DEPARTMENT OF TRANSPORTATION

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February 2024

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 peoplefocused 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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Technical Report Documentation Page

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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 selfsupporting approach to ensure a human-focused set of outcomes. These include tools like the <u>Census Business</u> <u>Builder</u>, <u>EJScreen</u>, and <u>Bicycle Network Analysis</u>. 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 transitaccessible 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-today 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											Review Matrix					
	Info	rmation				(Article conten	Livability Pillars I	Mentioned re of MnDOT's Livability Pillars)			Use / Understanding (How the pillar is understood)			Summary/Applicability		
Reference Number	e Title	Author	Publication year	Health & Environment	Economic Vitality	Sense of Place	Equity	Trust	Connectivity	Safety	Measure / Representation / Interpretation / Evaluation / Tracking	Context (Urban, Suburban, E Urban, Rura (Neinbhorbo	x- Results / Key findings I) od	Short Summary (1 - 2 sentences)	General Definition of Livabilit (if provided)	y Notes
1	A Proposed Framework for the incorporation of Economic Realines into Transportation Decision Making	Davis Chacon Hurtado	202	0No data	The literature review an unwey results have maz- evident that transportation is neces- sary but not a sufficient factor for accounti- resilience. Therefore, all other components of resilience should have considered. A koychallenge is identifying messurable outcomes of infrastructurumanagem nt that could be linked to accountir resilience.	nd e t ne No data	No data	No data	No data	No data	Based on previous research focused on the association of tame portation inflastructure and the economic performance in the region of indiana (Chacon-Hurtadostat.2017a, b), tho accessibility measures were considered accessibility to labor and accessibility to markets. The former is represented by the number of adopt that could be marked within 4.4 mm dist and the tattice type tacquitance within a bin min drive.	No data	No data	The results of the literature review and expo- opinion survey show that although transportation-related factors are possible associated with realience, they are not the permany factors larged to sellicent region. Factors such as doctation and industral Monever, these terms of the second second with industructure management because good infrastructure provides access to education opportunities and influences the level of integra graduational regions.	nt No data	No data
2	A Smart Growth B Equity Fammends and Food Too	Bruce Acciowand, et al.		No da	Nodata	Nodata	Nodata	Noda	Nodata	Nodas	Data Used in the Smart Growth & Social Equity Calculator Sustainability, Univellity, Equity component: Marty per bounded Marty per bounded Prederation relatedability Prederation and Stateballity Prederation and Stateballity Prederation and Stateballity Prederation and Stateballity Prederation and Stateballity Casesity Usitan Form, Uppeduality, Jong; Prederation and Stateballity, Jong; Pr	No data	10 551	Dr. Buce Appleyard, et al., developed an online Start Goovih Equity (SGE) Calculato and the start of the start of the start of the equitable (SLE) and cancer, understand what SLE performance areas in strem of how on response with policies, and provide guidant on how to ream gradicate to realize more related transportation land as integration specific the start of the strength of the strength specific the start of the start of the strength of the specific the start of the start of the strength of the specific the start of the start of the start of the start of the specific the start of the start of the start of the start of the specific the start of the specific the start of the start of the start of the start of the start o	r e	and planning support tools are useful only insofar as they help been as they help been as they help been as they help been as the second second plants, and investments, particular, particular, partornave measures help communities whether and investments help communities and been as the second help communities to people to a shale providing opportunities for people to a shale providing opportunities for people to a shale providing opportunities for people to a shale to use transportation system performance measures that are congestion and mobility subality sustainability, liveability beginning to enter beginning to enter
2	Active transportation and social capital: The association between walking or biking for transportation and community	eruce Appieyaro, et al.	206	Active transportation may not only promote physical and mental health, but also bolte social capital. The current study assesses everal aspects of soci capital and showed th active transportation was positively related greater community	r The survey revealed al that experts are aware at the concept of economi resilience, but the to concept is not necessarily applied in	No data of ic	NG 0312	No data These research that found perceived community wallability to be associated with community engagement and social capital The findings also support and expand researchthowing linkage between active transportation and social participation and social	No data 1	No data	reactional devicement (interfaction dentry)	No data	No asia These findings are important for policy and planning years as designing supportive environments and removing barriers to active transportation can foster social capit through badreting community participation. The been of active transportation may be broader than previous understood and underscore the need to promete activ	This study's findings are important for polic and planning work, as designing supportive environments, removing burriers, and creating policies to increase active trans- ork, portation can foster social capital through bolteting community participation. I be bittering community participation bittering community participation way be bit bitader than previously understood and underscore the potentially wide-ranging importance of promoting active	Ye data Transportation accessibility also contributes to a region's livebility, defined as the level of access to broader opportunities, such as employment centers, affordable housing, quality chocks, and as	appears to be no
3	participation Adaptation and testing of a microscie audi to to bases livebility using google street view. Mark's insubility	Ansica Stroppe	200	Iparticipation bo data	transportation planning	MAPS Liveability maple: assessments of micro-level characteristic (such as pavement, bicycle travel. This can inform recommendations for amenity/facility installation, rejournatic and/or modification,	No data 4 No data	trust.	No data organization of the set of the set organization of the set	No data d d y s s s , , , , , , , , , , , , , , , ,	Surveys of health Massues of study area include: Type of readential desire None readential desire None of straits territorial states None of straits territorial Social state data Social state	No data	Tangontion	transportation. Microscale Audit of Pedestrian Streetscape (MAS) has been adapted over time to provide a basical and inclusion render of a street releval. March Joulishing Journal of the street releval. March Joulishing Journal of the street releval. March Journal of the streets of the street relevant of the streets of the street of the streets of the street relevant of the streets of the street of the streets of the street of the streets of the street	threets and mask (PHWA 2018). Lippon review of the differing definitions, it is apparent that although each has been reflead to suit the focus of predict applications all distributions to varying degrees, suit the focus of predict applications and administrations to the suit of a sub- suit the focus of predict applications and administrations to varying degrees. We all the focus of predict applications and administrations to varying degrees. We all the focus of predicts and follow standards which relates and follow standards which relates and follow standards which relates and follow standards which relates and follow at leadings and the sub- stant of the scale additional determinants of health	No data 15, th, c d & No data
_	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 Ntherdende				Nodata	Transit-oriented development: a walkab 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	s,	Midda	No das		Masauto yuulitay tima tawal tana, aaf caaf fo hafuddak using an Autonomou. Malalan yu hannya ta inaal safama 1 sacata mahaa.	Nodara	koran	Despite its sustainability, public transport limited attractiveness, because of first and last mile connections. The combination of autonomous vehicles, ridedating, and use wireless fast charging is the most financially within connection.	as of	

							re Review Matrix						
Information			(Article content	Livability Pillars M speaks to one or mor	Ventioned e of MnDOT's Livability Pillars)			Use / Understanding (How the pillar is understood)			Summary/Applicability		
Reference Title Author Publication Number	year Health & Environme	Economic nt Vitality	Sense of Place	Equity	Trust	Connectivity	Safety	Measure / Representation / Interpretation / Evaluation / Tracking	(Urban, Suburban, Ex Urban, Rural	- Results / Key findings	Short Summary (1 - 2 sentences)	General Definition of Livabilit (if provided)	y Notes
An evaluation of leability in crusting transit emicked communities for g imported regional Weeky £ Manbail	2013 No data	No data	No data	Nodata	No data	No data	No data	1 Minimize insurantiplica of non-intensive technological constraints and are efficiency. One space within 1- miller of statistical constraints by technological constraints and constraints and constraints and constraints of technological constraints and constraints and constraints and constraints of technological constraints and con	No data	Asking how TOD can address bradler, more nuanced yes still measurable community issues, leads to a different se of solutions but may be better subtact based adheving myscarab tending the unbalay.	Using an adaptation of the Transportation Index for Sustainable Transportation (TBP), the research operative dialed astern of TOPs thoughout the Universe reteris. The measures of whole commonly metrics and realism of whole commonly metrics and realism of whole commonly metrics and realism of operation management shad not be most critical principies in TOD design or measurement of the scores.	The degreets which a place, be it a neighborhood, teams of a place, per the sequence of the sequence of the sequence of the sequence who have a high level of and widespend accessibility to, amonty?	ts L No data
Assenioj Mohlity Masaure for Socialy Sastanjak Visikarfoot 7 Redevigement Pagesta Basah Motaz Handoon	2022 Mo data	No data	The assessment method method on an established theoretical framework that defined the principles and indicators of both the mobility morphological measures including Compactness and Denvisy, Niked-Use Development, Accessibility, and Mobility Networks Connectivity and design mobility measures including Comfort and Usability, Safety and Security on the other land.	No data	No data	No data	No data	Marghological mobility-related measures: Compares and other than production of the sease cyclo (FAR) Compares and opposite the production of four area dedicated to account a strivity: howing: local ammentical Accessibility walking activitient distances Commentity and impairs of mobility relations areas of movement by each transport method walking activitient distances Commentity and impairs areas for a participant of the comparison of the sease compares and the sease for any operative test and product the compares the favorement (participant standard measures	No data	The research findings proved the validity of the applied assessment method, with its relevant investigation tools, makes it a logitimate reading method for the valencher our segmentation objects in the UKL gain of the attainment of social statisticability in waterhoot urban organeration projects.	This framework encompasses two sets of the main urban mobility measures, amely, the morphalogical/urban form mobility measure inclusing Compactness and Densky, Moad- Las Development, Accounting and Calendactivity and Integrated and Calendary and Integrated and Calendary Calendary and Society The main of the qualitative/parentiative investigation tools used in examining lates of dired mobility the results of an urban of the qualitative/parentiative investigation tools used in examining lates of dired mobility the direductive of	Nodata	Nodata
Assessing the influence of connected and	2022 Min data	Economic Vitality: Key financial levers, such ar read use pricing and parting revenues can drive a vitrous cycle (reinforcing effect with positive outcomes), by enabling investment le improved PT and more attractive public space both of which can improve community cohesion and strength leading to increased ci revenues, driving economic vitality.	Public Space: Connected and Automated Mobility (CAM) risks a continued lock-in of negative s, effects from privately owned vehicles, as there is likely to be an increase in WMT, leading to more a stronger traffic barrier effect	No deta	Community Colecion and Strength By increasing mobility options for non-motionic, CAM tast the potential to improve a city's ownall community strength and colesion, through a variety of exactl methanismis, includings improving methanismis includings improving community ungagement by readering the low backet of the readering the low backet of the reade	: No dan	Nodan			Quality of Life (QA) is a dominant concern for city planner, regardless of how it is achieved; the specific co new arrives or technologies (puch ac CAM) are second	Using qualitative methods, the massarch team produced a high level caual loog diagram (LD) that can be used as a start for any future research in the area of Connected and Automated Mobility (Automated Mobility Automated Mobility in others and which may research thereft may produce AUM model	Uneability in cities relates to the physical, acoust and cutural factors that can had to equal access to opportunities, ensuity of life (Oct) if and accession	le X
additivation industry terminal (w. a) Assessment of Socio- Economic Impacts of PMGV Reads Using Fuzzy Multi-Orten Doctorel Database Doctorel Martanel Waggle	2017 No data	economic vitanty: Rural roads have helps in stabilizing income sources and providing different avenues of income diversification diversification they also have assisted in improving access to health and education facilities.	enect. ad No data	No data	ene une canaparation options	For rural communities roads are lifelines, they provide new possibilitie for development by connecting them to the nearest economic certers (seasonal/regular).	no data	polarison of opchascing electrary Rizzy bagic reasoning is a best-suited methodology for handling uncertainty and complexity associated with the evaluation of sustainability conditions. Conversing data to 8-1814 statements.	Rural	Considering the outcomes, the fluxy logic reasoning rook Considering the outcomes, the fluxy logic reasoning more herein the asability to serve as realistic tool for decision as policity anakars. Advances to achieve their goal of sustainable rand development	sel d This study seeks to understand the socio- economic impacts (SB) of rural readway / transportation projects.	No data	No data
Bayord Multimodel Merics Advanced Services and Over 10 Evolving Environment Delicolaritis, Michaele Bicycle and Pederation Manual Count Programs Assessing the Facultary and Volucia for Manuaring	studies at the second studies of the seco	wels: arand J arand	y: s. No data	No data	No data	Impacts on other model Multimodal impacts have been the most studied—i.e., change in modal papel, increases thange in bus travel time, and access to change in bus travel goods and services. 7 Other research focused goods and services. 7 Other research focused indicators measuring pedietizina safety, indicators measuring pedietizina safety, activactiveness in urban areas.8	n No data	New Yol Larger, catalweightes for mixturkis, polististians, cyclistis, which great Volume of vehicles, bus passengers, Bingles inder Cascomic validity polisistism in a pulse status and the status polisistism in Tables passes status polisistism in a pulse status and the status polisistism is status and polisistism in a pulse status and the status polisistism is status and polisistism in a pulse status and the status polisistism is proport for polisistic difficult and the status polisistic and the statu	Urban	This paper outlined four lay areas that should be assess that impact on transit, locyclog, and autoing impact on impact of the state of the state of the state of the minimum rest impact, and a decomini impacts. These are numerous indicators within each of these areas, also all performance metrics should be assailable at the state of the period devolutions. How more projer data collection before and there communities devolution of the individual to conduct const. management d existing programs, and how they facilities allocating means, and community facilities in durations facilities allocating means, and community exagement. The statements or need for used is indervolutions for the facilities allocating means, and community exagement. The statements or need for a large in statements means for the conduct functions are a facilities assumed to fort	Pat metrics centered on automobiles each, interaction twice of rearice (SQS), and new new metrics cash a which emits of twice (MM), full to capture the full range of benefits of these new strategies to mobile regression of the strategies of the strategies of appendix the strategies of the strategies of appendix strates, the strategies of the strategies appendix strates, the strategies of the strategies appendix strates, the strategies of the strategies appendix strates, the strategies of the strategies of the appendix strategies and strategies of the appendix strategies and strategies and economy. Big System and patients in measure dischares and economy. Big System and patients in measure strates program as an used and patients and big System (strates) appendix and patients and big System (strates) appendix and appendix and big System (strates) appendix and appendix strates).	: No data	No data

