NCHRP Project 20-44(22)
Right Sizing Transportation Investments

FINAL SUMMARY

Prepared for
National Cooperative Highway Research Program
Transportation Research Board
of
The National Academies of Sciences, Engineering, and Medicine

1 Introduction

This implementation summary synoptically covers (1) the right-sizing challenges addressed in North Carolina, Utah, Iowa, and Georgia, (2) aspects of the NCHRP 917 research applied in each state implemented (and why chosen), (3) a brief description of the right-sizing approach taken in each state with its findings and results and (4) next steps for each of the respective states in implementing/ integrating the research into their business process with NCHRP 20-44(22) complete.

Each of the four states was able to identify previously unidentified needs and opportunities through the NCHRP 917 methods. Each state also (1) expanded the principles in the guidebook to address topics not envisioned by the original research, (2) encountered and addressed practical obstacles incorporating the research with lessons learned for future practitioners (3) developed implementation techniques that may be of assistance to other states applying right-sizing in similar ways.

Following this summary memorandum, the research team proposes to (1) encapsulate the experiences of these four states in educational videos that can serve as both leave-behinds for the implementing agencies and a resource for their peer agencies, (2) provide NCHRP with a brief ‘playbook’ for future agencies seeking to build on the experience of these initial four and (3) host a virtual peer-workshop with the four states to compare their experiences and document the workshop for an NCHRP deliverable.

2 North Carolina: Right-Sizing Networks and Corridors

Right-sizing Challenges: The North Carolina Department of Transportation (NCDOT), the French Broad River MPO in Asheville (FBRMPO) and the City of Raleigh have all been working with the research team to implement two key aspects of NCHRP 917. Key right-sizing challenges that NCDOT has sought to address through implementation include:

1. **Fast growth on undersized networks:** NCDOT and MPOs across the state have seen that fast-growing urbanization in previously rural areas is blocking the DOT’s ability to create needed corridors as these areas transition to suburban or urban patterns. They view the “Master Architecture” right-sizing concept of NCHRP 917 (Chapter 4.9) as strongly applicable in diagnosing weaknesses in the long-term resilience of their network, along with opportunities to prevent costly retro-fitting to right-size already built-out areas. Pro-actively right-sizing networks to prevent future bottlenecks or deficiencies is at the heart of this implementation effort.
2. **Right-sizing corridors to multiple objectives:** North Carolina has many historic corridors where the present configuration of infrastructure is not well suited to emerging land uses. NCDOT in association with the Capital area MPO (CAMPO) engaged the research team to study a specific corridor in Raleigh to see if the right-sizing design process could reveal opportunities they may not otherwise discover.

2.1 Right-sizing Asheville's Regional Network

Creating a "Fishnet Overlay": NCHRP 917 recommends that a right-sized region, at buildout, will have a range of collectors, arterials, and expressways, ideally following the pattern shown in **Figure 2.1.** The default pattern is a collector every half-mile, an arterial every 1-mile, and an expressway or freeway every 5-miles. Communities are welcome to adjust this default to their geographic, political, and desired modal environments, but the point is to imagine how their network should look in a built-out environment. In this case, the 5x5 "tile" would be repeated across the entire county or region.

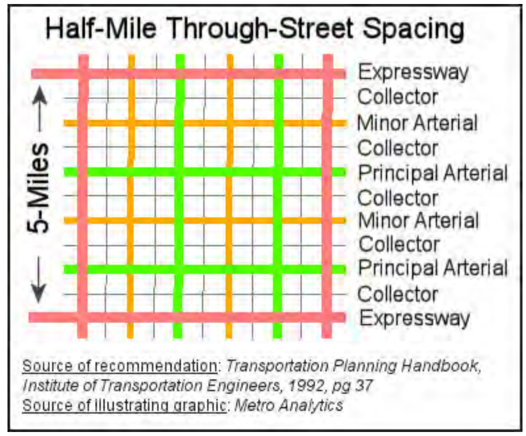


Figure 2-1 *Starting point pattern for roadway spacing from NCHRP 917*

Asheville is a fast-growing community that believes there will be benefits in adapting their horizon-year planning approach to incorporate this post-horizon spatial form of planning. **Figure 2.2** was developed by the research team in conjunction with the FBRMPO. On the left is existing plus planned for Buncombe County. On the right is a "fishnet overlay" developed using right-sizing methodologies. Because the area is mountainous (blue areas), the 5x5 tiles of "Error! Reference source not found" were considered less necessary since the area has less development potential. Thus, these are 10x10 tiles that emphasize more collectors and fewer arterials. But even at a lower network density, it is easy to see that many portions of the county lack network resiliency.

The purpose of the fishnet overlay is to make county, city, and other stakeholders aware that their network lacks resiliency and connectivity. The few through streets that exist will become overwhelmed as more portions of the region move toward buildout.

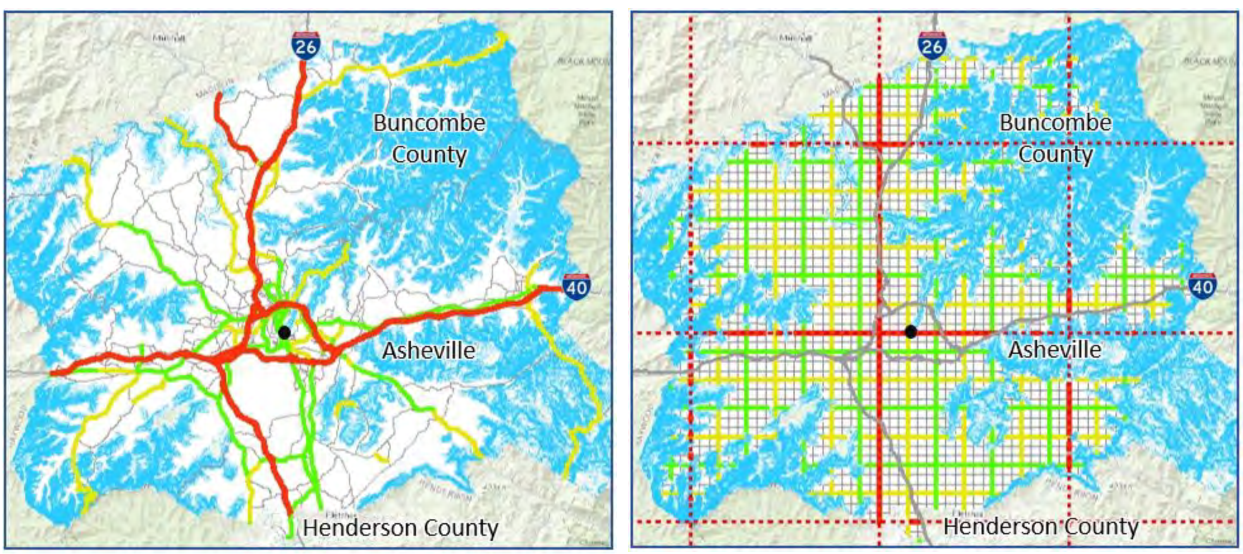


Figure 2-2 *Zooming in on Buncombe County*

Gap-Filling via Paths of Least Resistance: The fishnet overlay helps identify where there are significant gaps in the network and helps motivate communities to look for pathways to fill those gaps. The next step is to zoom in and use aerial photos and other GIS layers to define first-iteration paths of least resistance for filling those gaps.

Figure 2-3 Maps like this imply alignment decisions have been made. It fails to recognize that negotiation will change these paths considerably, and some segments may be abandoned.

As the research team helped FBRMPO develop paths of least resistance, graphics such as **Figure 2.3** emerged showing potential locations for new streets. However, both FBRMPO and NCDOT were concerned that depicting potential new corridors as "solid lines" may alarm the public that specific pathways have already been decided without any public input.

Figure 2.4 is the same area depicted in a more acceptable way. Buffers around potential new corridors help communicate that no decision has been made, and there will be opportunities to evaluate the need for and final location of these corridors. This figure also shows which segments are more threatened than others, revealing the urgency of working with stakeholders in these areas.

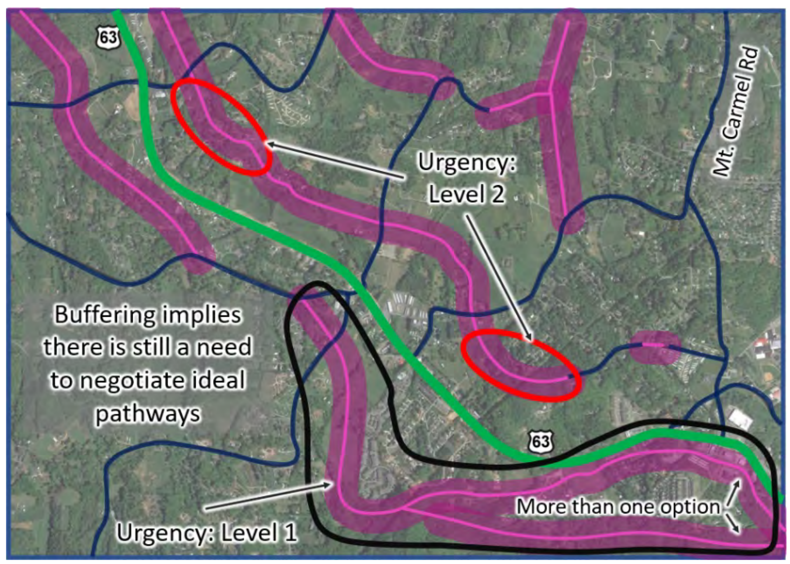


Figure 2-4 Aerial with buffers for potential new corridors implies there is a need to negotiate.

Integration With the Planning Process: Both FBRMPO and NCDOT found this process to be very useful. Both believe this process could fit into the visioning element of the MPO's Comprehensive Transportation Planning (CTP) process.

With a goal of getting needed corridors onto county and city master plans, our research team identified a nine-step process for creating a regional architecture with buy-in from local stakeholders.

Step 1: Use Fishnet "Ideal Grid" to Create Interagency Awareness: Create a "planned vs ideal" graphic to help counties, cities, and DOTs discover if their existing plus planned network will be adequate as parts of the region approach buildout. This can be part of Visioning or Needs Assessment.

Step 2: Paths of Least Resistance (Iteration 1): To close gaps, use aerial photos and other relevant layers to create "apparent paths of least resistance" similar to those in **Figure 1.4**. Concentrate on areas likely to become at least 20% developed over the next 20-30 years, as 20% will likely be enough to block many of the best path options. Finding pathways to support areas already at 20% or higher should be considered urgent.

Step 3: Paths of Least Resistance (Iteration 2): Assuming the MPO has gained buy-in from county, city, and DOT staff members that portions of the long-term network are undersized, and that the MPO has created first iteration paths to fill the gaps, seek interagency feedback on Iteration 1 paths to incorporate local awareness and sensitivities.

Step 4: Areas of Urgency: Assuming there is interagency agreement to include unthreatened paths in a subregional buildout architecture, guide interagency partners to potentially controversial "hot spots" where choke points and fast-paced development may soon make it impossible to create valuable links. Get interagency agreement that these are indeed the most urgent locations to focus on.

Step 5: High-Level Public Presentation: Present high-level graphics at MPO board meetings, interagency gatherings, etc. Encourage those who hear to utilize these graphics in their own presentations to broaden awareness of the need for a Master Architecture. Emphasize that candidate paths for the architecture appear to be desirable, but exact paths can be decided later at the local level.

Step 6: Add Architecture to MPO Regional Plan: The links created earlier become the architecture of the region at build-out. From there, use the regular MPO long range planning process to see which links and modes make sense to include in the fiscally constrained plan, by phase. Any links that are hard to afford or to justify by the horizon year can still be shown as an "illustrative" phase. Collectors and small arterials will often be built by developers, and do not need to be budgeted to a specific phase or otherwise justified – it is enough to just show them on MPO and subsequent city/county plans.

Step 7: Urgent Area Studies: For areas where emerging development will soon close down valuable connections, sponsor small area studies to reach stakeholder consensus on what to do. The outcome need not be "AutoCAD drawings" of the exact right-of-way needed, but it should have enough specificity for developers to form their own plans around the corridor.

Step 8: County and Municipal Plans: With the regional plan established, it will be easier for sub-regional plans to point to the regional plan to justify why they intend to add new links to their own plans.

2.2 Right-sizing Corridors: Raleigh Example

NCDOT and the City of Raleigh expressed interest in understanding how to evaluate arterial corridors to discover opportunities for enhanced multimodal mobility and safety as well as for place-making and economic development. This effort created additional evaluation tools based on guidance in NCHRP 917 and utilized several right-sizing design methods. NCDOT and the city together recommended looking at US-70 in northwest Raleigh as a location they had studied before and wondered if right-sizing could offer anything new.

To evaluate the corridor, the research team developed an "Arterial Right-sizing Tool" (ART) – a spreadsheet tool that serves as a framework for asking the right questions and evaluating the corridor across several key dimensions. The tool asks the user to enter key attributes of the corridor such as functional type, number of lanes, typical lane width, typical speed limit, and typical intersection configuration. It then creates a point system across the following key categories:

Traffic Volume Analysis: If present infrastructure is significantly oversized for foreseeable needs, there is a strong case for right-sizing as downsizing in this category. If the present is significantly undersized for emerging needs, right-sizing will then include new capacity. The focus then is on how to serve that demand using right-sizing design guidance.

Network Spacing Analysis: This section of the tool applies the architecture approach discussed previously and applies it to the corridor. How far is it to parallel corridors? Are there opportunities to enhance nearby alternatives?

Land Use Analysis: This section evaluates both the present and future in terms of the 7D's of sustainable land use: 1) Density; 2) Diversity; 3) Design; 4) Destinations; 5) Distance to Transit; 6) Demographics; 7) Demand Management.

Stakeholder Analysis: This section asks the user to estimate the scale of the need for affordable housing and transportation and equity. It also asks about the level of support for increasing or decreasing vehicle capacity, deploying better transit, and enhancing active modes. This section also asks the user to assess the potential for multi-agency funding and even private funding of corridor features based on the Stratified ROI concept.

Speed / Trip Length / Safety Analysis: This helps users assess the scale of demand for both long and short trips, and hence the need for high speed (bending toward mobility) vs low speed (bending toward safety and place-making).

Opportunity Analysis: Right-sizing through design is heavily dependent on the potential to implement key designs such as backage roads and place-making alternative intersections. This section helps the user think through different design options and their relative ease or difficulty.

2.3 Right-Sized Concepts That Emerged

The right-sizing process resulted in many design concepts, including the one-way couplet concept shown in **Figure 2.5**. The ART tool identified that because traffic volumes are high and getting higher, there is a strong case for mobility management right-sizing. There are several good community development design opportunities, but the overall case for right-sizing based on community development needs is weaker, largely because the corridor is not facing struggling land uses or equity concerns at this point.

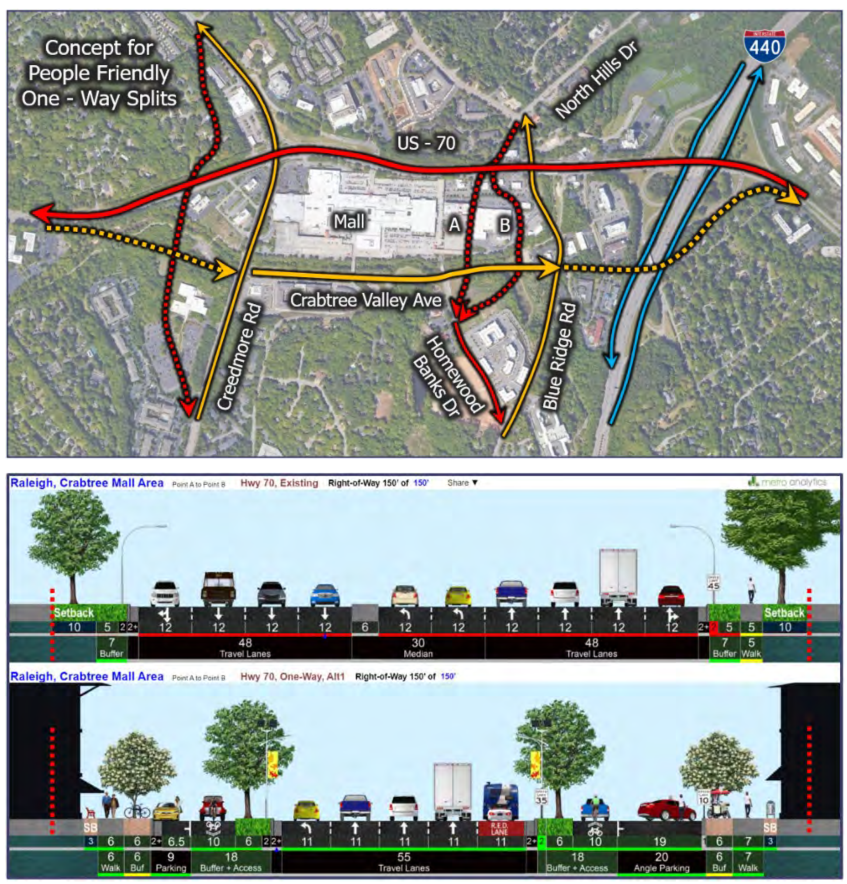


Figure 2-5 One-way concepts. Liked by NCDOT, but too late in planning cycle

Reaction of NCDOT and Raleigh Staff: The design concepts were circulated among several NCDOT and Raleigh city staff members. They were generally impressed that the process resulted in innovative strategies that address a host of various objectives. However, because this corridor has recently been studied, they were concerned that such brainstorming could conflict with previous efforts, and thus are hesitant to dig deeper into designs that emerged at this specific site.

Appropriate Placement within the Planning Process: NCDOT and Raleigh both agree that the brainstorming exercise prompted by the ART tool can be very helpful in generating concepts for further vetting, but they discovered it creates problems to do so after other ideas have already been vetted and there is a preferred expectation. Thus, right-sizing will be better received much earlier in the process. NCDOT follows a "Comprehensive Transportation Planning" process (CTP) where right-sizing at the corridor level could be part of establishing a corridor vision, identifying needs, and brainstorming right-sizing alternatives (CTP 1-3 in **Figure 2.7**).

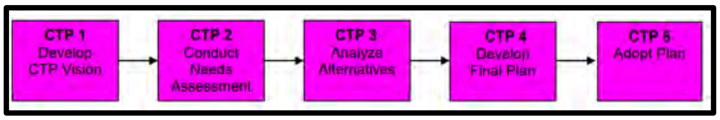


Figure 2-6 *NCDOT's Comprehensive Transportation Planning Process (CTP)*

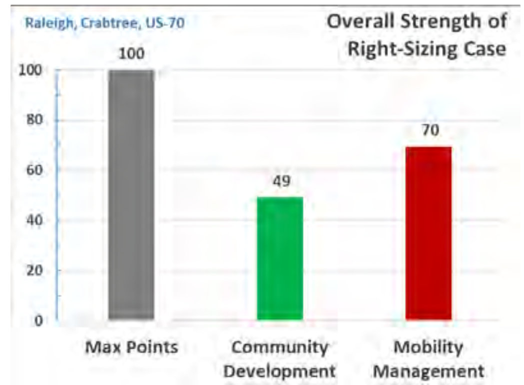


Figure 2-7 *ART tool results in US-70 Corridor*

Way Forward for NCDOT Right-Sizing - Ongoing Implementation and Next Steps for NCDOT and its MPO's: Upon concluding its right-sizing methodology, NCDOT identified several action items associated with educating its districts and MPO's on the types of methods and right-sizing solutions implemented through NCHRP 02-44. NCDOT requested that the research team offer a "neutral" case example (without controversial location-specific alternatives which might draw controversy) to demonstrate how the method works in an educational sense. The DOT currently envisions introducing right-sizing solution-sets into the CTP process as a way to identify alternatives before projects are scoped or budgeted. CAMPO and the FBRMBO's examples are also considered for presentation at the NCAMPO conference in 2022. The neutral teaching cases and CTP process are currently under review with the DOT and MPOs and will be further discussed at the July workshop as ongoing opportunities to integrate the lessons learned form the 20-44(22) implementation into the DOT's ongoing business process.

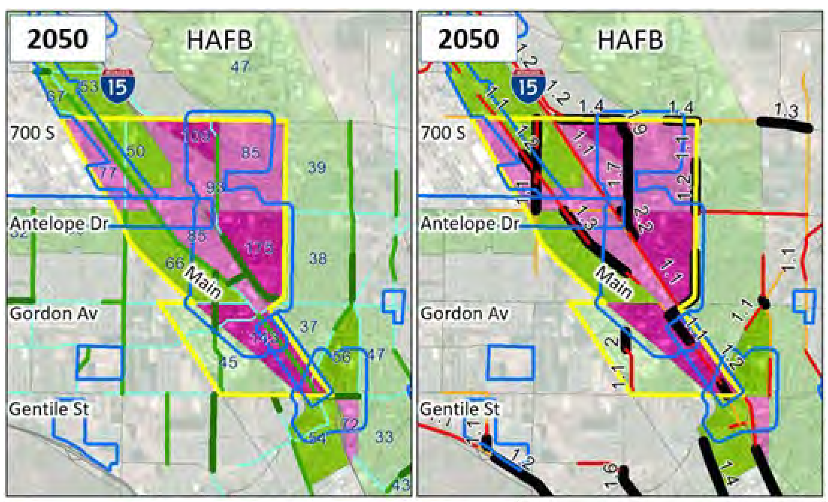
3 Utah: Right-Sizing for Walkable Activity Centers

Right-Sizing Challenges: The Wasatch Front Regional Council (WFRC – MPO for the Salt Lake City region), has a regional growth policy that aims to catalyze walkable, sustainable development along key corridors and Activity Centers across the region. These locations are usually suburban auto-oriented commercial areas built around 5-7-lane highways usually owned by the Utah Department of Transportation. The Utah DOT (UDOT) engaged with NCHRP 917 seeking ways to support WFRC in managing expansion needs and finding nimble and cost-effective ways to enhance performance while managing high volumes of traffic in more people-friendly ways.

Thus, WFRC and UDOT are interested in (1) the degree to which right-sizing tools/methods are helpful in developing sustainable Activity Centers, (2) the potential for the tools to support dialogue with local government that have land use authority over the centers and other stakeholders, and (3) input on how these tools can help during UDOT's solutions development process. Key elements of the guidebook implemented include the guidance on urban right-sizing (pages 34-39 of the Guidebook); and diagnosing/evaluating livable centers using trip-length analysis and related business and household demography (as described in chapter 4.1 of NCHRP 917 – starting on page 73). After applying these policy and methodological diagnostics and principles, UDOT and the MPO went on to consider design solutions consistent with the design section of the Technical Appendix)

3.1 Diagnosing Needs at Activity Centers

WFRC uses a land use model to determine how quickly different areas will grow. **Figure 2.1** shows the Layton Activity Center, north of Salt Lake City. Pink areas have more than 70 trips per acre in 2050, which is 3.1 times higher than the general suburban trip density. In the left image, green links are 60-80% short trips (under 5-miles), and dark green are more than 80% short trips, indicating a strong likelihood that active mode investments will be well utilized in this area.



Layton	2019	2050	Total Acres	3,100
HH / Acre	3	7	Trip increase since 2019	62%
Jobs / Acre	10	14	Compared to SL-19 suburbs	3.1
Trips / Acre	57	93	2050 Trips vs SL-19 CBD	63%

Yellow outline increases 62% over present, with 3.1x more trips/acre than SL's 2019 suburban average. Density is 63% of SL-19 CBD, and same acres.

Figure 3-1 *Left shows roadways with short trip lengths in green. Right shows V/C ratios exceeding 1.2 (black), suggesting that unless congestion is addressed, it may hinder the center's ability to increase in density.*

The right image has the same trip density map, but the link colors represent congestion. Red is Volume-Capacity ratios from 1.0 to 1.2, and Black is 1.2 or higher measured over a three-hour period (meaning one-hour demand would be even more congested). The table shows household, job, and trip densities within the yellow outline for 2019 vs 2050. It also shows comparisons with three benchmarks: 1) 2050 has 62% more trips than there were in the same center in 2019; 2) by 2050, the Layton center will have 3.1 times more trips per acre than the presently built out suburban areas of Salt Lake County, and 3) By 2050, an acre here is on average 63% as intense as an acre in downtown Salt Lake City. Thus, Layton in 2050 is about 63% as intense as downtown Salt Lake City today.

Additionally, our work with WFRC identified three different methods for conducting a trip-length analysis from which to judge the efficacy of Complete Street investments.

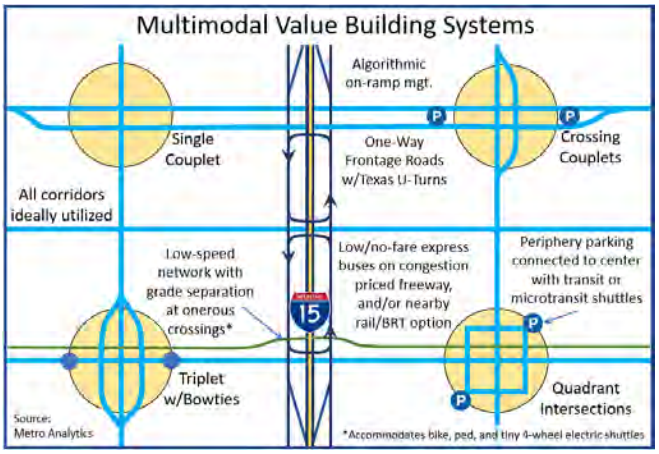


Figure 3-2 Example of value-building freeway and arterials

3.2 Right-Sizing Techniques for Walkable Activity Centers

The research team identified several multimodal strategies that can catalyze strong, valuable Activity Centers, a few of which are depicted in **Figure 2.2**. Several checklists of Activity Center right-sizing strategies were developed, and each element in these lists was expounded on in earlier memos. Below is a summary of these checklists.

3.3 Checklist of Framework and Analysis Techniques

3.3.1 7Ds of Placemaking that Reduce VMT: Focus on 1. Density, 2. Diversity of uses, 3. Design (blocks, trees, etc), 4. Destinations, 5. Distance from Transit, 6. Demographics, 7. Demand Management.

3.3.2 7Ds of Mobility Management: 1. Design with the end in mind, 2. Divert traffic to other paths, 3. Deduct traffic with alternative modes, 4. Delete VMT with land uses that shorten trips, 5. Dynamic ITS, 6. Directly create efficient capacity, 7. Deal-making for financing

3.3.3 8Fs of Transit Ridership: 1. Frequent service, 2. Familiar awareness of options, 3. Fares matched to demand and goals, 4. Fast for competing with cars, 5. Focused on key destinations, 6. Fun enough to remove stigmas, 7. Fusion with land uses, 8. Frugal to minimize capital + O&M cost.

3.3.4 Build-out Analysis: Size blocks and corridor preservation for post-horizon needs.

3.3.5 Trip Length Analysis: Links with more than 40% of trips under 5-miles are good candidates for walkable investment.

3.3.6 Volume / Capacity Analysis: Serious congestion may limit growth potential.

3.3.7 Stratified ROI Value Capture Analysis: Determine how much businesses and property owners can contribute toward capital and maintenance costs and still be motivated to build.

3.3.8 Duplicative Infrastructure Offset Analysis: Compact, mixed-use development consumes less land and uses less infrastructure. This analysis reveals land and infstructure costs savings.

3.4 Checklist of Freeway Right-Sizing as Relevant to Activity Centers

3.4.1 One-Way Frontage Roads: As a general rule, higher levels of urban development can be supported by freeways with one-way frontage and Texas-U-turn systems.

3.4.2 Cross-Freeway Connections: Look for opportunities for new crossings (bike, ped, and vehicles).

3.4.3 Maximum Size: Transitioning to Demand Management: Resolve against double-decker "Big Dig" freeways. Resolve that if demand exceeds a maximum practical size, the region will manage demand via transit, improving alternative paths, congestion pricing, algorithmic ramp meters, etc.

3.4.4 Low/No-Fare Transit: Reducing or eliminating fares could double ridership and address equity at only marginal additional cost. If considering congestion pricing, gain support by commiting funds from the program to replace any farebox losses.

3.5 Checklist of Transit, Microtransit, Alternative Modes, Parking

3.5.1 **Regional Transit:** Strong centers tend to have premium transit service in the form of passenger rail, BRT, and/or at least one high-frequency bus route with well-sheltered rest areas at stops.

3.5.2 **Circulatory Transit:** Explore free fares on nimble vehicles for short-trip circulation. by creating "moving sidewalk" micro-shuttles on a network dedicated to low-speed vehicles.

3.5.3 **Protected Cycle Tracks:** With increasing popularity of eBikes and scooters, there is a strong case for something better than a painted bike lane next to high speed traffic.

3.5.4 **Low-Speed Vehicle Network:** Make "cycle tracks" slightly wider to allow tiny 4-wheel electric vehicles, as long as they are low-speed.

3.5.5 **Low-Speed Grade Separation:** Consider broad, well-lit tunnels under freeways and major arterials to improve safety and travel speed for pedestrians and other low-speed vehicles.

3.5.6 **Reduce Parking Requirements:** Allow the market to determine parking needs. This will reduce wasted land and catalyze growth.

3.5.7 **Periphery Parking:** Limit parking directly in the center and motivate developers to pay into lower-cost parking at the periphery. Connect parking to the center with regional transit, center circulators, and "moving sidewalks" (scooters, eBikes, and micro-electric shuttles).

3.6 Checklist of Right-Sizing on High Volume Arterials

3.6.1 **10-ft Travel Lanes:** 12-ft travel lanes contribute to faster driving. 10-ft lanes can be safely navigated by large vehicles and they do not measurably reduce overall capacity.

3.6.2 **Calm arterial traffic to 35 mph or less:** Raised table-top intersections, street trees planted within a parking lane, planted medians, and other treatments will create safe speeds in walkable areas.

3.6.3 **Calming local traffic to 20 mph or less:** Yield Streets and other options described in NACTO's Urban Street Design Guide will help ensure that local traffic will travel at safer speeds.

3.6.4 **Reduce conflicts and 4-phase signals:** "Double lefts" at signals create massive hardscape footprints and high levels of congestion at low activity density. Consider these alternatives:

*3.6.4.1 **One-Way Arterials:** Couplets, crossing couplets, and even triplets – all can typically handle more traffic with fewer total lanes than comparable two-way arterials. Even at intentionally slow speeds, they can support high levels of activity without extreme delay.*

*3.6.4.2 **Quadrants:** Quadrants reduce congestion by rerouting lefts to secondary locations via backage roads. Former left-turn lanes become planted medians with pedestrian refuge.*

*3.6.4.3 **Bowties:** Bowties designed with teardrops or roundabouts make it easy to create planted medians as an access control safety measure. They reduce congestion and create efficient, safe access to properties.*

3.7 Checklist of Land Uses, Block Structure, Street Trees

3.7.1 **Arterial Backage Roads:** Aim for continuity of parallel local streets so that local circulation can occur without adding to friction, congestion, and safety hazards on arterials within the center.

3.7.2 **Block Division:** Within key centers, to the extent that there is vacant land or pathways for streets or pedestrian easements, aim for blocks of two to five-acres.

3.7.3 **Building Placement:** Establish form-based codes to minimize the odds of private surface parking between the building and the street. Establish maximum setbacks.

3.7.4 **Street Trees:** A value-building center will plant uniform street trees on both sides of an entire block at the same time, using structured soil such as Silva cells. Protect young trees from "weed whackers" and with summer irrigation, and replace any that die.

3.8 Checklist for Stratified Return on Investment

3.8.1 **Multi-Agency Coordination and Funding:** Build coalitions among agencies with a stake in the activity center. Secure agreements for multi-agency funding and maintenance of amenities, even if a single entity maintains ownership.

3.8.2 **PPP Value Capture:** To finance more items from this checklist, show businesses how they can profit by organizing a business improvement district to help construct and maintain "curb appeal" amenities and better multimodal accessibilty. Odds increase that they will participate if it is clear that the final project will be delayed or will lack value-add features unless they contribute.

These checklists were applied to an emerging Activity Center in Draper, Utah. Concepts that emerged here were shared with developers who are currently planning the site, as well as with UDOT and WFRC. All reported back that the checklists and strategies are helpful for crafting a comprehensive strategy that blends transportation with land use and economic development objectives.

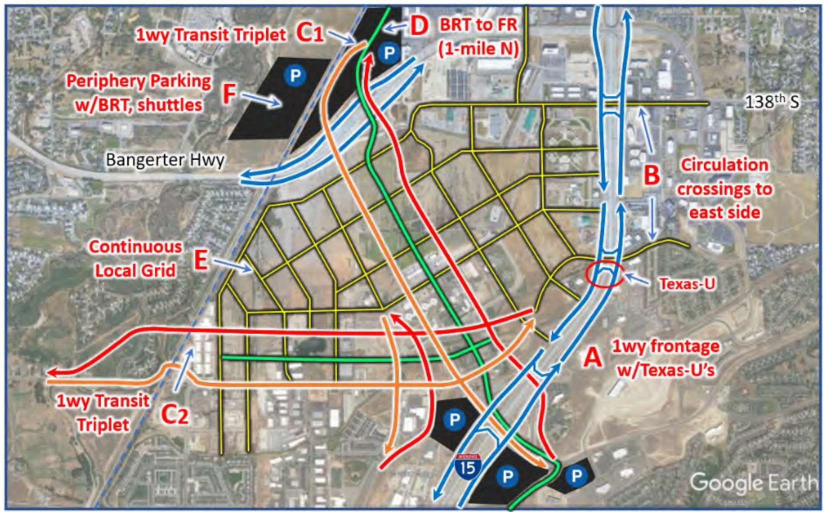


Figure 3-3 *Right-Sizing Checklist led to this Activity Center concept plan in Draper, Utah, which is being seriously studied by planners and developers.*

3.9 Utah Right-Sizing Workshops

In December of 2020 the research team, WFRC, and UDOT held a strategic workshop to consider the findings of the right-sizing diagnostics and associated strategies for mitigating hinderances to the implementation of compact, mixed-use Activity Centers. Specifically, both UDOT and WFRC staff sought to explore multimodal infrastructure strategies that would support localized circulation within those centers; balanced against the need to serve pass through trips. Between December of 2019 and March of 2021, the research team collaborated with DOT and MPO staff to refine particular solution sets for right-sized livable centers. In March of 2021, the research team held a roundtable with UDOT and WFRC to review the checklists and strategies previously described, and to explore how they might incorporate right-sizing tools into their existing workflows. The policy discussion focused on the following questions:

1. What insights were gained from the pilot?
2. Where in your respective planning and programming processes could you see tools / analyses of this type being the most helpful?
3. What types of training materials, workshops or other opportunities would be helpful for the agencies and their partners to explore the use and application of these tools?
4. What further testing, analysis, or reporting of the center's scenario would be of the most interest in the final phase of implementation?

As described in the April 25, 2021, Panel Update Memo, WFRC and UDOT staff suggested right-sizing tools and methods would be useful in 1) long-range planning scenario development, 2) activity center planning, and 3) UDOT's Solutions Develop Process. The two primary concerns expressed at the meeting included managing stakeholder responses to right-sizing strategies and indicators, and the accessibility of the tools. At the April policy meeting, UDOT and WFRC staff suggested an additional workshop for May to increase awareness of the tools and methods.

3.9.1 Utah Right-Sizing May 2021 Concluding Workshop

On May 24, 2021, Metro Analytics held a right-sizing workshop with a broad group of UDOT and WFRC stakeholders to both present the findings from the initial right-sizing implementation and arrive at a pathway to ongoing right-sizing implementation, especially relating to livable centers. Agency specialties included UDOT region, safety, travel demand management staff, as well as long-range planning and analytics staff from WFRC. The purpose was to increase awareness of right-sizing tools and methods, their range of uses, and how they can improve understanding of investment decision trade-offs. The workshop provided an overview of right-sizing implementation examples from Iowa, Georgia, and North Carolina, and a summary of what was done in Utah. The group discussed ways that right-sizing tools and methods could be used in current agency workflows.

- Of particular interest to WFRC and UDOT was the Des Moines, Iowa tele-commute and e-commerce example. WFRC is testing these types of scenarios as part of the long-range planning process, and they were very interested in the methodologies and assumptions used in the Des Moines effort. UDOT was also interested in the analysis to help bolster the business case for increased funding of their TravelWise demand management Program; a broad-based travel demand program aimed at shifting travel demand away from single occupant vehicles.
- There was discussion about how right-sizing tools and methods could help improve UDOT's Solutions Development process by incorporating outcome-based performance measures rather than current, problem centric performance measures.
- Everyone agreed that exploring land use and infrastructure synergies through a right-sizing lens could help the agencies get the most from their infrastructure investments. Agency staff again expressed concern about community perceptions of right-sizing strategies, which reinforces the decision to produce communication and education tools to help in stakeholder engagement.
- Agency staff shared that local governments are interested in exploring cost sharing strategies that would improve street network connectivity. Suggesting that if connectivity were improved through such strategies the distribution of vehicles over the entire network would improve state facility operations.
- An interesting question raised by agency staff concerned UDOT's financing of amenities and aesthetics. Currently UDOT policy limits the amount of money that can be used for such improvements. The research team suggested the Stratified ROI Calculator could help provide a way of finding mutually beneficial solutions to this issue.

Way Forward for UDOT and WFRC with Right-Sizing - Ongoing Implementation and Next Steps Based on the 20-44(22) implementation work and associated workshops both UDOT and WFRC are viewing the right-sizing paradigm as a framework for communicating the value of demand management, adaptive re-use, and the performance value of livable centers in relation to the costs of expansion or new infrastructure investment. Future directions currently under consideration entail applying not only trip-length but underlying household demography techniques to pinpoint equity issues, asset management strategies, project concepting, congestion analysis, safety analysis, active transportation, and cost sharing. Both UDOT and WFRC are anticipating takeaways from the workshop from Iowa and North Carolina which may help them make their existing models, tools, and program development processes responsive to what they have learned in their initial right-sizing pilot with the livable centers.

