Climate Vulnerability Index
A Tool for Transportation Planners

Texas Association of Municipal Planning Organizations
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+50 years of finding the ways that work.
Transportation Planning for Equity, Sustainability, Resilience and Health
Infrastructure Investment and Jobs Act – New Funds and Priorities for Transportation Projects

• Once in a generation opportunity for state and local governments to invest in future-proof transportation systems.

• More than $200 billion for transportation projects:
  • Roads, bridges and railways
  • Public transit and airports
  • Electric vehicle charging infrastructure
  • And more…

• Administration priorities include:
  • Reduce climate emissions,
  • Promote climate resilience
  • Reduce historic inequities

Source: https://www.gfoa.org/the-infrastructure-investment-and-jobs-act-iija-was
MPO Survey and Case Studies – Challenges, Barriers, Opportunities

• **Goal:**
  • *Characterize MPO current practice in incorporating sustainability, equity and resilience factors in transportation planning and project selection decisions.*

• **Survey of 40+ MPOs across United States** (data collection ongoing)

• **In-depth interviews with 5 large MPOs** –
  • Atlanta Regional Council (ARC)
  • Baltimore Metropolitan Council (BMC),
  • Houston Galveston Area Council (HGAC),
  • North Central Texas Council of Governments (NCTCOG),
  • San Diego Association of Governments (SANDAG)
Survey Results: MPO Priorities

- **Climate, equity and environmental justice are growing priorities for MPOs***(but still outweighed by traditional MPO responsibilities such as safety and infrastructure maintenance).

**Question:**
To what extent does consideration of the following criteria influence outcomes of your regional transportation planning?
Survey Results: Evaluating Equity

• A majority of MPOs did not have an official definition of “equity” as used in the transportation planning process.

*Question:* Do you have an official definition of the term equity as it relates to your transportation planning process?
How is Equity evaluated in transportation planning processes? – MPO Case Studies

• Most MPOs use demographic data to identify or “screen” for disadvantaged areas.

• Generally, equity is assessed focusing on equity of access to transportation.

• Environmental, climate or health criteria assessed separately if at all.
Survey Results – Environmental Justice Screening Tools

- A majority of respondents had not used major EJ screening tools (e.g. EPA’s EJ Screen) in transportation planning process.

**Question:**
Have you ever used EJ Screen in your transportation planning processes?
Air quality, GHG Emissions, Climate Resilience and Health – MPO Case Studies

• Stringent state GHG emission targets strongly influence long-range transportation plans for MPOs in those states (e.g. California).

• Traditional air quality-related priorities like congestion mitigation and transportation conformity play a larger role in other states (including Texas).

• Climate Resilience is an emerging and high-priority focus for many MPOs*.  
  • *But data is a big challenge

• Health is not explicitly addressed or tracked by most MPOs as a goal of transportation planning
  • *But implicitly addressed in actions on air quality, equity, GHGs
Black, Hispanic, and Indigenous individuals in the U.S. face the highest burden of asthma. These disparities are caused by complex factors including systemic and structural racism.

Compared to white Americans:

- Black Americans are nearly 1.5 times more likely to have asthma.
- Puerto Rican Americans are nearly 2 times more likely to have asthma.
- Black Americans are 5 times more likely to visit the emergency department due to asthma.
- Black Americans are 3 times more likely to die from asthma.

When sex is factored in, black women have the highest rates of death due to asthma.

aafa.org/asthmadisparities
Environmental Racism, Unequal Health Impacts

Average per person contribution and exposure to air pollution by race/ethnicity*

<table>
<thead>
<tr>
<th>Race/ethnicity</th>
<th>2003</th>
<th>2005</th>
<th>2013</th>
<th>2015</th>
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<tr>
<td>Black</td>
<td>12</td>
<td>10</td>
<td>8</td>
<td>6</td>
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<tr>
<td>Hispanic</td>
<td>4</td>
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<tr>
<td>White/Other</td>
<td>0</td>
<td>0</td>
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<td>0</td>
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</table>

*Group population-adjusted
Taylor Maggiacomo, NGM Staff
Sources: Jason Hill, University of Minnesota; Chris Tessum, University of Illinois

Deaths and Costs Due to PM$_{2.5}$ Exposure in Houston in 2015

<table>
<thead>
<tr>
<th>PM$_{2.5}$ Level</th>
<th>Deaths</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above EPA standard</td>
<td>1,318</td>
<td>$12.4 billion</td>
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<tr>
<td>Below EPA standard</td>
<td>3,895</td>
<td>$36.7 billion</td>
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<tr>
<td>Total</td>
<td>5,213</td>
<td>$49.1 billion</td>
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</table>

PM$_{2.5}$ level is annual average. EPA standard is 12 µg/m$^3$.