Literature Review Matrix																
	1-					(Article contr	Livability Pilla	rs Mentioned	(its Dilloct)		Use / Understanding			Cummen (Analisability		
Reference Number	Title	Author	Publication year	Health & Environment	Economic Vitality	Sense of Place	Equity	Tn.	ust Connectivity	Safety	(now the pillar is understood) Measure / Representation / Interpretation / Evaluation / Tracking	Context (Urban, Suburban, E Urban, Rura	Results / Key findings	Short Summary (1 - 2 sentences)	General Definition of Livabilit (if provided)	y Notes
	Causes of Spatial Patterns of Livability in	n			_							(Neighborho	Not Relevant government departments should pay full attention to the spatial pattern and spatial dependence urban livebility. 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 and the should be added to the should be added to the should be added to the spatial heterogeneity of influencing factors in policy formulation, and the	of This study explores the spatial distribution		
12	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	be put forward according to local conditions	and spatial driving factors of urban livability	y No data	No data
											Input metrics Ray lepot 1: Regional economic data: Modal split More population Economic growth ata Auranys lenatoric and Contrary Liparadia Difficult and Difficult					
13	Climate Resilient Urbar Mobility by Non- motorized Transport	in Joseph, Kigozi	2022	No data	Net present benefits of an improvement	No data	No data	No data	Modality	No data	Rahadron metrics Generation Manufactures (COD), Noncogen Duides (NDD) and Particulatemative (PM emissions Hashb benefics Difference in distance traveled, on of users, physical activity instructure, yielding and persent value of physical activity formount: yell and a racident reduction Samping of user costs Times anings Times anings	s) No data	All indicators discussed can be monetized and a net present value (MPV) for each indicator can be determine The sum of the NPV can be calculated, then, as the Net resent Bendin (Spil). The VP of the enter preject can calculated by subtracting the Net present Cast (NPC) for the NPB.	d. This paper seeks to answer the question whether non-motorized transport (MMT) se projects are economically viable and how cities can maximize benefits of NMT for Climate concisies corositic growth.	No data	No data
	Community and Quality of Life-Data Needs for Informed Decision- Makino	ty	nd 200	Nodara	Nodata	Nodata	No.data	Nodeta	Nodra	Nodeta	No served manufact	Nodata	Many geographic boundaries are arbitrary and affect the collection of geographic data and the measurement of lowability. Human settlement indicates exhibits ubattant and complex variability with respect to tima as well as place. Recording lowability data for a place only a tone particular time can misrepresent urban and regional structure and processes. Livebully houd be availyped on tima well as space at time scales varying from daily to available months under some finities a decorder and the most some some some some some some some some	ial This report discusses livability metric theory including but not limited to the importance of place-based indicators and the er appropriateness and comprehensiveness, o lack thereof, of both government and privat distance	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 other and behavior commuties	d Modeta
	Commute satisfaction, neighborhood satisfaction, and housir satisfaction as predicto of subjective well-bains and indicators of urban	ng ors 19 10				The pathways betwee the urban environme which includes both physical built environment and the social environment - subjective well-being can be explained by domains that mediat this relationship Oomain 1: Neighborhood astisfaction; Domain 2: Housing	en ant – the and g life te		Domain 3: Commute				Commute satisfaction was found to be linked to subject well-keing indirectly, manity via neighborhood satisfact and jub satisfaction. Neighborhood satisfaction as bor unitar to subjective talking diverticity but also unitar to subjective talking diverticity but also satisfaction, and leave satisfaction is but one satisfaction, and leave satisfaction scattering and satisfaction. And leave satisfaction scattering and scattering and scattering and scattering and scattering and scatter	Commute satisfaction, neighborhood we satisfaction, and housing satisfaction can be used as indicated or utarn quality of the model and the satisfaction of the satisfaction of the satisfaction and the satisfaction of the satisfaction indexed predictors of subjective web sheing and reliable indexed predictions of illubility and reliable predictors of subjective web sheing and reliable indexed predictions of illubility and satisfaction of the satisfaction of the satisfaction of the satisfaction of the satisfaction of t	e Lubbility could be described as "the destruction profile and the available environment and the available services fulfill the recident," needs	,
15	livability	Kostas Mouratidis	2020	No data	No data The economic benefits	satisfcation	No data	No data	satisfaction	No data	Survey instrument and descriptive statistics	No data	subjective well-being.	quality of life in cities	and expectations"	No data
16	How Do Complete Street Matter for Communice The Commencies of Skared advances	xe a Phinney, Robin	2020	Research suggests that any impact on health any impact on health cutcomes, except for injury or death due to accuest swith vehicles occurs targely through an impact on activity. Ja result, we would of activity emerge befor a factivity emerge befor a data with event outcomes. Second, the we significant data constraints on accession data that can be disaggregated below the city level	Interesting of the second s	i i of n No data	No data	No data	No data	By incorporating modifications to the rand designed to induce traffic speeds, sparsed and optimises from whickes, and potentianes, optimises, and potentianes, optimises, complete Streets, can public transit uncertainty rand can and existing accidents and an improvement in the perceived safety of the read	Luability measure: Difference in difference (DO) analysis. The DD 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 experimence the intervention or treatment common ways may measure similatural enterview. With over a card or on-site managem of businesses and the activity country via US corress and tempoin County 48 hour count data; qualitative and survey data and the activity country via US corress and tempoin County 48 hour count data; qualitative and survey data	a No data	At the time of the study, residents and business convers were still adjusting to the changes in street design business courses operated uncertainty and apprehension adds the impact of the new treet display course have a countable to the street display. The street display count in the street display and the street display counter the magnet on active histopheasen resident had not yet has the opportunity to experience the random in summer Residents and business owners are affected by steer adjustent to accounteration and street and the street adjustent to a reconstruction fraud. This means that adjust adjustent to a reconstruction fraud. This means that adjust adjustent to a reconstruction fraud. This means that adjust adjustent and ware and adjustent and business conversion one particularly a regular that occur in another part of the chy	In tradition to the Congrists Streets (Instantion), Richfeld Sines Streets include guiding priciples for transportation and and use painting, and specific plants of cyclists, pedestrains, and those with physics disabilities. This approach focusies attention on the needs of different types of users (true and multiple form or transportation, and the charge the experience of the rota for all bypes of users, the constructuations and about on trips the experience of the rough out the visition of the specific of the rough out the visit bypes of users, the rough to the visition about on the rough to the visition of the rough to the visition of the rough the rough to the visition of the rough to the visition of the rough the rough to the visition of the rough to the visition of the rough the rough to the visition of the rough to the visition of the rough the rough to the visition of the rough to the visition of the rough the rough to the visition of the rough to the visition of the rough the rough to the visition of the rough to the visition of the rough to the rough to the visition of the rough to the visition of the rough to the visition of the rough to the visition.	al 15 15 19	No data
	vehicles could make cities more livable,															[Think piece on shared
17	equitable Do corporate social responsibility ratings have any effect on traffic congestion	Zhi-Li Zhang ffic Bakare, Bukola, et al.	2002	Traffic Congestion (TC) continues to be a majo 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, athm and stunted lung grow in children.	No data TC is also an important economic issue: congestion-based delay result in restricted economic growth that directly impacts s revenue. Businesses los money due to delays in a, shipmentc, losses of trub productivity, and waste fuel.	No data rs d No data	No data	No data	No data No data	No data No data	(No metrics provided)	No data	No data Congestion has a titrong impact on the environment and that companies, through their employee poloice, can impact traffic, competition (C). The results also highling congestion indication company and their company congestion indication catagias as a part of their company measure or as part of their environmental or employee C antings.	No data Cities can curb congestion by implementing supply or demand side interventions to mitigate staff: congestion (TG) — so can congorations. This and/set sets to undername SR / congesto scoil a responsibility (SR) ratios mitilate to traffic congestion.	No data d S No data	autonomous vehicles]