4 Georgia: Addressing Excess Right-of-Way and Corridor Management

Right-Sizing Challenges: The Georgia Department of Transportation (GDOT) has undertaken implementation efforts for NCHRP Report 917 in two distinct applications: 1) property management of their remnant parcel inventory (over 8,000 remnant parcels), and 2) corridor management of critical corridors. Overall, right-sizing for GDOT may be understood as a practical extension of asset management where life-cycle costs are managed, investments are brought into alignment with agency goals and objectives, value capture is realized where practical, and the asset portfolio exists in its best and highest use. Right-sizing, at its heart, is a collaboration of both internal and external key stakeholders that combines all necessary authorities and resources in a consensus-building setting. Several GDOT departments have been involved including Right-of-Way Services, Planning, Performance-Based Management and Research, Legal Services, and Utilities.

4.1 Right-Sizing for Remnant Parcels

Mainstreaming the remnant parcel inventory framework into GDOT practices will manage life cycle costs in property management and maintenance costs and will achieve the best and highest use of the parcels in the inventory. Constructing the remnant parcel inventory framework in alignment with the GDOT Strategic Plan ensures property management decisions are consistent with agency goals and objectives. Application of right-sizing to the surplus property parcel inventory specifically supports the strategic goal of utilizing performance-based management, innovation, and public/private partnership (P3) by enhancing organizational efficiencies through performance review. The strategy of identifying challenges and needs and implementing improvements is at the heart of this right-sizing implementation. Mainstreaming this framework will also ensure that parcels are not released prematurely, they are released to the most appropriate user, and that any ongoing interest GDOT has in the parcel will be preserved. It is fundamentally acknowledged that surplus properties are not in their best and highest uses, and a decision process will be integrated to guide GDOT through assignment of a surplus parcel to various groups (categories) with its ultimate disposition as either retain for future traditional transportation uses, retain for future non-traditional transportation uses, or dispose.

<u>**Guidebook Elements:**</u>

1) **Asset management (p. 14)**. The land that comprises the surface transportation system is the only appreciating-value asset in the portfolio, and right-sizing that inventory is consistent with good asset management.
2) **Partnerships (p. 24)** are critical to the success of the remnant parcel inventory application.
    a. An Internal Decision Clinic is convened to step through the decision-tree process of assigning each parcel to its most appropriate group.
    b. An External Decision Clinic is convened where conveyance of parcels to other public agencies is contemplated.
3) **Right-Sizing as a Paradigm Shift (p. 53)** helping GDOT shift toward *proactive* identification and disposition of remnant parcels alongside the historical *reactive* paradigm of responding to external requests.
4) **Three-Part Test for Right-Sizing (p. 54)** is applied in terms of life-cycle costing, alignment test, and best and highest use test (remnant parcels are, by definition NOT in their best and highest use).
    a. <u>Life-Cycle Costing</u> - A remnant parcel held by GDOT is not generating any public or private revenues. There are costs to manage and maintain each remnant parcel that will accumulate indefinitely unless the parcel is needed for a future transportation purpose.
    b. <u>Alignment Test</u> – The retention or disposition of a parcel must align with GDOT's Strategic and Management Goals and Objectives, performance measures, and Governor's Initiatives.

c. Best-and Highest Use – Is particularly applicable to the remnant parcel application. A retained parcel that is not needed for future transportation purposes is, by definition, not in its best and highest use. It is widely accepted that the goal of adjacent private properties is to be in its best and highest use; however, right-sizing proposes that the public rights of way that make up the surface transportation system should also be in its best and highest use, and balanced between traditional transportation uses, active transportation uses, and non-traditional transportation uses.

Implementation Techniques Developed

For remnant parcels, a framework was developed that includes a decision-tree to guide internal decision-clinics in classifying remnant parcels into one of five categories.

- Category 1 – Parcels that have a marketable highest-and-best use of their own and can be transacted in an open market.
- Category 2 – Parcels that have their own best and highest use but cannot be conveyed arm's-length because of limited potential uses or buyers.
- Category 3 – Parcels that do not have their own best and highest use and must be conveyed non-arm's length.
- Category 4 – Parcels that do not have their own best and highest use but may be conveyed for transportation enhancement uses to a local partner.
- Category 5 – Parcels that do not have their own best and highest use but have been identified as needed for future uses by GDOT or a local partner.

With these categories established, the decision-tree is applied on a parcel-by-parcel basis:

1) Is it likely that this parcel will play a role in a future programmed project? If yes, then assign to Category 4 or 5. If no, then continue (unless local partner needs warrant reassignment to 4 or 5).
2) Is there a likely non-traditional transportation purpose (i.e., storage yard, park-n-ride) that GDOT can put the parcel? If yes, then assign to Category 4 or 5. If no, then continue (unless local partner needs warrant reassignment to 4 or 5).
3) Is this R-parcel (remnant parcel) a candidate for non-traditional transportation uses (i.e., telecommunications infrastructure, other utility accommodations, conservation banking) by GDOT? If yes, then assign to Category 4 or 5. If no, then continue (unless local partner needs warrant reassignment to 4 or 5).
4) Does GDOT hold fee title to the R-parcel? If yes, continue. If no, then assign to Category 3.
5) If the parcel is to be disposed, does it have its own independent best and highest use in the open market? If yes, assign to Category 1. If no, assign to Category 2.

4.2 Right-Sizing for Corridor Management

The fundamental goal of the Georgia corridor right-sizing effort is to leverage the best and highest use throughout the corridor in terms of balancing traditional transportation, non-traditional transportation, and active transportation needs. This also requires the best and highest use of adjacent land uses to be achieved and for the connectivity between transportation and land use to be optimized for safety, efficiency, agility, and sustainability. The GDOT Office of Performance-Based Management and Research has taken a strong interest in this right-sizing effort and is engaged in the development of metrics that will document the successes of these corridor efforts. These measures will also provide a foundation upon which resources can be targeted.

Guidebook Elements:

For the critical corridor management application, the primary NCHRP 917 tools applied include:

1) **Asset management (p. 14)**. It has long been held that property development should not be permitted without public utilities and social services in place (concurrency). Transportation, however, has historically not been included as an element of concurrency.
2) **Partnerships (p. 24)** are critical to the successful management of critical corridors.
    a. An Internal Decision Clinic is convened to step through the identification of critical corridors based upon willingness of local partners, logical termini, and long-term need. Though this application is championed by the GDOT Planning department, designation of corridors will begin with the GDOT District Offices.
    b. An External Decision Clinic is convened to bring together the authorities, knowledge, and capabilities to advance the critical corridors management process.
3) **Right-Sizing as a Paradigm Shift (p. 53)**: Helps GDOT shift toward *proactive* identification and management of critical corridors. Transportation and Land Use (Supply and Demand) have traditionally not been managed in tandem, and the governing dynamics of supply and demand suffer disequilibrium when transportation (supply) is slow to respond to changes in demand (land use).
4) **The Three-Part Test for Right-Sizing (p. 54)** is applied in terms of life-cycle costing, alignment test, and best and highest use test. That *both* sides of the right-of-way lines should be managed *concurrently* represents a fundamental shift in thinking.
    a. <u>Life-Cycle Costing</u> – By the time the need for capacity, safety, or mobility improvements become obvious, the solutions are often prohibitively expensive, invasive, and painful. The costs of the transportation improvements combined with the premature loss of property value means everyone loses out. This critical corridor management application strives to minimize the costs of providing transportation capacities, maximize the economic lives of public and private improvements, and position private property improvements to take advantage of transportation improvements rather than become the victims of those improvements.
    b. <u>Alignment Test</u> – A three-step corridor process is developed with the goal of aligning GDOT resources, local public resources, and private resources with GDOT goals, and with one another. If a private developer is given real assurances that their efforts align with local and GDOT investments, then their investment risks are better managed, and their entrepreneurial incentive is improved.
    c. <u>Best-and Highest Use</u> – The fundamental goal of a corridor right-sizing effort is to leverage the best and highest use throughout the corridor in terms of balancing traditional transportation, non-traditional transportation, and active transportation needs. This also requires the best and highest use of adjacent land uses to be achieved and for the connectivity between transportation and land use to be optimized for safety, efficiency, agility, and sustainability.

Implementation Techniques Developed

For management of critical corridors, a framework was developed that includes a three-step process:

1. <u>Designation of a Critical Corridor</u> – This is not limited to high-priority mobility corridors, and may include designations of active transportation corridors, or corridors of special cultural or historical significance.

2. Signature of a Partnering Agreement – While the designation discussed above is about the corridor, the partnering agreement is about the key stakeholders who will contribute physical or economic resources to the corridor.
3. Signature of a Special Corridor Plan – This is the document that will describe what success looks like in the clearest and most measurable terms possible. The implementation plans are written from three perspectives, each perspective building upon the previous:
   - Short-term Implementation Plan: This is a 100-day work plan of no-cost or low-cost elements that can be accomplished quickly to help build the awareness and the brand of the corridor.
   - Medium-term Implementation Plan: This is a five-year work plan that will identify both the nature and the sequence of transportation infrastructure improvements and will provide guidance to land-use changes and connections.
   - Long-term Implementation Plan: This is the gap analysis plan that examines the difference between the success described and the work remaining after the completion of the initial medium-term plan.

4.3 Findings and Results

The applications will be years in implementation, as they represent new ways of thinking and doing business by GDOT. The principal findings of the GDOT implementation efforts may be summarized as:

1) The champions identified and the "home bases" for the applications noted above are important, but the full implementation of both applications elevate them to enterprise-wide efforts.
2) The engagement of the Office of Performance-Based Management and Research and the Office of Legal Services has brought attention to these applications at the highest levels of GDOT.
3) The use of both internal and external decision clinics is found to be critical to the success of both applications.

Lessons Learned:

1) Both applications will utilize innovative public/private partnerships, disposition of parcels, and intergovernmental uses of rights-of-way that will produce their own legal challenges. The Office of Legal Services is a vital internal stakeholder to internal decision clinics for both applications.
2) The mainstreaming of the remnant parcel inventory management application will remain a significant challenge without spatial enablement (GIS supportable) of the inventory.
3) It is necessary to subdivide the remnant parcel inventory application into two parallel efforts that will seek to reduce (or at least better prepare for) the creation of remnant parcels as part of normal operations, and to more proactively manage (dispose of) the remnant parcels that are created.
4) It is necessary to fully utilize intergovernmental agreements to mainstream the critical corridor management application because GDOT does not possess all the authorities needed for full implementation.

Next Steps/Ongoing Process:

Next steps for mainstreaming these applications include:

1) Performance measures will be established for both applications by the Office of Performance-Based Management and Research. This will align both efforts with the GDOT Strategic and

Management Plan and will mainstream them through measurement of performance by multiple critical internal stakeholders.

2) Internal Decision Clinics for the remnant parcel inventory management application will be established that will include key internal stakeholders from:
    a. Right of Way Services department
    b. Office of Performance-Based Management and Research
    c. Office of Legal Services
    d. Office of Utilities
    e. Office of Maintenance, and
    f. Office of Environmental Services
3) Internal Decision Clinics for the critical corridor management application will be established that will include key stakeholders from:
    a. Planning department
    b. Office of Performance-Based Management and Research
    c. Office of Legal Services
    d. Office of Innovative Delivery
    e. Division Office, and
    f. Division of Permits and Operations

Way Forward for Georgia DOT with Right-Sizing - Ongoing Implementation and Next Steps Based on the paradigm established in the right-of-way office, the Georgia DOT staff is exploring ways to incrementally apply right-sizing techniques with the contest of their Statewide Strategic Transportation Plan (SSTP); which has a business-focused vision for transportation investment. The DOT would like for its transportation plans to be as reflective of private sector business planning principles as possible, assessing returns to different stakeholders for the value of both cash flows and investments on the part of the DOT. The staff and research team have briefed GDOT's executive leadership (who have requested more information about results from the other three states on areas beyond right-of-way) and anticipate coming to the July workshop with specific questions regarding how Utah's livable centers application might apply to Livable Centers Initiatives (LCI) in Atlanta, as well as how Iowa's modeling applications might be transferrable to Georgia, especially as the Savannah MPO had served as the pre-testing network for Iowa's applications.

5 Iowa: Incorporating Right-Sizing into a Travel Demand Model

Right-Sizing Challenges: Iowa DOT struggles with both statewide and localized right-sizing challenges. At the statewide level, Iowa has signifcant mileage of low-volume roads and pass-through traffic imposing significant highway and bridge preservation costs relative to the trips served. The DOT also struggles with serving remote areas, where the user cost (in terms of time and milage to access a location) are much higher in some areas of the state than others. An additional statewide challenge is the level of trans-continental traffic in Iowa shipping agricultural products to inter-modal hubs or on trans-continental highway routes. For this reason, Iowa's highway and bridge preservation costs are highly subject to global trade patterns. For Iowa DOT, statewide right-sizing entails understanding where the underlying sources of cost and value are on the statewide network, how statewide investment needs may vary with changing agricultural trade patterns, and setting adaptable investment and planning targets sensitive to these factors.

In additioin to statewide concerns, like metropolitan areas throughout the US, Iowa's metropolitan areas have seen unprecedented levels of telecommuting and and e-commerce in the COVID pandemic. The siting of a prospecive Amazon facility in Des Moines further accentuates that need for the DOT and its MPO partners to understand how changes in technology may affect the sufficiencey of transportation networks and the magnitude, location, and focus of future improvements.

5.1 Implementing NCHRP 917 in Iowa

Iowa DOT has focused very strongly on building into its current modeling (1) a range of post-COVID trade scenarios to enable the department to consider different potential ranges of growth or shifts in infrastructure demand and investment needs, and (2) a digital economy scenario as relates to commuting, and its potential impact on investment priorities and payoffs for investments in the Des Moines MPO.

Potential variability in trade at the statewide level and technology (both e-commerce and telecommuting) at the MPO level represent areas where the NCHRP 917 has proven to be of particular value to Iowa DOT. Iowa has used the NCHRP guidance to create business intelligence for right-sizing its understanding of needs as described in pages 55-60 of NCHRP 917; and by both applying and enhancing the trip-length/travel characteristics methodologies introduced in Chapter 4.1 of NCHRP 917.

Iowa DOT has implemented these techniques through enhancement of its travel demand models (both at the MPO and statewide level) to (1) account for different global trade and technology scenarios, (2) provide both spatial and network level mapping of the sources and incidence of avoidable costs stemming from inefficiencies in legacy infrastructure and (3) automating these applications into the graphic user interfaces of their existing statewide Iowa Traffic Analysis Model (ITRAM).

5.2 Identifying Sources of Cost in Existing Networks

Through the course of the implementation project, Iowa DOT sought to build on the mapping techniques shown in Chapter 4 of the NCHRP 917 Guidebook to pinpoint where Iowa's existing transportation network imposes the most avoidable costs on users. Most notably Iowa DOT has used the NCHRP 917 guidebook to pinpoint the incidence of (1) avoidable safety/crash cost, (2) avoidable travel time and operating costs and (3) agency preservation costs. Utilizing models to assess the incidence of costs in relation to the economic activity supported offers the DOT the ability to engage in planning without assuming that today's infrastructure arrangement represents an efficient structure to be preserved at all costs. However, it opens the door to pinpointing areas where some costs could be reduced, while investment in other areas could offer greater economic return. While the initial findings of this mapping approach have been presented in previous memoranda, Appendix I demonstrates the final template that Iowa is using to represent these costs. The Appendix is enhanced through iterations of DOT refinement including (1) normalizing the mapping of cost incidence to account for different ranges of cost between urban and rural areas and (2) insets in the cost incidence maps to demonstrate particular facilities and areas each of Iowa's cities that have either (1) the most cost to the agency to preserve supportive networks and (2) the most cost to users to access using the existing system.

5.3 Right-Sizing Deficiency and Need Estimates using Trade and Technology Scenarios

Accounting or Variability in Trade: To account for variability in the trade of agricultural commodities, the Iowa DOT consulted Moody's/Economy.com and other economic sources to arrive at alternative global forecasts in select agricultural commodity. The variability represents:

• Changes in international trade agreements

• Supply chain restructuring

Shifts in the pattern of trade can affect both goods movement to and from Iowa businesses, as well as pass-through traffic with origins and destinations outside of Iowa that use Iowa's road network, particularly its interstates. The figure below illustrates the framework for developing and implementing the trade scenario. The subsequent two figures show illustrative examples of this type of scenario and their implications for patterns of truck movement on the road network.

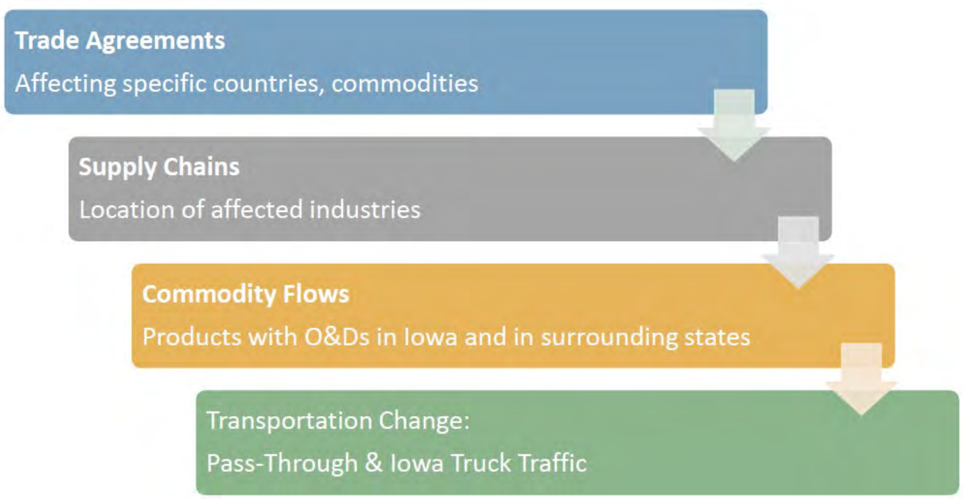


Figure 5-1 Framework for trade scenario implementation

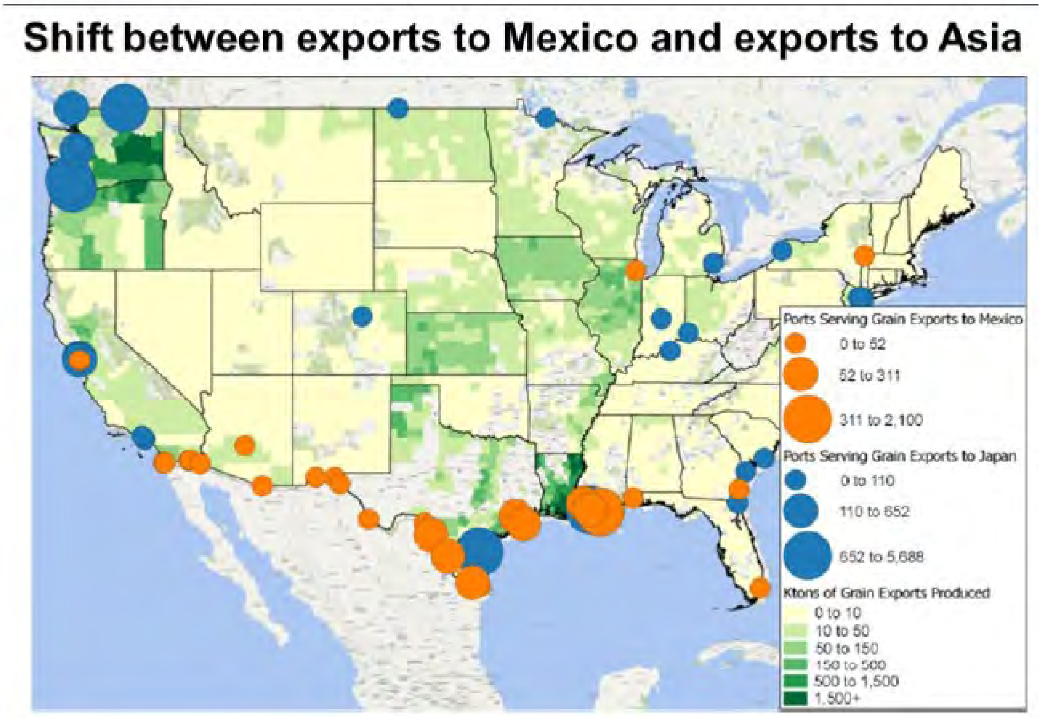


Figure 5-2 Illustrative Example: Vulnerability to New Export Tariffs

The above figure demonstrates the scenario tested by Iowa, in which there is a significant shift in US grain export markets, diverting US Exports currently traded with Latin America and Mexico to, in the future, be traded with Japan. The figure shows how global analysis finds a significant decline in utilization of Chicago (and the associated inland ports and waterways) accessing international gateways in Texas and the Gulf Coast, with significant expansion of utilization for gateways in the Pacific Northwest for these commodities. **Figure 5.3** represents changes in these commodities when assigned to a general national network

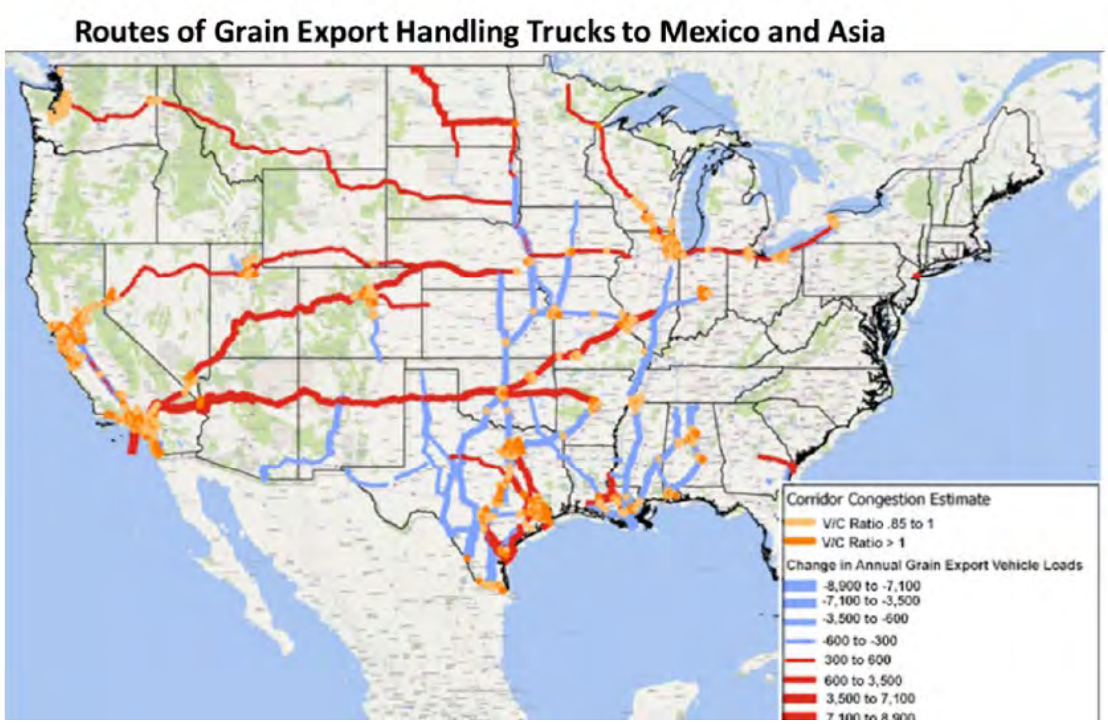


Figure 5-3 Illustrative Example: Tariff impacts on highway volumes

The figure illustrates that significant declines in agricultural commodities are likely to occur on I-35 in Iowa, however increases in west-bound traffic to Pacific Northwest ports (and to California ports) may lead to increases in some commodities on I-80 and I-90. While this scenario is helpful for understanding the national context for shifts in global trade, a national scenario alone is not sufficient for Iowa to understand its likely changes in VMT to right-size associated investment requirements.

Iowa DOT applied NCHRP 917 to integrate this analysis into its more refined statewide travel demand model to assess these shifts within the larger context of Iowa's statewide traffic pattern for both autos and trucks. The DOT was able to accomplish this by allocating diverted tonnage flows to Iowa traffic analysis zones and external stations based on observed trade patterns using a proprietary model from Quetica Inc. From the analysis, the DOT was able to demonstrate the following observations:

A shift in trade from Latin America to Asia Can significantly Reduce VMT on Iowa's Highways

Figure 5.4 illustrates the overall changes in tonnage traded with each traffic analysis zone in Iowa from the shift in trade from Mexico/Latin America to Asia. The figure shows that overall trade volumes will reduce in most areas in and around Iowa (shown in shades of red), with the largest increases in trade volumes (shown in shades of green) stemming from enhanced pass-through traffic to points west of Iowa, with external stations west of Iowa (shown by green arrows).

Figure 5.5 from the ITRAM model enhance with trade right-sizing scenario pinpoints the change in sources of traffic on I-35 at Iowa's northern border associated with the change in trade. The figure shows that the shift in trade reduces the overall southbound volumes on I-35 both through and within Iowa by the shift in trade. The greatest reductions are shown in shades orange, with increases shown in

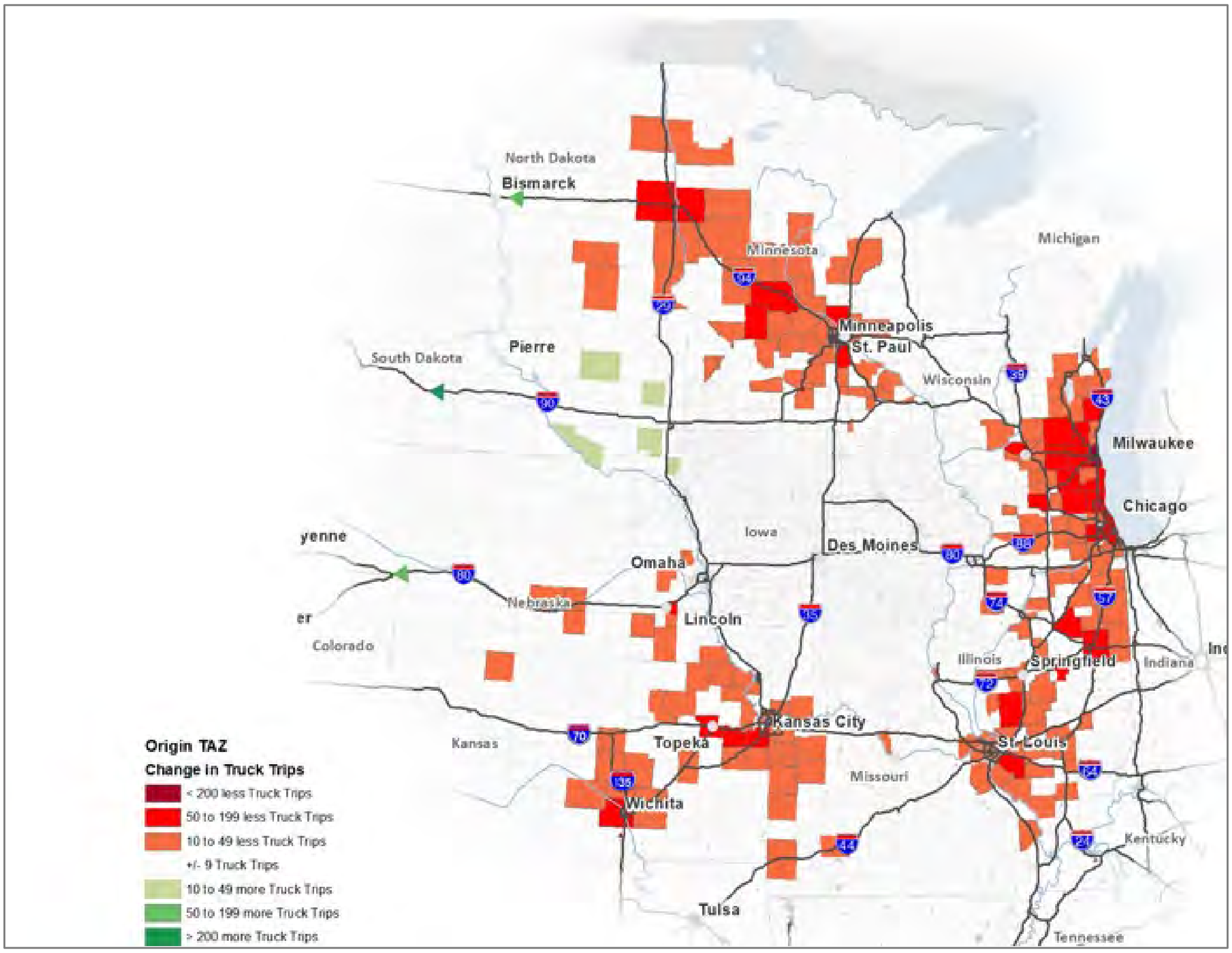


Figure 5-4 Truck Trips Difference by Origin

shades of green. The right-sizing analysis of I-35's southbound traffic in Iowa demonstrates that while the change in trade does actually increase the amount of traffic that I-35 carries through Iowa to routes I-80 and I-90 west of Iowa (shown by the green links in the western edge of the map) – the overall reductions due to north-south trade are of far greater magnitude, and lead to an overall significantly lower VMT and lower transportation preservation/investment requirement than would be the case if trade were to continue on its current trajectory. The analysis of I-35 traffic also demonstrates that I-35 exchanges significantly less traffic to I-80 and I-90 under the Asia-trade scenario (due to greatly reduced traffic to the gulf coast, and between locations served by I-35 and inland ports or rail facilities serving Mexican and Latin American markets.

A similar analysis of traffic on I-80 and I 90 (**Figure 5.6** and **Figure 5.7)** further demonstrates how this shift in trade directly relates to the requirements on Iowa's transportation system. The first figure demonstrates that the shift in trade increases utilization of I-80 for east-bound traffic entering at Iowa's western border, and the second demonstrates that there is an even greater increase in traffic carried by I-90 into Iowa from the west under the Asia-trade scenario.

Figure 5-5 Truck Select Link Difference: I-35 SB

Figure 5-6 Truck Select Link Difference I-90 EB

Figure 5-7 Truck Select Link Difference: I-80 EB

Overall, **Figure 5.8** demonstrates that the reduced north-south traffic, and reduced traffic with north-south inter-modal facilities in Chicago, St. Louis, Kansas City, Minneapolis, and other north-south hubs, accounts for more change on Iowa's highway system than the increases in trade on I-80 and I-90 serving California and Pacific coast ports. The result enables Iowa DOT to observe how a policy or economic change shifting trade from Mexico/Latin America to Asia could significantly alter the size and nature of Iowa's infrastructure needs in the long-term. These reductions in heavy commercial VMT, now available through the ITRAM model, can provide a basis for Iowa DOT to perform subsequent asset management analysis to ascertain how and where investment levels may respond to such a scenario if it should occur.

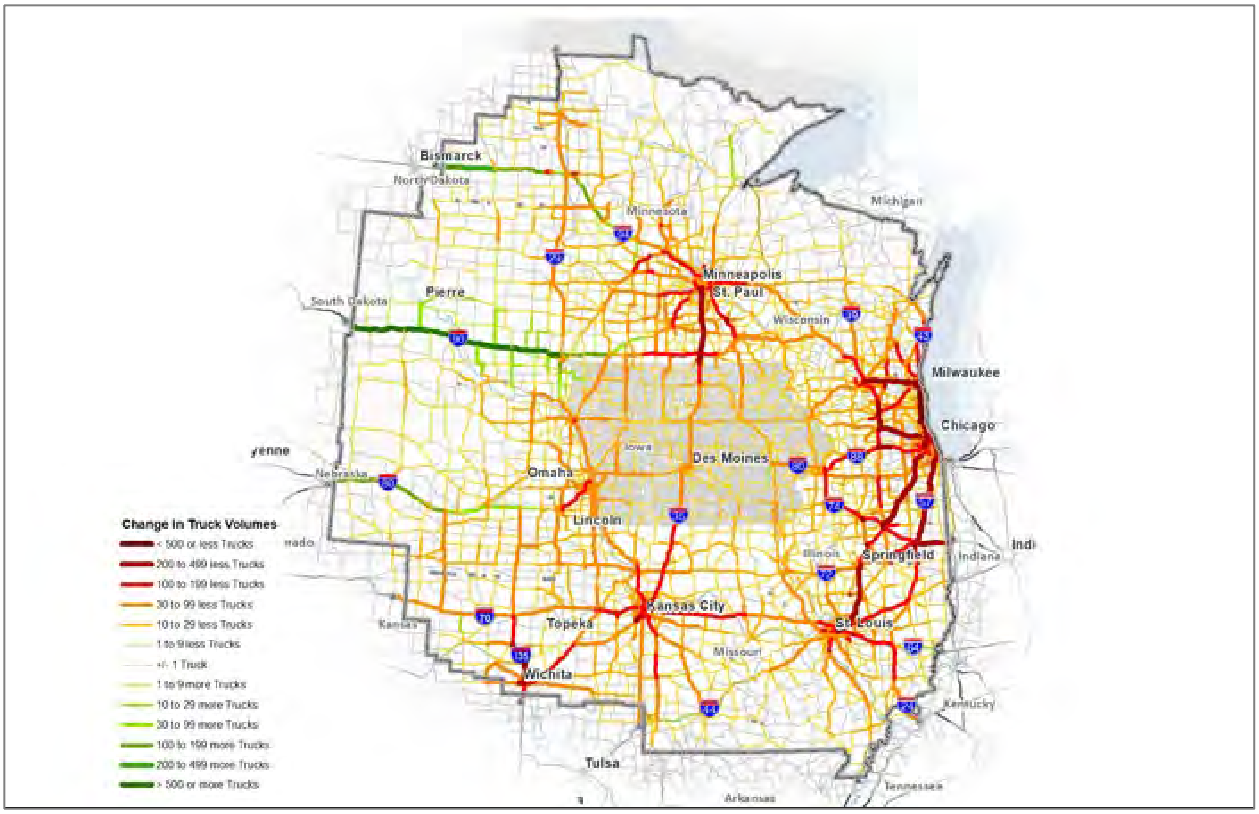


Figure 5-8 Truck Volume Difference by Link

Right-Sizing for trade and the digital economy: In addition to uncertainty about trade, the magnitude and nature of Iowa's future transportation needs is also largely subject to changes in telecommuting and the digital economy. Iowa DOT along with the NCHRP research team, in collaboration with the Des Moines MPO, applied right-sizing techniques based on elasticities in travel demand coming to the fore through the COVID 19 pandemic. In order to demonstrate the potential variability in investment and programming needs for Des Moines two right-sizing scenarios illustrate this potential change.

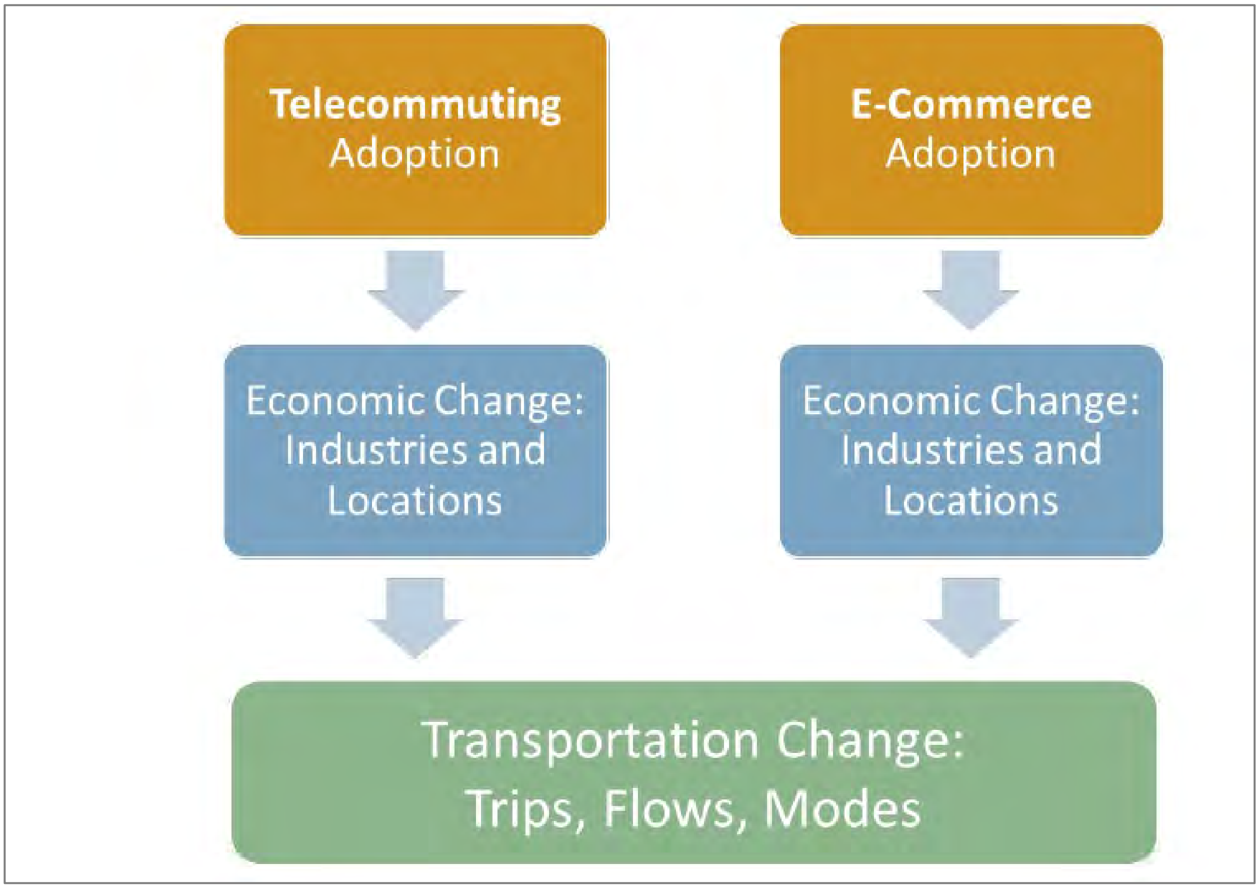


Figure 5-9 Digital Economy Scenario Implementation

Telecommuting is represented through adjustments to Home-Based Work trip tables, leveraging research on telecommuting potential by industry and data on the spatial patterns of industry activity[1]. 4.5% of workers in the Des Moines metro area worked from home according to 2018 ACS 5-Year Estimates. The level of telecommuting considered in this scenario is considerably higher than these pre-pandemic levels, but less than a theoretical limit based on the economic composition of the Des Moines area economy. Dingel and Neiman[2] estimate that 43% of jobs in the Des Moines Metro area can be performed entirely at home. Staff from DMAMPO and Iowa DOT expressed interest in exploring a level between 20 and 30 percent of workers working from home.