Source: Houston Harris Heat Action Team

http://blogs.edf.org/health/2020/05/11/pm-standards-houston-analysis/
www.understandinghouston.org/blog/examining-the-effects-of-environmental-racism-in-houston
Widespread Interest

• **Biden Executive Orders:**
  – Justice40
  – Tackling the Climate Crisis at Home and Abroad
  – Expanding EJ Screening tools

• **NOAA, EPA exploring these areas**
  – Recent EPA report
    www.epa.gov/cira/social-vulnerability-report

• **White House Environmental Justice Advisory Council (WHEJAC) recommendations**
  www.epa.gov/environmentaljustice/white-house-environmental-justice-advisory-council-final-recommendations
Data to Action

Environmental Challenges

Regulatory Air Monitor
Coming 2023!
Overall Goal: Identify local climate vulnerabilities on a national scale through a data-driven, GIS-based mapping tool integrating cumulative impacts of climate change, health, and environment

• Engage proactively with communities to guide CVI tool development
• Utilize a wide range of datasets, from national/state/county/census tract-level databases to citizen science
• Identify vulnerable communities by integrating disparate data sources to create unitless indices
• Elucidate local drivers of vulnerability, systemic inequities and cumulative burdens through data-driven visualization and analytics

Intended Impact: Mitigate climate vulnerabilities by assisting decision-making, policy development, resource allocation, preparedness planning, EJ advocacy
Climate Vulnerability Index

- 184 indicators
- Existing, publicly available data
  - Annual data
  - 2017-2019
- All 50 States + District of Columbia
- Neighborhood level / Census Tracts
  - 73,057 Census Tracts
Domains

**BASELINE DATA**
Reduce resilience to climate change related hazards

- Health (37)
- Environment (42)
- Social & Economic (24)
- Infrastructure (28)

**CLIMATE CHANGE IMPACTS**
Direct and indirect

- Health (8)
- Extreme Events (21)
- Social & Economic (16)

Census tract level
Nation-wide scale
Baseline Infrastructure Domain

Sub-Domains and Indicators (28)

**Transportation**
- Congestion Delay
- Flooding Risk to Roads
- Lane Miles
- Truck Lane Miles
- Public Transit
- Bridge Quality/Maintenance
- Walkability
- Transit Access
- Bikeability
- Road Quality/Maintenance

**Energy**
- Residential Energy Cost Burden
- Share of Energy from Fossil Fuels
- EV Charging

**Food, Water, Waste Management**
- Access to Healthy Foods
- Food Insecurity
- Modified Retail Food Environment Index
- Indoor Plumbing

**Communication**
- No Broadband/Internet Access
- Smartphone Only

**Governance**
- Real Estate Taxes
- Voter Turnout
- Public Library Locations
- HUD Public Housing
- HUD Funding

**Financial Services**
- Unbanked Households
- Payday Lending
- Housing Affordability (owners)
- Housing Affordability (renters)
Baseline Environment Domain

Sub-Domains and Indicators (42)

Transportation Sources

- Total Vehicle Miles Traveled (VMT)
- Passenger VMT
- Medium Duty Vehicle VMT
- Heavy Duty Vehicle VMT
- Proximity to Ports
- Railroad Crossings
- Traffic Proximity/Volume
- Transportation-Related Noise

Exposures & Risks

- Risk-Screening Environmental Indicators (RSEI)
- AirToxScreen HI:
  - Respiratory, Neurologic, Liver, Developmental, Reproductive, Kidney, Immune, Thyroid
- AirToxScreen Cancer
- Black Carbon
- Agricultural Pesticides
- Lead Paint: Housing units built before 1960
- Lead in Drinking Water

Pollution Sources

- Superfund Sites
- Brownfields
- Major direct dischargers to water
- Proximity to Facilities Participating in Air Markets
- Proximity to National Priorities List (NPL) sites
- Proximity to Treatment Storage and Disposal (TSDP) facilities
- Proximity to Hazardous Waste Generators
- Proximity to Facility with Enforcement/Violation
- Proximity to Landfills
- Proximity to TSCA Facilities
- Proximity to Risk Management Plan (RMP) facilities
- Proximity to Petrochem facilities
- Proximity to Metal Recyclers
- Proximity to Oil & Gas Wells

