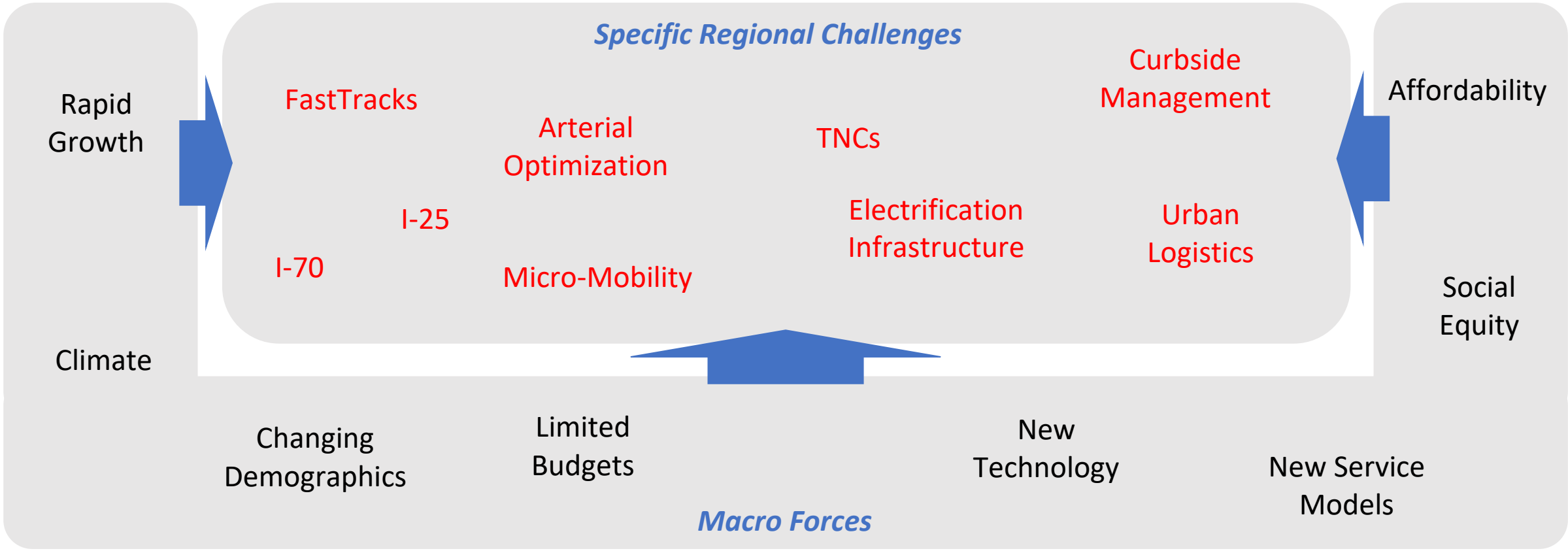
Overview for North Area Transportation Alliance (NATA), October 2019