Higher levels of E-commerce are also are implemented through adjustments to trip tables. Home-based shopping trips are adjusted downwards and truck trips to and from warehousing locations are adjusted upwards. Truck trips to residential areas (local delivery) are not as straightforward to represent in the model. The core focus for the purposes of the right-sizing demonstration is on trips to/from warehousing locations, as this is expected to have the most effect on major transportation facilities of interest.

Effects of Telecommuting:

The analysis finds that based on industries most subject to telecommuting and their locations in Des Moines, key telecommuting destinations can be readily identified by overlaying a traditional MPO travel demand model with industry by sector data and available trip rates. **Figure 5.11** demonstrates areas in

[1] 1 Dingel, J. I., & Neiman, B. (2020). How many jobs can be done at home? (No. w26948). National Bureau of Economic Research. https://bfi.uchicago.edu/working-paper/how-many-jobs-can-be-done-at-home/

[2] Ibid.

the region where telecommuting can have the greatest impact on AM peak travel destination for commuting. The shades of yellow-red represent the greatest telecommuting potential.

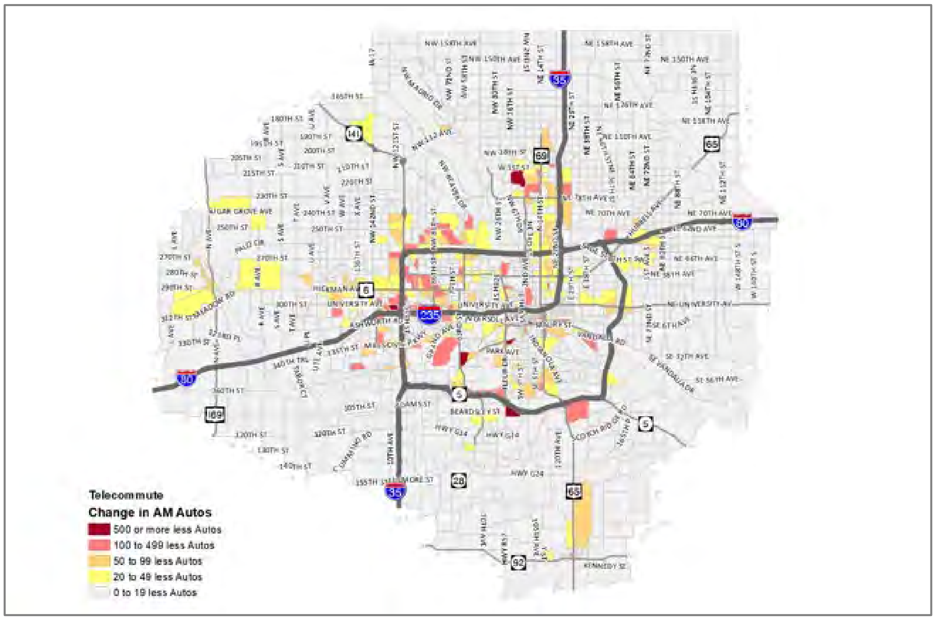


Figure 5-10 Difference vs. Base | Telecommute: AM Trips by Destination

From the map in **Figure 5.11**, general districts can be identified that represent spatial telecommuting markets where travel substitution can make the greatest reductions in trip making. **Figure 5.10** illustrates changes in commuting volumes possible for trips exchanged between these eight general districts if telecommuting were to increase by only a third of what was observed during COVID. The green lines represent the commutes with the least trip savings, while the thick red lines represent those with the greatest savings. **Figure 5.12** represents an example of how a dot-diagram shows the origins of AM peak work trips saved in district 3 (north central Des Moines west of I-35) through telecommuting to firms located in the district, in industries known by the COVID experience to have the highest potential for telecommuting.

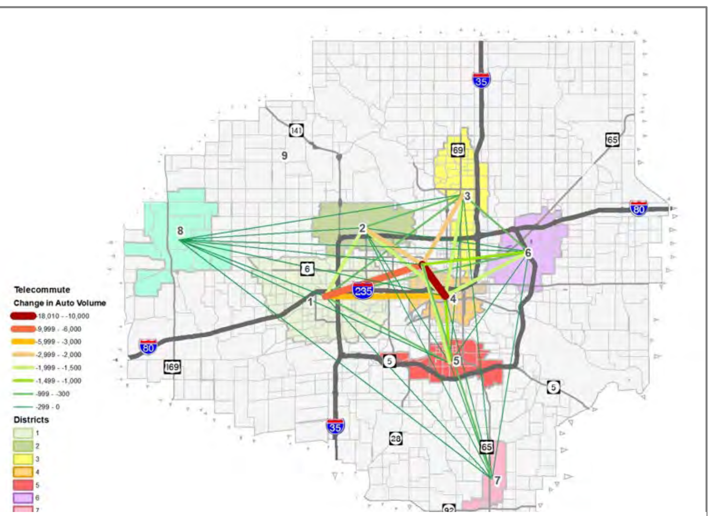


Figure 5-11 Telecommute Auto Difference Desire Lines by District - AM

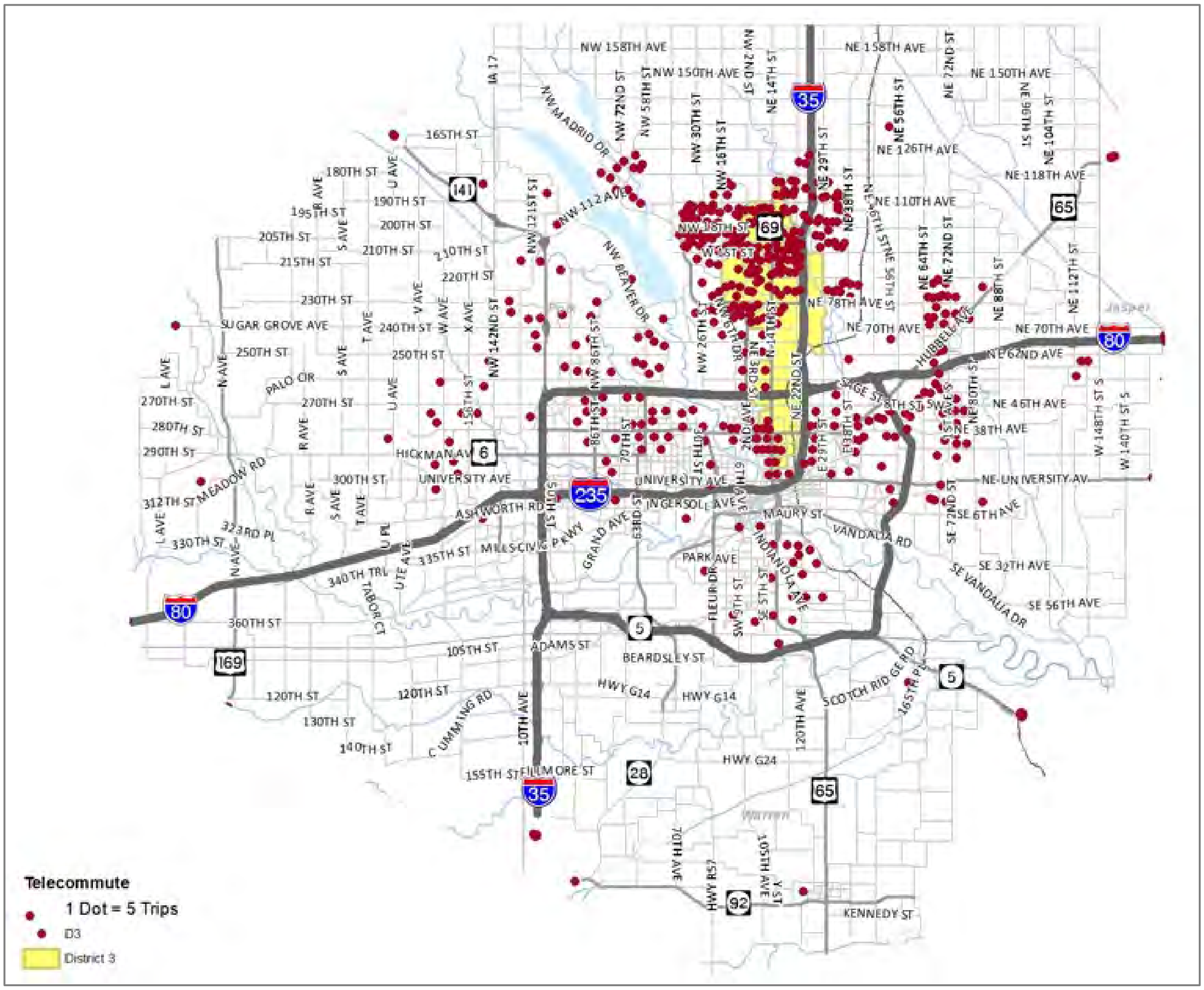


Figure 5-12 District 3

The changes in trip-making possible through sustained telecommuting at even a percentage of COVID levels can represent significant shifts in the future deficiencies and investment needs for the Des Moines transportation network. **Figure 5.13** demonstrates those facilities that can operate at a different (higher) level of service on the Des Moines network (absent any roadway construction) if telecommuting levels consistent with the above scenarios are maintained. I-35, I 235 and Des Moines' downtown interchanges can all have significant differences in the size and magnitudes of deficiencies or needs demonstrated through a right-sizing analysis accounting for telecommuting potential.

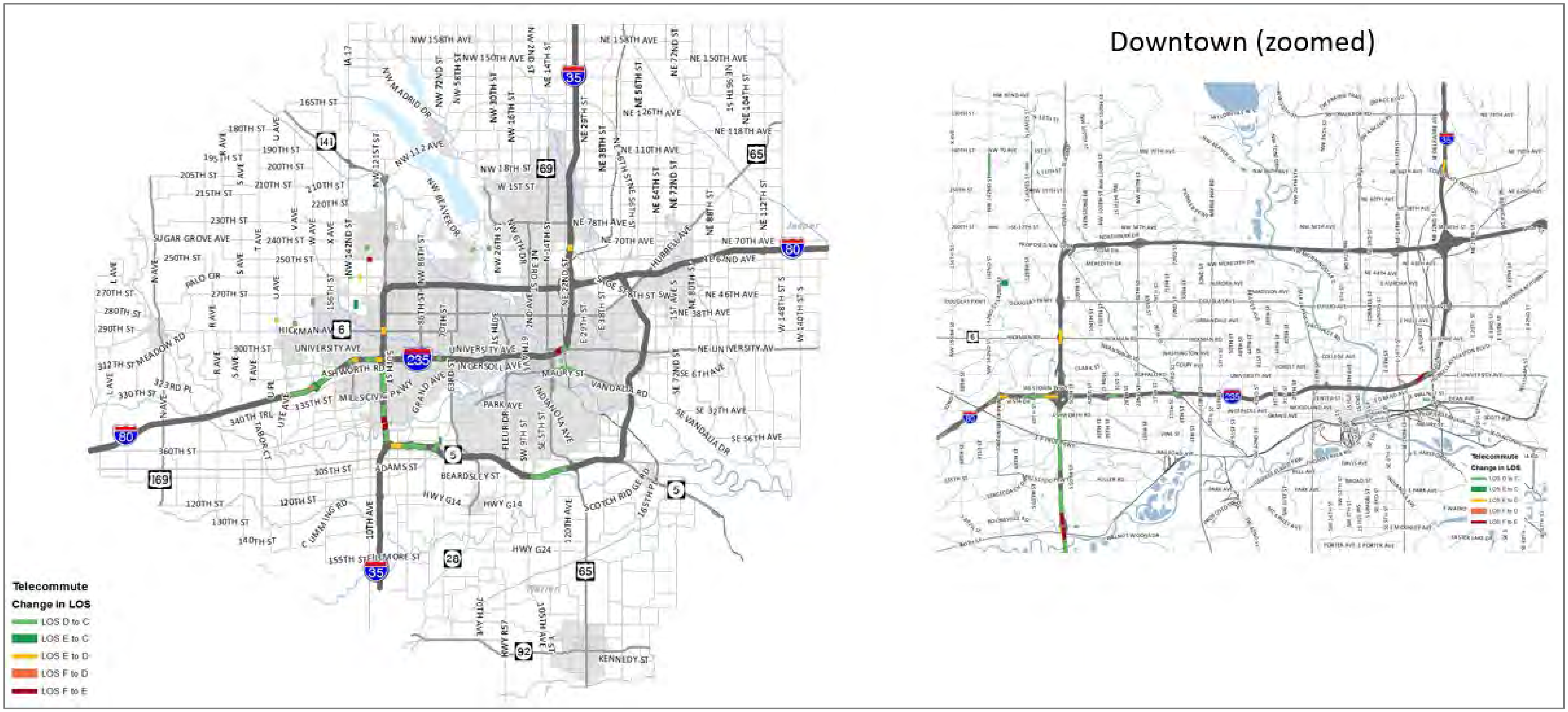


Figure 5-13 Telecommute LOS: Difference vs. Base

Effects of E-Commerce:

In Des Moines, E-commerce is represented primarily in terms of a scenario where significant shopping trips may be obviated by a new Amazon facility site in the city. In **Figure 5.14**, the new Amazon facility is represented by the areas in dark green, showing changes in daily volumes.

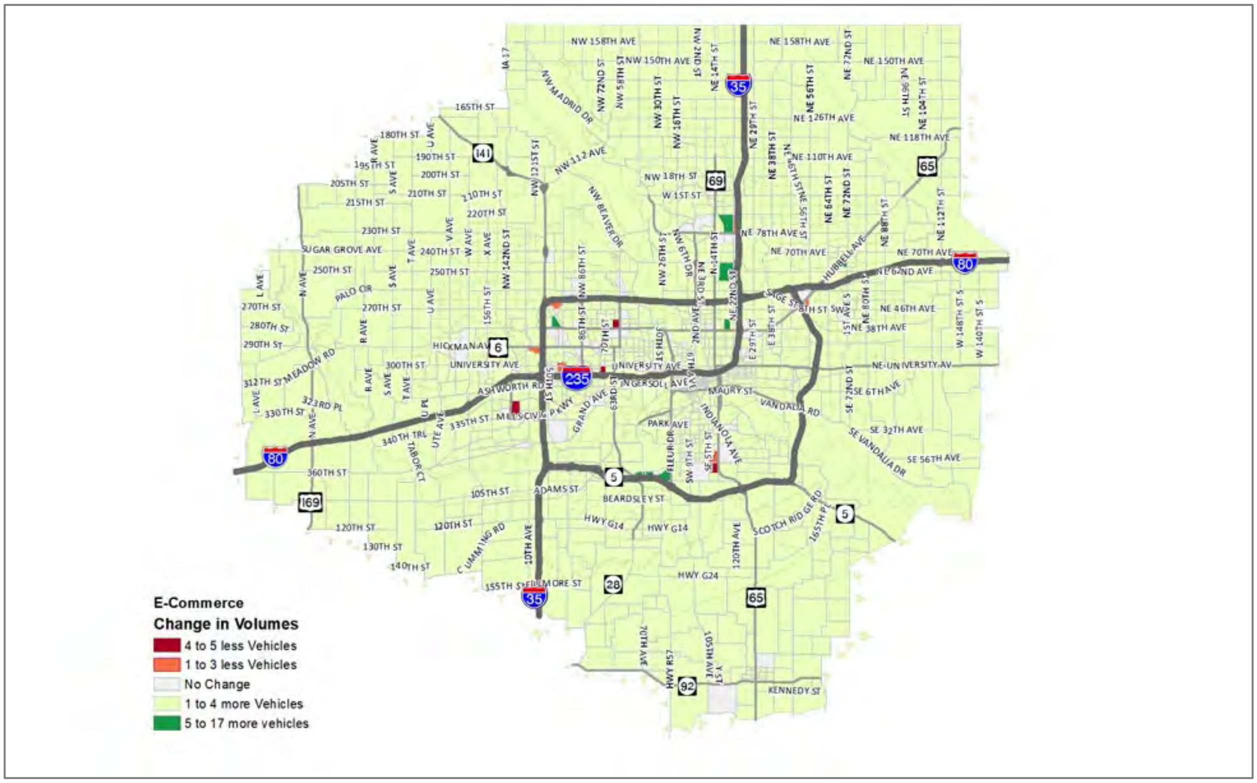


Figure 5-14 Difference vs Base | Ecommerce: Daily Combo Trips by Destination

Unlike telecommuting, e-commerce changes are likely to occur throughout the day, and hence are represented in changes in daily shopping trips. It is also understood that unlike commuting and telecommuting, shopping trips are not daily recurring events hence tend to have fewer daily trips affected, but more concentrated in particular locations. (Locations with the greatest savings from e-commerce trips are showing in red on the figure above).

Overall Impacts of Telecommuting and E-Commerce on VMT

The overall impacts of telecommuting and ecommerce on vehicle miles and vehicle hours traveled demonstrate considerable potential. When models are outfitted as Des Moines has been in this right-sizing implementation, MPOs are empowered to consider how technology changes can affect air quality, programming needs, delay, and economic performance of the overall system. **Figures 5.15 and 5.16** demonstrate the VMT and VHT savings that the Des Moines economy may experience as a result of these changes in technology, as illustrated by the above localized changes in transportation needs to right-size the overall understanding of needs.

	FACTYPE	Base	Ecom	TelCom	Ecom_TelCom
1	Interstate	9,723,487	9,683,108	9,122,037	9,066,182
6	Principal arterial	3,726,913	3,713,831	3,554,636	3,534,494
7	Minor arterial	4,496,566	4,467,671	4,148,398	4,103,273
8	Collector	2,147,966	2,127,919	1,904,035	1,874,304
9	Minor Collector	447,905	444,210	402,278	396,745
10	Local	630,036	620,997	540,412	527,428
	TOTAL	21,172,873	21,057,737	19,671,797	19,502,426

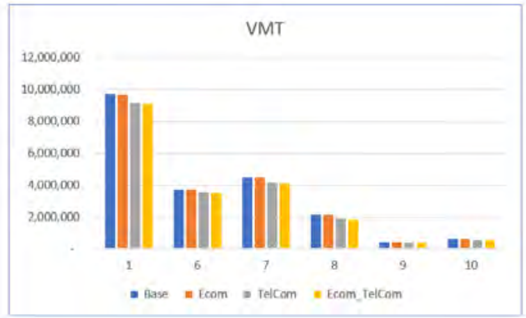


Figure 5-15 VMT

	FACTYPE	Base	Ecom	TelCom	Ecom_TelCom
1	Interstate	181,100	180,296	160,151	158,886
6	Principal arterial	134,948	133,695	121,324	119,670
7	Minor arterial	174,818	172,910	150,927	148,236
8	Collector	66,817	66,005	56,345	55,192
9	Minor Collector	11,906	11,781	10,441	10,259
10	Local	24,678	24,274	20,266	19,699
	TOTAL	594,267	588,961	519,454	511,942

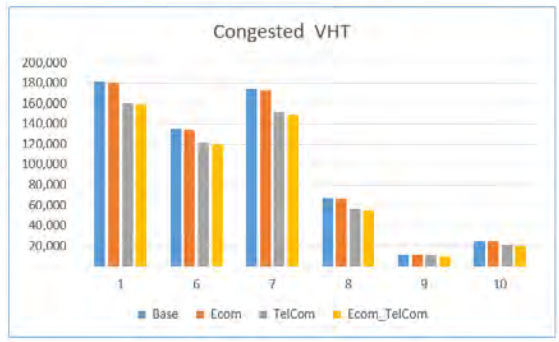


Figure 5-16 Congested VHT

Overall, it is observed that the combination of e-commerce and telecommuting could reduce overall VMT for the Des Moines region in 2050 by 8% and congested VHT by 13% without any outlays made for additional transportation infrastructure. The previous level of service analysis demonstrates how the MPO can use right-sizing techniques in modeling not only to pinpoint and quantify these savings, but also to translate them into likely corridors and locations where planning solutions and needs can be assessed considering these elasticities.

5.4 Way Forward for Iowa Right Sizing

NCHRP 20-44 (22) has equipped Iowa DOT and the Des Moines MPO with a powerful set of tools not previously available: (1) the ability to pinpoint where the inefficiencies of the current network may represent opportunities for right-sizing and (2) to identify which transportation investment needs are and are not susceptible to changes in trade and technology. Appendix I demonstrates the final template that Iowa is utilizing to visualize the statewide right-sizing assessments, with Appendix II representing the visualization templates for Des Moines. The above graphics are taken from these appendices. These scenarios now embedded in the ITRAM statewide model (1) enable the DOT to select sub-areas for right-sizing network and corridor strategies of the type demonstrated in the Utah and North Carolina cases (2) provide a guide to the creation and use of additional scenarios for testing and refining technology and trade assumptions and (3) offer the ability for the MPO and the DOT to track patterns in trade and e-commerce, pivoting their forecasting when critical changes can be observed to be occurring.

Key future directions for both Iowa DOT and the Des Moines MPO include:

(1) Integrating these right-sizing tools and their findings into their larger decision support systems
(2) Creating more interactive capabilities to refine and create new scenarios as policy, trade and technology situations continue to evolve

(3) Identify planning initiatives to explore ways that DOT or MPO partners may shape scenarios and manage demand to right-size the overall cost of the transportation system.

Because the Iowa 20-44(22) implementation focused strongly on modeling and business intelligence, the Iowa and Des Moines staff will approach the workshop with a strong interest in how agencies like UDOT and WFRC have utilized right-sizing within the context of specific initiatives, and how NCDOT understands right-sizing within particular discussions of corridor management, urbanization and growth management.

Iowa Right-Sizing Policy Summary – Appendix I

Preservation Cost

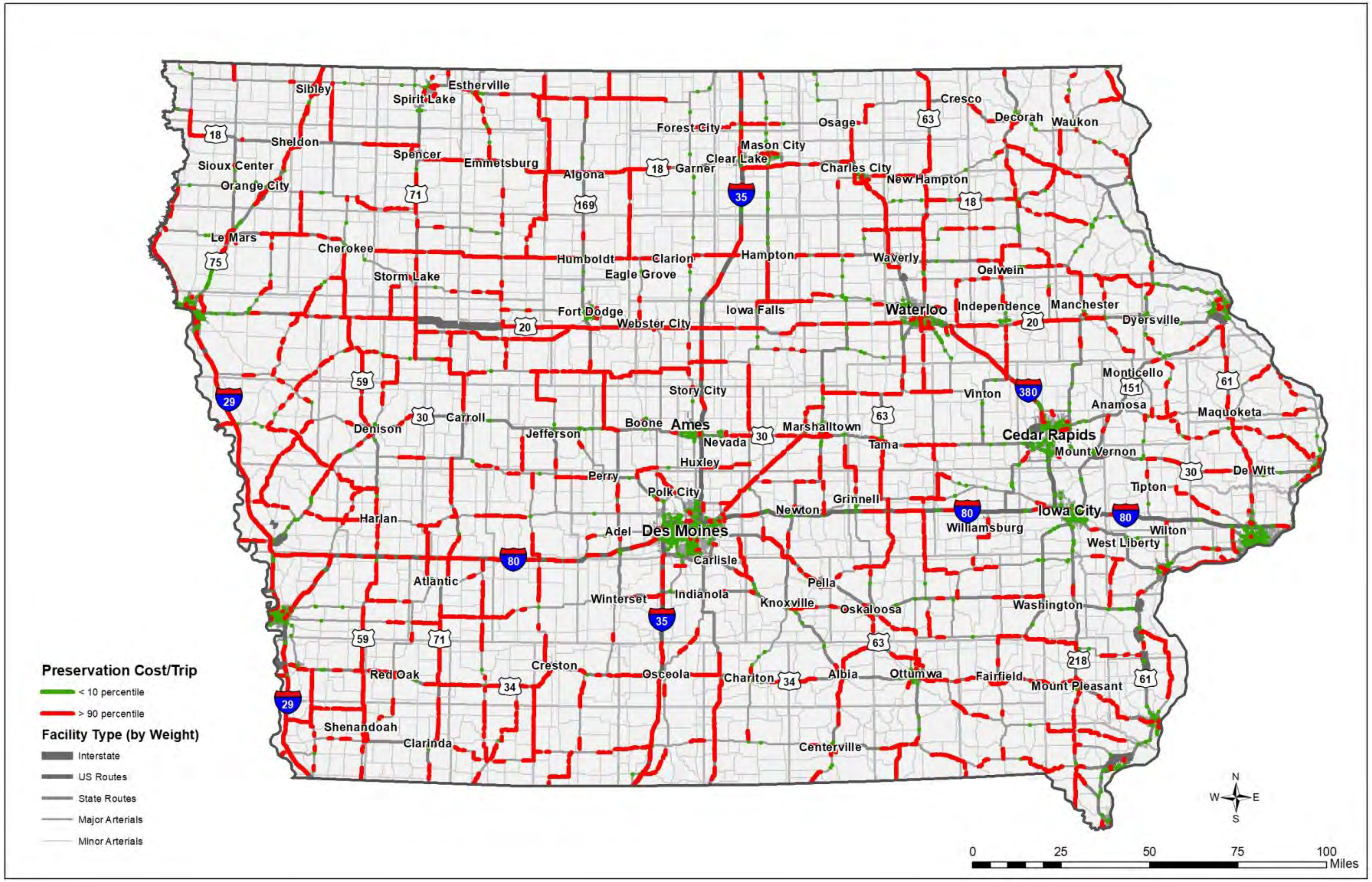
Assumptions

- High volume: Truck Percent>15% or LOS of D or worse
- Annualization Factor: 307.5

Annual Preservation Cost

Factype	Description		O&M	Preservation	Resurface	Pres Cycle	Resurf Cycle	Annualized per LM*
1	Freeway/Expressway	High Volume	$ 1,000	$ 40,000	$ 425,000	6	10	$ 50,167
		Low Volume	$ 1,000	$ 40,000	$ 365,000	8	12	$ 36,417
3	Principal Arterial	High Volume	$ 1,000	$ 40,000	$ 322,500	6	10	$ 39,917
		Low Volume	$ 1,000	$ 27,500	$ 250,000	8	12	$ 25,271
4	Minor Arterial	High Volume	$ 1,000	$ 40,000	$ 322,500	6	10	$ 39,917
		Low Volume	$ 1,000	$ 27,500	$ 250,000	8	12	$ 25,271
5	Major Collector	High Volume	$ 1,000	$ 40,000	$ 322,500	6	12	$ 34,542
		Low Volume	$ 1,000	$ 27,500	$ 250,000	8	14	$ 22,295
6	Minor Collector / Local	All	$ 1,000	$ 40,000	$ 250,000	6	12	$ 28,500
7	ramps	All	$ 1,000	$ 40,000	$ 425,000	6	12	$ 43,083

Preservation Cost per Trip by Link



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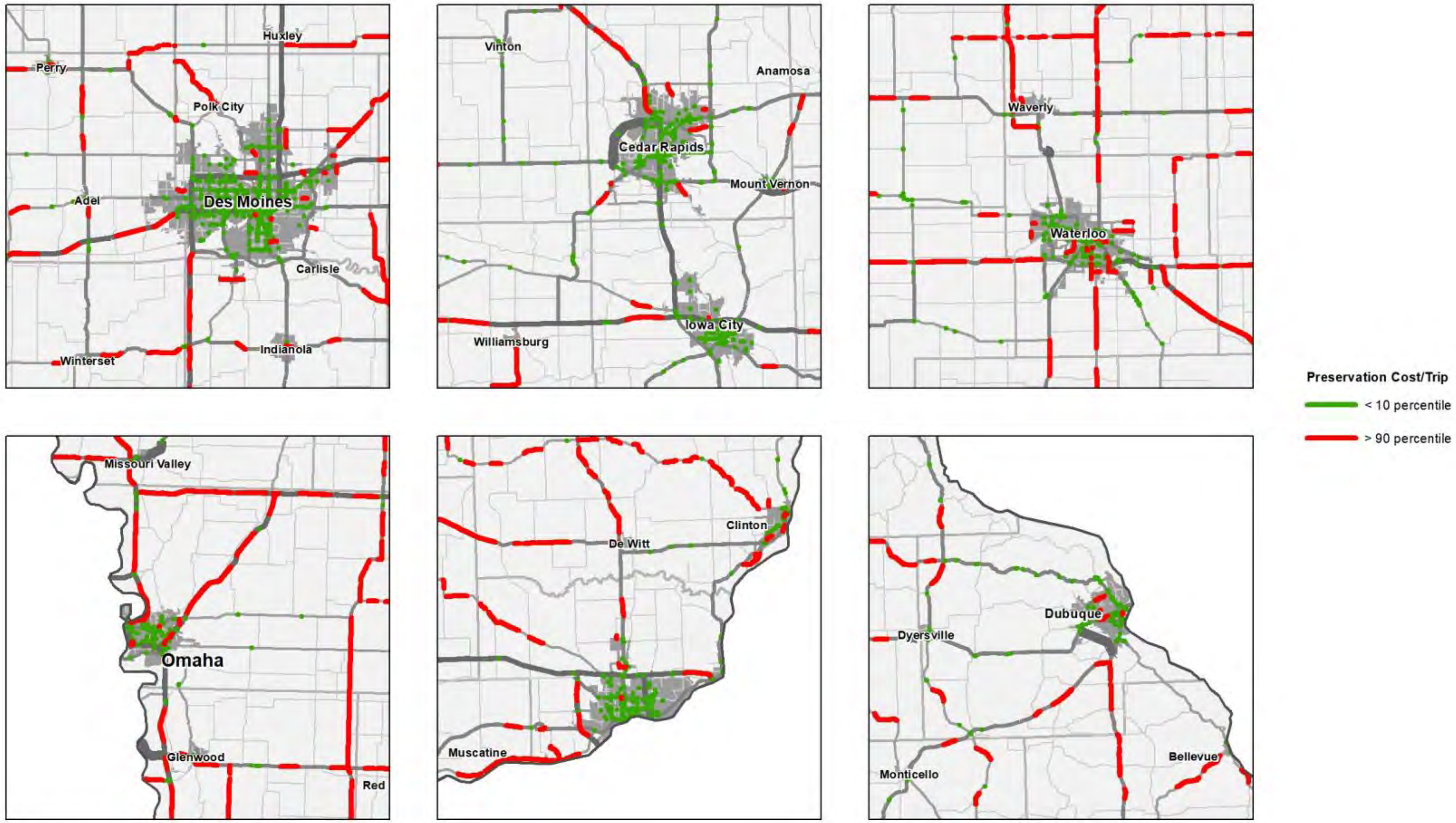
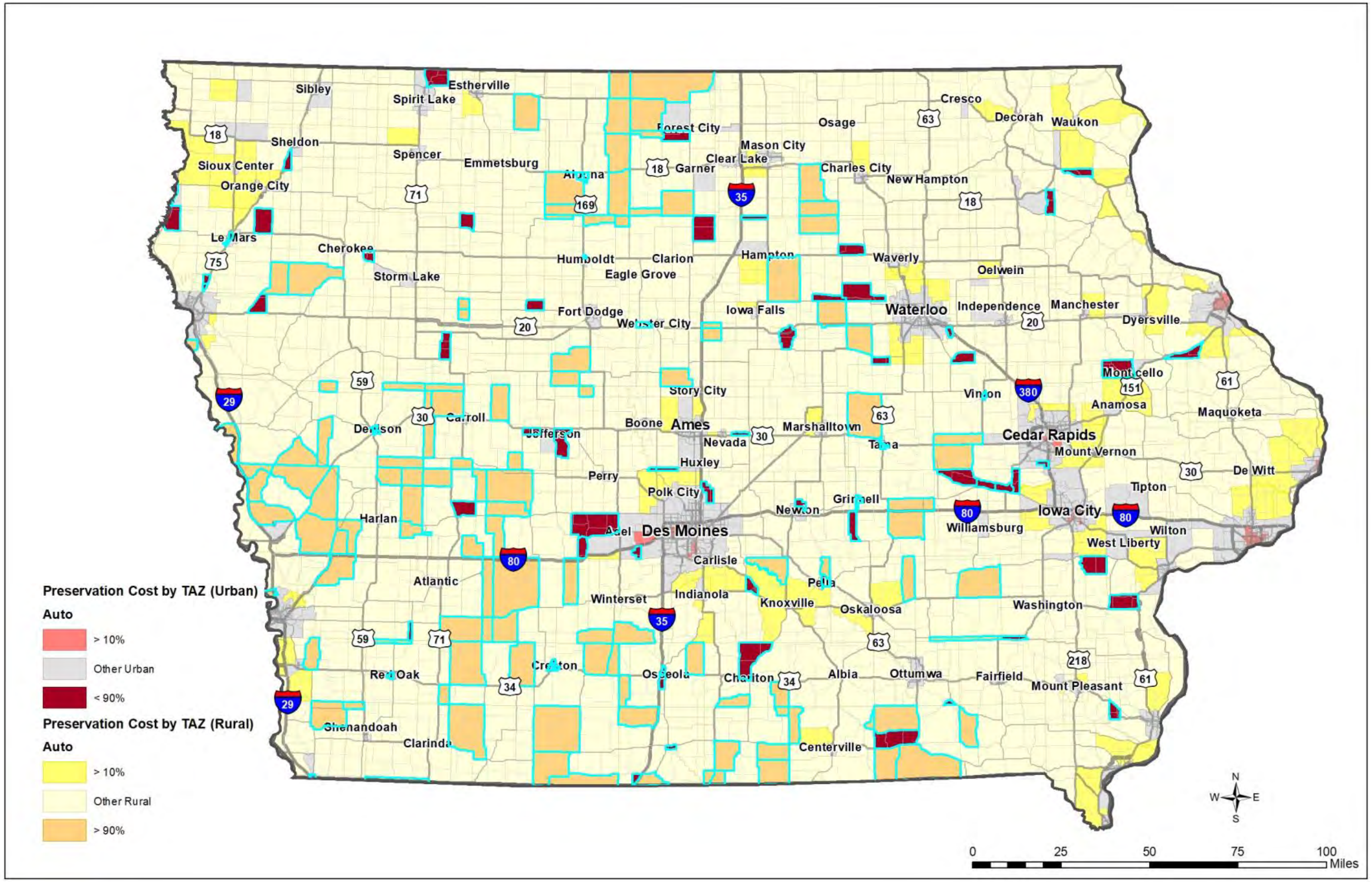
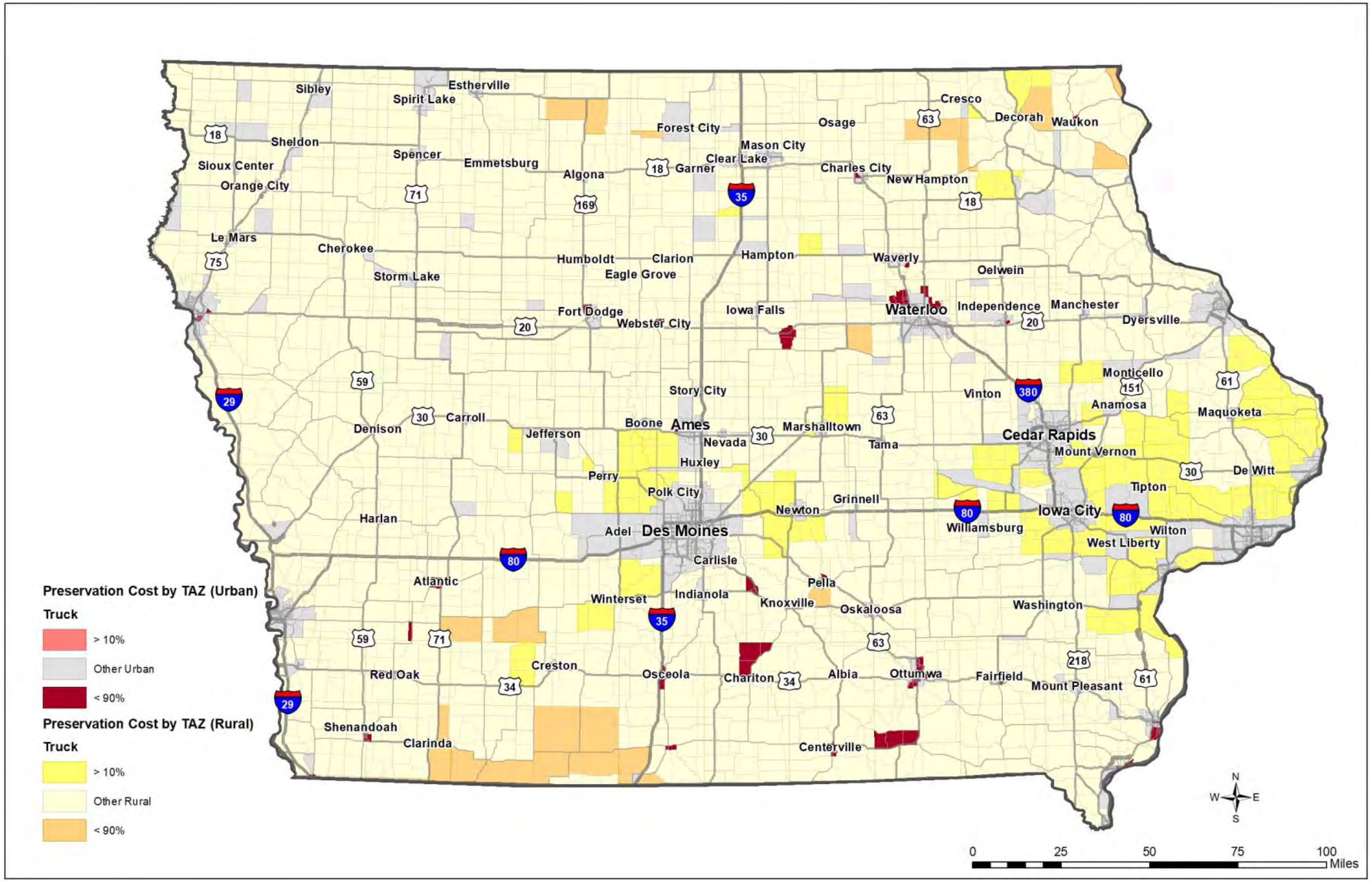
Preservation Cost per Trip by Link (Urban)