										Literature	Review Matrix					
	Inf	ormation				(Article conte	Livability Pillars	Mentioned re of MnDOT's Livability Pillars)			Use / Understanding (How the pillar is understood)	Context		Summary/Applicability		
Reference Number	Title	Author	Publication year	Health & Environment	Economic Vitality	Sense of Place	Equity	Trust	Connectivity	Safety	Measure / Representation / Interpretation / Evaluation / Tracking	(Urban, Suburban, E Urban, Rura	- Results / Key findings	(1 - 2 sentences)	General Definition of Livabilit (if provided)	y Notes
19	Dynamic Modal Accessibility dap Messurement and Application Using Travel Route Data	4 Arpeng Guan	2000	No data	No data	No data	No data	Nedata	conjection, makar emergy consumption an emergy consumption an emergy consumption an emergy consumption and protein/ingpublic transportation is a common strategy. However, many tacple for their ability tacks, or moged for their ability tacks, which can destinations, which can destinations, which can destinations, which can be appreciated in their product targeorportation, such as bus and methor has appropriate integration on and provide milable accessibility to certain Polita targe given time	d 5 9 No data	Data sets Taul data collected from orbioard devices, metro smart card data and metro station locations, and PC data statuted from maps (including hotels; restaurants, supermarkets, malis, parks, schools, parking lots, pharmacisk, hopping lata, and banks) Departic accessibility calculation with the real-travel covered areas by TAD as travel mode) —(Pparmic accessibility calculation with the real-travel covered areas by METPD as travel mode) (Dynamic conclusions) and HTMC calculation with the real-travel covered areas by METPD as travel mode).	Urban	o Tasis are better at getting to PDA in the city conter and periphery, generally, the metro-gets higher PDD accessibility during monigin and evening peak hours on workstyr.	This study proposes a new index called dynamic modal accessi-bility gap (DMAG), which draws upon assible data on resident's risk towell routine, using dynamic interest (POA), whereas PDA accessible pro- prodominantly been considered via usage or POA:	r No data	Nodata
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 precinit structure planning guideline: 2.2 Place measuring access to transport and the built environment features in growth areas 2.3 Lincostnet data with diversing paragraphic structures and the structure of the built environment (struct 2.2 Descriptions) and interfaced on pulphorhood boundhards, measurement of the built environment (struct 2.2 Descriptions) and interfaced on, endition of gravity data (blocks) and open spaces, and fineh lood and spacially strong, and access to transport (distance to closer 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 scittle transport. However, access in redeet when these demonst 6 not exist or are didayed in their delivey to area:	Although planning policies support the development of active transport and healthy lovable cites they are insufficient for influencing healthy behaviour, when on twe implemented. Early delivery of social and transport inflastructure and services must coccur any in the development cycle of new growth areas to support healthier and more sustainable behaviours.	i Ii No data	No data
21	Effectiveness of Transportation Funding Mechanisms for Achieving National Economic Health and Colomic Health and Colomic Health and Colomic Health and Colomic Health and Colomic Health Colomic Health Col	Rebecca Lewis	2018	No data	No data	No data	No data	Fouring public funds and recover an being effectively inspectively sport on transportation investme	cce nts ccs No data	No data	Pineter Valley MPO (Mastachusethe) Regional Performance Measures and Targets Model Emosuses Connected, Naholila Area MPO. Number of Repells Region With Meise Markon 2. Number of Repells Region With Meise Markon 2. Number of Repells Region With Meise Markon 2. Number of Repells and Day 4. Fatal Weise Miles Traveled or Dorspetel Acutes the Region 3. Dow way Trays For Capita and Day 4. Fatal Weise Miles Traveled or Days Miles Traveled per Capita and Day 4. Teach Capita and MPO, 2116). Tabal Long Range Transportation Meise Monte Strategies and Meise Traveled on Competend Routes 10. Daily Travel Meise Markon 2. Tabal Long Range Transportation Res (2015). Tabal Long Range Transportation Res (2015) Tabal Long Range Transportation Res (2015) Capitation Malinity UBOCT continuously drives to naile the transportation system work better while quickly means. This and Progetory and Technical UBOT is committed to safety and work treat while quickly means this and Progetory and Technical UBOT is committed to tarkey and work treat while quickly means. This and an effect and Longaring capacity: a Manage Spettern traveler Information derithalmon- ments and tradition and and tradition of antibulano. Progeneemistic 1. Capacity Capacity Transportation system work better while quickly means. This and antibular derivation and tradesing index the management. B. Ophimias System: signal optimization improvements and managed lates performation. Premers Informations prevent and tradesing index tradesing index the presention. UDOT will and the Kium a Phemeent Conditions paneters conditions cafe and though practice presentation. Program	No data	The study covered sizes at studies dates and their enables, respective MCS, Hava 1: Flarming . - Develop performance measures that reflect local priorities, - Paulo tanhow devide ductomes cost effectively. Hava 2: Covernees 6 Interest - Paulo tanhow devide ductomes cost effectively. Hava 2: Covernees 6 Interest - Paulo tanhow devide ductomes cost effectively. Hava 2: Covernees 6 Interest - Paulo tanhow devide ductomes cost effectively. Hava 2: The covernees for the covernees for the covernees for the covernees of the	This study pagets a understand how effectively as the particular investment define dealed outcomes: multi-ong commu- tions, improving the accouncy, supporting community development, enhancing public health, providing care is and advanced profile and the production of the APGA were generalized transportation. Fundal public and how rates and APGA report plans, and how rates and APGA report plans. The advanced to children and advanced to children and advanced to children and advanced to children and plans. The advanced to children and plans. The advanced to children and advanced to children and	e J	Nodata
21	Equitable transportation planning- curriculum Final-Report	nitoloco Levit n- Tia Boyd, et al.		No data	No data	No data	No data Equity in transportati planning helps to en- equal access to atransportation, as well transportation, as well distribution of its benefits and burders. Without inclusive processes, transportation planning and negatively imp erconsumities, inclusive percensumities, inclusive percensumities, inclusive communities, inclusive percensumities, inclusit	That fire equilation, worthy impair are as as as as as as as as as as as as as	No data	No data	constant, age dutricultion, povement and tringle expenditure. C Maintenance Upany Addutice Program Measurement of Isaming and comprehension through a Learning Outcome Assessment Rubric Learning outcome Electers (Good) Poor	No data	Apport industria on investments to supplies: This surficience provides emerging transportation professional with an extension optimal or paragonation	extronue to citation. This curriculum will provide emerging professionals with the training and took needed to successfully integrate equily into transportation discharching integrate students taking the curate will gain an appreciation for the takinois impects to di- generation and the student and the student of instance concepts, including accessibility, endelity, advicatibility and sustainability	No data	NO 333
23	From tempocary arrangements to	Katherine Vankoose	2022	No data	No data	No data	No data	The transition is more sustainable and linebic cites is a formdable ones an entire water mobility system, including user behavior, governmere policies and maket farmovok, institutional arrangements, and existing infrastructure, must be ownhave for the set operation of the cost, box is any to explore (City these t-operations) and existing infrastructure, must be ownhave for the set operation of the cost, box is any to explore output of the set of the cost, box is any to explore to the street user, and using A "interintional and temporary charge sustainability and isolating. At "interintional and temporary charge sustainability and isolating and and public life" (and a significant data public life") and and any public life" (and a significant the usban mobility system "that enconcents street as split-foliac to convivality"	e v- ges x y y y t s SNo data	No data	2759/JRE Free and an interview of the second	No data	City steet experiments are investingly being implemented as ways to epidon possible solutions to indusing and internation of contemporary unan molity. The analysis highlighted the following patterns regardler ty treet experiments and their transitional capacity - There insta a brand consideration between the candidate dimensions of sharps and their transitional or well dimensions of sharps. - The shartwrite dimensional sharps matching be the dimensions of sharps. - The shartwrite dimension of sharps matching be the dimension of sharps. - The shartwrite dimension of sharps matching be the dimension of sharps. - The chartwrite challenge-dimens in wask, however - The chartwrite challenge-dimension in galaxies informal jackmobility as a social molecular and the dimension of charps. - The chartwrite charge is used as deposed to have - the dimension of chargs. - The chartwrite charge is used as deposed to have - The chartwrite charge is used as deposed to have - The chartwrite charge is used as deposed to have - the charge is social capacity is the dimensione of - the charge is social charge is social dimensioned - the charge is social charge is used as deposed to have - of demonstration of - the charge is social charge is used as deposed to have - demonstrationed - the charge is social charge is used as deposed to have - demonstrationed - the charge is social charge is social charge - the - the charge - the charge is social charge - the - the charge - the charge is used as deposed to have - the charge - the charge is used as deposed to have - the charge - the charge is used as deposed to have - the charge - the charge is used as deposed to have - the charge - the charge is used as deposed to have - the charge - the charge is used - the charge - the	a This report presents case studies of instrum/vemporary /snpainmentil urbanism projects. The study investigates how city and server their stancional capacity good more urban mobility system to become a lasting solutions	s No data	Nodata

										Literature	e Review Matrix					
	Inform	nation				(Article conte	Livability Pillar	rs Mentioned more of MnDOT's Livability Pillars)		Use / Understanding (How the pillar is understood)			Summary/Applicability		
Reference Number	Title	Author	Publication year	Health & Environment	Economic Vitality	c Sense of Place	Equity	Trust	Connectivity	Safety	Measure / Representation / Interpretation / Evaluation / Tracking	Context (Urban, Suburban, Ex- Urban, Rural)	Results / Key findings	Short Summary (1 - 2 sentences)	General Definition of Livability (if provided)	y Notes
					-						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.	(Neighborhoor	4			
											From the featmenuck: Density Horizing (Mick) Populations (popular) Repulsations (Poto)					
											Enterprise (Section 2) Example 2: Section 2:					
											Retail (jobs/ac)		After an extensive, iterative process, seven major arche- types of California neighborhoods were identified as fol-			
				Building on previous typology studies, this							Diversity Building diversity		lows: urban centers, urban places, compact suburbanplaces, suburban places, rural places,	This paper describes the development of a place typology and sustainability		
				paper improves the typology classification							Multi-family housing Renters		employment centers, and special districts.	performance measurement framework based on census tracts that will fill the gap in	1	
				the performance metrics to holistically compare							Decion		urban and suburban living. These include reduced annua VMT_lower transport-related GHG emissions per capita	urban and suburban place-types affect economic social and environmental		
	Quantifying the			how different urban forms affect economic.							Street intersection Ped intersection		and savings in annual trnaportation expenses, while consuming less electricity and water per capita. Costs of	outcomes at small geographic scales. This analysis and place typology could prove		
	Sustainability, Livability, and Equity Performance			social, and environmental outcomes							Walkscore		home ownership are much higher in urban areas, howeve despite rents being cheaper. There's less obesity and	 useful in identifying areas with the highest potential for lower-ing vehicle miles traveled 		
24	of Urban and Suburban Places in California Ale	exander Rijiro Frost	2018	of all 8,043 census tracts in the state of California.	No data	No data	No data	No data	No data	No data	Distance Transit station distance	Urban/suburban	cardiovascular disease in urban areas but higher rates of athsma.	and other sustainability, livability, and equity goals	/ No data	No data
											Subjective Measures Neighborhood Level Walkability Neighborhood Environment Walkability Score (NEWS)		There were three main types of approaches to measure			
											International Physical Activity and Environment Network (IPEN)		walkability during the study period: (1) subjective measurement of the neighborhood level walkability; (2)			
											Objective Measures Neighborhood Level Walkability Walk Score		objective measurement of the neighborhood level walkability; and (3) objective measurement of the street			
											Objective Measures Street Level Walkability Redectring Environment Data Scan (REDS)		level walkability.			
											(1) environment, (2) pedes-trian facilities, (3) road attributes, and (4) walking or cycling		of the factors that influence walkability. The widely recognized built environment factors that include			
											Pedestrian Environment Review System (PERS) (See separate tab)		accessibility of facilities, safety, and comfort of sidewalks promoted walkability, which			
											Microscale Audit of Pedestrian Streetscapes (MAPS)		was supported by evidence from a variety of countries an pop-ulations. The socioeconomic and sociocultural	d		
											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		differences werepotentialreasonsforthedifficultyinconsistentwalkabil	ty		
											between twocrossings); (3)crossings; and (4) cul-de-sacs, which were recorded at their respective occurrences along the survey route		evalu-ations. For example, residential forms in certain cultural contexts(e.g., gated communities) might lead to			
											SPOTLIGHT virtual audit tool (S-VAT)		barriers or changes in theinfluences on walking behavior. People that live in lower socioe-conomic neighborhoods have a different willingness and frequency to walk	This report consists of a literature review of		
	International Methods										Virtual Systematic Tool for Evaluating Pedestrian Streetscapes (Virtual STEPS) Used Gopole Street View to re-motely evaluate microscale features of the built environment. Thetool		compared with those in better conditions. These findings could serve as a reminder that researchers should consid	studies on walkability as a critical factor in er sustainable and livable urban development.	It	
25	and Local Factors of Walkability Ru	ii Wang	2022	No data	No data	No data	No data	No data	No data	No data	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	local differences and the reasons behind them when conducting walkability assessments.	includes a review of neighborhood and stree level measurment methods.	t No data	No data
											Multidimenstional Livability Index (MLI) 11 Phase I - Identifying Ilyability definition (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 S Quality affordable housing					
											e Havnig a park in my negritorinoda 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			The focus of this study is on interpreting a linkage between society stated preferences		
											11 Having alternative transportation options (walk, bike, public transit)			and quantitative measures of livability by extracting information from survey-based		
											 Phase II - Proxy Settings (Behavioral and Socio-Economic Data) Leanring the users' mobility, commuting and mode choice patterns as a measure of livability 			methods and translating it to a quantitative framework using combined service industry		
	Investigating Customer										b. Correlating the behaviroal metric to Livability Index			and urban computing methodologies. The study covers understanding existing livabilit	y	
	Community Livability										s) megrating encomercy-overnee decision walking a. The research outcomes provide a practical standard for urban metrics studies to assess their planning performance			perceptions of quality of life, prioritizing public preferences, and developing a		
26	Oriented Decision- Making Approach Go	olnaz Sarram	2018	8 No data	No data	No data	No data	No data	No data	No data	b. The updated urban modeling procedure can consider residential satisfaction in scenario planning through forecasting project impacts on urban configuations.	No data	No data	multidimensional livability index (MLI)	(Six principles of livability from FHWA)	No data
						This paper aims to explore for the first tie	ne				-					
						whether urban livabili is correlated to	ty									
						happiness in Europe. Does living in a city w	ith									
						high levels of livability increase happiness? C	/ Dr									
						is individual happines independent from the	3 1				Another definition for livability is quality of place (Burton 2014) and its synonyms: environmental quality or when quality defined as the "the physical characteristic or an another the synonyms: the second statement of the		Smaller ritier room biober on both Rooblith and the state		Livability refers to the quality of life,	
						Similarly, is the rela- tionship between					ensuri quarry common as the time physical characteristics or community, the way it is planned, designed, developed, and maintained.		well-being (SWB). Subjective indicators do not replace, b complement objective indicators (Stiolitz	at .	being of a population in a specific region, area, or city. It is the sum of	
						livability and happine consistent throughout	ss t				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 counitive		et al. 2009). At the same time subjective indicators are in some ways more useful.	This study aims to show the correlation between measured livability and subjective	factors that add up to a community's quality of life (economic prosperity.	5
	Livability and Subjective Well-Being Across	ulles Kennen A		and date	No. data	Europe or are thereregional	No. data	No. data	No. doin	No. data	judgments of one's lifesatisfaction in addition to affective evaluations of mood and emotions"	Habara Kabu I	Only SWB can be measured completely, while livability at QOL consist of innu-merable items that cannot be	d well-being (ie happiness), which is self- reported by participants, across european	social equity and stability, educational opportunities, recreation	n No dota