The Denver Metro Region is facing major mobility challenges

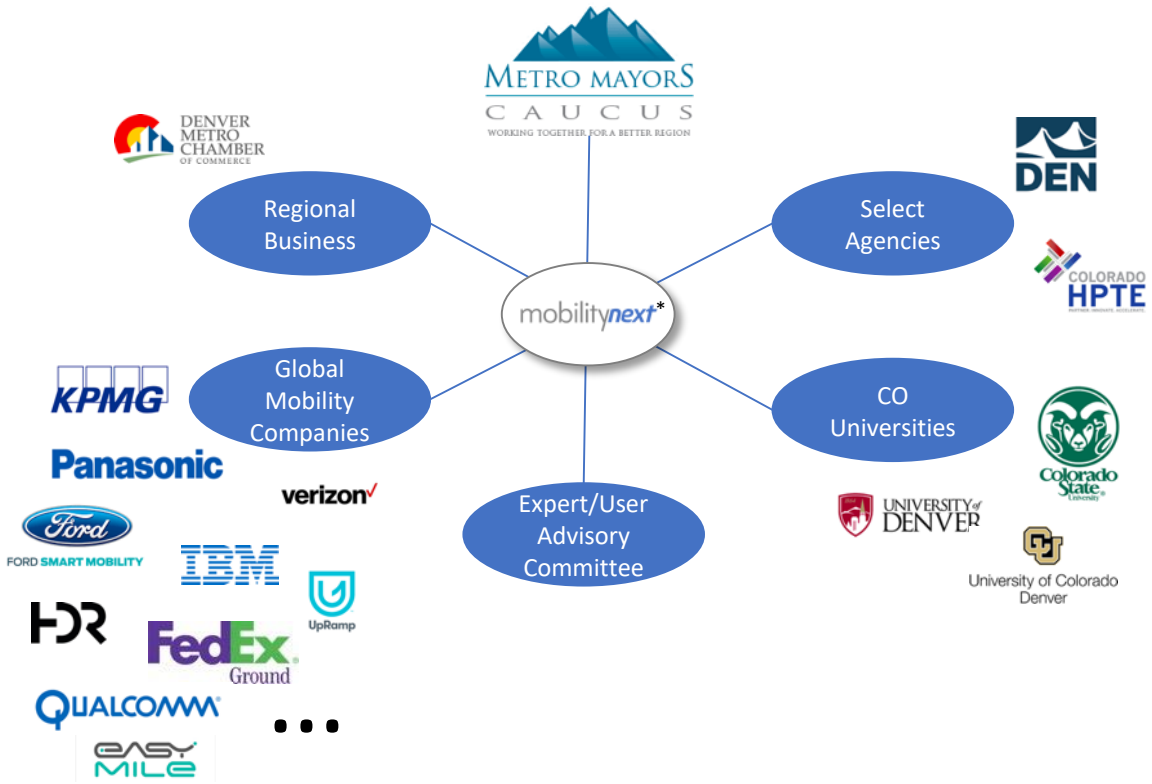


This is complicated by political gridlock, biases and inertia…

…so, how do we overcome this to make real progress?

mobilitynext is a nonprofit, member funded organization focused on developing the best possible solutions for Metro Denver

Mission: *To leverage the best and brightest minds, regionally and globally, to accelerate pragmatic solutions to Metro Denver's growing mobility challenges.*



Benefits:

- *Leverage as an "alternative" input*
- *Unbiased and without any inertia*
- *Focused on only Metro mobility*
- *Alternate funding sources: Grants & Corporate investment*
- *Focus on action*

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** Members above have signed agreements, LOIs or verbally agreed to participate*

Our approach looks at Mobility pragmatically & broadly

Strategy

- Evaluate in & across Mobility Topic Areas →
- Look at Regional, Sub-Region & City Levels
- Develop specific "Focus Areas" to Pilot

Pilots

- Only select pilots that have bias for action
- Fund via grants, corporate & city investment
- Test with only 3 outcomes: Yes, Yes but or No

Deployment (Not in scope)

- Deploy after fully informed
- Measure and assess with data from above

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** Transportation Research Board, 2019*

Top Focus Areas so far….and key considerations

1. FasTracks Options and Ideas
   - Simple answer: Build it and they will come
   - Ridership or coverage?
   - Structural changes: Who should manage/control FLM?
   - What is coming and when: CASE

2. Beyond Signal & Timing (Mobility Synchronization)
   - Can we reduce congestion 25%?
   - Can we agree on "how" to implement a system?

3. Congestion & Mode Shifting/FLM
   - People first: ~~Build it and they will come~~
   - Induced Demand issues (Roads vs. Transit)

4. Safety/Vision Zero
   - Speed limit changes
   - Future technology implications

5. Sustainability/Emissions
   - EV Roadblocks/Speed Bumps
   - Per user per mile

What are the underlying issues, what are the solution options to assess, and then how do we best assess their impact & effectiveness (e.g. pilots)?


mobility*next*: *accelerating* mobility innovation

Example Focus Areas (1 of 3):

Focus Area Idea: Arterial Synchronization

Problem Statement

Many of the Denver region's arterial roadways see heavy traffic, congested intersections, and unreliable travel times during peak travel periods. Traffic signal synchronization is thus essential to optimizing traffic flow across time and space, ensuring safe passage for bikes and pedestrians, and reducing infrastructure strain. Intelligent synchronization is equally vital to implementing public transit services, and managing special situations such as emergencies and special events.

But multi-jurisdictional corridors present unique challenges for transportation planners when the needs and resources of individual jurisdictions vary, and in some cases, are at odds. Smart synchronization and prioritization is even more consequential for special situations, such as emergencies, special events, and unplanned public transit needs.

Furthermore, synchronization in four directions – east, west, north and south - is nearly impossible to achieve when macro-traffic patterns differ greatly across jurisdictions, and when incumbent technologies cannot adapt quickly enough to new modes and travel behaviors which dramatically shift more common and historically predictable traffic patterns.