Preservation Cost per Auto Trip by TAZ

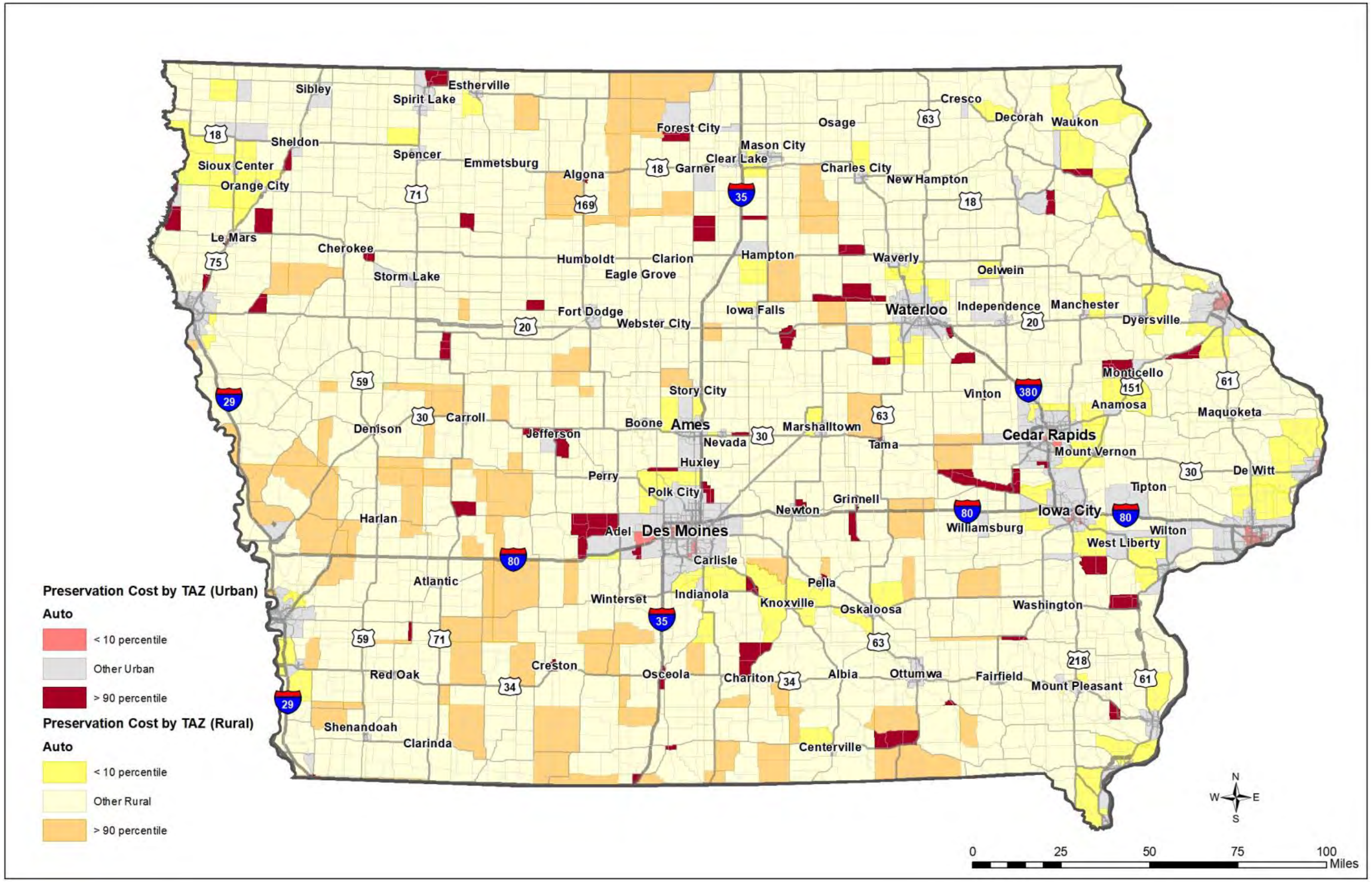


Preservation Cost per Truck Trip by TAZ

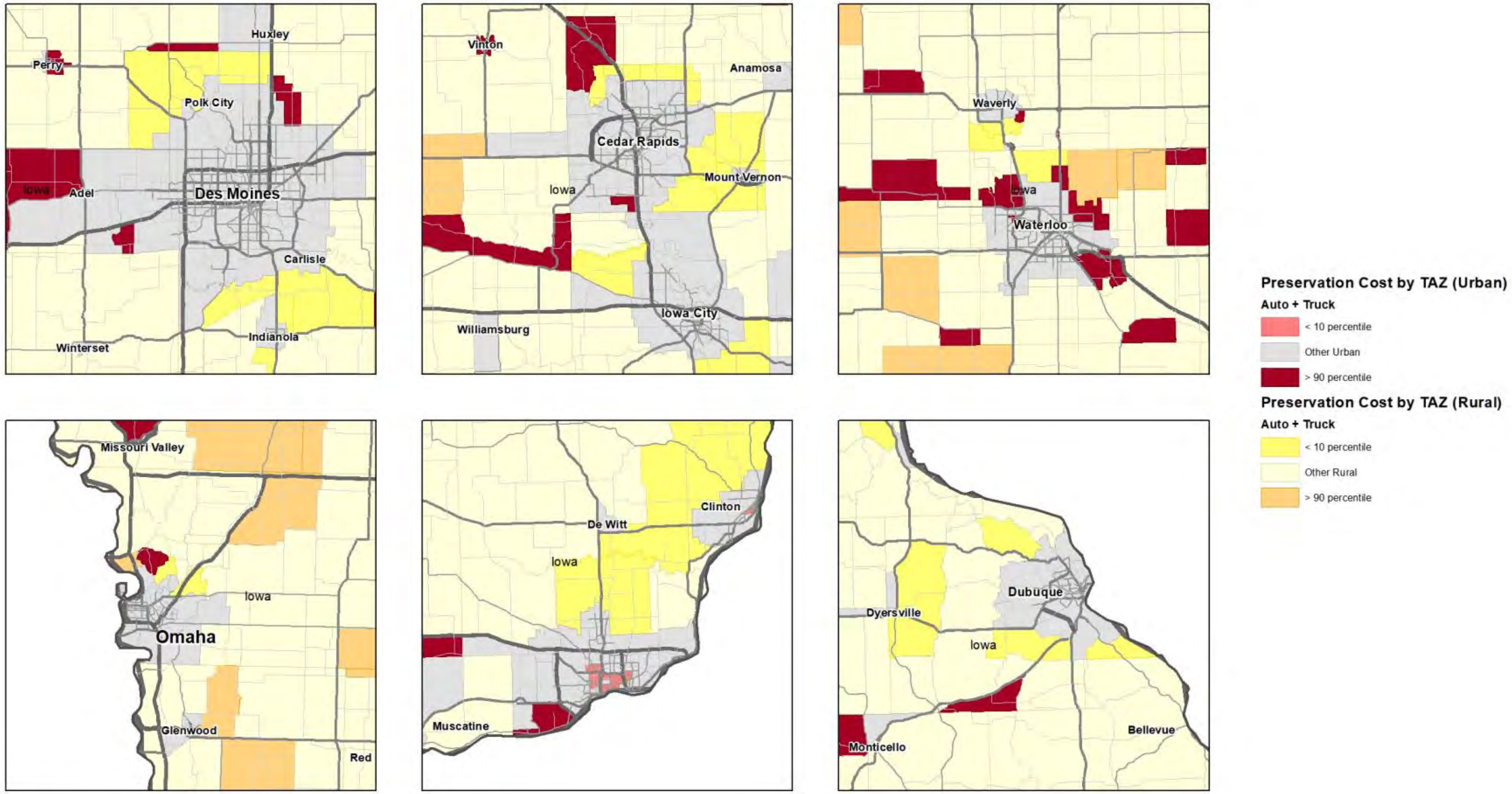


metro analytics

Preservation Cost per Trip by TAZ



Preservation Cost per Trip by TAZ (Urban)



User Cost

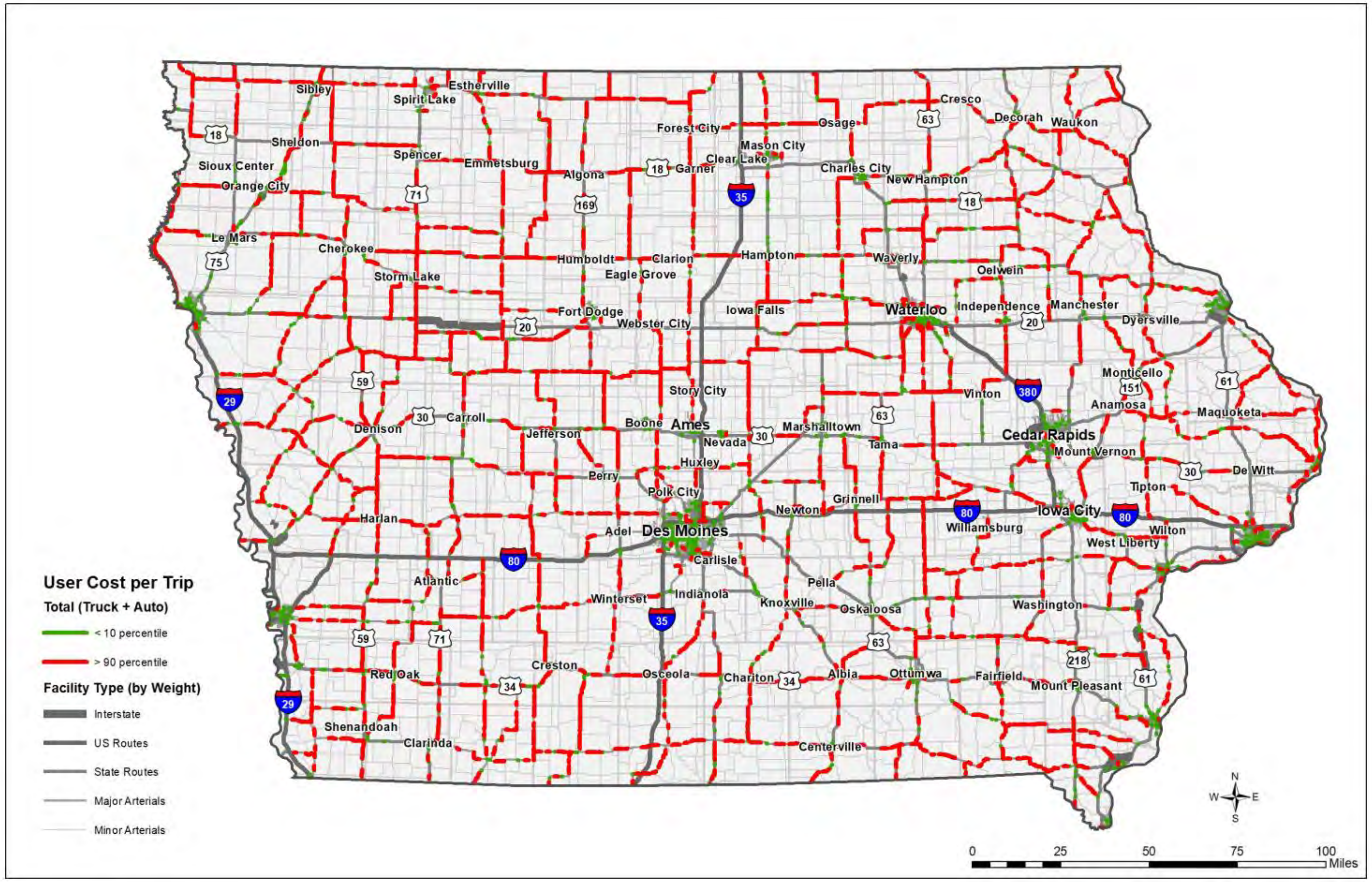
Value of Time Cost

- VOT ($/hr)
  - Auto: 16.6
  - Truck: 29.5
- Occupancy
  - Auto: 1.67
  - Truck: 1

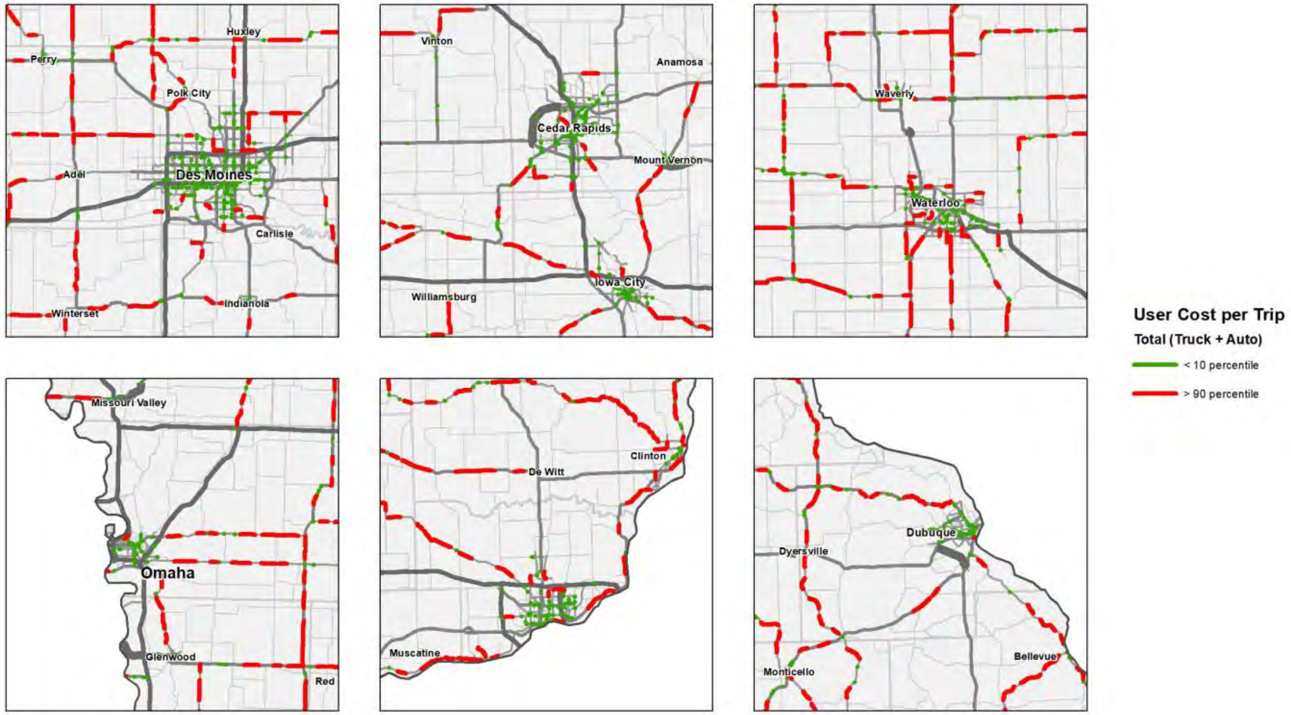
Vehicle Operating Cost

- VOC ($/mile)
  - Auto: 0.41
  - Truck: 0.96

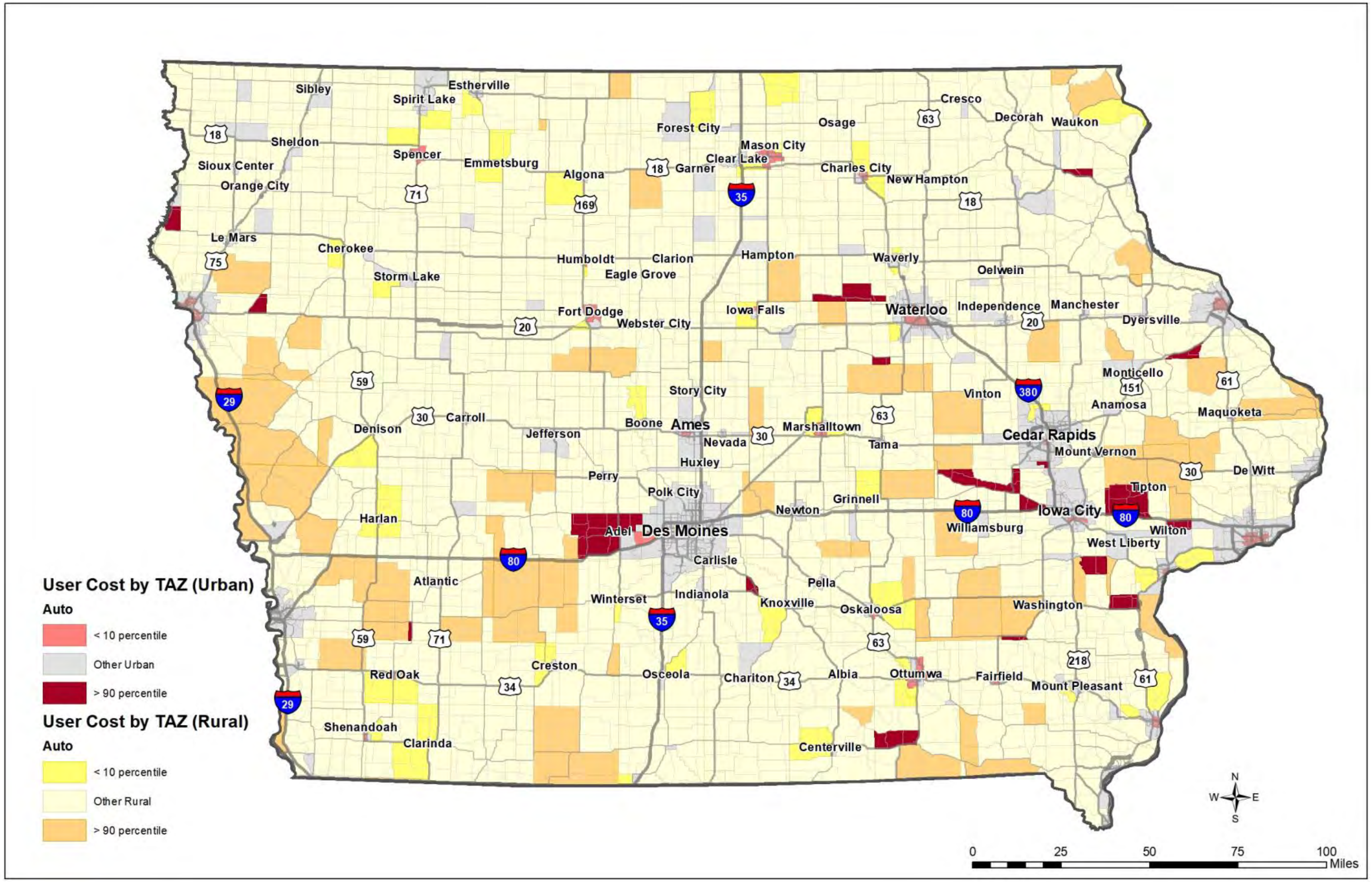
User Cost per Trip by Link



User Cost per Trip by Link (Urban)

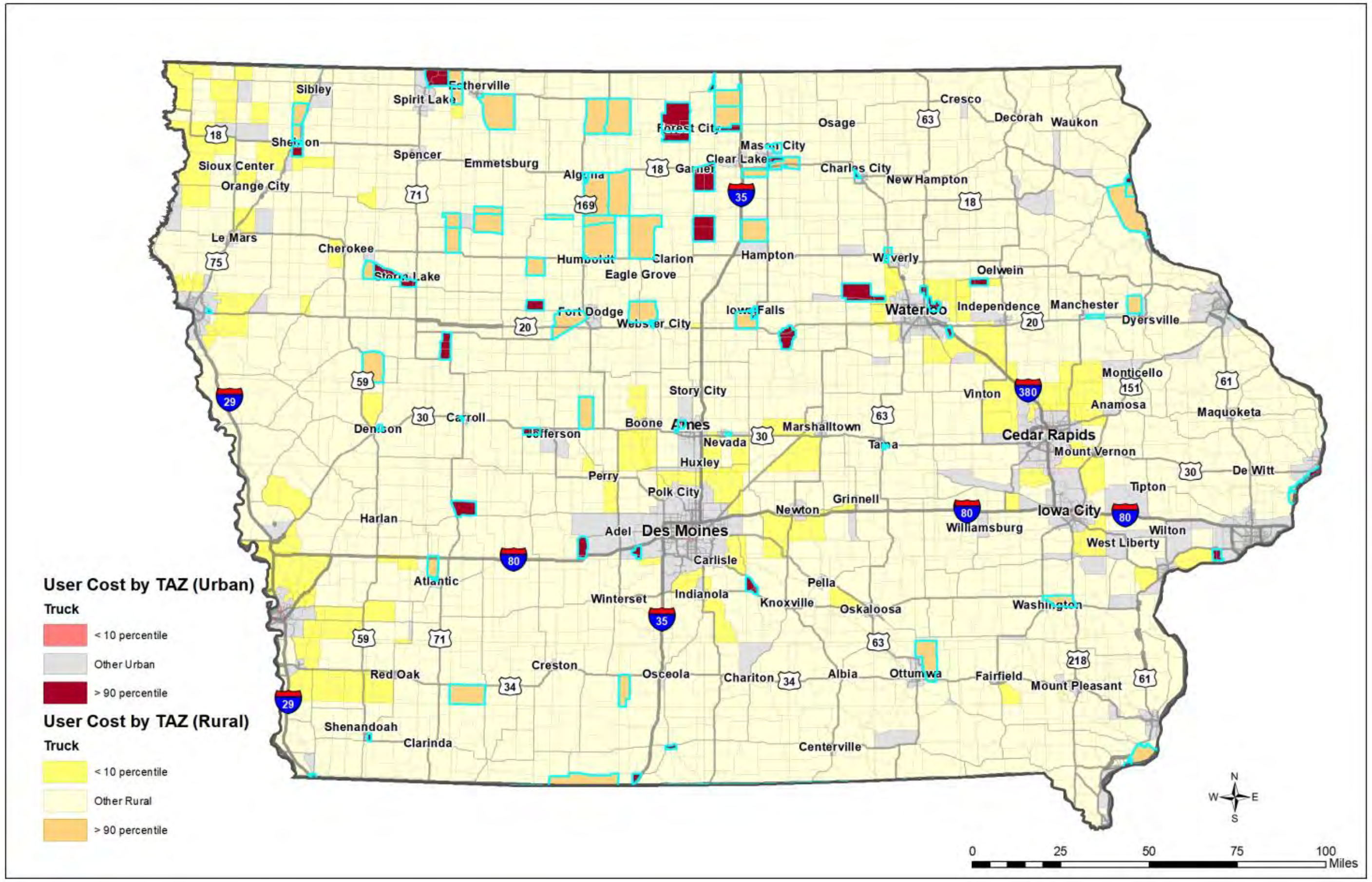


User Cost per Auto Trip by TAZ



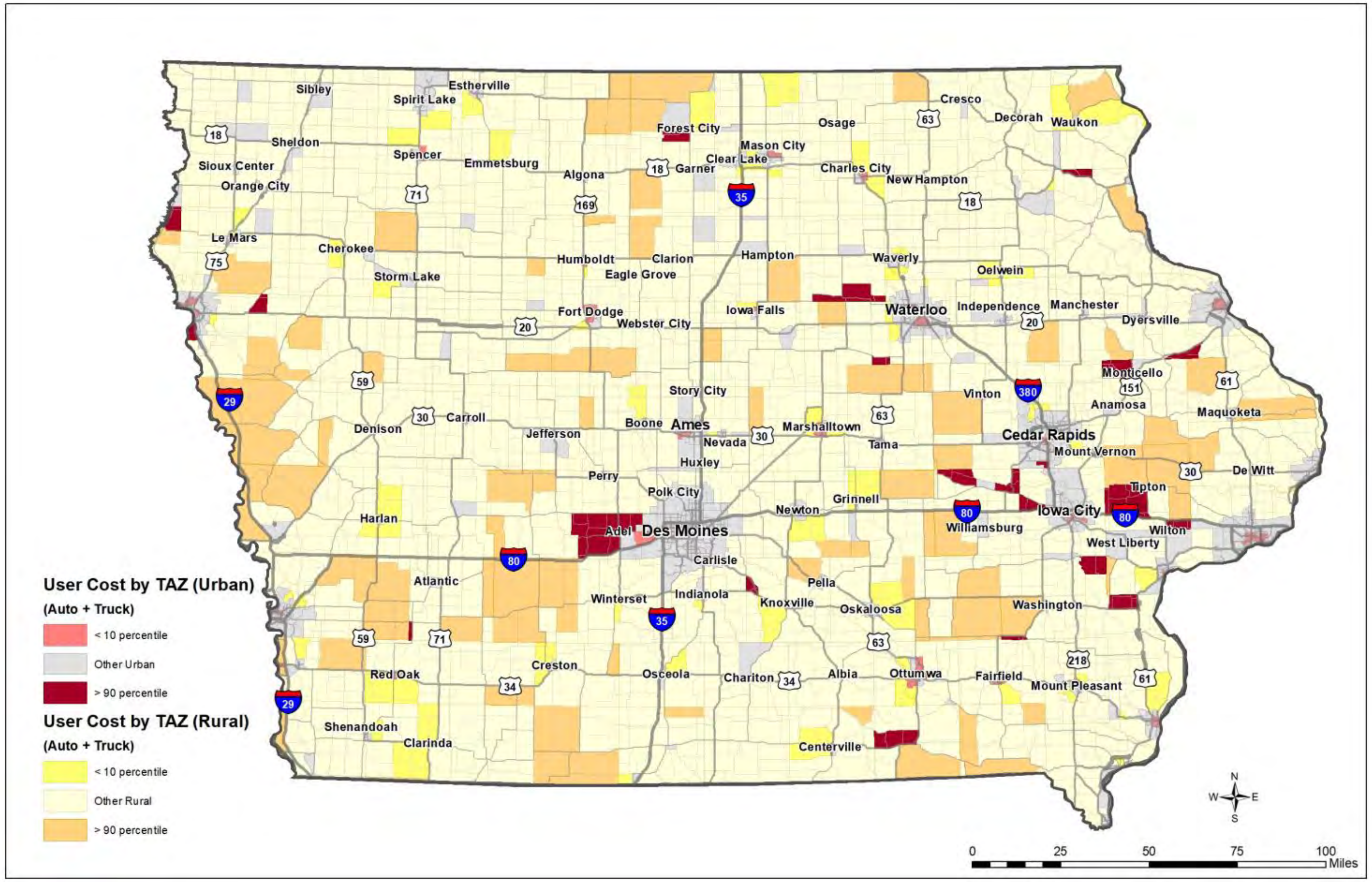
metro analytics

User Cost per Truck Trip by TAZ



metro analytics

User Cost per Trip by TAZ



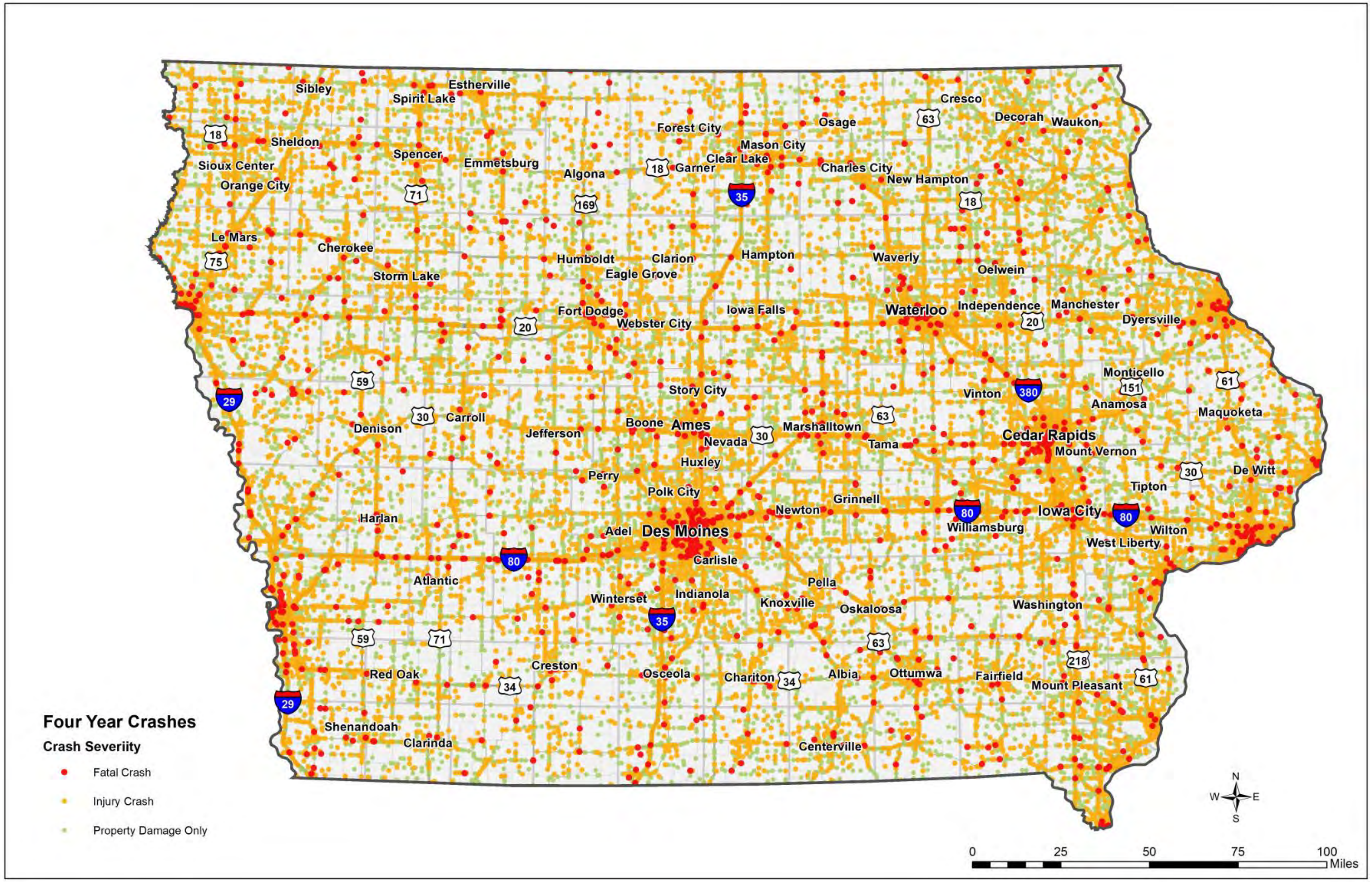
metro analytics

User Cost per Trip by TAZ (Urban)

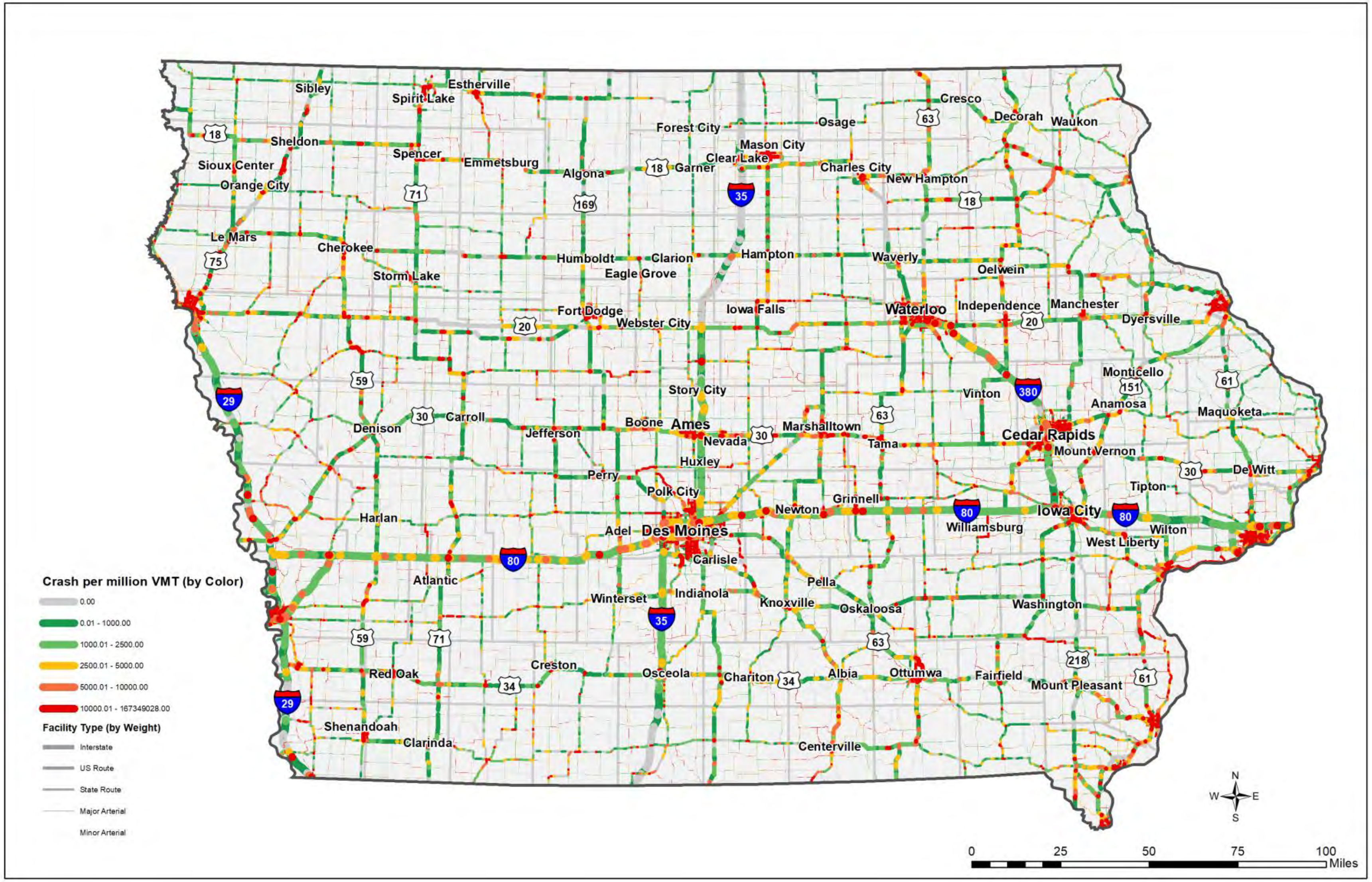
Crash Cost

- Four-year crash data: 2017,2018,2019 and 2020
- Crash Cost
  - Fatality: $10,636,600
  - Injury: $250,600
  - Property Damage Only: $4,400
- Annualization: 307.5

