework for the Incorporation of Economic Resilience into Transportation Decision Making
Authors: Davis Chacon-Hurtado, Lisa L. Losada-Rojas, David Yu, Konstantina Gkritza and Jon D. Fricker
Citation: Journal of Management in EngineeringVolume 36, Issue 6
Abstract: The profound effects of the Great Recession sparked not only research in terms of the definition and characterization of resilience to economic shocks, but also policy-making discussions about building more resilient economies. Nonetheless, whereas regional economic resilience is frequently discussed in the political and research agenda for civil infrastructure, project-level analysis integrating resilience into decision making is still scarce even though the built environment, and in particular transportation systems, are recognized as crucial elements affecting regional economic resilience. Consequently, the assessment of the role of transportation infrastructure in economic resilience is limited. This paper discusses literature on the intersection between transportation and economic resilience planning, describes the findings from an expert opinion survey about economic resilience and transportation, and proposes a theoretical framework to incorporate resilience indicators into the decision-making process for transportation projects at the sketch-planning level (i.e., the initial level of decision making). A case study for State Road 3 (SR-03) in Indiana is presented to demonstrate an application of the conceptual framework. The survey revealed that experts are aware of the concept of economic resilience, but the concept is not necessarily applied in transportation planning. In addition, the reviewed studies and survey results showed that planning for economic resilience requires the

consideration of regional characteristics, including industrial diversity and human capital, in addition to transportation accessibility.

Title: A review of quality of life (QOL) assessments and indicators: Towards a ‘‘QOL-Climate’’ Assessment framework
Authors: Ronald C. Estoque, Takuya Togawa, Makoto Ooba, Kei Gomi, Shogo Nakamura, Yasuaki Hijioka, Yasuko Kameyama
Citation: Royal Swedish Academy of Sciences. 11 September 2018.
Abstract: Quality of life (QOL), although a complex and amorphous concept, is a term that warrants attention, especially in discussions on issues that touch on the impacts of climate change and variability. Based on the principles of Reporting Standards for Systematic Evidence Synthesis, we present a systematic review aimed at gaining insights into the conceptualization and methodological construct of previous studies regarding QOL and QOL-related indexes. We find that (i) QOL assessments vary in terms of conceptual foundations, dimensions, indicators, and units of analysis, (ii) social indicators are consistently used across assessments, (iii) most assessments consider indicators that pertain to the livability of the environment, and (iv) QOL can be based on objective indicators and/or subjective well-being, and on a composite index or unaggregated dimensions and indicators. However, we also find that QOL assessments remain poorly connected with climate-related issues, an important research gap. Our proposed ‘‘QOL-Climate’’ assessment framework, designed to capture the social-ecological impacts of climate change and variability, can potentially help fill this gap.

Title: Victims of their own (definition of) success: Urban discourse and expert knowledge production in the Liveable City.
Authors: Jenny McArthur and Enora Robin
Citation: Urban Studies. Volume 56(9).
Abstract: The notion of ‘liveability’ has endured for over 50 years within policy discourses, shaping urban strategy and planning across the world. This Debates paper examines the current state of liveability discourse. Liveability is unpacked to consider the rhetorical work that it does to frame urban problems, select and order concepts and build narratives that shape policy action. Liveability dis-course has a dual role: it defines normative goals for a city and also reifies and demands particular forms of expert knowledge to justify and maintain its discursive power. This power is created by connecting the vague rhetoric of the ‘liveable city’ to expertise represented in liveability rankingsand indicators. The experiences of apparently ‘liveable’ cities show how liveability discourse cre-ates a representation of the city that is in contrast to the experience of many residents. The useof aggregate metrics and reliance on indices generated from undisclosed data sources and ‘expert judgement’ obscures the differentiated quality of life and everyday experience for urban populations. Therefore, liveability discourse has exerted and maintained stronger discursive power to undermine urban livelihoods than to improve them, due to the phenomena and qualities that it conceals. Liveability’s distinct type of discursive power must be recognised and mobilised to sup-port a counter-narrative that reconnects urban policy with everyday urban life.

Title: Livability for whom?: Planning for livability and the gentrification of memory in Vancouver
Authors: Giuseppe Tolfo, Brian Doucet
Citation: Cities: The International Journal of Urban Policy and Planning. Volume 123.
Abstract: ‘Livability’ is common planning term that erases conflict over urban space: who would oppose a more livable city? This article investigates differing manifestations of the City of Vancouver's commitment to livability. Planning policy in two adjacent downtown neighbourhoods frames livability in

distinct ways: in one neighbourhood, it is centred on aesthetics, design and amenities; in the other, its focus includes affordability. A frame analysis helps to understand what aspects of reality are included and omitted in these differing interpretations of the same term. Because this framing of livability has spatial boundaries, we argue that when land is shifted from one planning area to another, policy priorities change, and gentrification can occur as a result. But in both neighbourhoods, livability discourses facilitate and justify dispossession through the gentrification of memory – selectively omitting the past to build more productive narratives in the present. Vancouver's heroic story of urbanity and livability come at the expense of others who are erased from these narratives. Planners and scholars can render visible these histories by centring conflict and displacement within any analysis of livability, building stronger and more meaningful ties with community activists and advocates, and by addressing the question of 'livability for whom?'