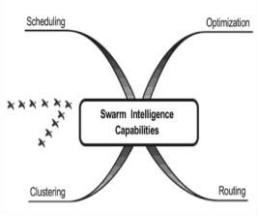
Hypothesis

Traffic management systems powered by swarm intelligence – defined as the collective behavior of decentralized, self-organized systems, and which incorporates principles drawn from evolutionary game theory - will unlock new arterial efficiencies and offer multi-jurisdictional arterials the most flexible and adaptive control solutions. Swarm intelligence will also increase public transit performance, improve emergency response, and dynamically manage special event inflections.

Arterial intersections informed by swarm intelligence are modeled as individually-motivated agents taking part in a dynamic process in which both the local goals and region-wide goals can be simultaneously taken into account. Jurisdictions will benefit from this form of intelligence because 1) it is not necessary to have a central system operator determine the direction of the coordination 2) system operators can build subgroups of synchronization which meet discrete local needs in terms of allowing vehicles to pass in one given direction, and 3) it avoids explicit 'negotiation' between jurisdictions when they have to decide which direction to give priority.

Key Questions to Answer

1. Can decentralized, artificial intelligence-powered systems deliver better results than coordinated human decision making?
2. What are the legal and ethical risks of deployment?
3. How can such a system be A/B tested against proven, existing systems and methods?
4. How long will it take for such a system to 'learn' and optimize itself



Key Topic Areas (Highlighted)

1. Transformational Technology & Services	2. Serving a Growing & Shifting Population.	3. Energy & Sustainability: Protecting the Planet	4. Resilience & Security: Preparing for Threats
5. Safety & Public Health: Safeguarding the Public	6. Equity: Serving the Disadvantaged	7. Governance: Managing our Systems	8. System Performance & Mgt: Improving Performance of Transportation Networks
9. Funding & Finance: Paying the Tab	10. Goods Movement: Moving Freight	11. Institutional & Workforce Capacity: Providing a Capable & Diverse Workforce	12. Research & Innovation: Preparing for the Future

Key Stakeholders to Participate

- Affected jurisdictions
- Surface transportation users (Public, First Responders, Commercial Freight, School Districts, etc.)
- CDOT
- RTD

Focus Area Idea: FasTracks

Problem Statement

FasTracks was approved by voters in 2004 to expand transit across the Denver metro region. The original program budget was $4.7B, with a target completion of 2017. Rising costs, right of way constraints, and the 2008 recession have put many projects decades behind schedule, and billions of dollars over budget. Flat / declining public transit demand across the Denver metro region is compounding funding challenges for unfinished corridors.

The projected cost to finish the Northwest Rail (Westminster – Longmont) is $1.5-1.7B, with full service not expected until after 2050.

RTD is currently exploring an interim service plan, called the Peak Service Plan, to provide limited rush hour rail service along the unfinished portion of the Northwest Corridor from Westminster to Longmont. RTD staff estimates that the reduced service plan would cost $117M to launch, and initially carry 1,400 passengers every weekday.

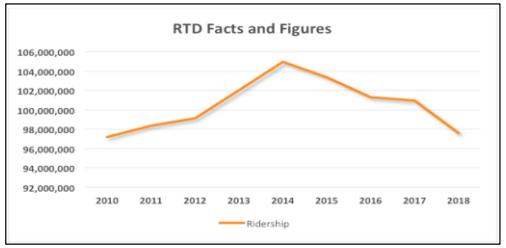
Hypothesis

New mobility technologies and services that are less expensive, faster to implement, and which are likely to see higher adoption rates will be available before the Peak Service Plan can be implemented – if even approved. These new, alternative technologies and services will obviate an interim service plan, and potentially the remaining unfinished 35 miles of rail.

These services could provide the region with viable alternatives for future expansion in ways that could be more customizable by community, more cost effective and far more flexible.

Key Questions to Answer

1. What new technologies and service types are best suited for this corridor?
2. Which of these can perform better than RTD's proposed alternatives?
3. What are the costs of implementation?
4. What are the available funding mechanisms?
5. What are the marginal savings, functional advantages, and environmental benefits of the alternatives?



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Key Stakeholders to Participate

- Taxpayers
- Communities and commuters along the Northwest Corridor
- US 36 Mayors & Commissioners Coalition
- RTD
- CDOT
- Commuting Solutions

Example Focus Areas (2 of 3):

Focus Area Idea: The Intersection of Mobility and Outdoor Recreation

Problem Statement

Outdoor Recreation demand in Colorado exceeds the capacity of the land, and the roads which are used to access it. As a result, we are rapidly degrading natural resources, and experiencing untenable levels of traffic and infrastructure strain along roads that access recreation destinations. Population growth and tourism growth add proportionate pain, and traditional work schedules leave little room to spread recreation demand more evenly across the work week.