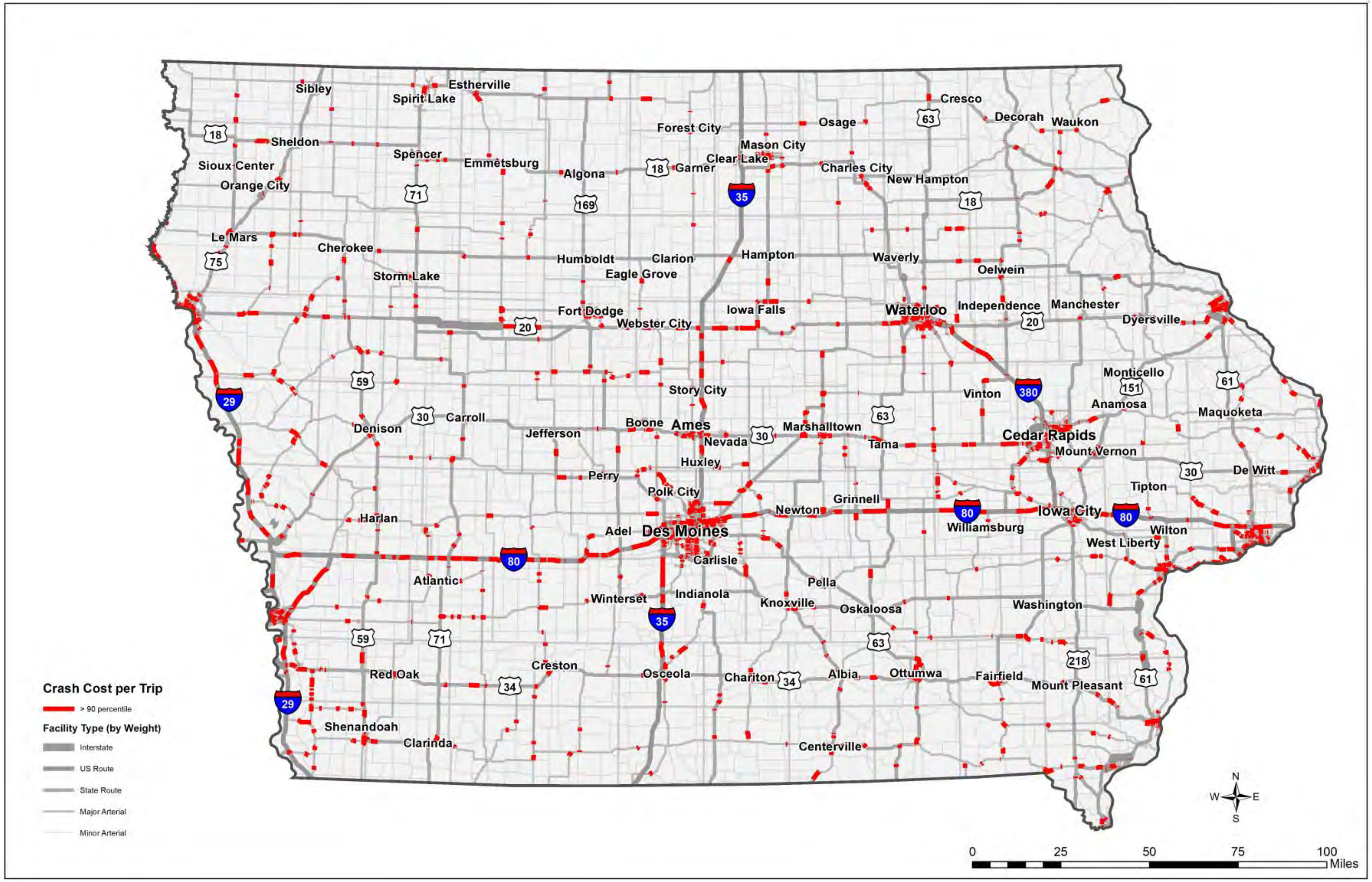
Four-year crash locations



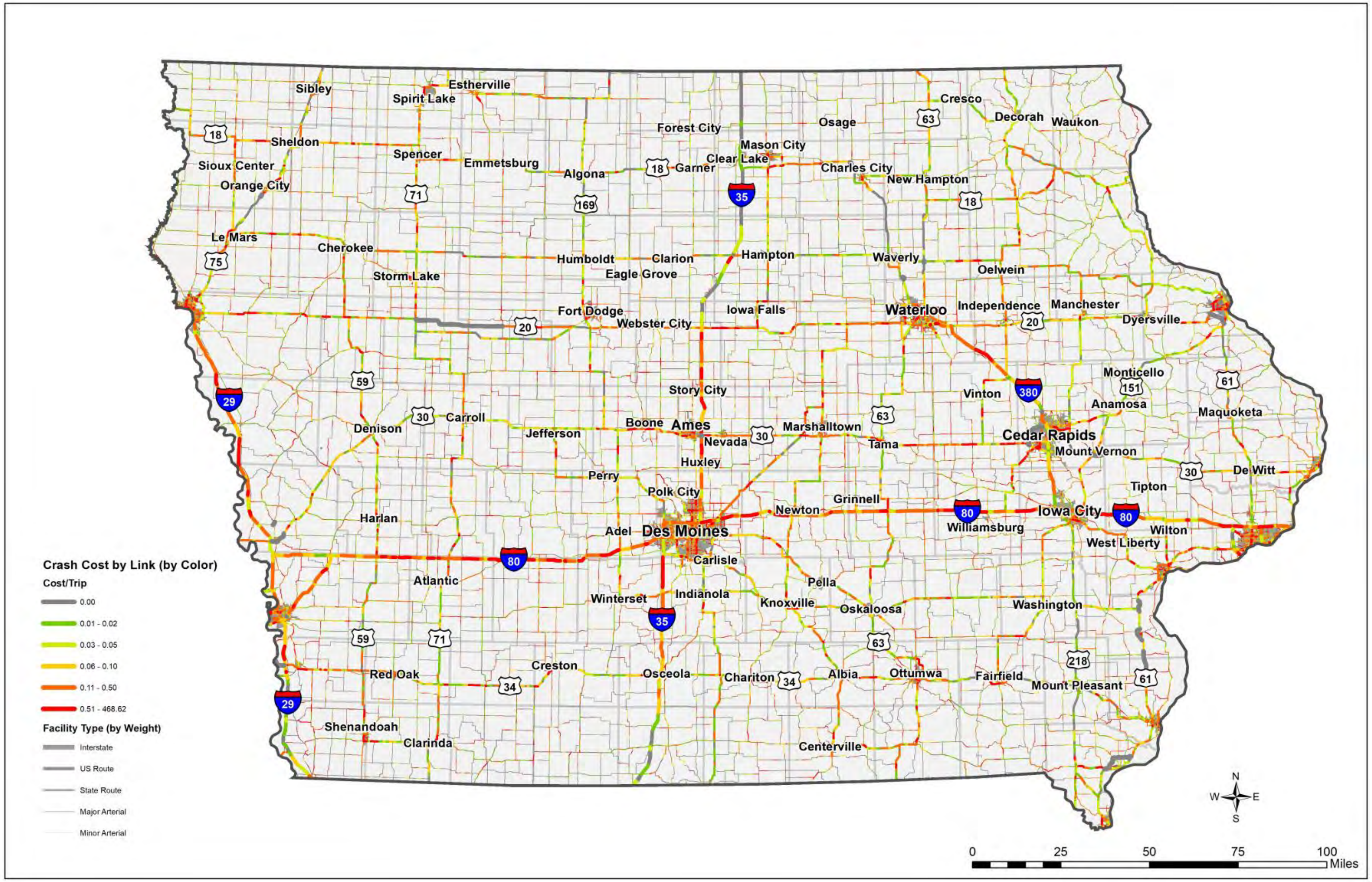
Crash per Million VMT



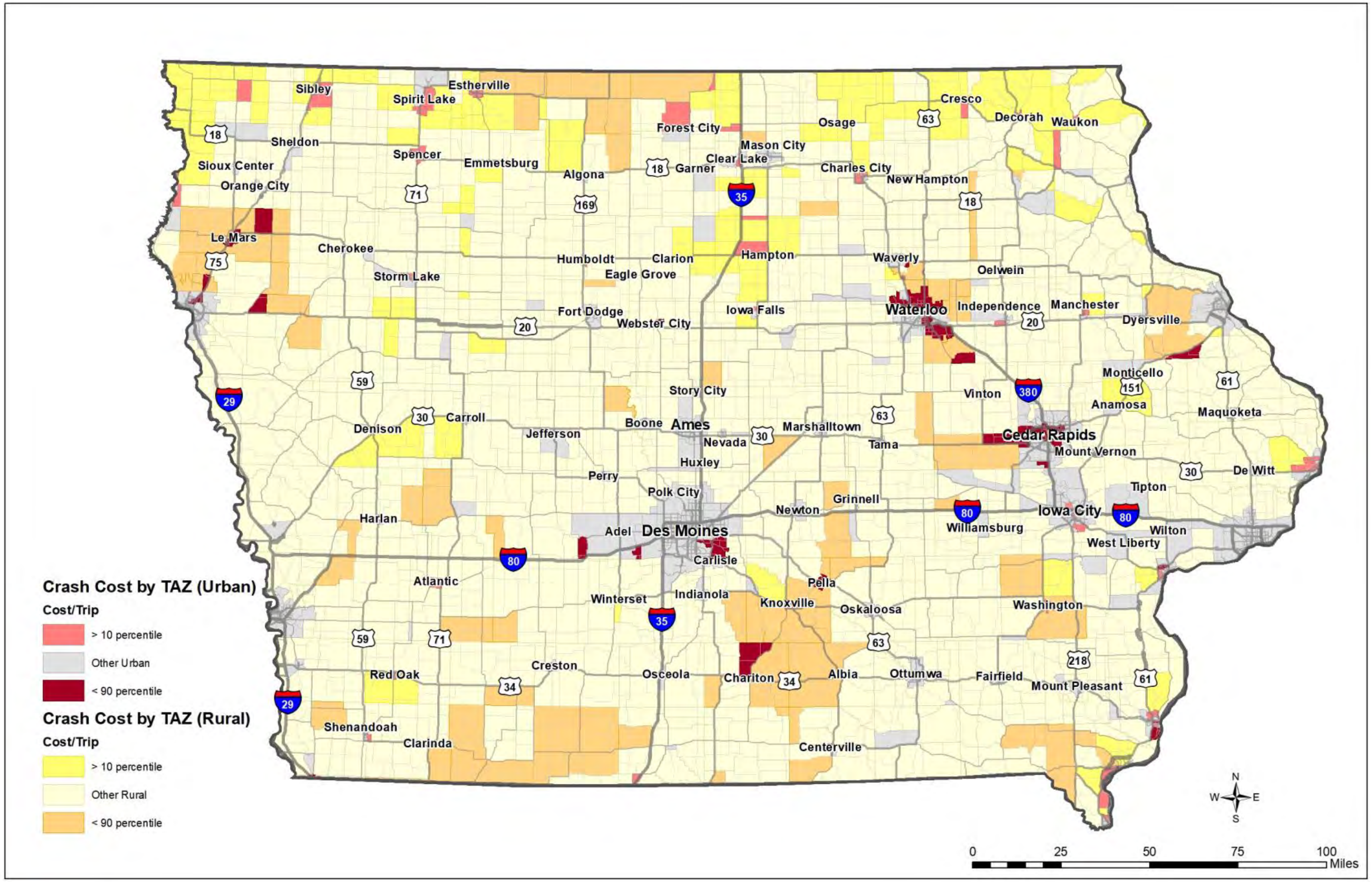
Crash Cost per Trip by Link (>90 percentile)



Crash Cost per Trip by Link

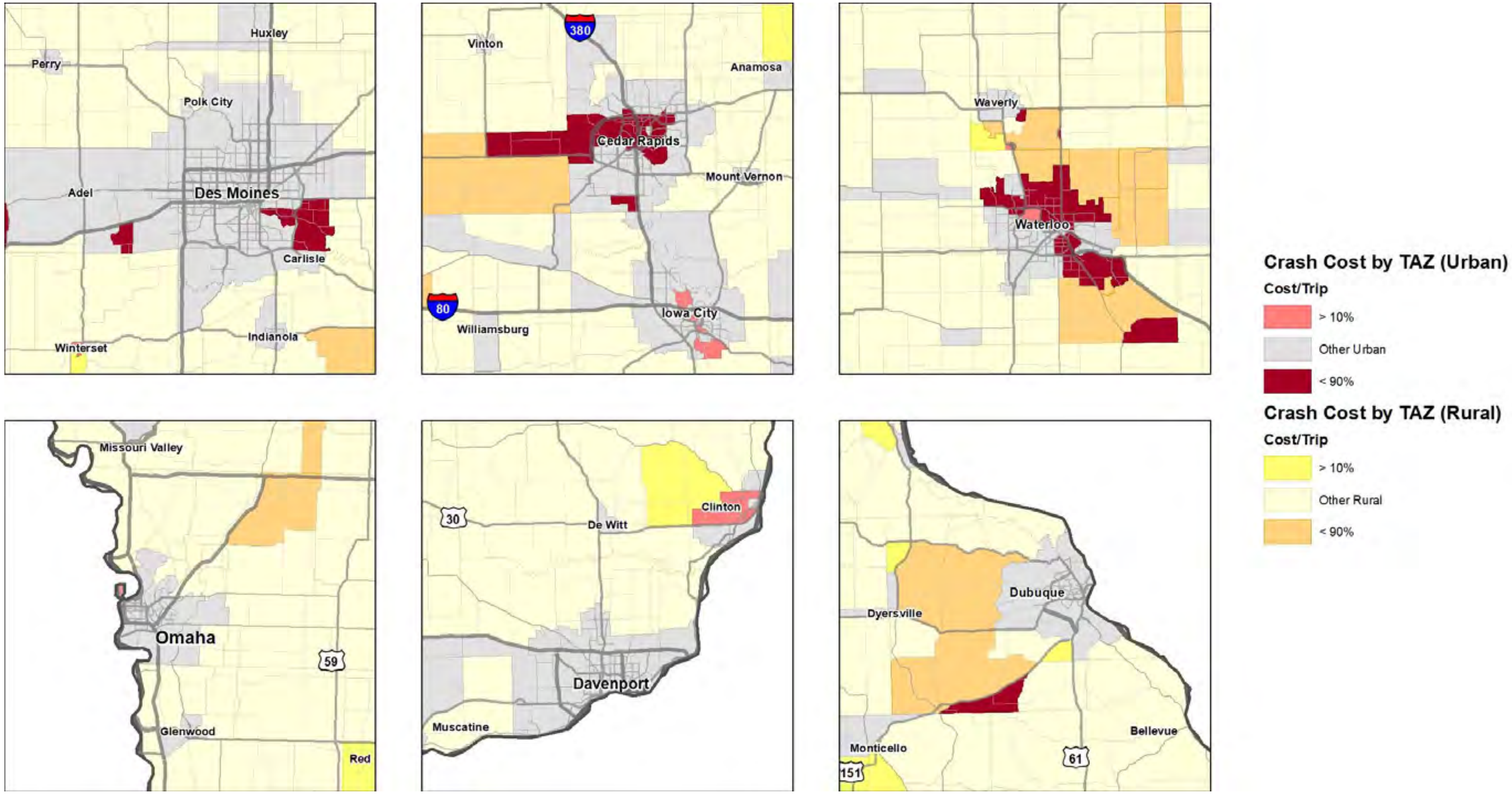


Crash Cost per Trip by TAZ



metro analytics

Crash Cost per Trip by TAZ (Urban)

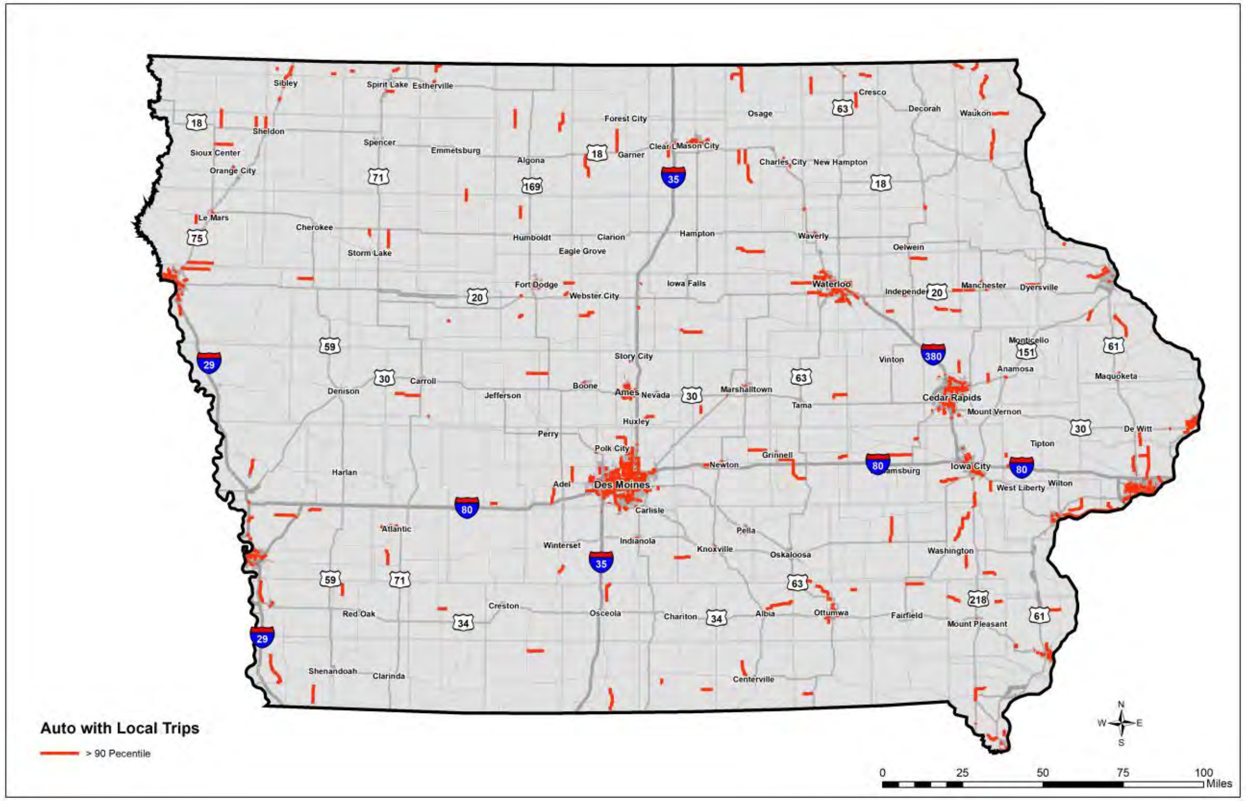


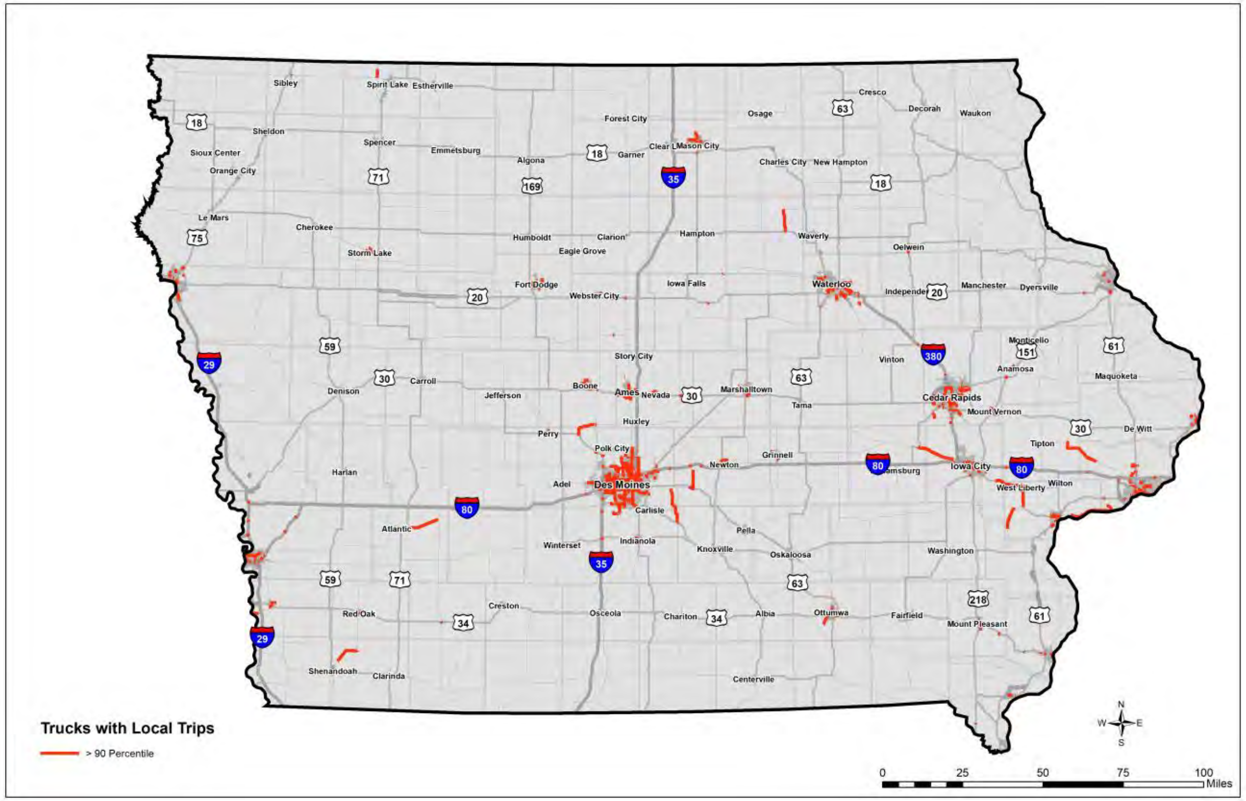
Trip Length Analysis

Trip Length (miles)

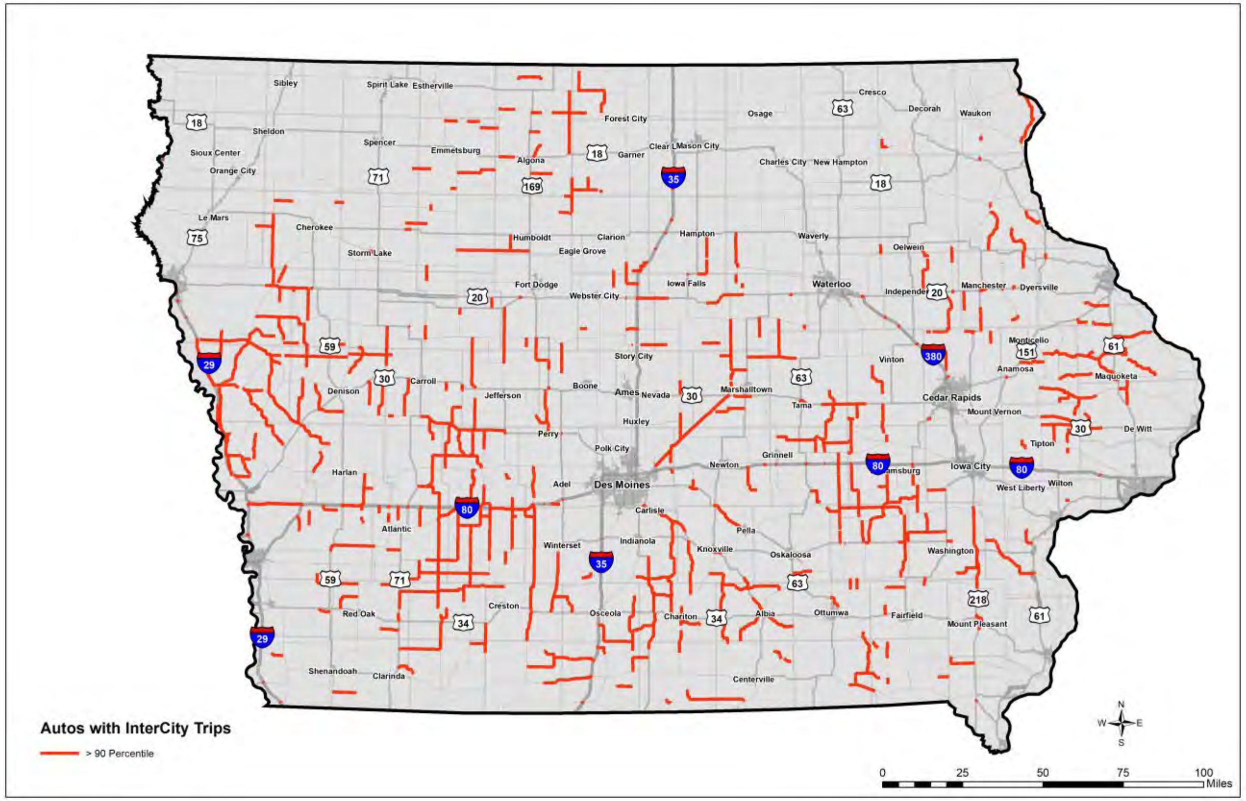
- Local : 0-50
- Inter-city : 50-150
- Statewide : 150-300
- Inter-state : >300

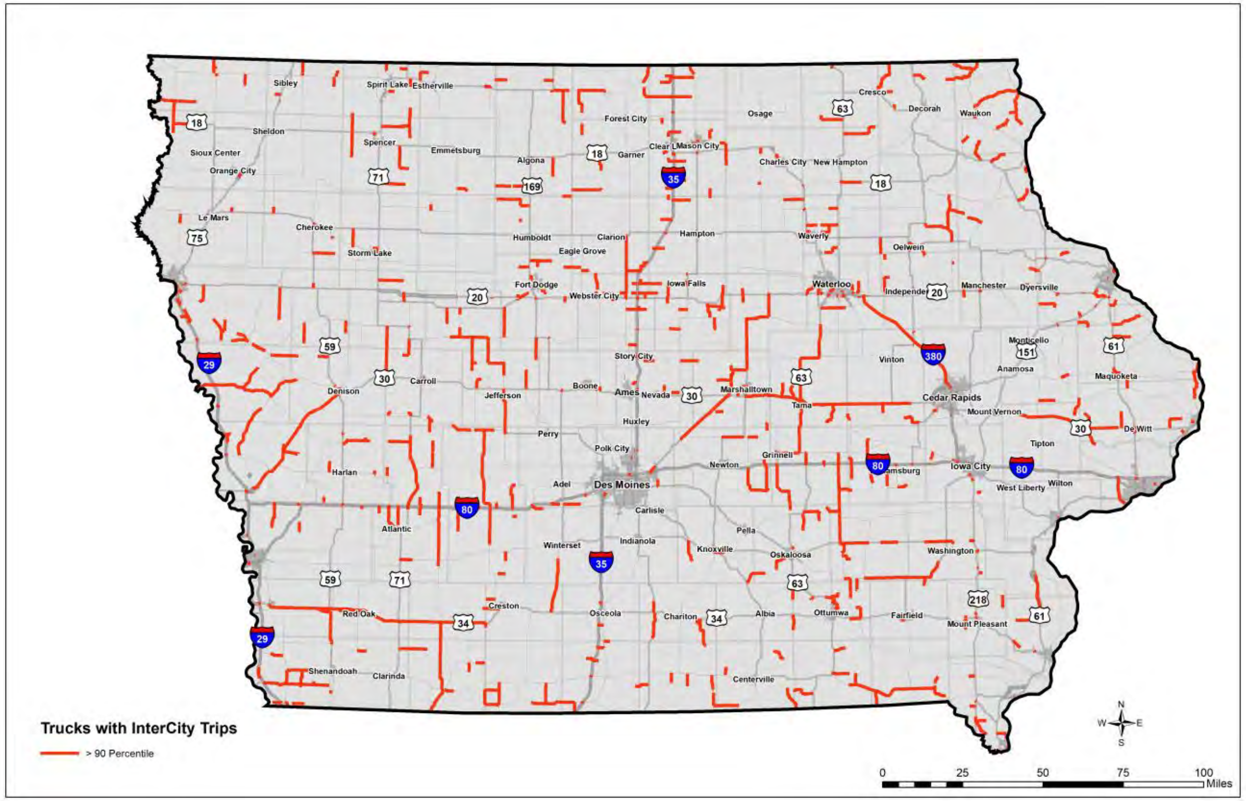
Links with Local Trips > 90 percentile Auto and Truck



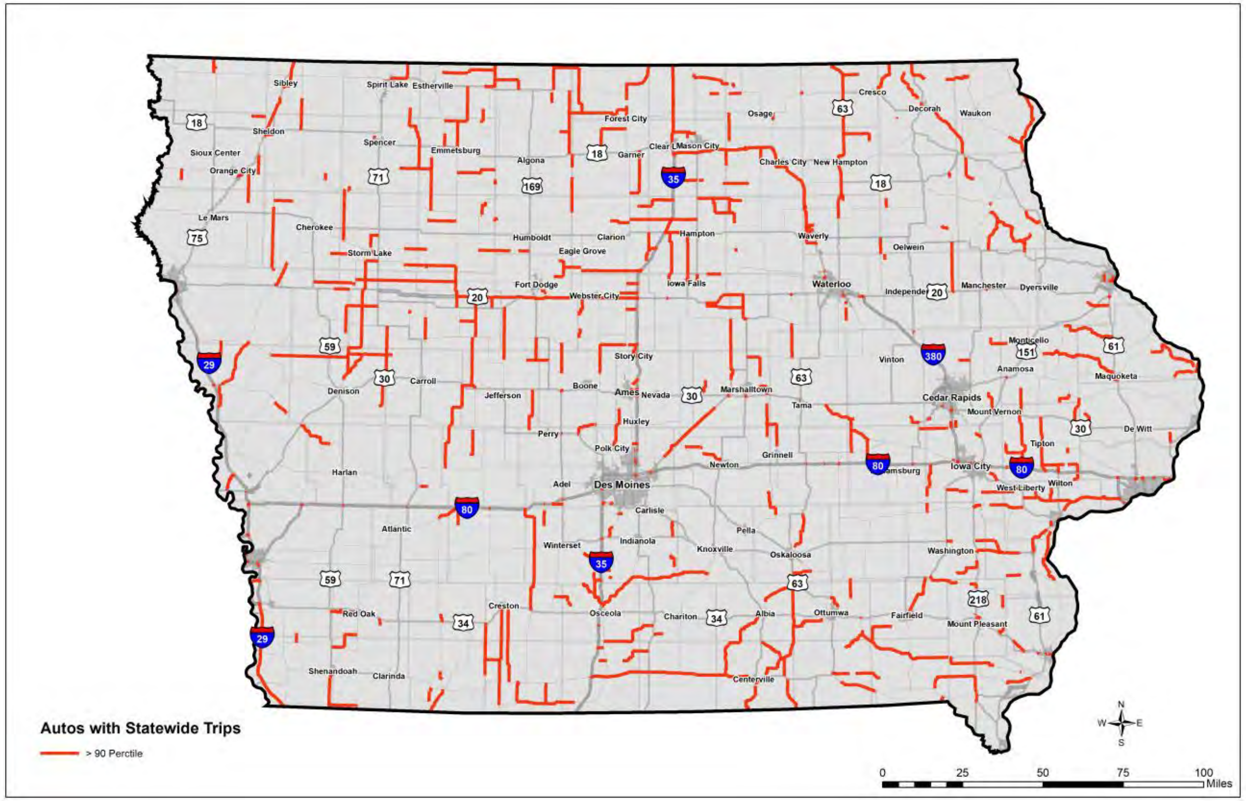


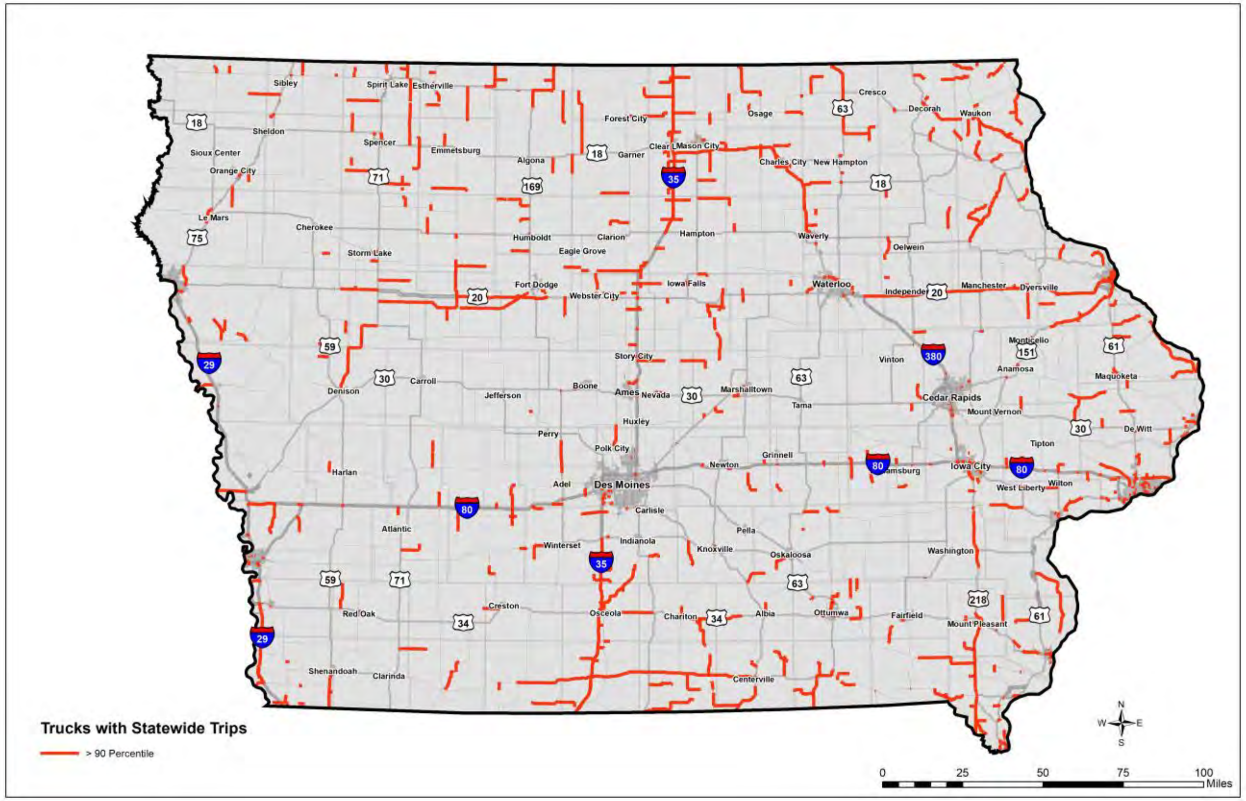
Links with Inter-city Trips > 90 percentile
Auto and Truck



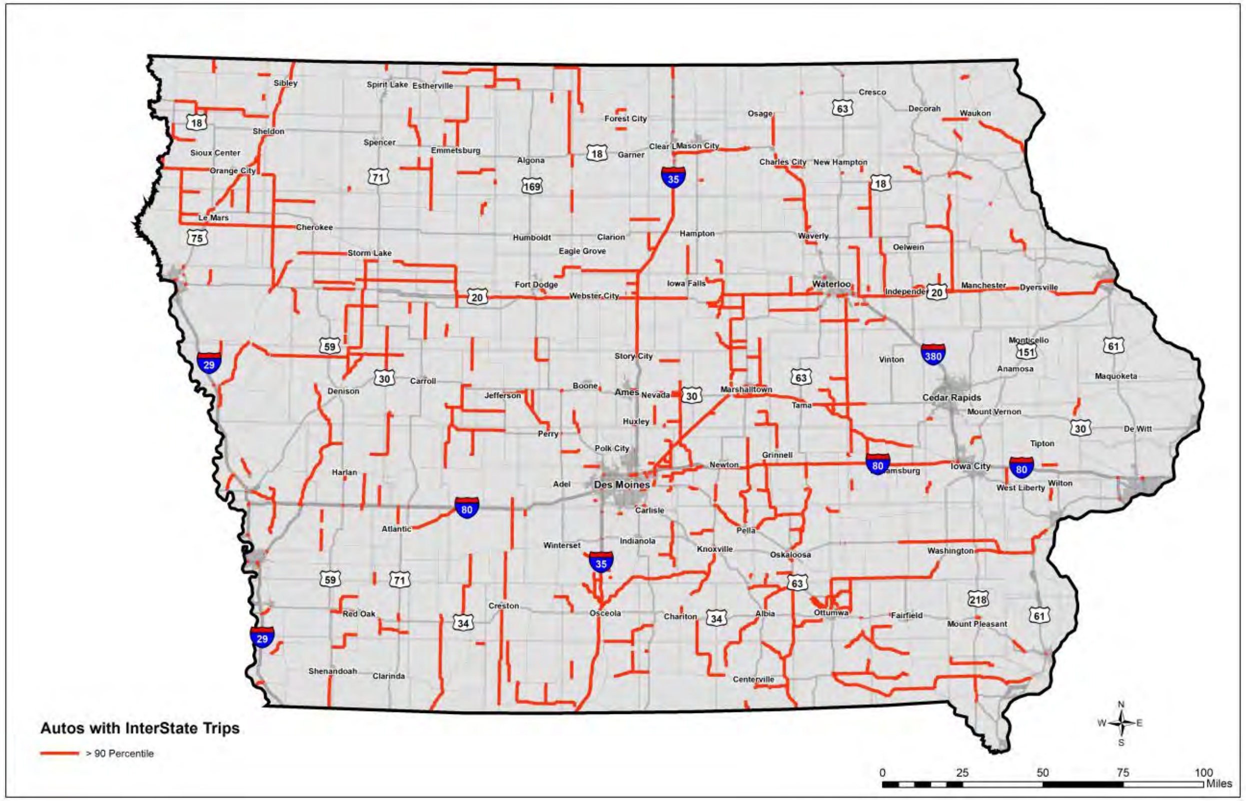


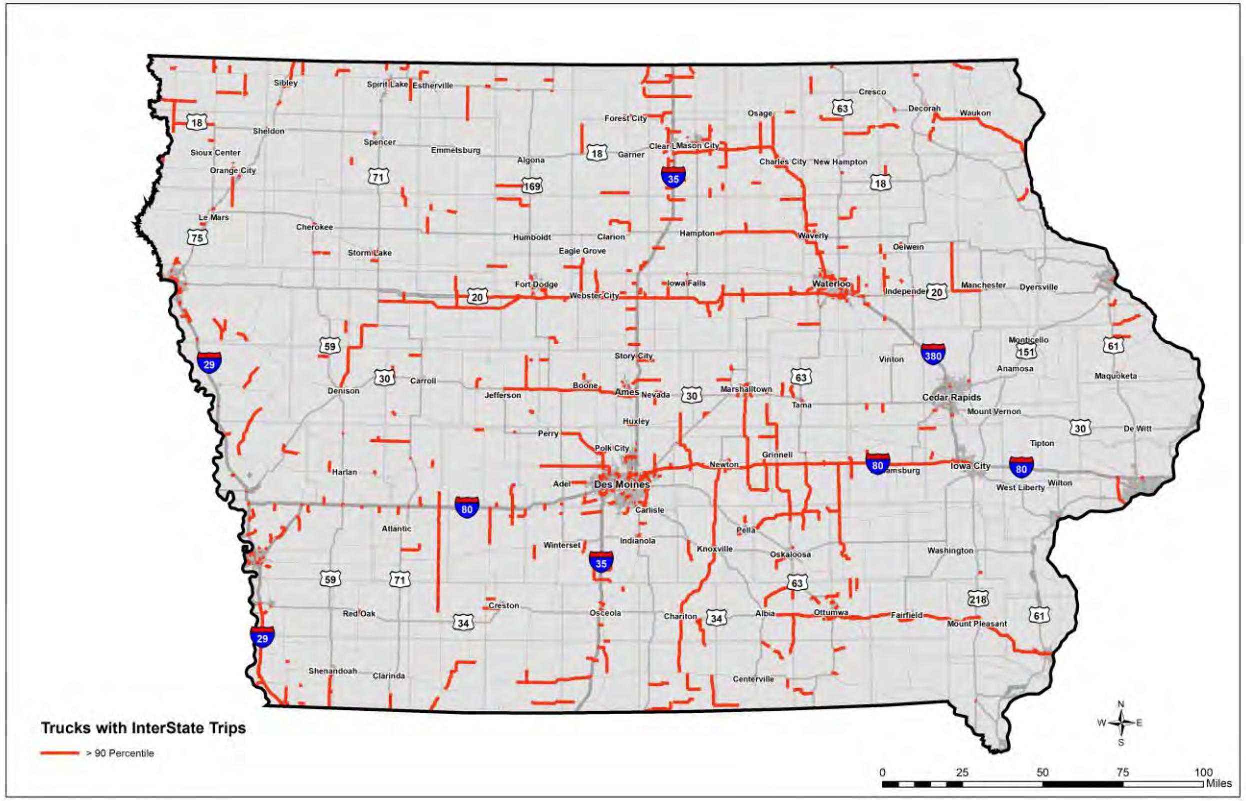
Links with Statewide Trips > 90 percentile
Auto and Truck