										Literature	Review Matrix					
	In	formation				(Article content	Livability Pillars M	entioned of MnDOT's Livability Pillars)			Use / Understanding (How the pillar is understood)			Summary/Applicability		
						-		,,				Context (Urban,		Short Summary (1 - 2 sentences)		
Number	Title	Author	Publication year	Environment	Vitality	of Place	Equity	Trust	Connectivity	Safety	Measure / Representation / Interpretation / Evaluation / Tracking	Suburban, Ex Urban, Rural	- Results / Key findings		(if provided)	V Notes
					_				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 environment can limit access to jobs, housing, schools, and neighborhood amentiles brazues trotest		Measuring six variables using publicly available administrative data for n sites. 1.3 Ark tradit cruars: 3. Carls and cruars and the site of the sit	Reinhortes	a			
28	Livable Streets Livable Arterials Characteristic of Commercial Arterial Roads Associated With Neighborhood Livabili	s ty Carolyn McAndrews, et	al. 201	8 No data	No data	Arterial roads can be neighborhood cultural assets and social places in addition to playing roles as travel corridors	No data	Nodata	because streets designed for motorized traffic alone function as barriers to other types o users. Researchers toda recognize, however, that traffic can also make certain streets dynamic and interesting, despite being noisy and polluted. Where's the balance?	f Y No data	and garpen the visible in their detection, response of a direct adjunction with vession (assessment table time) conserved with Network of prices of street functions of states adjunction with the based of a street transparsence of Network of prices of street functions of states transparsence of the street of prices of street functions of states and prices of the diagrees with propile can see or precisive what line bayced has diagrees the diagree of the street or diagree prices of the street adjunction of the street adjunction (adjunction) bayced the diagree of the street or diagree prices of the street adjunction of the street adjunc	No data	Neighbors like article that they prevelve as a jubrane with good transit access and big airs and dans they disite arterials that they perceives as a unpleasant and katchly. Vitarian attraitic contributes that hereared leaking of the sumauniting neighborhoods, whereas attracthy articles are active simulationary violating both they amena attraction are active simulationary violating that they amena attraction are active simulationary violating attractive provide and seems is as and or affaired volumes, some low-volume attestia are one more leaking than the with higher traffic volumes.	d This study investigates the positive and negative impacts of commercial arterials with e nodes of activity on the Wability of surrounding neighborhoods.	h How happy (residents) were with their neighborhood	No data
29	Liveability and freight	Maria Rosaria Trecozzia Giureppe Firitanoa , Giureppe Pertungarpa	v. 200	Environmental sustainability concerns the reduction of pollution in all its form acoustic, atmospheric, environmental (Waygood et al., 2013; 2 Taciquehi 2014)	Economic sustainabilit s: concerns the reduction of transport costs for trade and distribution operators (Russo and Comi 2700)	ty n	No data	Nodela	No data	social sustainability concerns, among other things, increasing road safety and accessibility (Tariguchi et al. 2013; Russo and Come 2017)	Time windows, access dimensions of fleet whicher, namby delivery area and whan distribution centers, pick	linan	Collaboration between regional and local uterinistration watanable critics and towns. The regional administration at the factors of the start displacitive, while the local administration is reporsible for execution, managemen monitoring and data origin regional administration training services and the start of the start hardware excital for exhancing the capabilitie of local hardware excital for exhancing the capabilities of local monitorial and assisting utera hardware to use.	Livestiliny is used on conjunction with statisticability, in the correct of this study, statisticability has three prongs: economic, social, and environmental. Economic statisticability concerns the reductor of transport of this frame and distribution and Corrul, 2020. Environmental substatisticability concerns the network of pollucion and all forms: acoustic, antrophenic, environmental (Waygood et al. 2012, Tangiach, 2014, social sustatisability concerns: anno quick, and all all things, increasing nod subty and things, increasing nod subty and things, increasing nod subty and things. Increasing nod subty and	r No data	No data
30	Perceived Invability, transport, and mental health: A story of complying inequalities	Daniel Oviedo a.* , Orlando Sabogal a , Natalai Vullemizzo Data i	1e ng 200	2] 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 Sanitators incorporating the questions of how bad or good people evaluate the environmental pollution, noise, garbage collection, and aways system of their neighbourhood. - Lesure Facilities: That has questly evaluation of a ultura and encention facilities and of good Tacilities where higher values map and coll autors and a good people evaluate the street design, polici- regime mapse, mancer of them and the strengthourhood to the street design. Polici- ensities and them and the street and street playing of their neighbourhood. and design of their neighbourhood targing from very unaffer ' very verk'. Crime and storing values the street design, polici- ationary of their neighbourhood ranging from 'very unaffer ' very verk'. Crime and storing values that the street design policies and design of a dative its in entiphonologi from 'and' very verk'. Crime and Storing values that the test of the street design policies and design of a dative its in entiphonologi from 'and' very verk'.	Urban	Transport investments tend to accomodate already soci economically advantaged insidents. Elococitaliva reality of propertings to tend and lovability income level, that Merral Health, is having ranceg reflects and in the hypothesized direction.	This spare meetingues the relationship between perceival (meeting) and mental health, focusing on the role of transport- rial and variables and factures of the built environment. Using Cali. Calorobia sa case study, data fran an an long participativo planning to calind accordary sources are allowed. The results indicates that perceiva- lineability transter as a latent variable, influences utals metalent that and the source higher meetal health, with cal uses caling higher meetal health, with cal uses calind with better meetal health, with cal uses caling higher residents, and the impact of mass transition in exability cores are according to the transport residents, and the impact of mass transit on inveshifty in coreculary.	urban form, the environment, access to transport, and fear of crima, and sanitation, Urban design, Learner Lealities, and Crima ad security -	e Nodata
31	Is a liveable city a haality city Health impacts of urban ang in Vienna, Austria.	Ibomenko Sasha: Nicureehuijan Mak, Ambro: Albert Wogne Sandra: Mueller Natalie	- 	Used indicators like green tapace, air pollution, physical activity, noles, and bea sixwys to measure liveability, healthcare, culture and environme education, and Onfrastructure,	t D No data	No data	No data	Nodata	No data	No data	Physical activity was assessed using data from the 2014 Austrian Health Survey, estimating minutes per week through the Health Dehancing Physical Activity (HZPA) indicator. Air politions was measured with annual mean IM24 and M202 constant across using the ELAPE Land Land Surgements and the Mark Mag. Gene access and was and the constant across starts and the second start across within a second start across within a 200 minese dataset, using data from Utban Adas and the Physical Activity through Satasituable Transport approaches study. Aware massed and using insuface constity means the measured for universal across within data Reportable study. Aware massed and using insuface monity mean temperatures chaland through Maderate Resolution Imaging Spectroadiometer (MCDIS) and ambient daily mean temperatures from the Header Wahr's water Lation.	Urban	The study interception the constantion beating the study interception of the constantion of the study was raised as the most liveable of type the Constanti- ent and the study of the data of the liveable and TranspOP Havines (Hashih Ingoda ed 13% Lives (Hashi and TranspOP Havines) (Hashih Ingoda ed 13% Lives (Hashi and TranspOP Havines) (Hashih Ingoda ed 13% Lives (Hashi Interactional exposure live (Hashiman Markov Interactional exposure live) (Hashiman Hashing) (Hashihi) (Hashida ed 13% Lives (Hashida ed 14%)) exposure and instificiant (Hashida ed 14%), (Hashida ed 14%), exposure and instificiant (Hashida ed 14%), exposure and (H	h The study examines Viena, ranked as the most liveable city, to assess the instancing between relating handh, and city and the study of the study o	A liveable and healthy city is a city that provides all existents with equat opportunities (i.e. with respect to excess on environmental quality) health and with beings, as well as the environmental and social justice environmental and social justice indicative content of the object of the base concidence monotonics, null indicative, Generalpool, and indicative, Generalpool, and indicative, Generalpool, and pool activity	il No data
	Measuring Linability at			"Key Indicators" that a decisive for liveability capaci	9				"Key' indicators that are decisive for linability: Connectivity of the state of the state of statance between two public transport stopy, publicing density, factoriation connections, publicing density, factoriation density, district coverage		any national connection yie productina, man addated seleven he public transport tops, building design population advances and public space and public space and public transport tops, building design population advances and public space and pu		Indicators play a social rabe in guiding long-term planning distributing social for guiding long-term progress over time conversari inability indicators, anning a teta primary qualitativa and quantitative impo- fer hanth reckes, hould be carefully closes. The a nafee recommends a plassed approach, tegaring with a collectively agreed are for care indicators that can be	The paper presents a method to assess neighborhood i lualibility by defining 51 comparing bit ing/borhoods in its hearborn, demany, The approximation index sets of the emany comparison index the sets of the presenting enaulism and charts for easy comparison. The method is faultile, allowing months and the sets of the sets of the elevative sets of the sets of the sets of the comparison. The method is faultile, allowing own city based on control -dependent allow which considering factors like rents, survey feedback, and adhietural currentices. The study emphasizes the importance of content-specific assessments for accurate		

										Literature	Review Matrix					
		Information				(Article conten	Livability Pillars M	Mentioned e of MnDOT's Livability Pillars)			Use / Understanding (How the pillar is understood)			Summary/Applicability		
Re	ference Ti umber	itle Author	Publication year	Health & Environment	Economic Vitality	Sense of Place	Equity	Trust	Connectivity	Safety	Measure / Representation / Interpretation / Evaluation / Tracking	Context (Urban, Suburban, E- Urban, Rural	<- Results / Key findings	Short Summary (1 - 2 sentences)	General Definition of Livability (if provided)	y Notes
	Messuring	the livebility centre an			the concepts of vitality and visality have been used to assess the 1994U load ingenter these two dimensions refer to whether the oil centre befits levely to	,					performance and sales; car parking boothil; of me safety, classifiers, tourise and evening economy. Circhear constraintiation locicitates How houring devolutioned How houring devolution Kale and constraintiation exercise Downham constraintiation exercise Downham constraintiation How and the safety of the safe	Neishborhor	ad	This paper analyses the concept of city- centes livebility and how it can be measures (PRI)s. The arrice advices that a phanel approxich is recommended to measure	"Jingkitty jac one to mean the ability of a context to municity and the provest the validity of validity. These two terms mean the capacity of a context and with a second second second a directory to anticity of the second second "A loade place is safe, clean. "A loade place is safe, clean. "A loade place is safe, clean. a deficiently administence, with a directory administence, with a directory administence, with context and efficiently administence, with context and activities and institutions."	of Recalls Kevin Lynch's S dimensions of
	exploratory performanc	e Carlor II. Balcar	2004	No data	people and whether it has a capacity for com-	No data	No data	No.data	No data	No data	Pedestrian flows Customer views and behaviour Cited of two-notice servicesmental quality	Urban,	No.dvta	livability of a city center, starting with a collectively agreed set of core indicators that can be will upon upon after upon	transportation and broad oppor- tunities for employment. It also	performace: vitality, sense, fit, access and control
	33 indicators Neighborhc places of ol active trave interaction	CarlosILBalsas iod streets as der adults' and social - A study in	2004	No data	merce to live in it	No data Observed social interaction of older	No data	No data	No data Observed active living	No data	Date of toon-centre environmental quarky walkability, environmental materiance, and street surface evenness, and counted the numbers of restroom, direction sign, street light, and society camera along the streets percentages of greeney, skuldings, and	Downtown	No data the most popular type of active travel was independent waiking (67%). Of their oscial interaction, the most popula types were staying and chatting (67%), group walking, and chess or card playing. On the street considered more age-friendly to active travel, older adults engaged in more social	can bebuilt upon year after year. r this research observed older adults' active travel and social interaction or two neighborhood streets and investigated the difference in social engagement between	connotes asense of community."	control
	Outdoor sp. buildings, transportat environmen qualitative i meta-svah	nces and biptocc: A reteprotoc A reteprotoc A Resi a. Y.1.				Create well lit and maintained public spaces. Drivers to show more care for passengers. Public amenities not accessible	v		Lack of connectivity to transportation because		Outdoor spaces; clean and pleasant; substantial outdoor seating, well maintained; safe, wheelchair accessible bile paths apparate from paremeters, well it, Transportation analoba, affordatile, related, well and make and which, clear, well-forced provide paths y unclearling to provide the paremeters to becar with disclosing		In sum, the main findings of this QMS were that older adults faced barriers to accessing analoss repares, public buildings, and rangoratation. The major accurse of the barriers to outdoor spaces and public buildings was imagencytate interpretation. Regarding transportation, older adults experienced difficulty accessing transportation during and forced althy transportation during and forced althy	The same goal of this study is to construct a detailed appendix to how doer addes perceive audioor spaces, buildings, and transportation whith the famework of age- fringed yassesments. To attain this objectiv the researchers utilized a qualitative study of the second second approximation of the interpretence meta-synthesis (RMA) incorporating various existing gualitative studies from difference countries. The methodology included systematic sampling data analysis involvement forme entracionan synthesis, and methodological induction. Addiscondy, the travel symphose and the systematic sampling data sets the synthesis of the synthesis, and methodological induction.	8. domins of liability cadator spaces and building. 2) total participation (c) support and another and the state of the state of the cadation function (c) to participation and employment. 7) communication and enformation on (R).	
	35 age-friendly Overview of	domains Dabeliko-Schoeny b	2020	No data	No data	because too far	No data	No data emergency accessibility services to provide contentity during the mo-	accessibility	No data	draining of for roads	urban	In this study demonstrates a lack of environmental justice Infrastructure encompasses physical and organizational ancetures crucial for societal operations. Infrastructure Residence is instructured with community surfaces. The accention of sinstructures Social and encommon Acching, and Community (welthering, liceality, equip), Community entibleing involves coal and encommunity performance target floating. Element 7 atts community performance target predicting upperformance targets that are essential for predicting upperformance targets. Both are essential for predicting upperformance targets. Both are essential for	obtailed through these processe. The infratructure realises framework presented is a studied approach to asses are build realiser systems impacted by harank, employating the connection prelineers to guardifier realisers through addressing collaborative emergency service integrating assessment, it consider economic and soci to soci, efforts pool and processes for evaluation point/ formulation, barming and data down mailmost actions. This famous	community and health services	No data
	36 Infrastructu Performanc Growth & T	e of Smart Bruce S. Appleyarda,*, Alexander R. Frosto.	2022	No data	No data Livability principles Provide more transportation choices Promote equitable and affordable housing Enhance economic competitiveness Suppo existing communities Coordinate and leverag federal policies and investments Value communities and	No data e	No data	deliver basic services	No data	No data	and time to repair Deality of the indicator: Journey to work, Auto overstelp, income, opportunity for civic engagement, access to cultural arts extentionment; obesity rates, cardioxaccular disease, atthmu, unemployment, education,	No data	Indecommic losses. The study evaluates urbain quality performance in relation to Transportation Land was Conditation (TLL) "smart lisophility of the studens, studied with higher mixibility opportunity access show significant associations with improved quality of liso access, should be a emissions. However, these high patforming stations take coord nuclearly the patforming stations take coord nuclearly the patforming stations take coord nuclearly the outpoint of the access to poportunities for all promoting statianability, likelity,	system supporting community resilience. This spare address the lack of research measuring and understanding the performance of "start Growth," Tamishi Oriented Development, and "Lingbing and Lingbing Lingbing and Lingbing and Lingbing Lingbing and Lingbing and Lingbing Lingbing Lingbing and Lingbing Hingbin Lingbing Lingbing and Lingbing Hingbing Lingbing Lingbing and Lingbing Lingbing Lingbing Lingbing and Lingbing Lingbi	No data Livability opportunities: (affordable housing, jobs, safe and accessible sualability) heatur, safey, social	No data
	37 Oriented-Dr Planning in Natural Am Community Understand Uniquestand Associated Transportat 38 and Livabili	Cateway and Cateway and mity Region ric Ting the Banges Banges Bange Atmost Philip Mobility Stoler, Zachols Levine, by Lindsay Romanielo	2019	No data	neighterhoods	Quality of life inidicato	rs No data	No data No data	No data desire to transportation toyfrom accessible and affordable housing	No data No data	powrity, linguistic isolation growth and inoreased relation generally correlate with increased opportunity and are likely to increase quality of life and quality of visitor experience. However, may be correlated with decreased quality of life, and even with decreased quality of	Urban	health, and equity outcomes. The study suggests that, depite challenges, the spuility inground in the lange spectrum of CMRR. Its generally inground in the last decade. However, score segondense noted declines, and territoris thereine movemers and definient, as well as tourist and residents, vary among instation preserve, concerne shade quality of file, valore explorations, and community territorism may asia. Futher analysis unit regions the specific challenges faced by analysis unit regions the specific challenges faced by and transportation issues on their dynamics.	for all notivitability of the straight straight straight the straight strai	Inclusion and emissions reductions	No data
	Prioritizatio for propose grade separ projects alo 39 rail corridor	n procedure d road-rail ation National Academies of ng specific Sciences, Engineering, ar s Medicine	nd 2019	Emissions	No data	No data	No data	No data	time savings, access to work	returns from expenditures made for improving an large number of grade consings 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 dentity, unenable populations, envergence delay	No data	Survey respondents weighed safety and accident data as the most important for making grade separation decision while current and future delays to motorists also influence project decisions	more research is needed for the livability module deviceped for this study. s, Determining criterion to score each crossing appears dependent on organizations and or regional considerations.	quality and location of transportatio facilities to broader opportunities such as access to good jobs, affordable housing, quality schools, and safer streets and roads.	in No data