Criteria Air Pollutants

- PM$_{2.5}$
- NO$_2$
- O$_3$

Land Use

- Parks/Greenspace
- Impermeable Surfaces
- Forest Land Cover
- Native American Lands
Climate Change Impact: Extreme Events
Sub-Domains and Indicators (21)

Temperature
- Historical: Cold Wave, Heat Wave
- Projected: Days with maximum Temperature above 35°C, Days with Temperature above 40°C, Frost Days, Maximum of maximum temperatures, Mean temperature, Urban Heat Island

Precipitation
- Projected: Snowfall, Total Precipitation, Standardized Precipitation Index

Flooding
- Historical: Coastal Flooding, Riverine Flooding
- Projected: Sea Level Rise

Storms
- Historical: Hurricanes, Tornadoes, Winter Weather

Droughts
- Historical: Drought
- Projected: Consecutive Dry Days

Wildfires
- Historical: Wildfire
- Projected: Surface PM$_{2.5}$
Combined Climate Change Impact Domains
## Fifth Ward

<table>
<thead>
<tr>
<th>Community</th>
<th>Census Tract</th>
<th>ToxPi Score</th>
<th>ToxPi RANK (N=73,057)</th>
<th>Percentile</th>
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<tr>
<td>Fifth Ward</td>
<td>48201210100</td>
<td>0.53711</td>
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<td>48201212300</td>
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<table>
<thead>
<tr>
<th>Census Tract</th>
<th>Baseline Health</th>
<th>SocialEconomic</th>
<th>Baseline Infrastructure</th>
<th>Baseline Environment</th>
<th>Climate Change Health</th>
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Fifth Ward
Overall ToxPi
Score & Ranking

Drivers of Vulnerability
Baseline Infrastructure
Baseline Environment
Baseline Health
Baseline Social & Economic
Climate Change Impact Social & Economic

DO NOT CIRCULATE
Justice40: List of Initial Programs

HHS: 13 programs

1. National Institutes of Health - National Institute of Environmental Health Sciences (NIEHS) Environmental Career Worker Training Program
2. Administration for Children and Families - Low Income Home Energy Assistance Program (LIHEAP)
3. Indian Health Service - Sanitation Facilities Construction Program
4. Administration for Children and Families - Low Income Household Water Assistance Program
5. Administration for Children and Families - Community Services Block Grant
6. Administration for Children and Families - Community Economic Development
7. Administration for Children and Families - Rural Community Development Program
8. Centers for Disease Control and Prevention - Climate-Ready States & Cities Initiative
9. Centers for Disease Control and Prevention - Agency for Toxic Substances and Disease Registry (ATSDR) - Pediatric Environmental Health Specialty Units
10. Centers for Disease Control and Prevention - ATSDR - Office of Community Health and Hazard Assessment
11. Centers for Disease Control and Prevention - ATSDR - Partnership to Promote Local Efforts to Reduce Environmental Exposure (APPLETREE) Cooperative Agreement Program
12. Centers for Disease Control and Prevention - Flint Lead Exposure Registry
13. Assistant Secretary for Administration - Federal Real Property Assistance Program

Data Source: www.hhs.gov/about/news/2022/06/24/hhs-announces-programs-to-join-president-bidens-justice40-initiative.html
Justice40: List of Initial Programs

• EPA: 72 Covered Programs  
  Drinking water, Brownfields, Lead risk reduction, Targeted Airshed Grants, Environmental Education and Information, etc  

• Dept. of Interior: 65 Covered programs  
  www.doi.gov/justice40-initiative

• Dept. of Agriculture: 40 Covered programs  
- Publish research paper (under review *Environment Int’l*)
- Build interactive dashboard
- Develop Texas Specific tool
  - Gather feedback from stakeholders
- Justice40 benefits to communities
Climate, Health and Equity in Transportation Planning –

Attendee Poll:

• We want to hear from you – go to the link below on your mobile device and respond to a few quick questions about how your MPO is tackling environmental, health and equity challenges.

• Scan this QR code to access poll or access the link at bit.ly/mpo-survey:
Opportunities and Data-Driven Environmental Screening Tools

• Sustainability, Equity and Resilience goals increasingly a part of transportation planning, with benefits for health.

• Data and data-driven decision support tools are critical for evaluating these criteria and prioritizing policies.

• National and region-specific data is available to support evaluation of environmental, climate and equity factors.
  • New environmental screening tools leverage this data and can be used for transportation planning