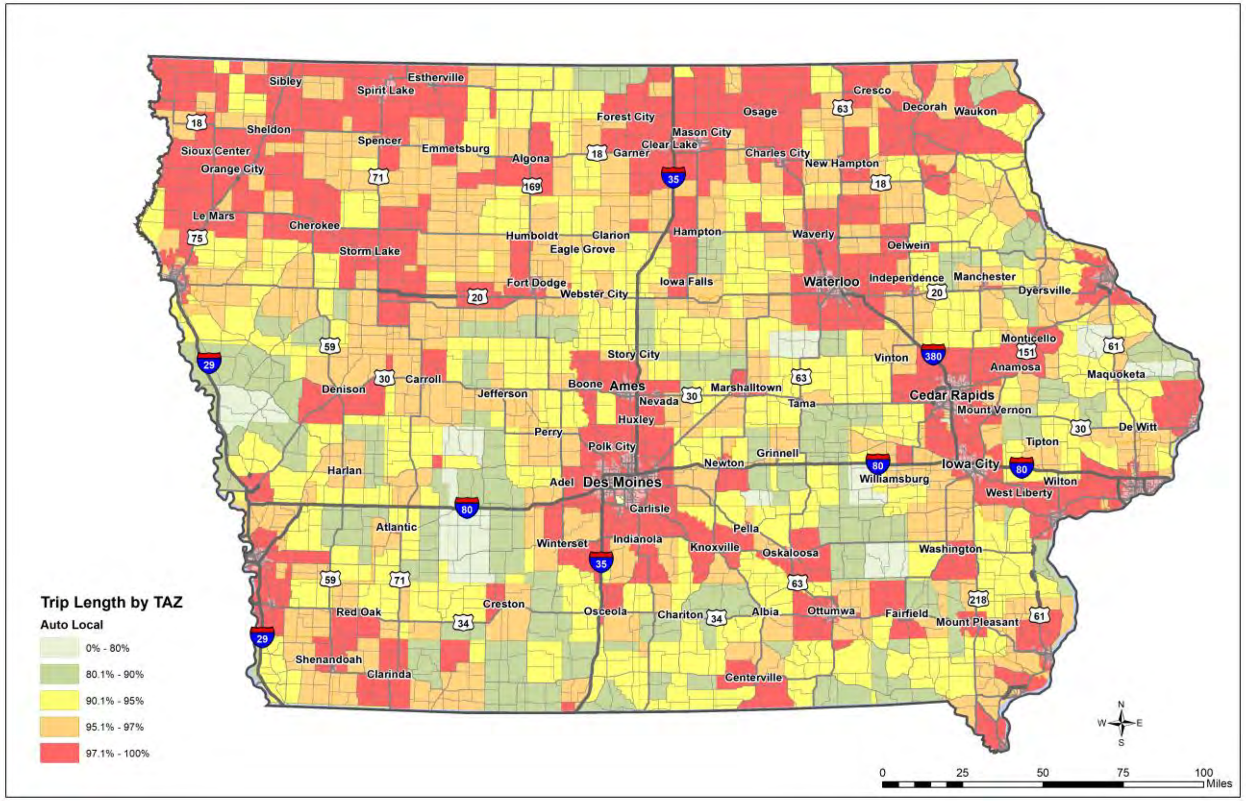


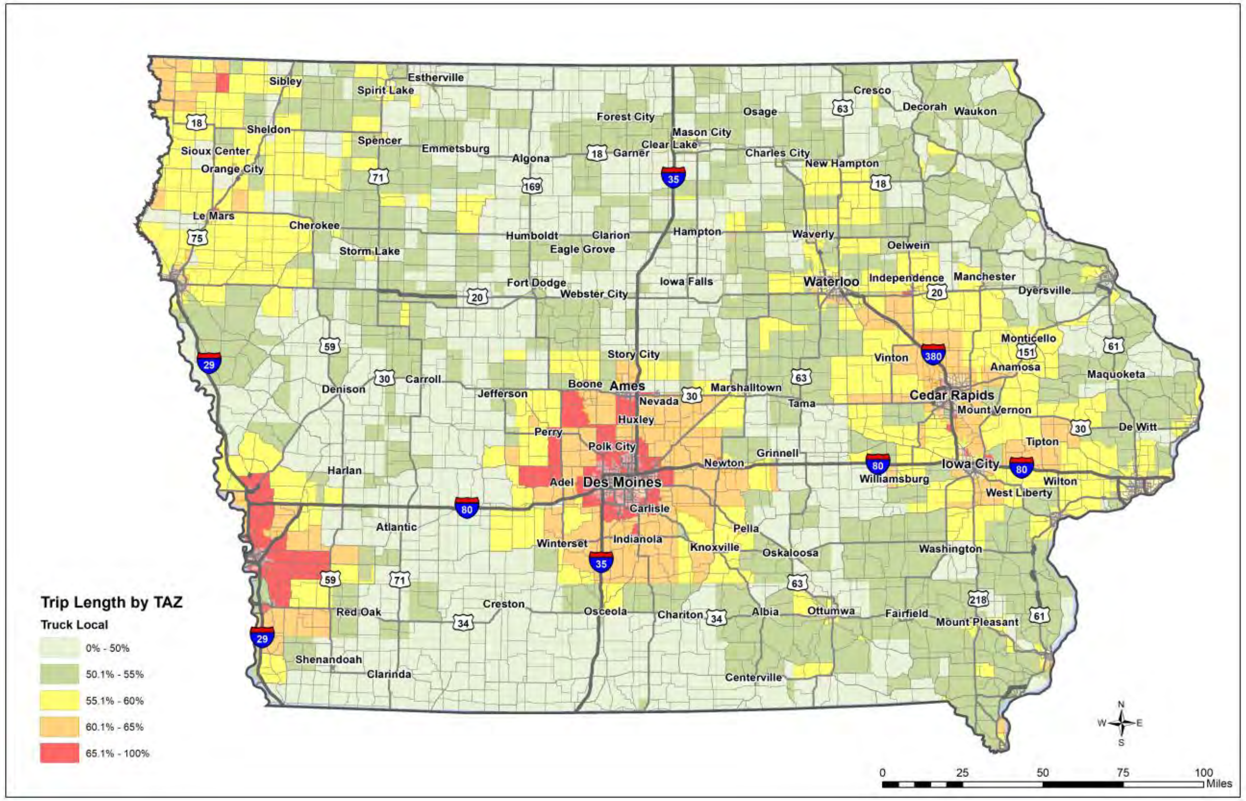
Links with Inter-state Trips > 90 percentile
Auto and Truck



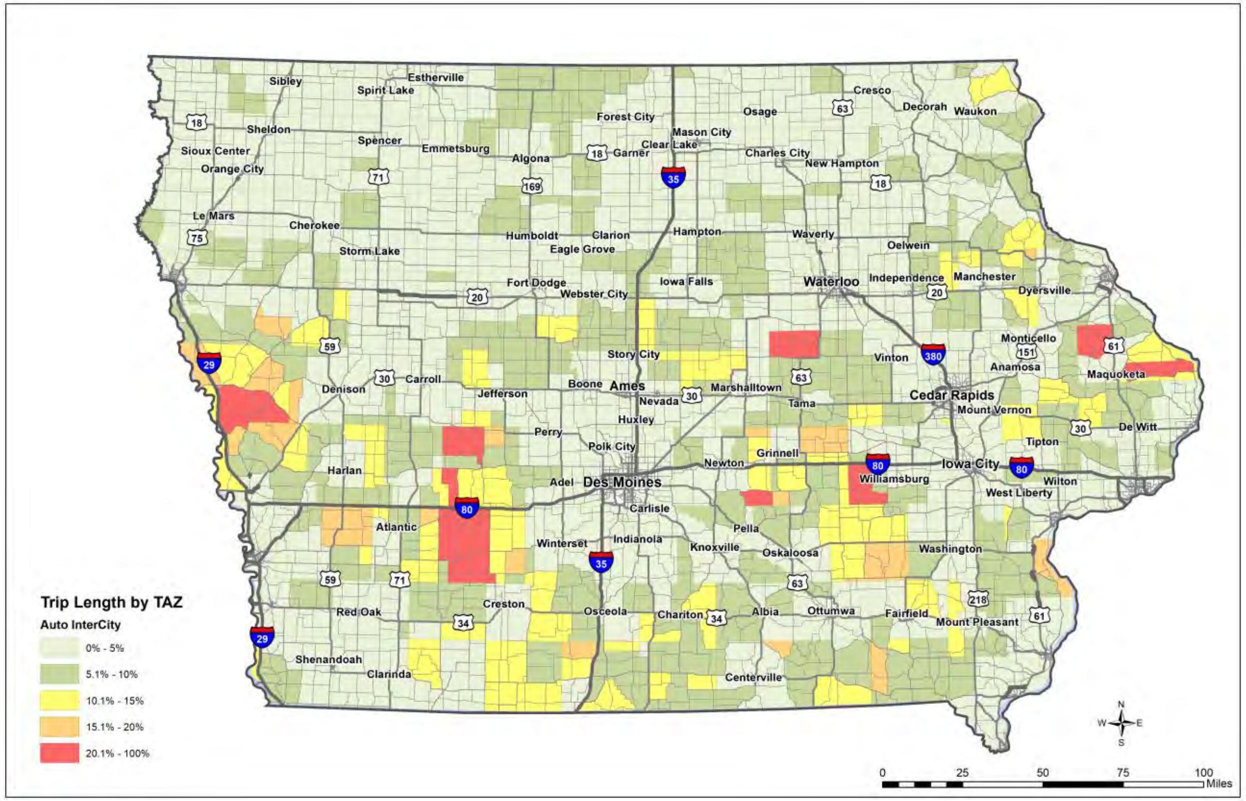


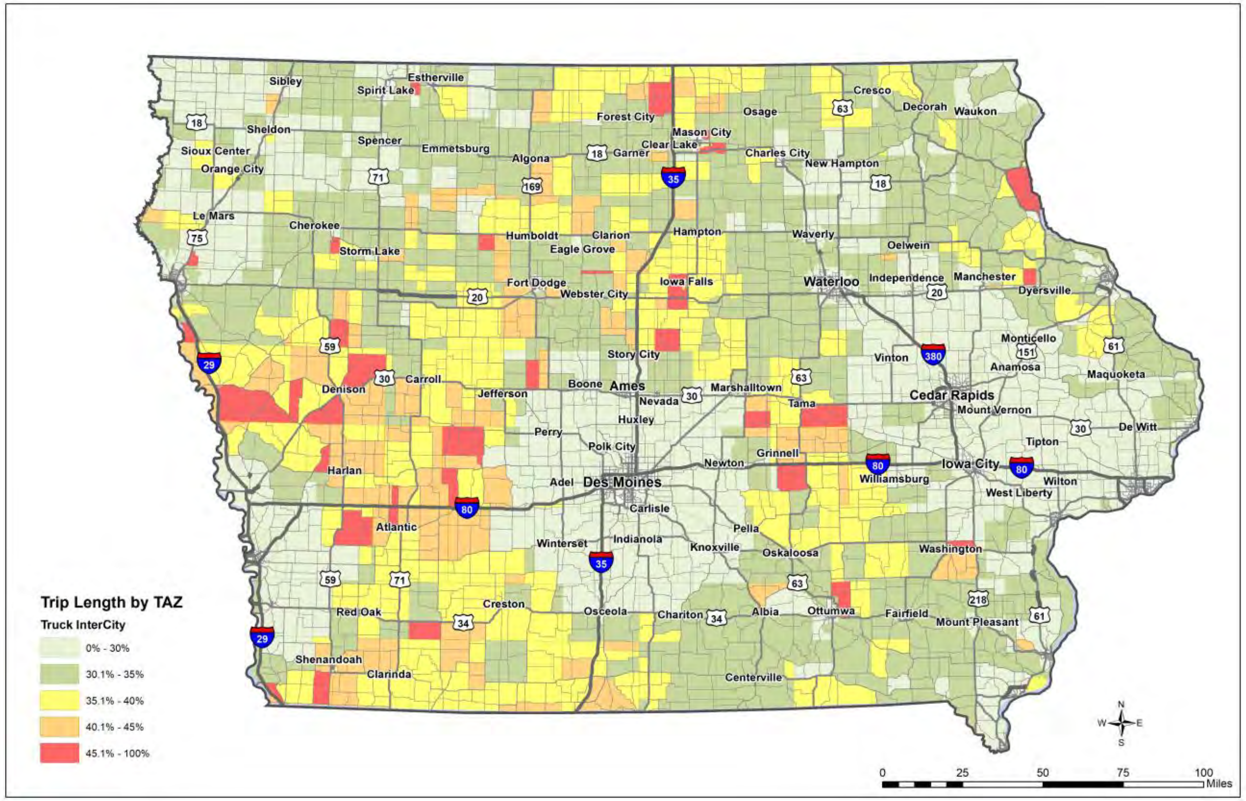
TAZs with Percentage of Local Trips Auto and Truck



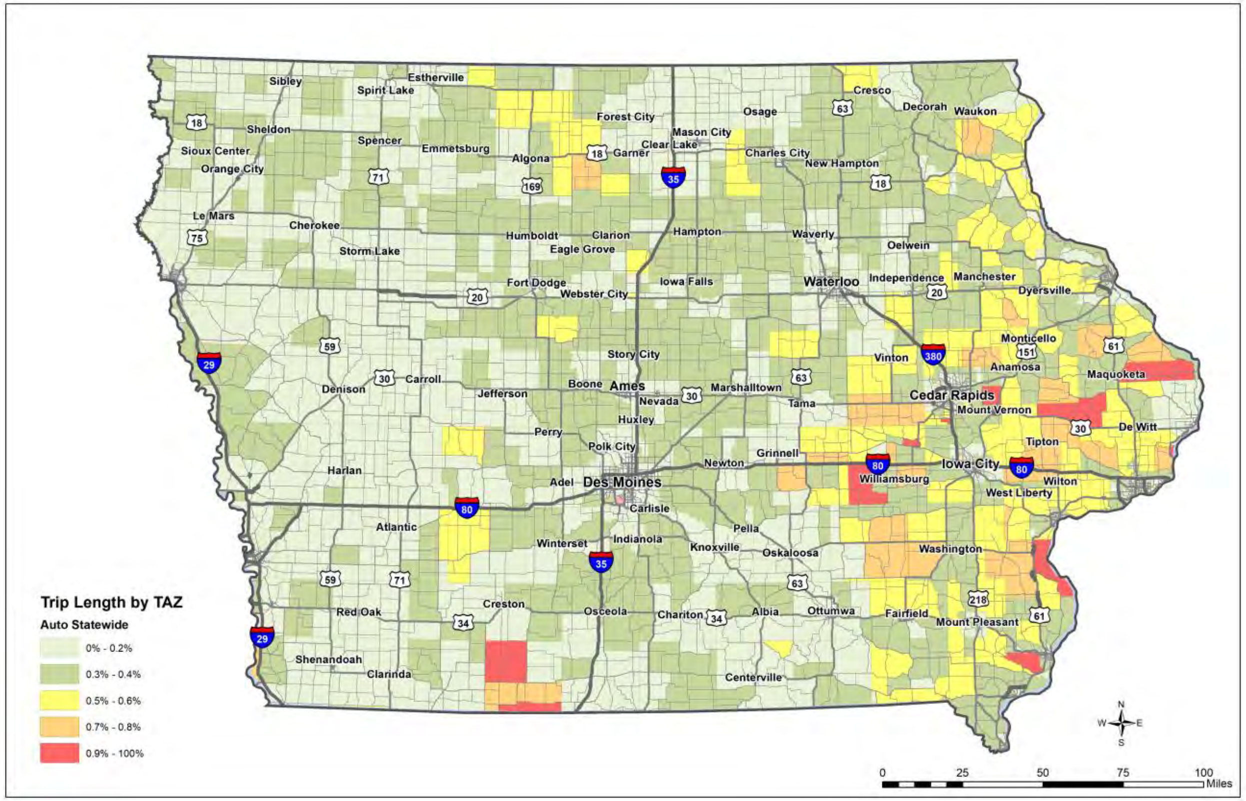


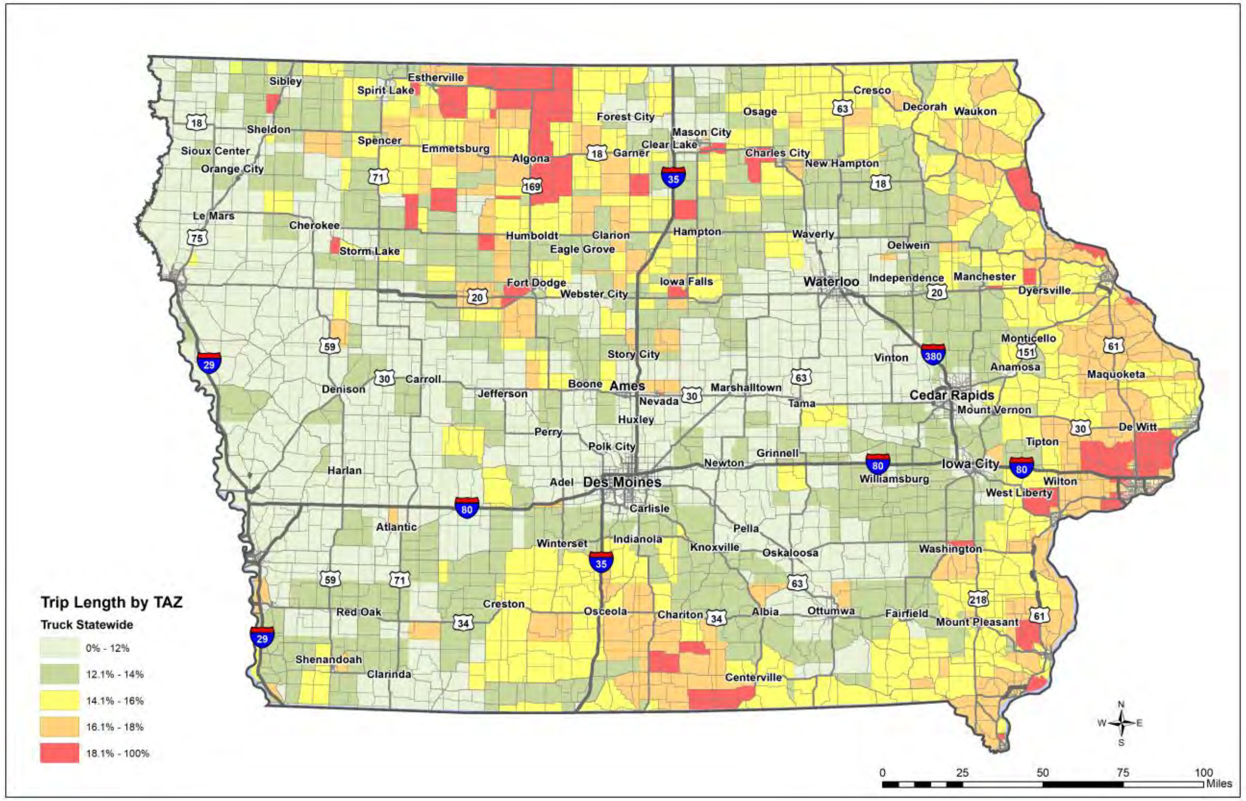
TAZs with Percentage of Inter-city Trips Auto and Truck



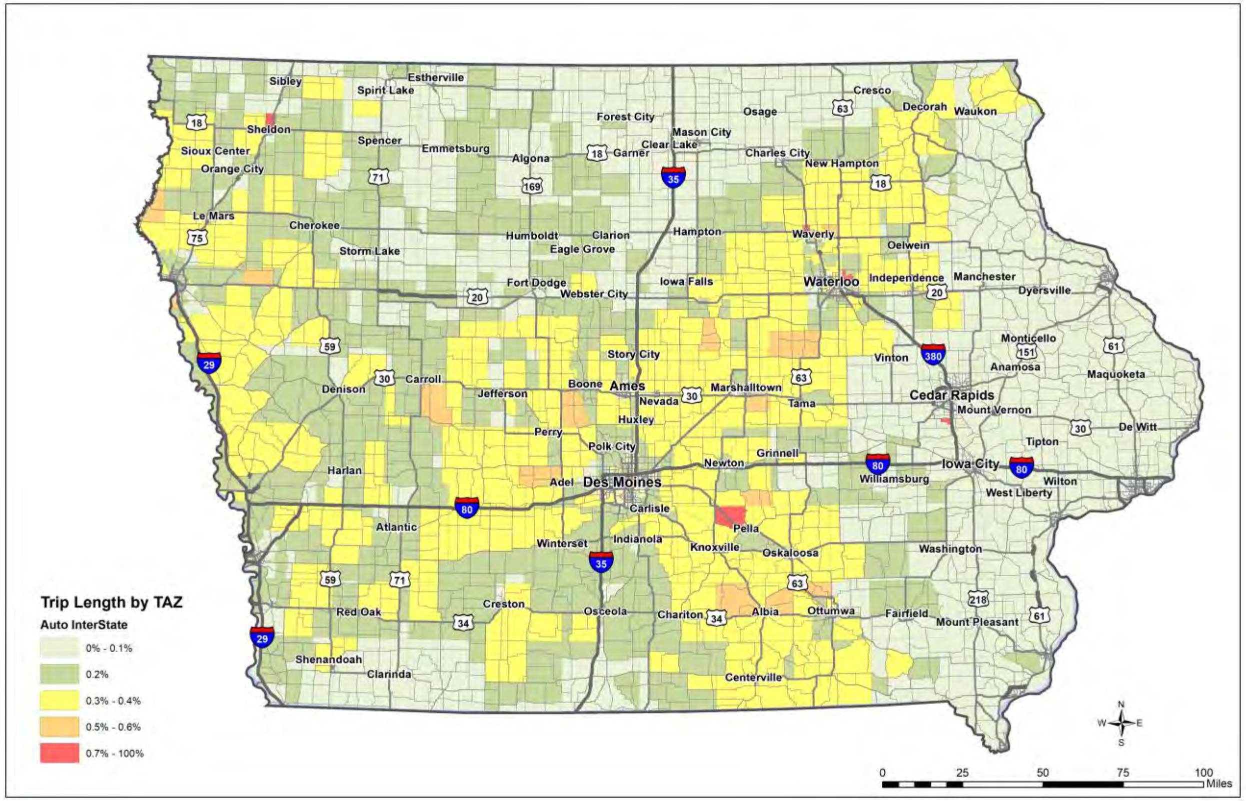


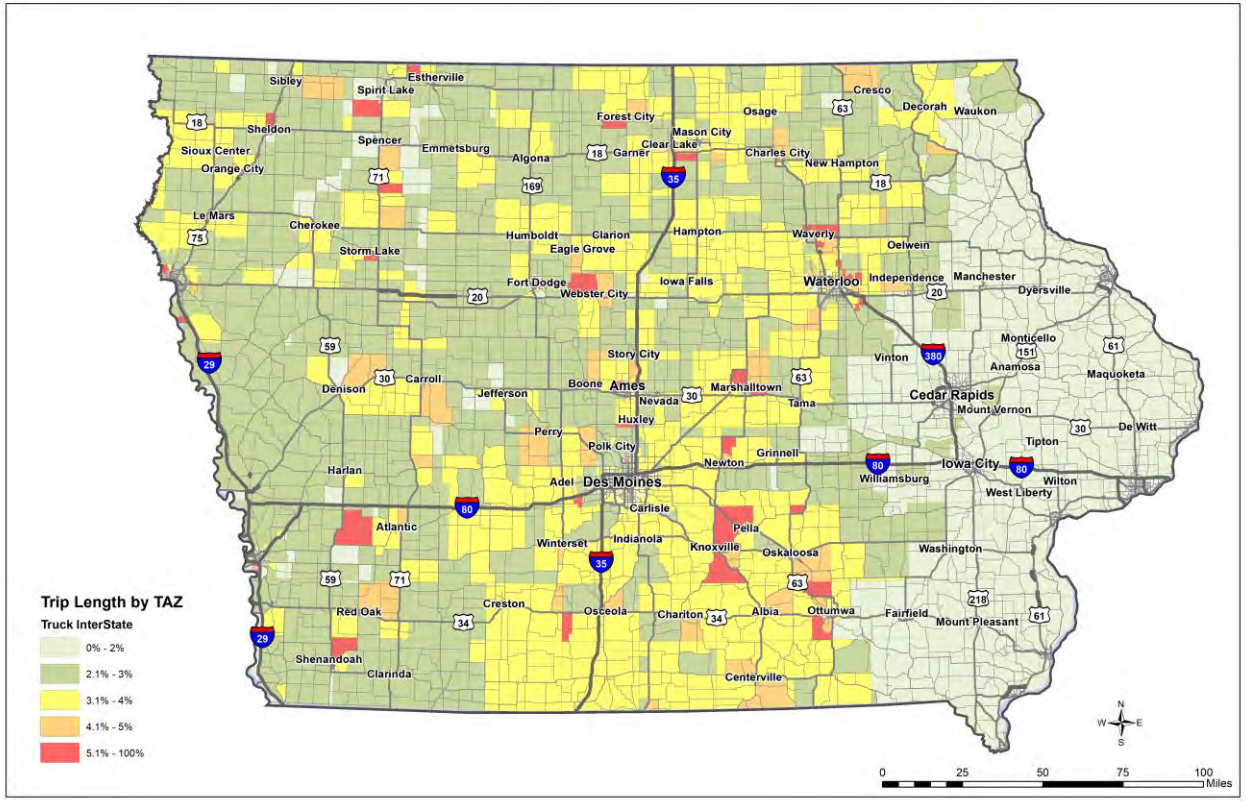
TAZs with Percentage of Statewide Trips Auto and Truck





TAZs with Percentage of Inter-state Trips Auto and Truck





Trade Scenario

Input Data

- 2050 Base
  - FAF/County to FAF/County to flows
- 2050 Trade Scenario
  - FAF/County to FAF/County to flows
  - Multimodal flows
- 2040 iTRAM truck trips

Methodology/Assumptions

- Calculate distance to each external for FAF and iTRAM zones
- FAF-iTRAM flows
  - Calculate total distance via each external. Minimum distance via each external
  - Selected external based on minimum distance and allocate to FAF
- FAF-to-FAF flows
  - Tag links within 100 miles of external stations with respective external
  - Create skims by including viaitram field and tagged external field
  - Get nearest external for O and for D
- Multimodal
  - Split the shares between rail, barge and truck only (Shares by Noel)
  - Rail: Nearest Rail TAZ (discard when same TAZ) irrespective of which FAF trip is going to. From each production zone, the assigned zone becomes the attraction zone.
  - Barge: Nearest Barge TAZ to each FAF. Trips from each iTRAM zone assigned to that Barge TAZ.

Methodology/Assumptions

- No-Build: Main commodity flows converted to trucks
- Build: Main + multimodal commodity flows converted to trucks
- Distribution taken from iTRAM 2040 truck trips
- Annualization: 365
- Trucks: Tons/Truck=20
- Empty load factors not used
- OD: (PA+PA.t)/2

Methodology/Assumptions

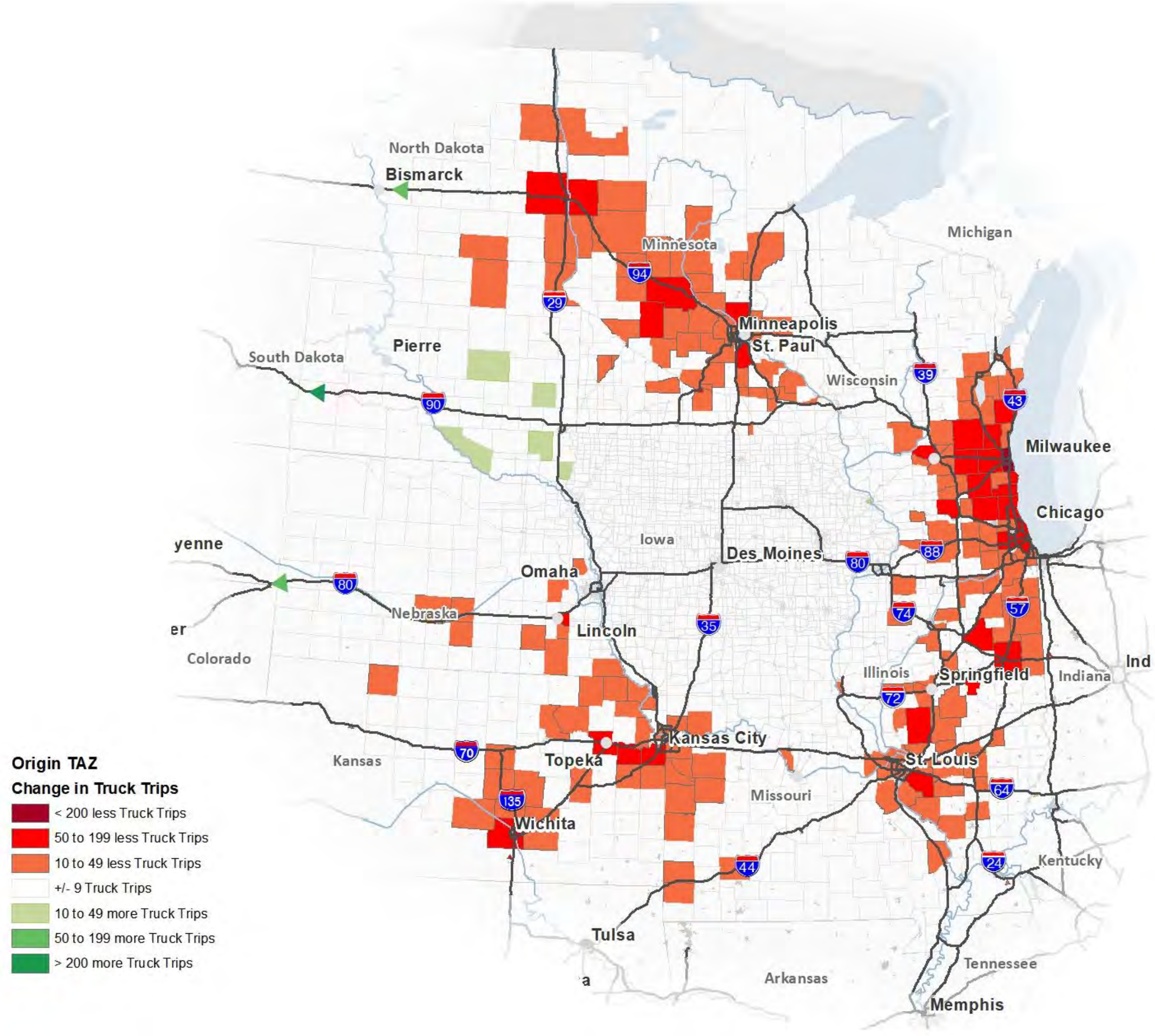
Daily Trips	Before processing	After processing
Model		2,035,713
Base	231,156	2,066,261
Trade	227,999	2,056,517

Scaling

If Model trips = 0, NB and Build trips from new flows

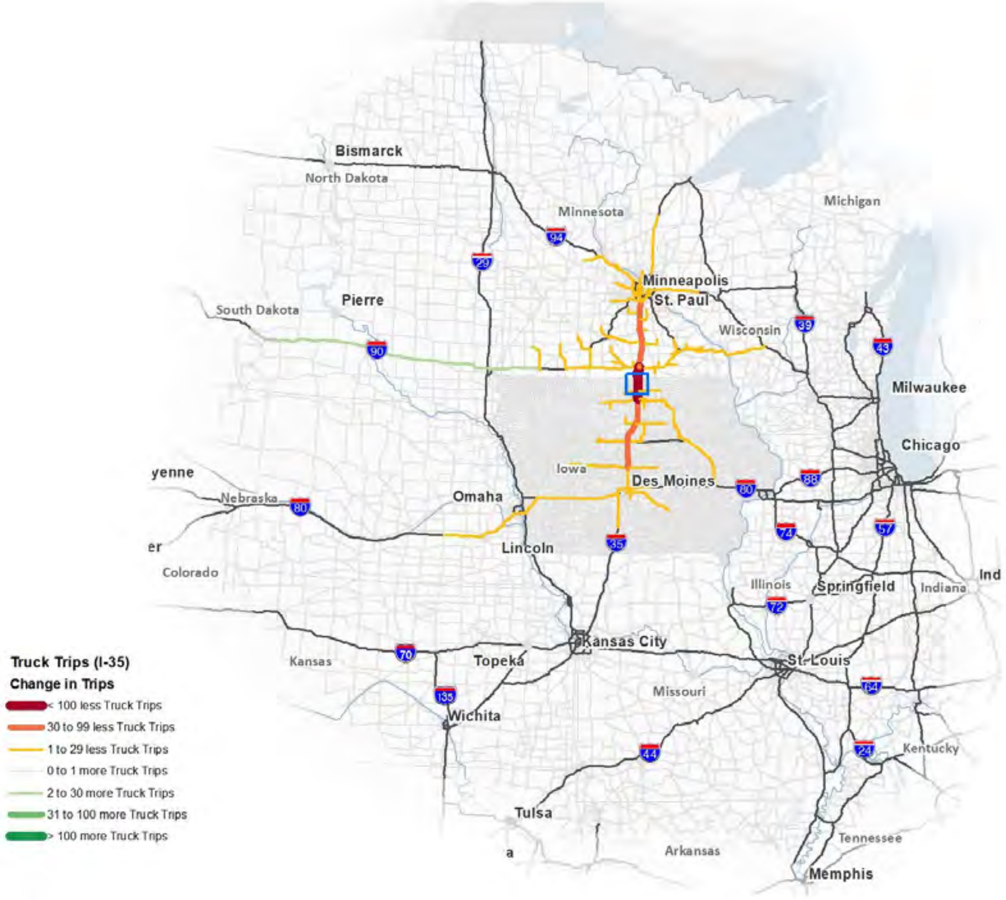
If Model trips > 0, NB=model trips and build=proportional increase

Truck Trips Difference by Origin TAZ



Truck volume difference by link

Truck Select Link Difference: I-35 SB



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Truck Select Link Difference: I-80 EB

Truck Select Link Difference: I-90 EB

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Results
Des Moines Rightsizing
Policy Summary – Appendix 2

Scenarios

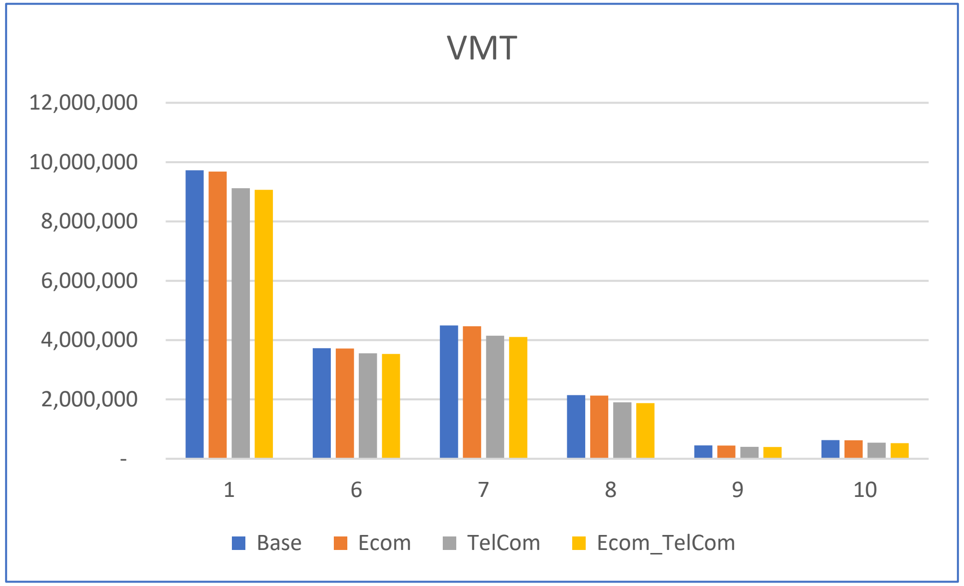
- 2040 Base
- 2040 Ecommerce
- 2040 Tele-Commute
- 2040 Ecommerce + Tele-Commute

Summary Statistics

- The summaries (VMT, VHT, Delays and Speeds) are based on Average daily weekday results