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	Int	formation				(Article content	Livability Pillars M	entioned of MnDOT's Livability Pillars)			Use / Understanding (How the pillar is understood)			Summary/Applicability		
Referer Numb	nce Title er	Author	Publication year	Health & Environment	Economic Vitality	Sense of Place	Equity	Trust	Connectivity	Safety	Measure / Representation / Interpretation / Evaluation / Tracking	Context (Urban, Suburban, Ex Urban, Rural (Neighborhog	c- Results / Key findings)) ad	Short Summary (1 - 2 sentences)	General Definition of Livability (if provided)	Notes
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, an ? close social relationship	d s No data	Family, work, education and religious communt	iy No data	No data	No data	No data	Four pathways to human floarishing - family, work, education, and religious community, unemployment rate, ording sites, rates of religious affiliation. Scale of + 100 chappings and like artification, menta/physoal match, meaning and purpose, character and visit cales scale visit antiboting, functional and metariate at ability.	No data	No data	The text recommends policy changes, such i eliminating maritage penalities and promoting supportive employment programs, to strengthen maritages 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.	is No data	No data
41	Public health impacts o urban traffic jam in Sanandaj, Izar. A case study with mixed- method desjn.	Nadrian Haidar; Mahmoodi Hassan; di Taghdisi Mohammad Hossein; Aphemiri Mehran; Babazadeh Towhid; Ansari Babjat; Tathipoor Asaad	2000	Physical health, mental health, social determinants of health,	Congension and delay	rs No data	No data	No data	Accessibility for mobility impairs groups, adfrability of public transport, satisfaction of public transport, multimodal integration, opportunity for active mobility	f Community health Impacts from traffic Jame	cardiovascular, pulmonary, neural, gastrointestinul, musculoskeletal and popchosomatic disease, as well as flogue and early aging inclutions impacts were lack of physical activity like valing and biografield due to the recidentic relativice on private car use, presentative death, diability, and bodily pain due to provincing disease due to these sa result of getting disclic in the utuates traffic jum, loss of lives and property due to tais and of emergency well and the distance of the same of property politicity accounted distance.	Urban	The study meleved archival recerts and identified a sight increase in registrate desthhosphalance cases related to disease linked to air politicino, revealing a concerning recent in tooth row quadrys and rises for anti-ciano infrastructural, managerial, solocitata is prophological, and behavioral appects. Hashit hungets a concerning and behavioral appects. Hashit hungets accompared and behavioral appects. Hashit hungets accompared and behavioral appects. Hashit hungets accompared affects on air quality public services, accessibility concerning and the service instead and for an infrastructure, lack of parking, and inadequate traffic infrastructure, lack of parking and inadequate traffic exclusion. The study undercores the need for health- oriented pluris in low- and middle-income countries grapping with unstraffic issues.	Ubtain traffic jam challenges were identified under in the second traffic and the second traffic and infrastructure and second traffic appendix and metal well-being, with community second second traffic and the second traffic and metal well-being with community and traffic appendix and the second traffic infrastructure of community half information fails respectively in the virial metal to urban countries facing issues related to urban traffic.	No data	No data
42	Quantitative and Quantitative Analysis to Advance Transportation	n 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	2016	Discourse reganited around transportation's relationship to human hashth, sepacitally in relation to four key dements - stafety, air quality, active living opportunities, and access to critical destinations. Discussions of sustainability in transportation that are centered on long-term environmental and ecological consideration, most	No data	Nodata	No data	Discourse related to transportation ability to continue functioning with faced with distribute events.	vîs m Nodata	No data	Swality, Engloyment-population balance Provinsity, bicycch ranse Mainaliny to transfer Poinsity purks and Rearration Habith. Endle density Safety Poinsity of Links: and Poinsity of Links and	urban	Observations indicate that regions with favorable livebilit and health scores are typically islated nearer to downtoen and utransiand aones, containing with sustainability performance, which appears to be more the results indicates organized and the score of the provide the state of the score of the score of the constainton confictions of 93.0, 82, and 20 Petereen the 2018 and 2020, 2020, and 2040 values, respectively. Simil- phic consistonce on for hashing and what hindices apple, the correlations between sustainability, livebility, and patch indices are costably low.	y This study assesses the connection between sustainability, batth and livability in transportation phaning for the IP and metopolitan area. Using indication based for each covergo view a 30 year planning horizon, revealing little correlation among them. The findings assigns that despite it theoretical overlaps, livability and hashit ma or difficulty prepared sustainability of a dialongs and lowader of hanses in chiving maningful drangs over them.	y Discourse that is generally, concerned this manageration as it relates the community-usel impacts, primarily on huma well-tensors.	1 No data
44	Ranking Sustainable Urban Mobility Indicators and Their Matching Transport Pelicies to Support Liveable City Futures - MICMAC Approach	Isannis Chatzilsaannou a , Alexandros Niktas K.y. Panagiotis G. Tozura s , Efhimios Batoglannis : , , Luis Alvarez-Icaza C. , Unisto Nardemesa a , Stefanos Tugdinos a , , Fontus Valigen e , Odara Redele e	2022	Environmental	Sustainability has three essential axe the environment, the social and the economi one and all of them are linked with transport	s: ic Nodata	No data	No data	No data	No data	Histobility of public bangoor for the powert. Accessibility of public transport for mubliky impained groups all politations entropy to the biodefances, rand earths. Journal on anability service, generatorus gause, congestions and delays, energy efficiency, opportunity for active mubliky, multimodal integration, satistaction hit public transport, miller selary	urban	The most crucial group of strangels for sustainable who woldly is used assign, with Travit Circited Development (FOD) being the most influential, linking transport investment with land use planning. The next agardizant group, focusie on alternative transport modes, including blac happed transf (BHT) public transit systems, and black loss, promoting non-motivitial model, meghanisting parking drange and minimum paking requirements to control at strategies associated with whicks movement, efficient automobile usage, and ownership, without completes strategies associated with whicks movement, efficient automobile usage, and schedulegies and strategies associated with wholes movement, whiles compared strategies associated with wholes movement, while screament, while and prove addresses no mobility strategies while and plantiset by the mast of the COVD-10 parkmin.	The study emphasizes the critical importance of understanding promoting and managing statisticable use how the solid or the fact of the climate crisis. Theorgh a qualitative approach methicing instrator where and discussion with sports. Scatariable Using Arrive and discussion comparison, Anderstative of public transport energy efficiency, access to mobility enrole, and multimodal imagenion densified and the most impact. All the analysis allo craded stratingies to upgoing on inderling and transport encounter of the strategies on the most impact. All the analysis allo craded strategies to upgoing or inderling and public and active transport enhancement energy finance (Sented Development, public and active transport enhancement).	e	No data
45	Re-Working Appleyard in a Low Density Environment: An Exploration of the Impact of Motosised Traffic Volume on Stree Livability of Motosised Livability in Christchurc New Zealand	t h. Wiki J., Kingham S., and Banwell K.	2016	No data	No data	Those on lighter and moderast trafficide to tretters reported better liveability motorised traffic cats as barrier to street liveability and social interaction. There was a significant relationship, indicating that as motorised traffic volumes rose residents were linerasaingly aware of the impact it was havin on the liveability of their street	g No data	No data	Nodata	No data	larger fixing space, more frequent interactions with community members, community severance or sense of balonging. Light staffic: 0-500 yod, moderate: 1.400 - 2.001, and heavy: 8.400 - 1.1.720	suburban	In a study involving 52 respondents from different traffic areas, it was found that resolutes on light and moderate perspectives, more anglight-throad connections, and respect community interactions, relations, the test respect to the study interactions, relations, better interactions, and engines perceptions, better street liveability, in contrast, heavy trafficient streets had smalls calc home areas, registry and resolutions, four- interactions, and encession community in and communi- tions of the study of the strength of the strength of the study of the study of the strength of the strength of the study of the strength of the study of the strength of the interactions, and insight spikated resolutions and interactions, within their communities.	The reserch in Christhurch shows that residents on light to moderate trafficide streets preceive their neighborhoods as non linear-citors, while these on handly trafficide reserves the an angewer perception, ruling field in the areas, and reduced community realfic on street leability and community wellbeing.	e d No data	No data
46	Ridership dynamics and characteristics of potential idders of a transit system	Mehmet Baran Ulak a.*, Eren Erman Coguven b. Mark W. Horner c. Linds d Weaver d. Jorge Puente Jereny Crute d. Denni Smith d. Michael Dunca d. Elizabeth Whitton e	ay d s J sn 2002	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 type	Urban	The findings of the study show that the assessment of factors which are influential for a transit system to thrive a complet task and not very straightforward. For sample behary station is one of the stations that produce the largest ridentiby and avalysis show that large parateger books occur during Al and PM pake pakeness between Debary and ubaryluban core stations. However, we among bopped rangedic cause for the large domhlyp.	This study investigates the SunRail transit system in Greater Chando, Florida, emphazizing the importance of dustainable transportation for urban accessibility and is hability, by avaiging in denthy dynamics and socio demographic characteristics around SunRail tation, the research aims to offer insights to urban and transport plane for developing strategies to enhance indenting and promote a less car-dependent multimodal transportation system.	o rs No data	No data
47	Smart and Equitable Parks: Quantifying Returns on Investments Based on Probabilistic Mobility-Dependent Corrolates of Park Usag Using Cyber-Physical Sectem Technologie	e Kutharian A. Elanianan		Nodar	Nodan	Noder	No data	Nodus	day to day travel time	enferty dicke	Pourty youth and series, neighborhood condition, resident health, site condition, investment need, black	libe	The study evaluates the proposed framework's flexibility comparing accessibility for the same origin-destination pair in four cases. Cases involve watations in available transportation modes and different travelate preferences, considering factors like cost and erability. Results highlight the patiential of stand microscolity modes in reducing tarelet costs, the impact of removing certain modes on accessibility for specific population groups, and the influence of travelet sensitivity to initiability.	Park gay a crucial rele in urban vtallity, combined to a comonic growth, public by health, and social interactions. In Pithuburg Innucial constitution have led to underinvestment in its 165 parks, creating challenges for equilable distribution of benefits. This study aims to explore urban park use and its constability, providing data- dependent accessibility, providing data- dependent accessibility, providing data- tionen singlist for city difficult and planners to enhance the equilable distribution of benefits instead to parks and mobility	Noden	Nedar

										Review Matrix						
	In	formation				(Article content	Livability Pillars M speaks to one or more	entioned of MnDOT's Livability Pillars)			Use / Understanding (How the pillar is understood)			Summary/Applicability		
Refere	nce Title	Author	Publication year	Health &	Economic	Sense	Fauity	Trust	Connectivity	Safety	Measure / Representation / Interpretation / Evaluation / Tracking	Context (Urban, Suburban, Ex-	Results / Key findings	Short Summary (1 - 2 sentences)	General Definition of Livability	y Notes
Numb	ber	Autor	r ublication year	Environment	Vitality	of Place	Liferity	nux	connectivity	Survey	терлек у перескаталогу террекалогу счалакогу такжиз	Urban, Rural) (Neighborhoo	i		(if provided)	itous
48	Study on Building a Smart Sustainable City Assessment Framework Using Big Data and Anaylic Network Process	c Wann-Ming Wey and Ti- Ching Peng	20	Indicators include: GHu emissions, Air and hois pollution, domestic 21 water use,	G Indicators include: In human resource quality and prevalence of technology	Indicators include: living environment quality	lidicators include: publi transportation availability	c Indicator includes: government transparency	Indicators include: public transportation availability	No data	GLG envisions: reduce greenhouse gas envisions to mitigate the impact of climate charge on ecological environment Air pollution and noise. Provide basic data for air quality and roise monitoring and reduce air individual and roise is possible transportation banketic water use monitor and control the use and quality of eater in the city Public transportation availability. Completion and high availability of public transportation systems increase the number of public transportation uses, reduce the number of private which uses to be control to the state of the state of the state of the state of the state method state. The state of the method state. The state of the method state. The state of the state state of the state of the state state of the state of the public.	urban	The results of the questionnaire survey used the FDM (Fuzzy Delph) Method) to identify itery principles of smart grants. The constrance values were ranket, and therebodd value value demined. The top 10 ortical indicators, in disconding order, included granthouse aga emissions, living improvement, public transports and an emission of the improvement public transports and the strangest against the strangest monostron and improvement public transports monostron and improvement public transports quality, and domestic water use.	This study aims to bridge the gap between sustainable crisis and smart crisis by identifying and integrating indicators rise at unified concept. Using a static evaluation develops a dynamic model that assesses the impact of factors on utwas sustainability and martners under changing conditions. The proposed model, demonstrated through case studies in Tajano (To ad Singapore, evaluates inclutors such as public transportation availability, theohology meaning used and single and such as controls to the overall assessment of smart sustainable crises.	No data	Nodata
49	The indicators and methods used for measuring urban liveability: a scoping review	Zahra Khonami, Tingting Ye, Ali Sadatmocavi, moghaddameh Sadatmocavi, Mohammad Mehdi Fadakar Davarni, Nargete Kharjani	Under peer review	Conducted Interature review and identified indexes for livability	Conducted Renature review and identified indexes for invability	No data	No data	Conducted literature review and identified indexes for livability	No data	Conducted literature review and identified indexes for livability	Conomic Vitality Economic Vitality Social Weil-beings Safety (including orime safety): Health and healthcare; Calural environment richnes; Daginger di cocal hamano, etc. Conversionce (including transportation and amention); Infrastructure exalify; Natural and Calural Environment: Natural environment comfort level; Community Livebility; Community; convenience; Community environment; Community management	n/a	five main domains of indicators for measuring urban liveability. These domains include Encomin, Environmental, Donestic Security, Subio Chanari and Militocificomentor etomains.	The study aimed to systematically review indicators and methods for evaluating used invability by employing a five stage methodological amover. A comprehensive search of decisionic atalaases and other and the study of the stage of the stage crucial for huality is commissi, scruic and for huality is commissi, scruic and for huality is commissi, and communical, training and the Generators. The most frequently applied in the study energy is constrained and for a stage of the stage of the stage of the stage of the stage of the stage of the methodologies used for assessing unan luability. The finding provide valuability insights for future reason in systematicity measuring unan luability.	A liveable urban environment refers to a piace where the built structure promotes quality of life by supporting the basic needs of its readersts. The founding premise is the accounties where, and social that clies should be comprised of a built indicage that encountege that that may be a supported by and sustainable living	n, d No data
50	The 15-minute city interpreting the model to bring out urban resiliences	Lamia Abdelfartaha , Diego Oppontea , Giograma Fosa	200	Building volume dentification around tations, suggested by the TOD approach in combination with land taving, now constitute health risk due to the clustering of people	sa Nodata	General Theory of Walkability focuses on the importance grides appealing or grides appealing	Nodata	Nodata	we should better optimize uses and services around transit stations	No data	Service proximity, travel time, population density, destinations: book/grocery stores, commercial stores (including controls stops, electronics controls, edited including controls, sports builties and other (poor exclusional building and grain sports, escanaria, kundin facilitais, sports builties and other (poor	urban	The analysis of population density and workplace distribution in Malan result district traits in duractivity of the second second second second second second second traits and the second second second second second second microclusters of local centralities, with the borned distribu- microclusters of local centralities, with the borned distribu- comparesee demonstrates variations in service analysis at 15-minute radius configuration of the Second analysis at 15-minute radius configurations and the Second analysis at 15-minute radius configurations that the Second analysis at 15-minute radius configurations that the Second analysis at 15-minute radius configurations that the Second analysis to the Second Second Second Second Second analysis based on the Second Second Second Second and population distributions theors a correlation distribution tradius to constantly algo with population distribution tradius assess with they are proportioned and the Second Second Second Second Second analysis based on the Second Second Second Second and Second distribution tradius data second the Second and population distribution tradius data second the Second and population distribution tradius data second the Second and population distribution tradius data second the Second and Second data second the Second data second the Second and Second data second the Second data sec	In the context of a globally connected world and smart cites, the concept of the TS- minuta city responds to a growing denier for community and global betterity. This model, emploating proximity and minimizing daily commutes, gained selections; This model, emploating proximity and minimizing daily commutes, gained selections; This model COVD-TB pandemic, Tagli Selecting the value englishedholds: The gaper approx to Table minute city theory theoretically and particular, focusing on Milan as care care with mapping the potential for inclusion walkable or data model minimized to minimize the minimized of theory theoretical walkable mapping the potential for inclusion walkable or data multipline statemeng the situation.	Nodata	Nodata
	Tools for addressing						IPTI to measure		Establisher a 1971 (Inde of Personaly Travel	x			The process involves assigning transportation moder based on reportater information, the potalial, and an advatation of time and iteracial costs for both private and collective transport options. Con-life distance is determined using public calculators, and financial cost at pump planning social calculators, and financial cost at pump planning social candering factors such as time of	This paper introduces the locate of Research transk lenses (PT) is a locate instance of assessing transport ineguality in the context of creating located locate. Unlike constrained accessibility metrics, UPI focuses on individual-level estimates, considering desing transport and accounting for factors sud attins, francial impact, and personal characteristics. The IPI is designed to other accessibility of the second second second characteristics. The IPI is designed to other access and informing the approartic particular tests and informing the approartic parts in reliable conduces with aggesciences for there in reach on IPI sequences.		
51	transport inequality Toward a Guide for Smart Mobility Corridors Framework and Ton-4	Tom Cohen Bruce Appleyard, Jonatha	in 200	20 No data	No data Transit-accessible economic opportunities Mixed income housing near transit (this currently upports the social equity principle, which measures housing affordability and income diversity	No data Vibrant & accessible g community, cultural & e recreational opporturijine	inequality Accessible social & government converse	No data	Impact) Transit-accessible	No data Livability Calculator currently assesses urban quality by operationalizing the Six HUD/FRA/ USDOT principics 2. Nealthy, safe & wallable transit corridge replication-choose	Tanvel time, door to door time, travel cash baard on income Tanvel time, door to door time, travel cash baard on income Tanvel jabe accessibility Tanvit service coverage togotgabe theorem of travel travel motion parts, and the counting uncome theorem of theorem of the motion, and the counting uncome develop travel motion, and the counting of the counting theorem of theorem of motion, and the counting of the counting of the counting of the motion, and the counting of the counting of the counting of the motion, and the counting of the counting of the counting of the motion of the counting of the counting of the counting of the second, access to colume & arts is or conder counting of the counting of the counting of the motion of the counting of the counting of the counting of the motion of the counting of the counting of the counting of the motion of the counting of the counting of the counting of the motion of the counting of the counting of the counting of the motion of the counting of the counting of the counting of the motion of the counting of the counting of the counting of the motion of the counting of the counting of the counting of the motion of the counting of the counting of the counting of the motion of the counting of the counting of the counting of the motion of the counting of the counting of the counting of the motion of the counting of the counting of the counting of the counting of the motion of the counting of the counting of the counting of the counting of the motion of the counting of the counting of the counting of the counting of the motion of the counting of the motion of the counting of	urban	travel, which type of applicable, and note preference. The Shart Mobility Calculator offers valuable functional for assessing Dally VMI (Velucic Miles Traveled) metrics, ading Cinteste Action Thaming and ovaluating and an experimental impacts of development projects under SB 124. Utilizing official VMI data is too full-amain, thatgu- table SMI and SMI and SMI and SMI and SMI 243. SMI and SMI and SMI and SMI and SMI and SMI and SMI and SMI and SMI and SMI equity, maining I versatelle of climas action planning sharing small section planning planning planning sharing small section planning planning planning sharing sharing small section planning planning sharing sharing small section planning planning sharing sharing sharing sharing sharing planning planning sharing sharing sharing sharing sharing sharing sharing planning planning sharing sharing sharing sharing sharing sharing sharing planning planning sharing sharing sha	Implications. This apport address the challenge of achieving coordination between the coordination between the coordination of the coordination of the requiry (31) principles. Utilities of calibration (coording Paramy Packs, Utilities) of calibration Mobility Fannevsk, the report reviews literative, practice, and planning support tool, aimplication of the second reviews literative, practice, and planning support tool, aimplication of the second reviews literative, practice, and coordination of the resource for decision makers to achieved before the decision in control of the coordination in control of the coordination in control of the coordination of the definition of the coordination in control of the coordination of the coordination of the coordination of the definition of the coordination of	No data	No data
53	Towards an enriched framework of service walaution for potenti- infrastructure accinoveloging the power of users' perceptions	an Alvaro Rodriguez-Valenci - Jose Agustin Vallejo-Borda - German A Barero - Herran A Barero Ortiz-Ramirez	a 200	21 No data	, No data	Experiences, unlike services, are related to individual' sensory events, revealed over the duration, which are memorable	h No data	Nodata	No data	Feeling of safety contributes to overall riding experience.	Song reported to projection sheet and/o parents parents totalights safe policion, asset more an advancement course policitary parents of parents of parents and advanced advanced parents advancement course policitary parents and parents advanced advanced advanced advanced, parents advanced parents parents advanced advanced advanced could on regioners to advanced parents provide advanced parents advanced could on regioners to advanced parents advanced parents. Is called a protection, clearlines, humane	No data	perceptional variables appear in both models as significat surface condition, reijonener, signage, and read selfly- aggeving only the occommon variables, we found that enjoyment has the accord and the surface conditions of all times the magnitude of the surface conditions of all times that in a signage conditions. Takinally, the signage conditions is almost 1.5 times that of read selfly.	This study aims to enhance action transportation by proposing and wildsing a fammework that infegrates user oriented inputs with traditional supply-oriented variables to english the calling of Service Code, for patch, the traditional supply-oriented variables to english and out of Service and and generative years and out of the service findequent years the results highlight the superior explanatory power of parceptor percented Code, parcelland the proposed fammework for both peterstrain and buychts.	No data	Nodata