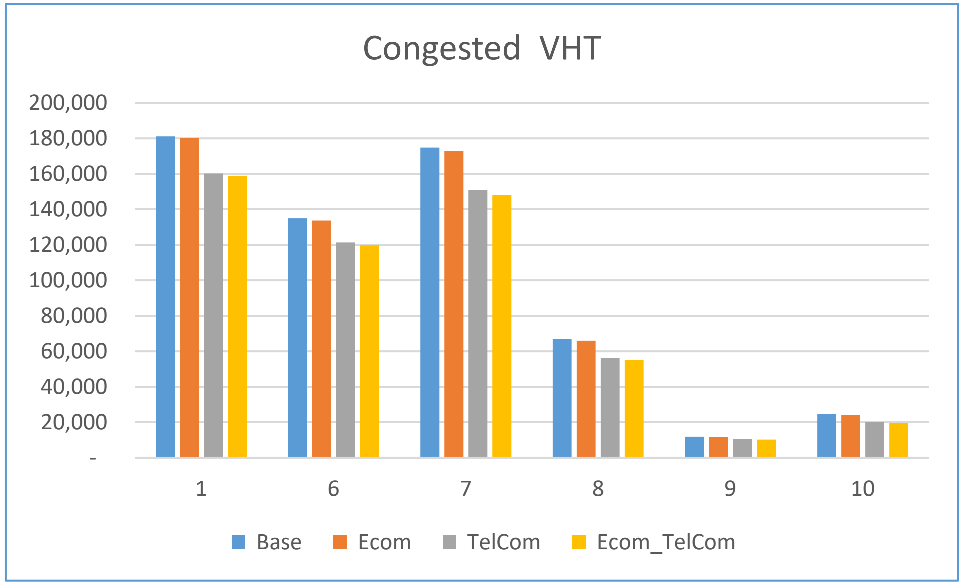
VMT

	FACTYPE	Base	Ecom	TelCom	Ecom_TelCom
1	Interstate	9,723,487	9,683,108	9,122,037	9,066,182
6	Principal arterial	3,726,913	3,713,831	3,554,636	3,534,494
7	Minor arterial	4,496,566	4,467,671	4,148,398	4,103,273
8	Collector	2,147,966	2,127,919	1,904,035	1,874,304
9	Minor Collector	447,905	444,210	402,278	396,745
10	Local	630,036	620,997	540,412	527,428
	TOTAL	21,172,873	21,057,737	19,671,797	19,502,426



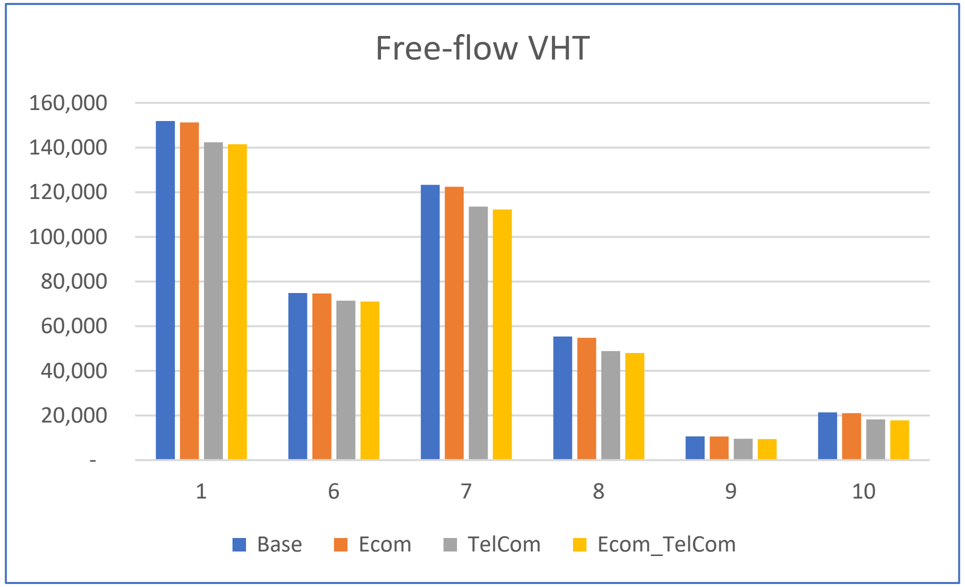
Congested VHT

	FACTYPE	Base	Ecom	TelCom	Ecom_TelCom
1	Interstate	181,100	180,296	160,151	158,886
6	Principal arterial	134,948	133,695	121,324	119,670
7	Minor arterial	174,818	172,910	150,927	148,236
8	Collector	66,817	66,005	56,345	55,192
9	Minor Collector	11,906	11,781	10,441	10,259
10	Local	24,678	24,274	20,266	19,699
	TOTAL	594,267	588,961	519,454	511,942



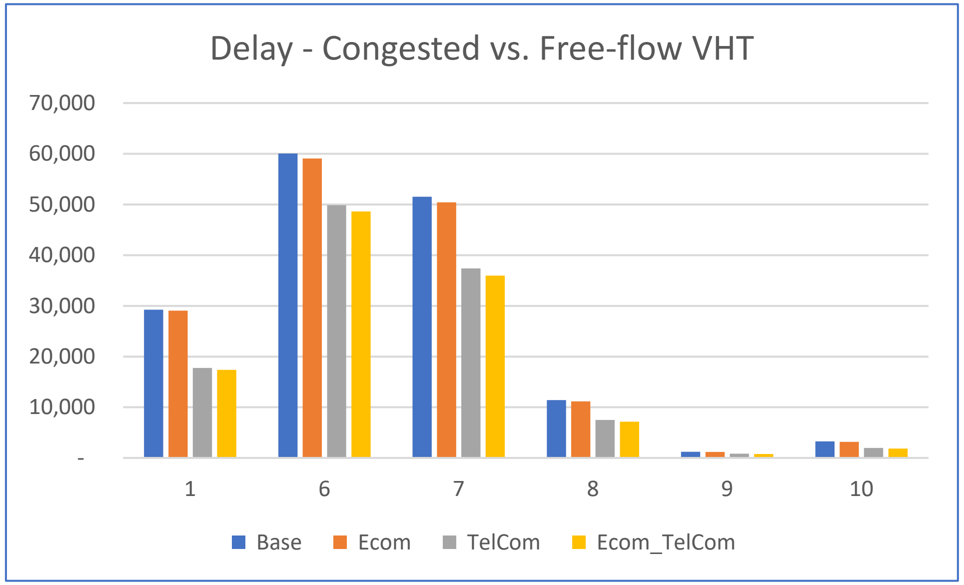
Free-flow VHT

	FACTYPE	Base	Ecom	TelCom	Ecom_TelCom
1	Interstate	151,868	151,230	142,380	141,500
6	Principal arterial	74,908	74,641	71,461	71,050
7	Minor arterial	123,307	122,484	113,537	112,273
8	Collector	55,388	54,826	48,840	48,028
9	Minor Collector	10,669	10,576	9,605	9,468
10	Local	21,404	21,084	18,296	17,839
	TOTAL	437,544	434,840	404,119	400,157



Delay – Congested vs. Free-flow VHT

	FACTYPE	Base	Ecom	TelCom	Ecom_TelCom
1	Interstate	29,233	29,066	17,771	17,386
6	Principal arterial	60,039	59,054	49,863	48,621
7	Minor arterial	51,512	50,426	37,390	35,962
8	Collector	11,429	11,179	7,504	7,164
9	Minor Collector	1,237	1,205	836	791
10	Local	3,274	3,191	1,970	1,860
	TOTAL	156,723	154,121	115,335	111,784



Average speed

Average Free-flow Speed

	FACTYPE	Base	Ecom	TelCom	Ecom_TelCom
1	Interstate	64.0	64.0	64.1	64.1
6	Principal arterial	49.8	49.8	49.7	49.7
7	Minor arterial	36.5	36.5	36.5	36.5
8	Collector	38.8	38.8	39.0	39.0
9	Minor Collector	42.0	42.0	41.9	41.9
10	Local	29.4	29.5	29.5	29.6
	TOTAL	**48.4**	**48.4**	**48.7**	**48.7**

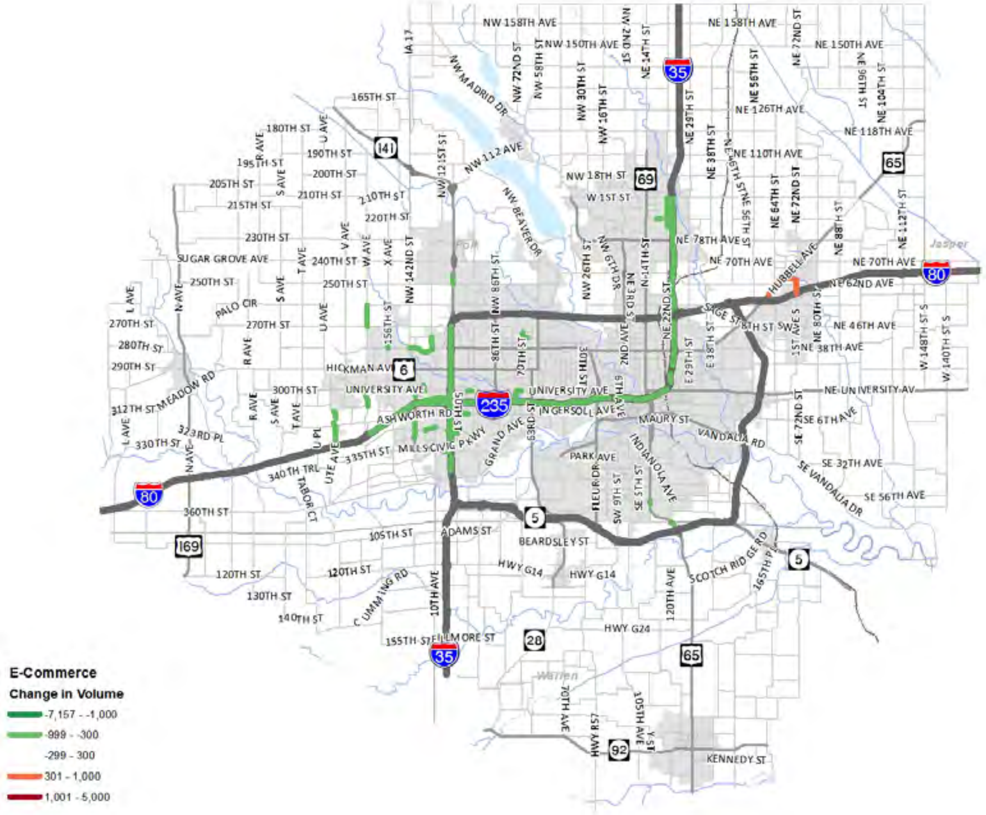
Average Congested Speed

	FACTYPE	Base	Ecom	TelCom	Ecom_TelCom
1	Interstate	53.7	53.7	57.0	57.1
6	Principal arterial	27.6	27.8	29.3	29.5
7	Minor arterial	25.7	25.8	27.5	27.7
8	Collector	32.1	32.2	33.8	34.0
9	Minor Collector	37.6	37.7	38.5	38.7
10	Local	25.5	25.6	26.7	26.8
	TOTAL	**35.6**	**35.8**	**37.9**	**38.1**

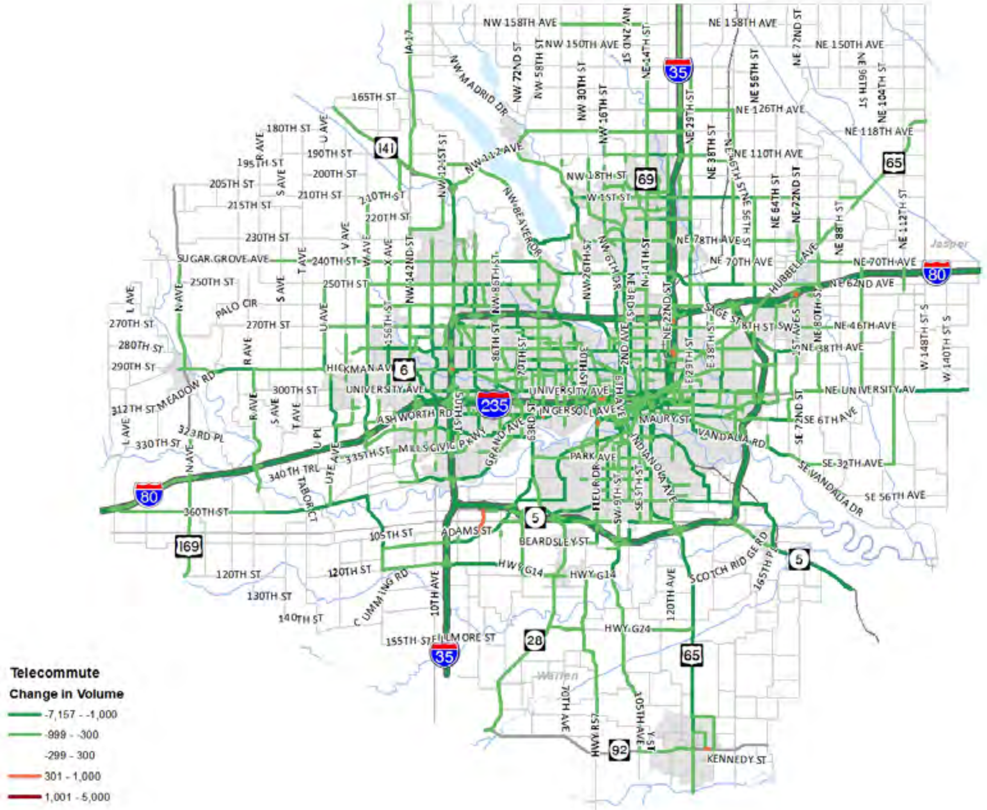
Volumes and LOS Maps

- Based on average weekday results

Daily Volume Difference (All vehicles): Ecommerce vs. Base

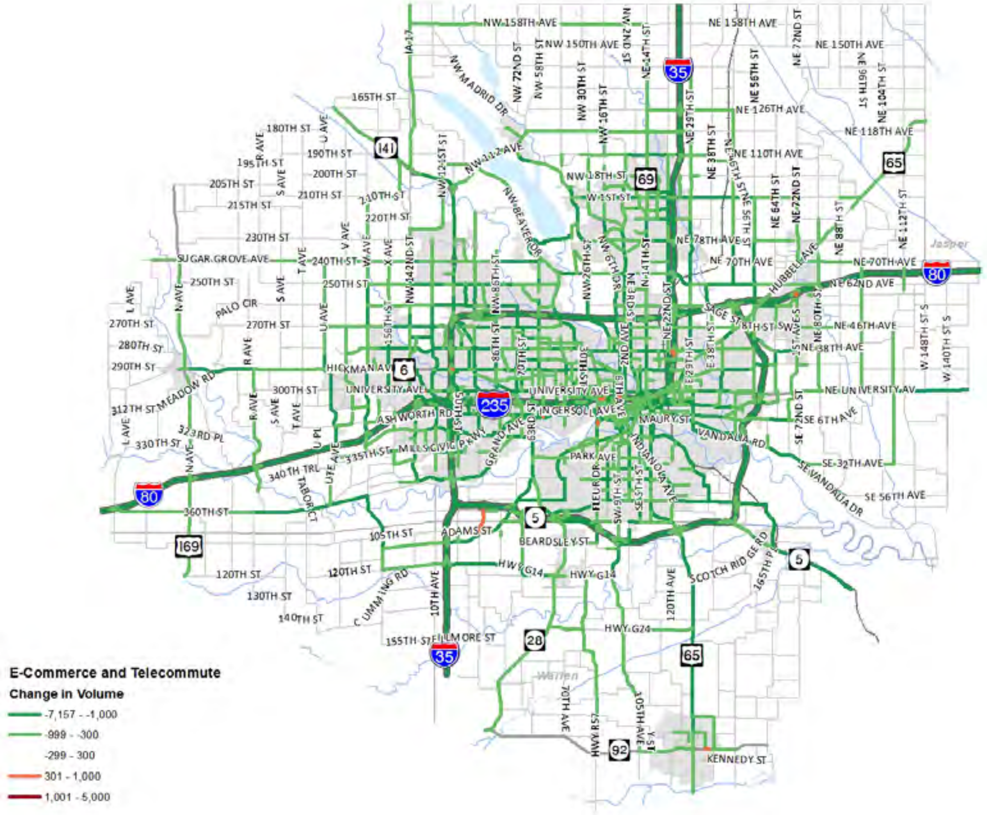


Daily Volume Difference (All vehicles): Telecommute vs. Base

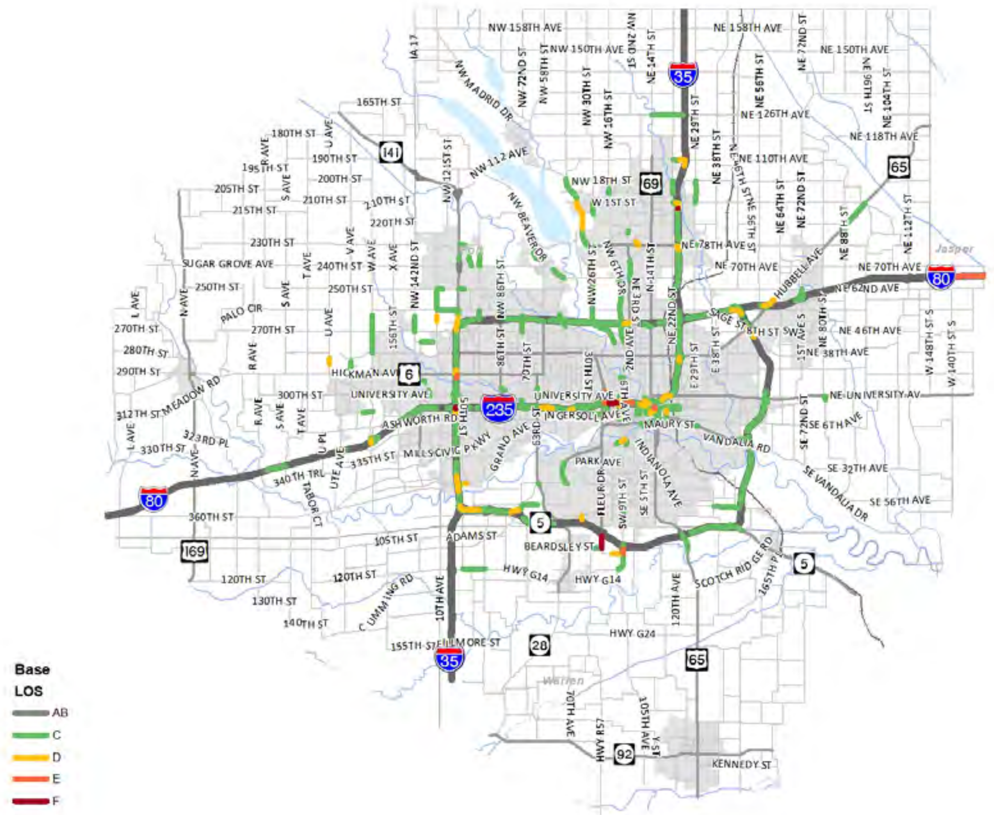


metro analytics

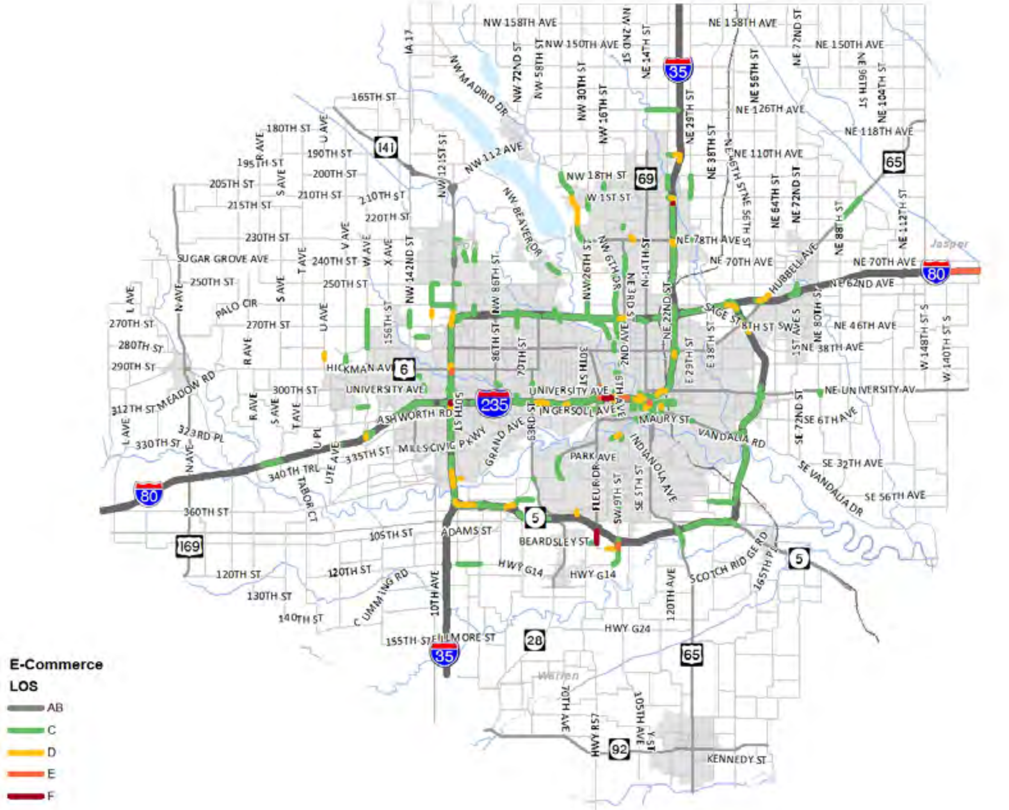
Daily Volume Difference (All vehicles): Ecom_Telecom vs. Base



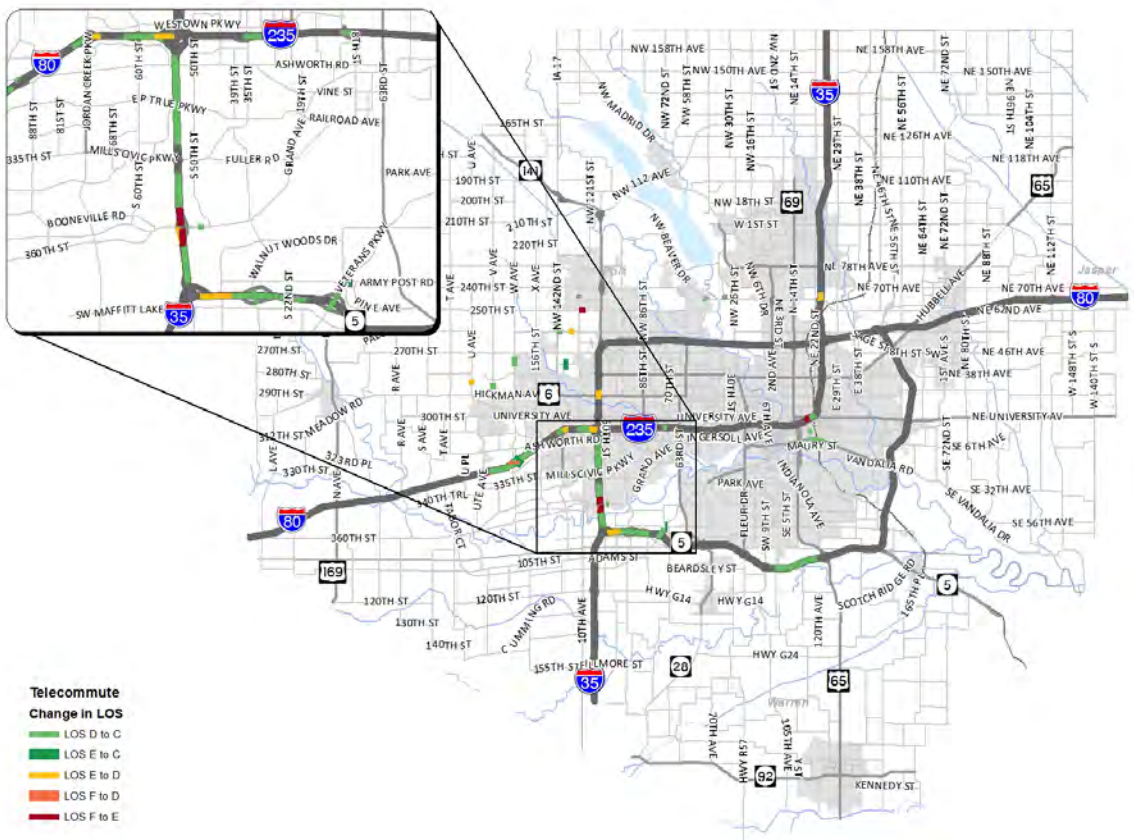
Daily LOS: Base



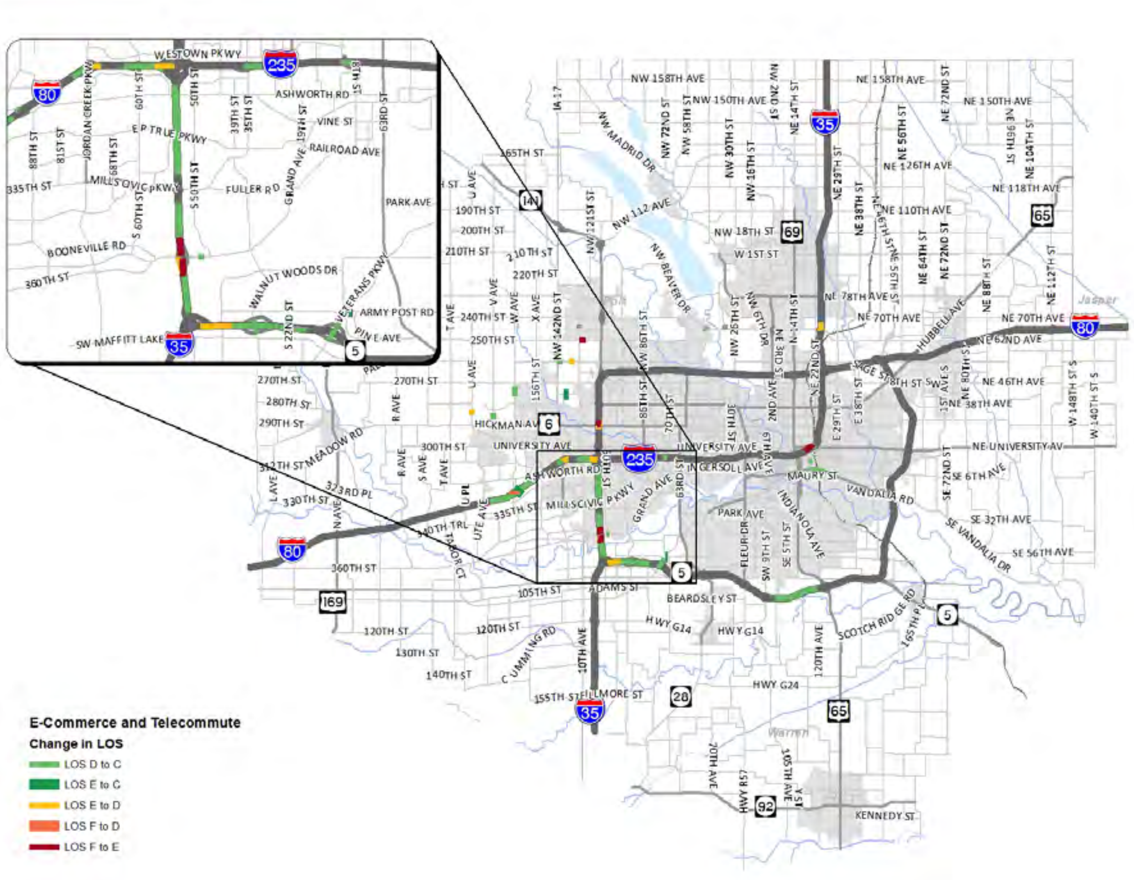
Daily LOS: Ecommerce



Daily LOS: Telecommute



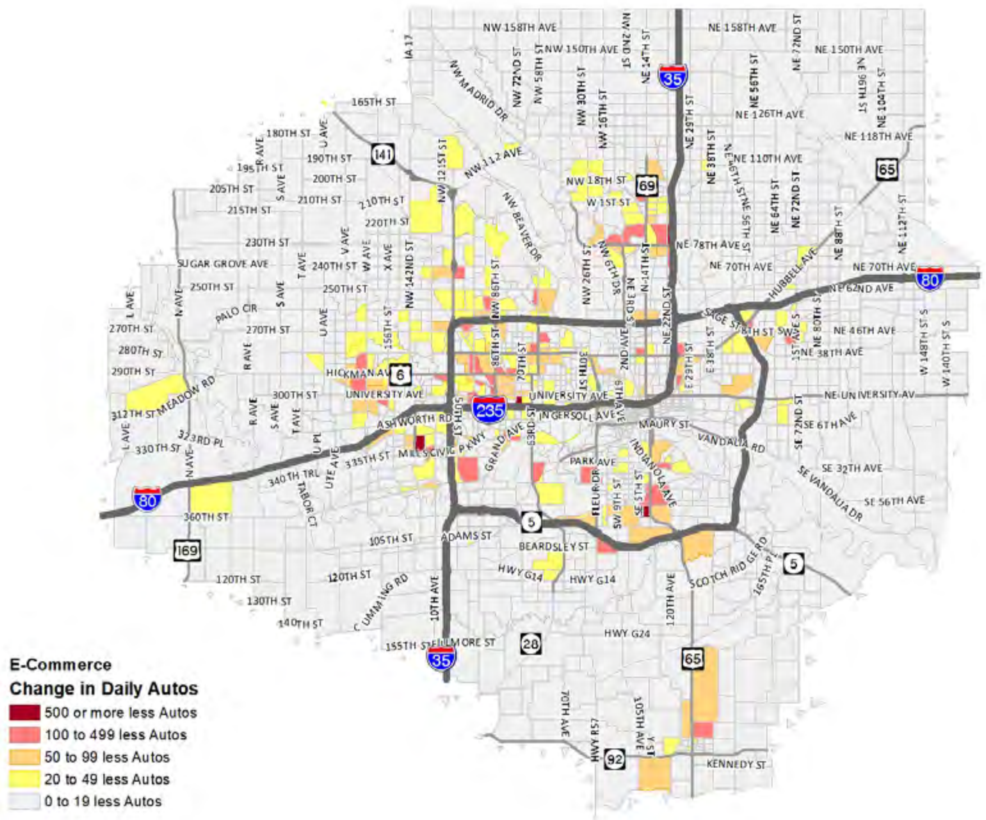
Daily LOS: Ecommerce_Telecommute



TAZ-based Trips

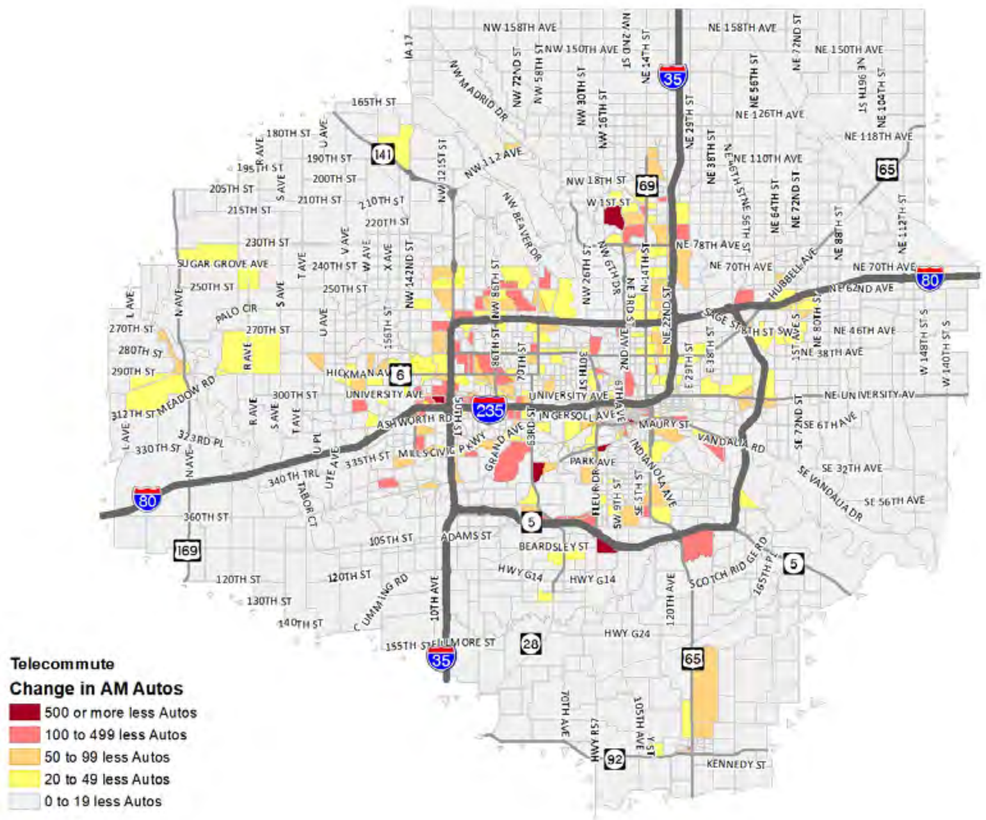
- Trip difference (vs. Base)
  - Ecom: Daily Auto by Origin and Daily Combo by destination
  - Telecommute: AM Auto by Destination
  - Ecom + Telecommute: AM Auto by Destination
- Desire Lines – AM Commute auto trips between districts (Difference Telecommute vs. Base)
- Dot density maps – Auto trips difference (AM commute) by origin TAZs to destination district

Difference vs. Base
Ecommerce: Daily Auto Trips by Origin

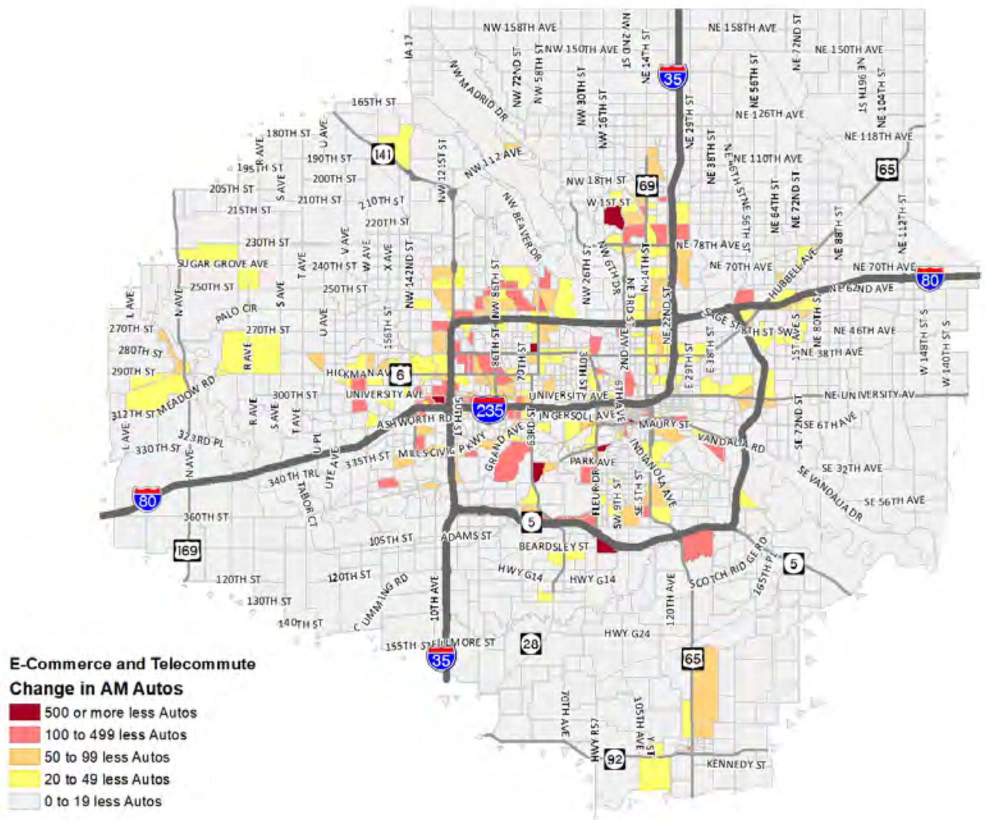


Difference vs. Base
Ecommerce: Daily Combo Trips by Destination

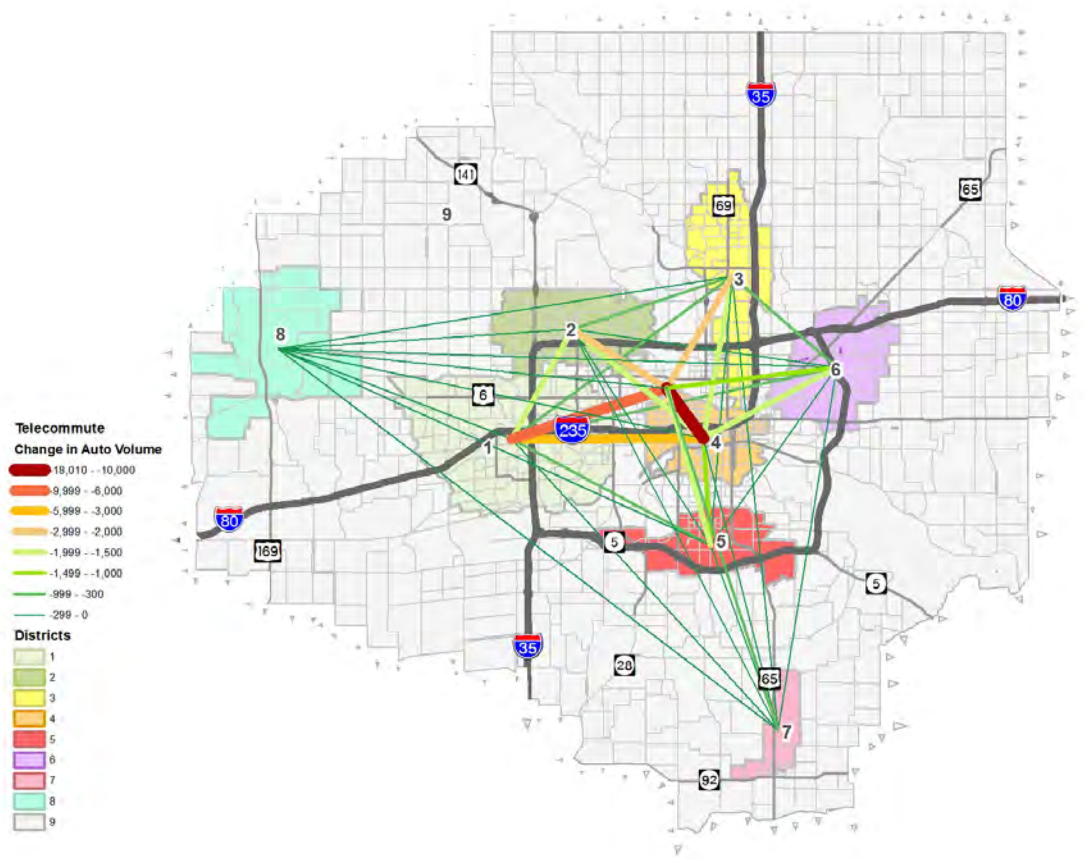
Difference vs. Base
Telecommute: AM Auto Trips by Destination