	Literature Review Matrix																
	Inf	ormation				(Article content	Livability Pillars M speaks to one or more	Aentioned e of MnDOT's Livabili	ity Pillars)			Use / Understanding (How the pillar is understood)	Context		Summary/Applicability		
Referenc	e Title	Author	Publication year	Health & Environment	Economic Vitality	Sense of Place	Equity	Trus	st	Connectivity	Safety	Measure / Representation / Interpretation / Evaluation / Tracking	(Urban, Suburban, E Urban, Rura	x- Results / Key findings	(1 - 2 sentences)	General Definition of Livability (if provided)	Notes
	Transport policy for liveability - Valuing the	Paulo darina - Paulo			Economic activity							The quality "Seed opf service" survey reporties, place quality	<u>(Neiahbarho</u>	d Apatential solution to address the complexity of satencial impacts is to assume serve overlag, allowing impacts to pre- regisaced or includes a sumbused or directs. The multidimensional nature of impacts, difficulty in describi- tem with single indicators, and the subjective experience of inselling pase challenges in monitation. The police multidimensional pressures in monitation. The police instella transfering press, solar uncertainty in forecasting future impacts technic complicate the apatiential presses. Address controlling, evolving policy concerns, urban pressures, new technologis, and duranging solar concorner. Lators any queries a broader in the adverging solar concorner. Lators any queries a broader.	This paper explores the challenges in grandating priorities for healthy, equitable, and sustainable arrangen systems into competiting eccomeric cares for funding agaretics. The focus is on appraising input impacts related to Investibility, including trip agaretics, the focus interport, page against perioral accordity, visual blight, and health/wellenge, the reveive assesses for another and the second second second inpacts to challenges in areas the monotonic inpacts to challenges in areas the monoting sing more areas represent and visual resolutions of the second second inpacts to challenges in areas the monoting sing more areas represent and visual for the second second in the second second in the second in th		
54	impacts on movement, place, and society.	Paulo Anciaesx , Peter Jones	2020	No data	generated by those in public spaces	Trip quality, street audit tools, surveys	No data	No data		Pedestrian route options	Data collecte dby govts	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	perspective, considering the joint optimization of transpo and other goods and services.	rt blight without further methodological developments.	No data Livability means being able to take	No data
55	Tribal Transk Study: Demographic Needs Meeds and United	Elvis Ndemba Fazji (Godavathy Jereny Matson Ji Hopah PhD	2021	No data	nural transit is more expansive to provide pe trip compared to utban transit, and the costs of operating inibial transit which to person the pro- duct to be person to the densities and longer transit former than the densities and longer.	recognizing and meeting community reserves, in statist sense, in statist energy, water and white education, energy water and transportation. Second transportation. Second the built and hatural environment of builts, and air sole and air sole and air neit and air neit and entermining role in determining role in determining role in determining	The increased operatin costs underscore the ead for higher public funding, particularly bee incomes and may out afford holder farges	rg No data		Nordata	Nodata	cart ar this knowledge of nublic transit access to transit destination of importance	Rural/Tribal	The research examines travel behavior in tribal areas, which den face unique demographic and geographic challenges cuts. At the other contentation of the income background and the second of the second analyses at 11 local Area Transportation Chesterkeiters / Nuclearkeids (ALTA) days areas proportion of the technicity of Results indicat the households in Nutlea American tratt have feere daily parton miles person trips, which miles and white it mysterios and the second particularly where daily parton miles person trips, which miles and white it mysterios and the second particularly which accoss. The tudy amplatosis the recorsily of twelface accoss. The tudy amplatosis the recorsily of the result and second to the second second to result area, where gaps in morice still exist despite an increase in that and tradity steres or the patient About 60% of those holds on temportane the tudy approximation and the first myster of the second second and the first myster of the second second threads in the second to the second and the time of the second second the second temportaneous the tudy and the interpret of the second second the second second temportaneous the tudy and the interpret of the second second the second second the second second the second second the second second the second the second the second temport te	The research aims to investigate demographic indicators of robal communities related to transportation needs assess existing that harant operation and that and the second second second second relative and painty of this in U.S. tradi- ation of the second second second second indicators tails population demographics. Cash and of the second second second relative second second second relative second second second relative second second relative second research on the second relative second demoistics, the mobility callingings, especial initial consists, highlighting the patiential limited mources, highlighting the patiential analytic of this.	your like is school, gio to work, see dicto, dero by the graces or post office, goo to dimense and a movie, all without having to part in your can all with the scheme to part in your can all with direct integrat to require full without in your can you integrative to your can you can all without the scheme to part in your can be part with direct integrat to require full without the scheme to part in your can all without th	No data
56	The TROLLEY Study: Assessing Travel Health and Rayly Inpacts of Health New Light Ray La Transit Investment During the COVID-19 Pantament During the	Katie Crist, Tarik Benmarhnia I.awrence D. Frank J. Gana Song . Elizabeth Zundhie adu James F. Sallis	2021	Self reporting of health outcomes, Density (population, employment, etc.): Diversity (incurse etc.): Diversity (incurse, etc.): Diversity (incurse, etc.): Design (walkability/intersection density), and Destination Accessibility (inumber of the trailog line of residential and extenses occupational addresses (dis from geocoded locations	n f it No data	Nodata	Self reporting of transportation costs	No data		No data	No data	measure of the percentage of new employees using LXT as their primary commute methods, PGL-30 scale asking satisfaction with various life sepects.	urban	quantify changes in travel, health, and equity outcomes for a new light rail travel, health and equity outcomes for a new light rail travel. (RFI) ince nearly two years into the OCMU-19 spandmits. It addressas the deline in travel indentity during the pandemic, with a focus or understanding how behaviors and health actorness say the reasarch, uniquely generalizable within the post- pandemic period, softwares prior AFE nearliness for pandemic period, softwares prior AFE nearliness for including participants who both live and work near rail trations.	The TROLLEY study aims to prospectively investigate the impact of a new light rail transit. ENT his and the assuig of COVID-19 diverse other of university rend/open- diverse other of university rend/open- diverse other of university rend/open- distances from the LRT, will be monitored for changes in physical and long at university additional and the study and university and modified and the study of the study and and employ multiles traveled, and half in landersit, to assess the study of the study of the study of the study of the study of the study of the travelet and the study of th	i No data	Nodata
57	Use of Geographical Accessibility indicates in Felicy Main	Barry Zondag Significance En Molennelje Rijlewaterstaat -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, bublic trangenes, and bublicyte. The goal is to acceptable transition. This turned inne should be reasonable, avoiding excessive lengths and bard barries, and is mode-specific, reflection from empirical travel survey data.	g No data	No data	No data		Proximity and density of	No data	Cooperion Indicate (Network Indicato) This commonly and indicate measure sharel inter losses on the search compared to the refer larved time population or employment as a measure of decretation attractiveness, coupled with a distance decay function. The decay function may consider that of the measure generation time including waters (times or operaultic docs functions). The total search attractiveness of the couple of the search operation of the functions that attract measure docs at the search operation of the function of the search operation of the function of the decay of the docs by possing the fully for travelers.	af- Urban and rurs	The study introduces cognestrations based on function/goals, modes, geographical scate, and trip length, facilitating a top-down approach that identifies that interpret and opportunities across different felds. The main communication challings was transitioning from anteoxic centric approach ha a boade geographical policy makers over the study years. The accessibility adabboard and a trating living accessibility developments with policy potion japaid crucial roles in supporting policymaker in this paralogin white.	Geographical accessibility indicators, considering changes in land use and transport system, have been part of academic literature but jay a minor role to partical policy making due to a acctual and the system of the system of the system to adopt a more integrated approach transport and land use, especially in urban areas, driven by dismits and lowality concerns. The study supplexes thus are of geographical accouncily indicators in policy discussion.	y 4 No data	No data
58	Using street view image to examine the association between locate and urban vitile in Strender, China	s Wu Char, Ye Yu Gao Fanzang, Ye Xinyue	2023	No data	No data	the residential, commercial, and public, uses and public and public commercial, and public calculated using POI data. POI data are calculated using POI data. POI data are commercial and and and public and and are displays and point and and ministration and services, markets and services and services, markets and services and services, markets and service	, i No data	No data		Accessibility is important for residents to reach certain destinations, such as school: and entertainmere workers	No data	The likelihood of passing through a space. The suitability of a space as a destination to attract aniving traffic namely, centrality. The proportion of the total area of urban roads to the total area. The road of the total pace related of this nail active to the small horn where of advances that to the total form pace related of this is 300 m girls. The number of inductant DNGs is 300 m girls. The number of golden pace related of this is 300 m girls. The number of inductant DNGs is 300 m girls. The number of golden this is 300 m girls. The house this value manuel by Subnom emberging the proportion of the total fore area characterizing the spatial density of building from: The proportion of the total fore manuely the statistical statistical deviation of the proportion of the total fore impresenting the comparison of proportion of the comparison of his and the state fore total proportion of the statistical statistical deviation of the proportion of the total fore impresenting the related ensity of proportion of the state (the state house) provide the state and the state of the number of proportion of the state house proportion of the state and the state house proportion of the advance of a local head head total fore the state proportion of the advance of a local head head total head total total is a state head total total state head total states (the state of the state head total states).	n Urban	The findings provide decision making support for comprehensive locale evaluations and improvements in utana vatality, emplaining and management. The study study and then planning and management. The study by different factors, with usan factoria logitagia prominent role. The integration of comprehensive factors for searcing local environments yields mol insights, highlighting the need for parloymakers and plannes to conduct reasant in the human scale and the humon conduct reasant in the human scale and the humon multiple sources to promote urban vitality and optimize urban areas.	The study investigates daytime and registrine visitigs in Shanchen, China, using EaryGo data from Tencers. Subjective and objective variable disined from street visite images are employed to reflect human perceptions of local. Relations for start variablanced what functional subscription perceptions are local form, and human perceptions are local form, and human perceptions are local form, and human perceptions are local driven start with subscriptions. The start start variable entropy, with distinct variations unable, for the start start variable entropy, with distinct variations importance of human perception in mightime variable, the notices into the relationship between human perceptions and user variable, informing and and the crustion of high-quarky, loade at and the crustion of high-quarky, loade at	Nodata	Nodata

Literature Review Matrix														
Information		Livabil (Article content speaks to	ity Pillars Mentioned one or more of MnDOT's Livability Pillars)		Use / Understanding (How the pillar is understood)	Context	Summary/Applicability Short Summary							
Reference Title Author Publication year Number	Health & Econor Environment Vitalit	mic Sense E ity of Place E	iquity Trust	Connectivity Safety	Measure / Representation / Interpretation / Evaluation / Tracking	(Urban, Suburban, Ex- Urban, Rural) (Wickhowad	(1 - 2 sentences)	General Definition of Livability (if provided)	Notes					
Incorporating Lindbilly into Transportation Aust Management Part Management Part Management States of Nanage 9 Herefords Cours & Chang 20	19 No data No data	No data No data	Nodata	bilinency that are identified as meeting maintenance in the assessment are marked based on their importance, location, cord of determine the street and determine the street life.	agency expenditures, level of non-motortad investment, bakeway pavement condition, bakeway pavement marking condition, and jets created. Two strate purpose categories are considered. Private the posterior proposal, includes category acctions with bitways identified in applicable compared and correspondence accions.	This saper underscores the importance of incorporating liability principles into Transportanio Automation (IMA) practices, particularly be to forwait and the forwait of the same of the same of the same of the managing and the same of the propose a pointization rate behave weighted effectiveness and software and the same of the same of the effectiveness and software and the same of the same of the effectiveness and software and construction schedule and an early of a construction schedule and an early of a construction schedule and and the same of the same of the same of the same of the same of the same of the same of t	This paper introduces a framework for integrating loability into transportation axis management, with a specific focus of the specific focus of the specific focus of the specific focus of the specific focus of entropy of the specific focus of papers of the specific focus of loading reasons and phoned sates with local plane and phoned sates with local plane and phoned sates with local plane and phoned sates with local planes and phoned sates with local planes and phoned sates with local planes and phoned sates with more than a disposition of the importance location maintenance cost, and muniting service flat, see conducted, a concentrative blacking, see conducted, application to Thisback long actions in fam aparetodies.	A hubbe neighborhood is one which ecconnic id transportation rhoises ecconnic id transportation rhoises the promote pail-frakt, whole oil dependency and genehous gase. I have a second transportation enhances and transportation is enhances and transportation community design and traid use transportation rhoise and opportunities for transport transportation rhoise and opportunities for transport population rhoise and opportunities for transport basesen hubblity which is more laced and parts the basis basesen hubblity which is incom- laced and parts generation, without compressing the ability of the media of the present generation, without compressing the ability of the media of the present generation, without compressing the ability of social early in these dimensions.	40 data					
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Livability for whom? Planning for livability and the gentrification 42 Telfo Doucet 2022 Guargee Tolfo, et al. 20 Fact of whother	22 No data No data	Liability decores facilitate and junti digocoscient intrody the generatication of memory— allectively omitting the part to build now part to build now part to build now the present No data	No data	No data No data	No metrica and provided, but consider basilability as autobics, amendeas and design basilability as altotability	In the Case 1. Nucleily is seeded with imposing the liver of the income inductor, who are imposing the magaget in Case 2. Nucleity is an areafter an advectory concept that aims to create a mainploundous three (middle-task) middle-task maintenance in the set of the imposed of the set of the set of the set of the imposed of the set of the set of the set of the imposed of the set of the set of the set of the and derivant clean interest. Through the same protocol and derivant clean interest. Through the same protocol employees, the discussed fragment (MCLIndox, 2011; the 2018), the seasons of the set of the set of the additional clean interest. Through the same of used and the set of the set of the set of the set of the 2018; the seasons of protocol the through the universal right control to princing the history of these setulated. Framing leaking including including the universal right to housing, not justice, pablic transportation and inference, executory, used instructure, the set of the set	w. 2 6 90 90 91 91 91 91 91 91 91 91 91 91 91 91 91	Linkshiry is meant as a borthand for reacter quality of tifs, batif interned by policies tat gown ownership and transs, services and internet by policies tat gown constrainty of transports, and charal adequay of long conditions. Beause of its augues, loading can also be arabulan concept. The Beause of its augues, loading can also be arabulan concept. The Beause of its augues, loading can also be a nabulan concept. The Beause of its augues, loading can also be a nabulan concept. The allower and the second second adequarks to insplace, the is part of the "Tubblicy parados" next adjusts to insplace. The other matches the other and the other "Tubble". "Linkshift" as it currents discusses - sinishing discuss one in bu understit stefin instructioned discusses - sinishing discuss cover in bu	Aetaanulysis/critique vability as a concept meneurous (a sa an exercise					
Health & Environment Measures														
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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											
	The increase in the amount of energy consumed by buildings and													
	transportation based upon the assumed development types and travel													
Consumption	forecasts.	No data	21											
Consumption	Water use	No data	48											
Emissions	Audits of polluted areas	No data	30, 39											
	Greenhouse gas emissions related to transportation or development,													
Freeinging	Including CO2, Nitrogen Oxides (NOX), and Particulatematter emitted per													
	Puilding density	No data	0, 13, 21, 22, 44, 47, 48											
	Building density	NO data	32											
	Change in impervious surface area to measure stormwater mitigation		10											
	(measure of environment)	No data	10											
		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
	Percent of all regional employment and higher education opportunities		
Access to labor	accessible within 20 minutes of the average household.	No data	21
	Percent of all regional employment and higher education opportunities		
	accessible within a 20 minute transit ride on rail or BRT for the average		
Access to labor	household.	No data	21
	Regional access to jobs by transit (% of land area within 1-mile of station		
Access to labor, transit richness	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
	Construction costs of roads in the Draft Preferred RTP divided by the		
	increase in total job and college enrollment opportunities within 20		
Cost efficiency	minute drive as compared to if no RTP projects were built by 2040.	No data	21
	Construction costs of transit in the Draft Preferred RTP divided by the		
	forecasted annual system ridership in 2040 multiplied by 30 to represent		
Cost efficiency	a generalized transit project lifespan.	No data	21
	Semi-structured interviews with owners and/or on-site managers of		
Firm effects	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
	Property values surrounding the project area to measure economic		
Performance and revenues	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
	Value Added Tax Revenue (money that will be saved by the users will be		
Cost savings	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, big	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,	Feeling of the distinctness of the	
and memorable)	area	
Imageability (the quality of a place		
that makes it distinct, recognizable,	Legacy and tenure of business,	
and memorable)	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	
	Connection to measures of human	
Health equity	health	
	Disproportionate burdens	
	experienced by BIPOC and low-	
Diverse neighborhoods	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	
	Impact of vehicle and pedestrian	
Collective trauma	injuries and deaths on community	
End of workheet		

Connectivity Measures			
Concept/Issue/Goal	Measure	Data Source (if available)	Consensus (Reference Number)
	Dyanmic accessibility calculation with the real-travel covered areas by	Taxi data collected from	
	TAXI as travel mode) — (Dyanmic accessibility calculation with the real-	onboard devices, metro smart	
	travel covered areas by METRO as travel mode) (Dynamic modal	card data and metro station	
	accessibility gap (TAXI vs METRO) calculation with real-travel covered	locations, and POI data	
Access	areas)	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	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 STE	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		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	
	Location-specific research (e.g., tribal	
Culturally-competent safety	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.

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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-forinformed-decision

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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 wellbeing (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: <u>https://www.tandfonline.com/doi/full/10.1080/0269745042000246603?needAccess=true</u> Abstract: N/A

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

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

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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

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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 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

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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 subcharacteristics (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 microlevel 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 streetlevel 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 semistructured 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 Landuse 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.

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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.

DEPARTMENT OF TRANSPORTATION **RESEARCH & INNOVATION**

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.

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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 mixedmethod 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

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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
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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 gualitative/guantitative 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 physiopsychological 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 15minute 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

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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; liritano 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 technicaladministrative 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

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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 Corporate Authors:

Mobility21 (University Transportation Center) Heinz College, Carnegie Mellon University 5000 Forbes Ave, Hamburg Hall Pittsburgh, PA 15213-3890 United States Office of the Assistant Secretary for Research and Technology University Transportation Centers Program Department of Transportation Washington, DC 20590 United States URL: https://ppms.cit.cmu.edu/media/project_files/366 - Final_Report.pdf

https://ppms.cit.cmu.edu/projects/detail/366

https://rosap.ntl.bts.gov/view/dot/63343

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 guantitatively and gualitatively 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

RESEARCH & INNOVATION

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 midmornings 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

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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 supplyoriented 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-travelerbehavior-data/ Project Contract Numbers: 69A3551947136; 79075-00-B Status: Active Funding Amount: 150000 **Sponsor Organizations:** Office of the Assistant Secretary for Research and Technology University Transportation Centers Program Department of Transportation Washington, DC 20590 United States National Institute for Congestion Reduction University of South Florida Tampa, FL 33620 United States Managing Organizations: National Institute for Congestion Reduction University of South Florida Tampa, FL 33620 United States

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Project Managers: Li, Xiaopeng 0000-0002-5264-3775 xiaopengli@usf.edu Performing Organizations: Texas A&M Transportation Institute (TTI) 400 Harvey Mitchell Parkway South Suite 300 College Station, TX 77845-4375 United States Principal Investigators: Lasley, Phil 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 **Authors:** Ndembe, Elvis; Godavarthy, Ranjit; Mattson, Jeremy; Hough, Jill **Corporate Authors:**

Upper Great Plains Transportation Institute Small Urban and Rural Center on Mobility North Dakota State University Fargo, ND United States Office of the Assistant Secretary for Research and Technology University Transportation Centers Program Department of Transportation Washington, DC 20590 United States 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,

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and examine the role of transit in livability and guality 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 Status: Active Funding Amount: \$156,154 **Sponsor Organizations:** Center for Transportation Equity, Decisions, & Dollars

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University of Texas at Arlington Arlington, TX 76019 United States University of Texas at Arlington Box 19308 Arlington, TX 76019-0308 United States Office of the Assistant Secretary for Research and Technology University Transportation Centers Program **Department of Transportation** Washington, DC 20590 United States **Managing Organizations:** Center for Transportation Equity, Decisions, & Dollars University of Texas at Arlington Arlington, TX 76019 United States University of Texas at Arlington Box 19308 Arlington, TX 76019-0308 United States **Performing Organizations:** University of South Florida, Tampa Center for Urban Transportation Research 3650 Spectrum Boulevard Tampa, FL 33612-9446 United States University of Wisconsin, Madison Department of Civil and Environmental Engineering 1415 Engineering Drive Madison, WI 53706 United States California State Polytechnic University, San Luis Obispo California Polytehcnic State Univeristy San Luis Obispo, CA 93407 United States **Principal Investigators:** Williams, Kristine M University of South Florida, Tampa (813) 974-9807 (813) 974-5168 Kwilliams@cutr.usf.edu McAndrews, Carolyn 0000-0002-0809-4449 Tanvir, Shams Start Date: 2021-03-01 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 Authors: Appleyard, Bruce; Stanton, Jonathan; Allen, Chris **Corporate Authors:** Mineta Transportation Institute **College of Business**

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San José State University San Jose, CA 95192-0219 United States California Department of Transportation Sacramento, CA 95819 United States Department of Transportation 1200 New Jersey Avenue, SE Washington, DC 20590 United States URL: https://doi.org/10.31979/mti.2020.1805; https://rosap.ntl.bts.gov/view/dot/54001 Edition: Final Report Pagination: 75p Publication Date: 2020-12-00

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 wellbeing. 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

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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 wellbeing. 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 Authors: Phinney, Robin; Fonseca, Camila; Bean, Nathan; Zhirong, Jerry **Corporate Authors:**

Institute for Urban and Regional Infrastructure Finance

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Minnesota Department of Transportation 395 John Ireland Boulevard St Paul, MN 55155-1899 United States Pagination: 133p Publication Date: 2020-07-00 URL: http://mndot.gov/research/reports/2020/202022.pdf https://rosap.ntl.bts.gov/view/dot/53975

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

DEPARTMENT OF TRANSPORTATION **RESEARCH & INNOVATION**

Authors: Appleyard, Bruce; Allen, Chris; Stanton, Jonathan **Corporate Authors:** Mineta Transportation Institute **College of Business** San José State University San Jose, CA 95192-0219 United States Office of the Assistant Secretary for Research and Technology University Transportation Centers Program **Department of Transportation** Washington, DC 20590 United States URL: https://doi.org/10.31979/mti.2020.1899 https://merritt.cdlib.org/api/presign-file/ark%253A%252F13030%252Fm5z661fn/1/producer%252FCA-MTI-1899.pdf https://transweb.sjsu.edu/sites/default/files/1899-RB-Appleyard-Smart-Growth-Equity-Framework-Tool.pdf https://rosap.ntl.bts.gov/view/dot/56237 **Edition:** Final Report Pagination: 43p

Publication Date: 2020-02-00

Report/Paper Numbers: 20-02; CA-MTI-1899

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 guality, 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 Project Contract Numbers: Project TFPE 00 Status: Active Funding Amount: 834747 **Sponsor Organizations:** American Association of State Highway and Transportation Officials (AASHTO) 444 North Capitol Street, NW Washington, DC 20001 United States Federal Highway Administration 1200 New Jersey Avenue, SE Washington, DC 20590 United States National Cooperative Highway Research Program **Transportation Research Board** 500 Fifth Street, NW Washington, DC 20001 United States **Project Managers:** Hartell, Ann M **Performing Organizations: Research Triangle Institute** 3040 East Cornwallis Road P.O. Box 12194 Research Triangle Park, NC 27709 United States Principal Investigator: Gallaher, Michael 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

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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

Authors: Zondag, Barry; Molenwijk, Eric

Corporate Authors:

Association for European Transport (AET)

1 Vernon Mews, Vernon Street, West Kensington

London W14 ORL

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

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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 Authors: Rumore, Danya; Stoker, Philip; Levine, Zacharia; Romaniello, Lindsey **Corporate Authors:** University of Utah, Salt Lake City Salt Lake City, UT United States University of Arizona, Tucson Tucson, AZ 85721 United States National Institute for Transportation and Communities Portland State University P.O. Box 751 Portland, OR 97207 United States Office of the Assistant Secretary for Research and Technology University Transportation Centers Program **Department of Transportation** Washington, DC 20590 United States Pagination: 69p Publication Date: 2019-06-00 Report/Paper Numbers: NITC-RR-1118 Edition: Final Report URL: https://ppms.trec.pdx.edu/media/project_files/NITC-RR1118 Planning in Gateway and Natural Amenity Regions C1OBJF2.pdf 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

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rapid growth and increases in tourism. Surprisingly, while the unique transportation and planningrelated 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.

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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 decisionmaking 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-communitiestechnical-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:** Western Transportation Institute Montana State University, Bozeman P.O. Box 174250 Bozeman, MT 59717-4250 United States **Project Managers:** Tucker-Thomas, Dawn dawn.tucker-thomas@dot.gov **Performing Organizations:** Western Transportation Institute Montana State University, Bozeman P.O. Box 174250 Bozeman, MT 59717-4250 United States **Principal Investigators:** Gleason, Rebecca (406) 994-6541 rebecco.gleason@coe.montana.edu Start Date: 2018-11-01 Expected Completion Date: 2019-12-31 USDOT Program: University Transportation Centers Program Source Agency: Western Transportation Institute Montana State University, Bozeman P.O. Box 174250 Bozeman, MT 59717-4250 United States 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:** New England University Transportation Center Massachusetts Institute of Technology 77 Massachusetts Avenue, Room 40-279 Cambridge, MA 01239 United States **Project Managers:** Coughlin, Joseph F Massachusetts Institute of Technology coughlin@mit.edu **Performing Organizations:** Massachusetts Institute of Technology 77 Massachusetts Avenue Cambridge, MA 02139 United States **Principal Investigators:** Coughlin, Joseph F Massachusetts Institute of Technology coughlin@mit.edu 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 77 Massachusetts Avenue, Room 40-279 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)

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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: Southeastern Transportation Research, Innovation, Development and Education Center (STRIDE) University of Florida 365 Weil Hall Gainesville, FL 32611 United States **Project Managers:** Tucker-Thomas, Dawn dawn.tucker-thomas@dot.gov **Performing Organizations:** The Citadel Department of Civil and Environmental Engineering **171 Moultrie Street** Charleston, SC 29409 United States Medical University of South Carolina **Department of Public Health Sciences** 135 Cannon Street Charleston, SC 29425 United States **Principal Investigators:** Michalaka, Dimitra 843-953-7676 dimitra.michalaka@citadel.edu 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) University of Florida 365 Weil Hall Gainesville, FL 32611 United States 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,

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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

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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.

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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 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). 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 wellbeing, 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



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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?'