Difference vs. Base
Ecommerce_Telecommute: AM Auto Trips by Destination

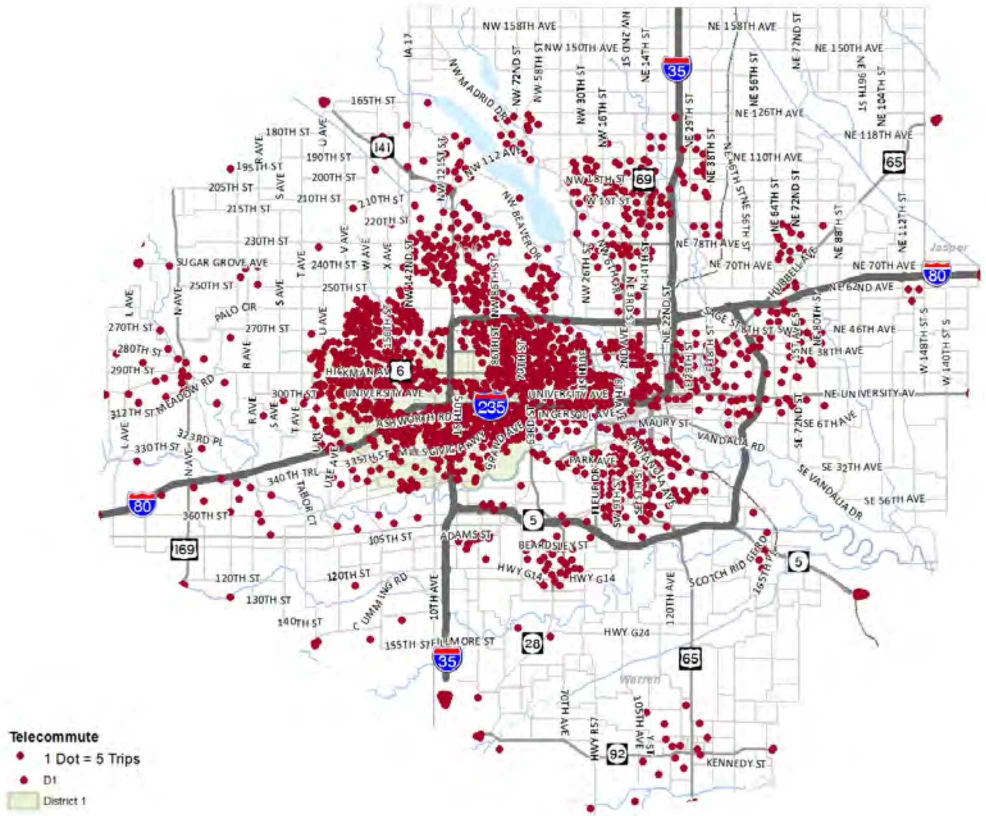


Telecommute Auto Difference Desire Lines By District - AM

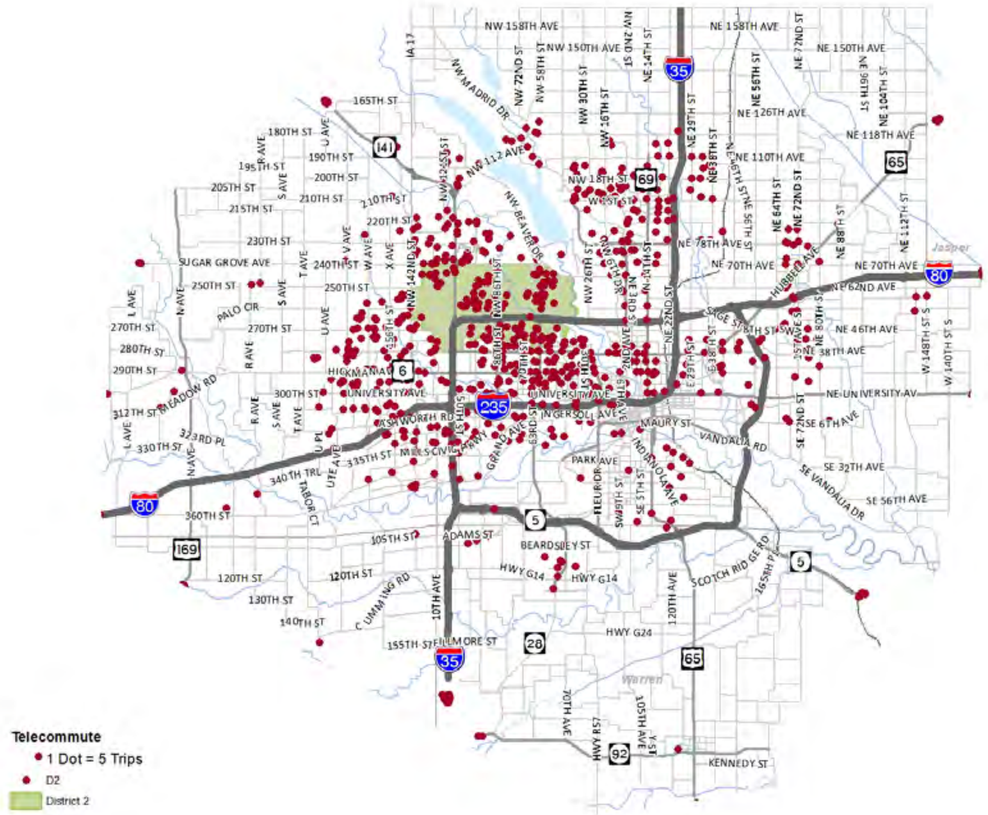


Telecommute: Difference vs. Base (Loss of Auto Trips)

District 1

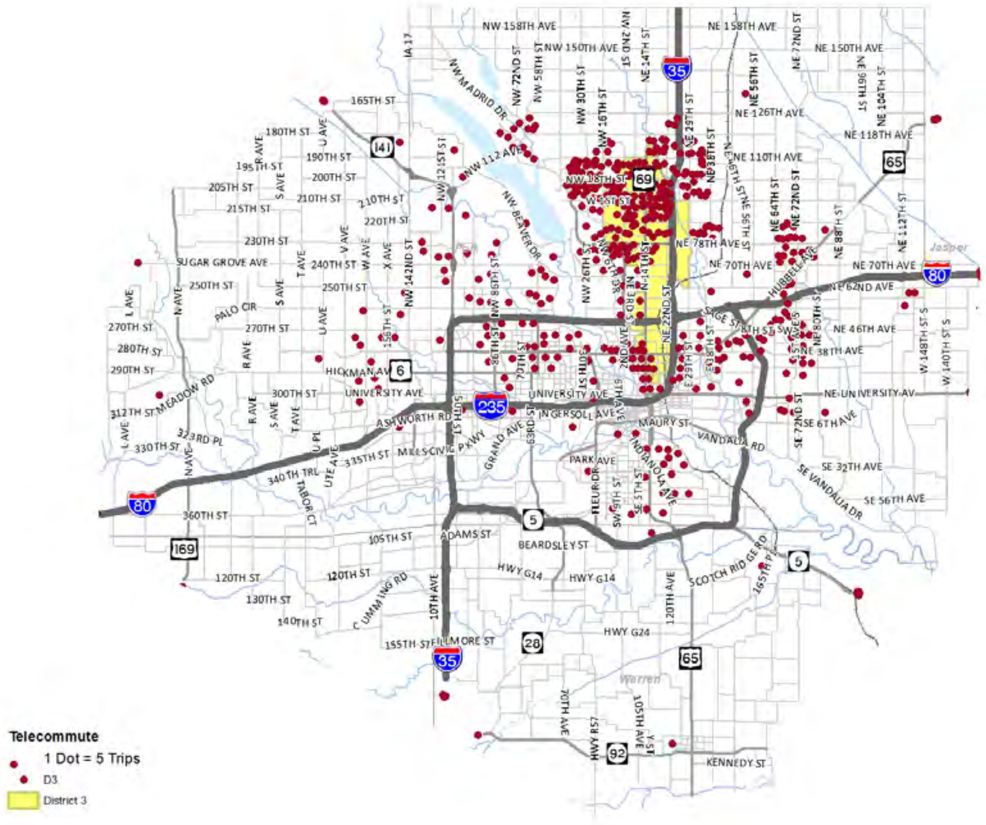


District 2

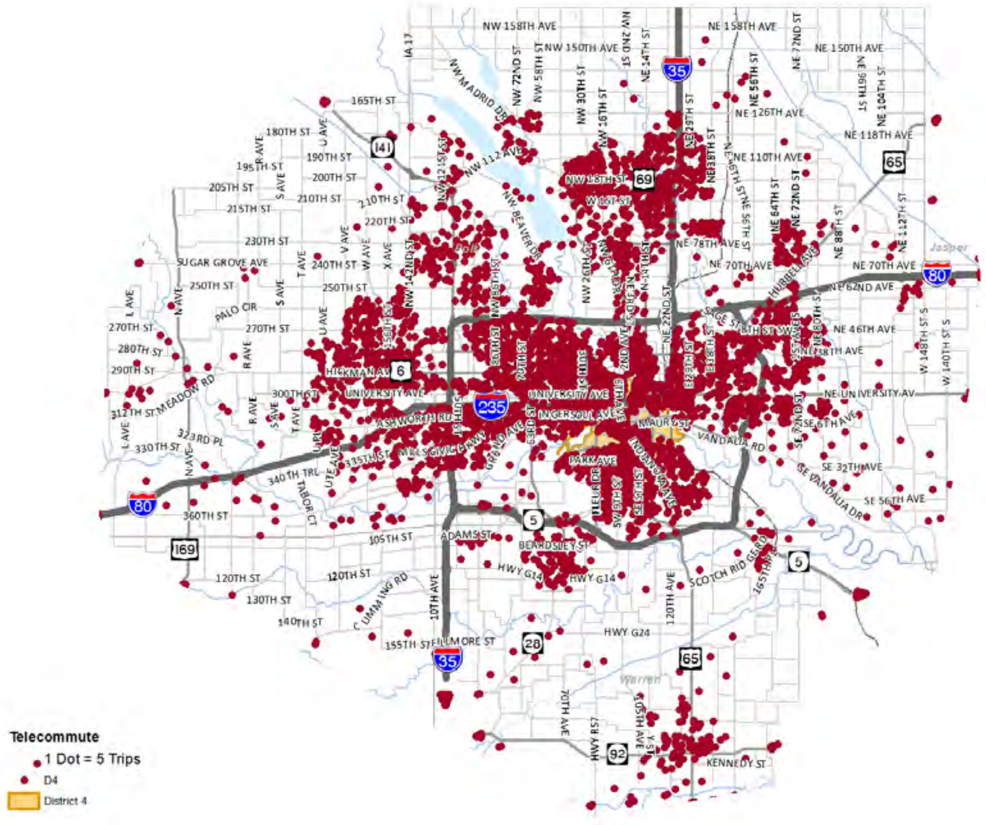


Telecommute: Difference vs. Base (Loss of Auto Trips)

District 3

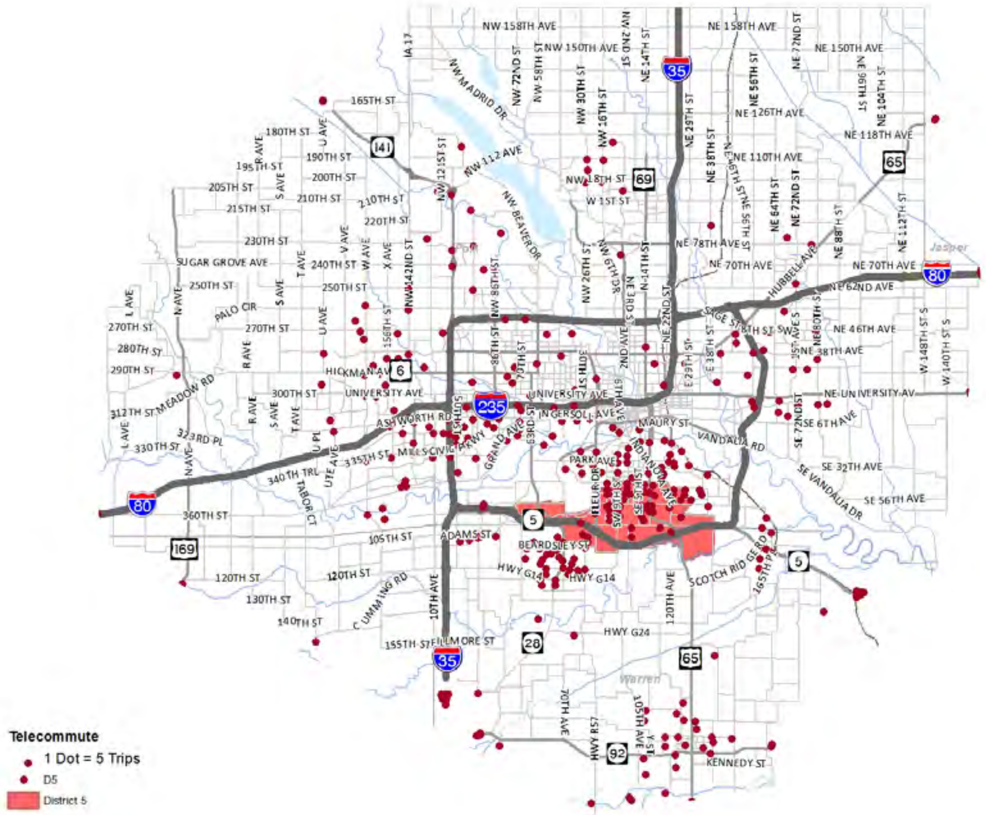


District 4

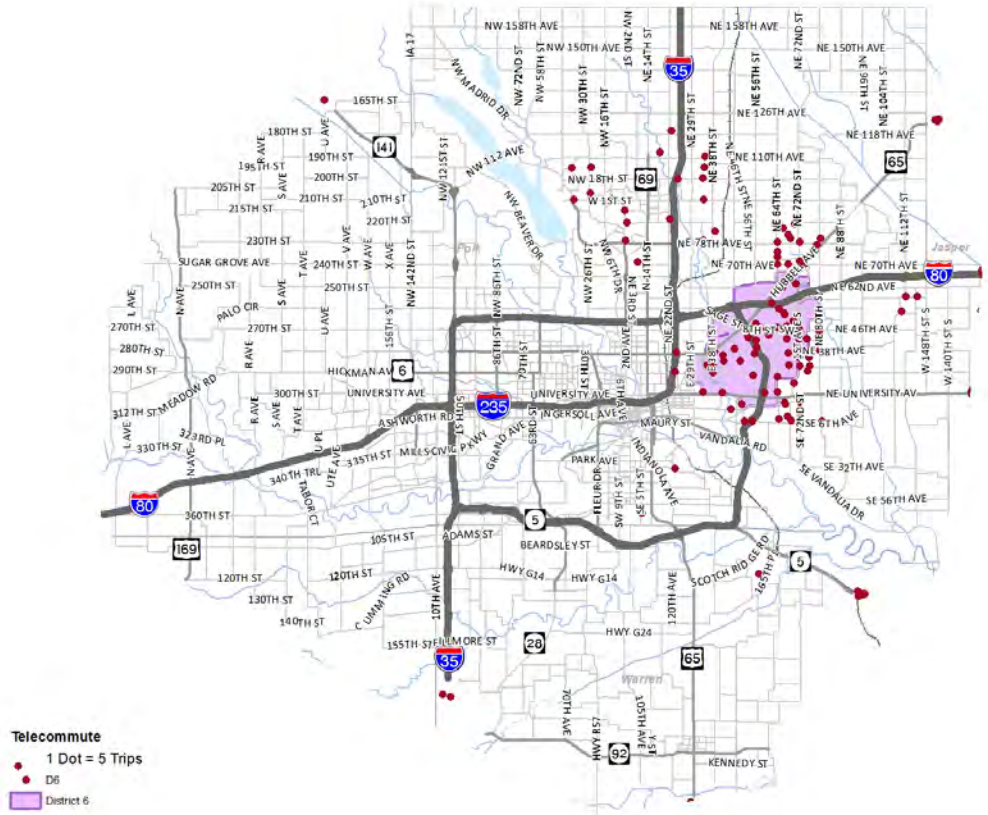


Telecommute: Difference vs. Base (Loss of Auto Trips)

District 5

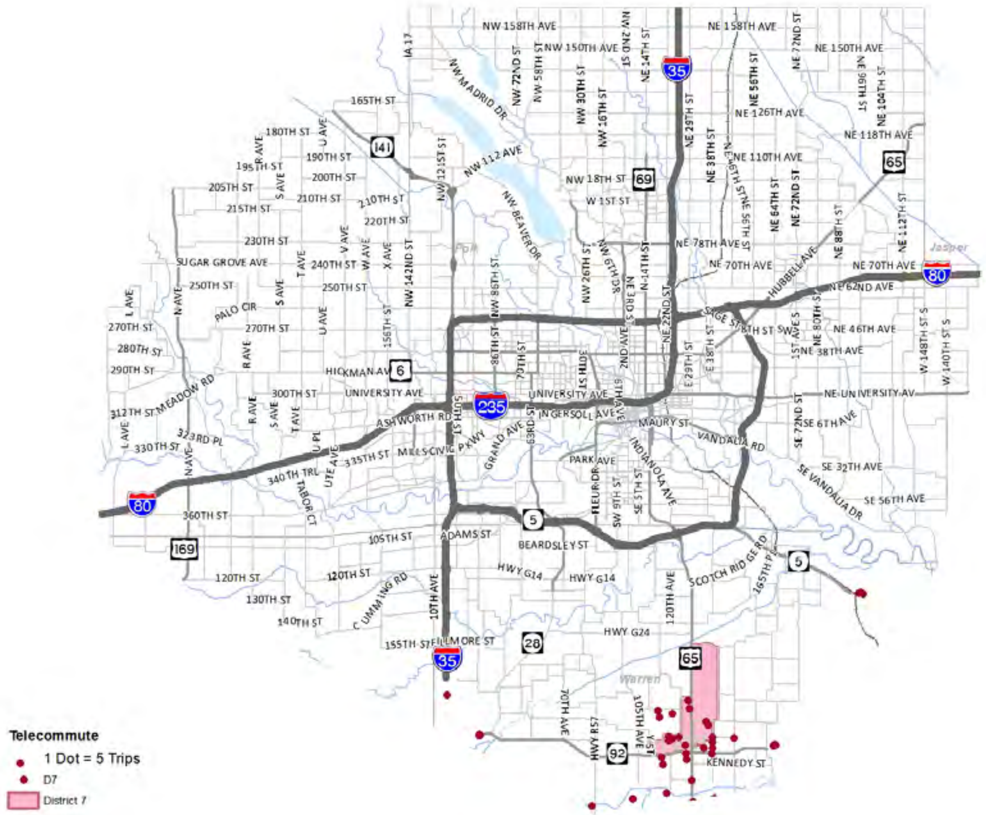


District 6

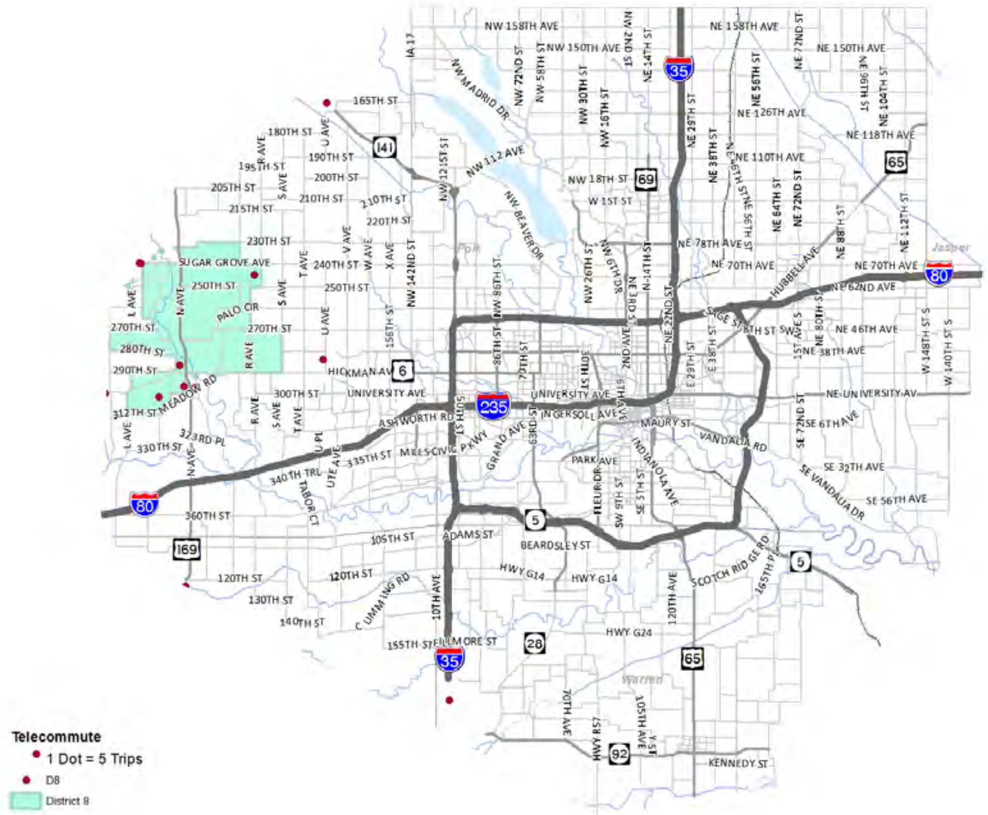


Telecommute: Difference vs. Base (Loss of Auto Trips)

District 7



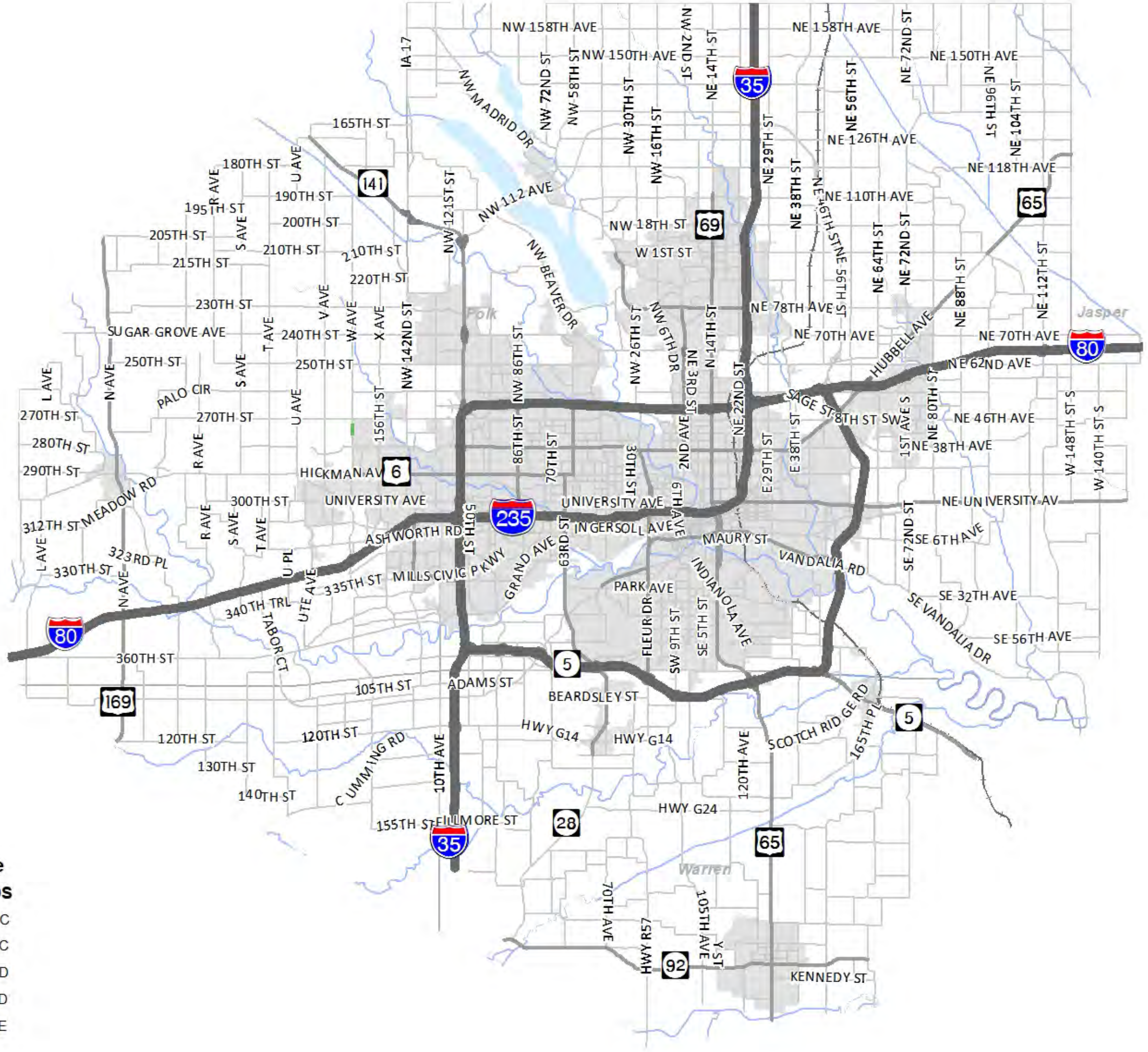
District 8



LOS change maps

- Based on Daily LOS
- The colors show final LOS
  - Green: LOS A-C (V/C<0.7)
  - Yellow: LOS D (V/C<0.85)
  - Orange: LOS E (V/C<0.1)
  - Red: LOS F (V/C>=1)
- Thinner line shows one level better and thicker shows two levels better. Example: In Telecommute if a link is “thick green”, it’s level of service is A-C, and in the Bas, it was E. If it was “thin green”, it had changed from D to A-C,
- Use fields Diff_E, Diff_T, Diff_E_T in VC_improvment.dbf
  - First digit is LOS and second digit is level of improvement

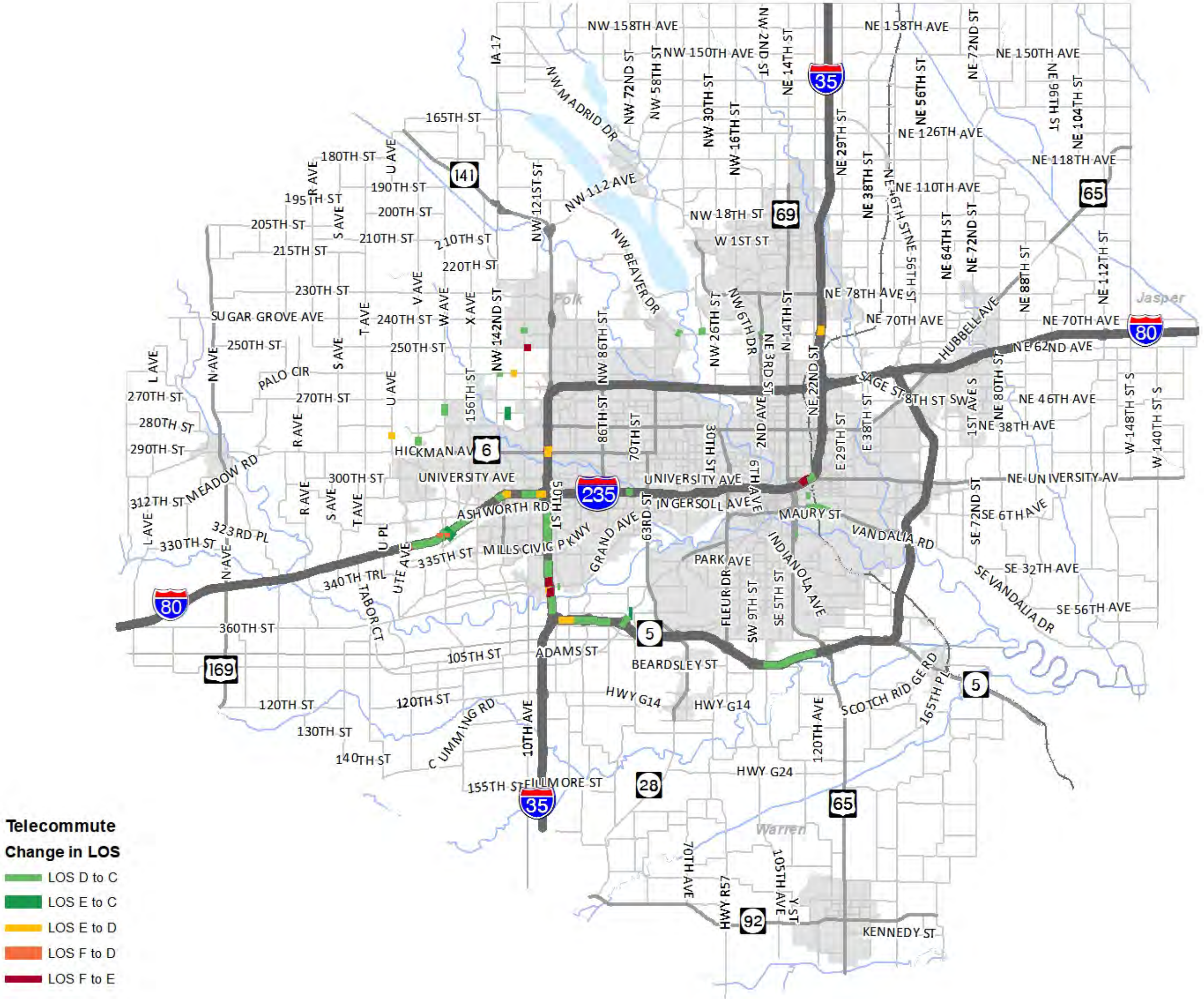
Ecommerce LOS: Difference vs. Base



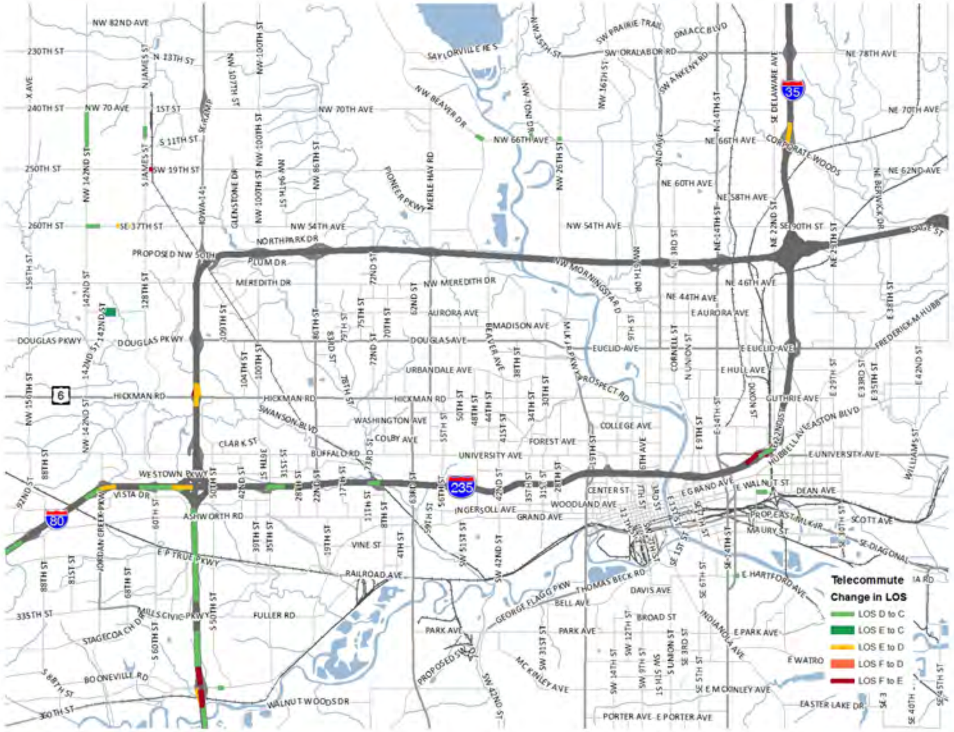
E-Commerce Change in LOS

- LOS D to C
- LOS E to C
- LOS E to D
- LOS F to D
- LOS F to E

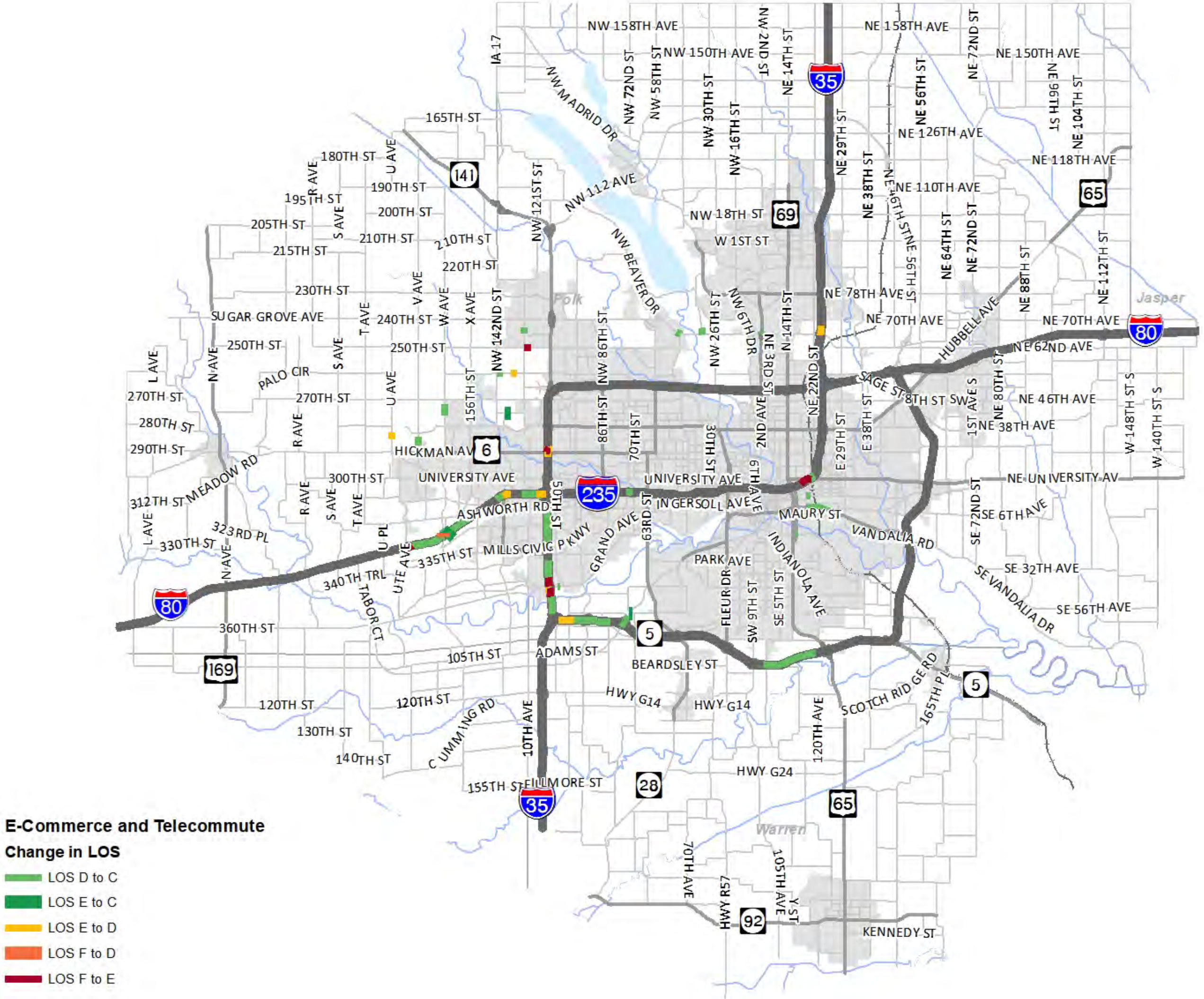
Telecommute LOS: Difference vs. Base



Downtown (zoomed)



Ecommerce Telecommute LOS: Difference vs. Base



Downtown (zoomed)