Hypothesis

An Intelligent Recreation System (IRiS) can capture data generated during the recreation decision-making process to 'see' recreation demand as it develops, and before it hits the roads and trails. IRiS will provide land and transportation managers with new tools for measuring and analyzing recreation demand, and travel demand associated with these pursuits.

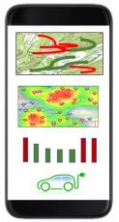
Data collected by the IRiS platform can be used to nudge users away from over-burdened destinations, and toward more sustainable recreation and transportation alternatives in real time, at the most influential touchpoints, and *before* action is taken.

Insights from IRiS can also be integrated with TDM platforms to improve understanding of origin-destination and trip purpose demand inputs for outdoor recreation goals, which are less predictable and more fluid than work commute goals. A fully developed platform will:

- Redirect people from congested areas to lightly used areas
- Promote shared and sustainable transportation alternatives for recreation pursuits.
- Encourage and incentivize off-peak recreation travel.

Key Questions to Answer

1. What are the legal and ethical issues associated with collecting data from government digital assets on user preferences and intent?
2. Will the system inadvertently shift critical economic activity away from dependent communities?
3. How long will it take for such a system to 'learn' and optimize itself?
4. Will it be effective?



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Key Stakeholders to Participate

- Land Management Agencies (USFS, NPS, Open Space)
- CDOT
- Jurisdictions through which access roads pass
- Communities that are economically dependent on outdoor recreation
- Colorado residents
- OEDIT
- The Environment

Focus Area Idea: DEN Access | POV and TNC reduction

Problem Statement

Denver International Airport is the third largest domestic hub in the U.S., with 35 million annual domestic O&D passengers. DEN's location on the eastern edge of the Denver metro region is far from most population centers, many of which do not have convenient public transit options for reaching the airport. As a result, many passengers prefer to - or must - drive their own cars (POVs) or use Transportation Network Companies (TNCs) like Uber or Lyft to reach the airport. POVs and TNCs create congestion, impose infrastructure strain, and drive increased capital expenditures to support.

Although the University of Colorado A Line, which opened in April 2016, has proven to be a viable and desirable alternative for reaching/departing the airport, it is inconvenient for a majority of DEN passengers whose origin-destination is not along the line's path. Connections are available, but reaching these connection points often requires driving, and once people get in their cars, they tend to remain in their cars and not use mass transit. To reduce POV and TNC use for DEN access, the Denver metro region must provide additional, more convenient, and more flexible alternatives for transporting passengers to and from the airport through public and shared services.

Hypothesis

An expanded portfolio of transportation alternatives will reduce POV and TNC use for reaching DEN. Crucially, this portfolio must be robust and diverse enough to accommodate a wide range of consumer preferences, travel time constraints, convenience thresholds, price points, and geographic Originations-Destinations. To create such a portfolio, public and private mobility assets must be coordinated and choreographed to serve a wide range of traveler use cases, with the primary goal of feeding the A Line and SkyRide/BRT stops.

Key Questions to Answer

1. Can public-private partnerships between RTD and TNCs be created to make the A-line more accessible to more people?
2. Can TNC fees be leveraged to support alternatives and improvements?
3. What incentives can be offered to employers to increase employee use of public transit to DEN for business travel.
4. Can options to driving be done in a way that they are relatively as convenient, less costly, and overall a great experience?

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Key Stakeholders to Participate

- DEN
- RTD
- CDOT | HPTE
- DEN passengers
- Transportation Network Companies
- Ground Transportation Services
- DEN employees

Example Focus Areas (3 of 3):

Focus Area Idea: Micromobility Policy Frameworks

Problem Statement

Micromobility is defined as a form of personal mobility enabled by light vehicles such as electric scooters, electric skateboards, and electric pedal assisted bicycles. The primary condition for inclusion in this category is a vehicle weight less than 1100 lbs; a secondary condition is that these vehicles are made available as a shared service. The global explosion of shared bikes and scooters has been deemed by some mobility experts as the "the fastest technological adoption in history".

As shared bikes and scooters suddenly appeared in great numbers on streets and sidewalks around the Denver metro region, policymakers have been scrambling to understand how, when, and where these vehicles are being deployed and used. Many communities, notably downtown Denver, now face significant safety and right-of-way issues in the absence of proactively crafted, well-informed policy and regulation.

Hypothesis

Cities across the Denver metro region should create a framework of common standards and implementation road maps to better understand and integrate new modes of transportation. This framework should include, but not be limited to, the following core principles*:

- Adaptive regulation that can be quickly updated as technology and consumer preferences evolve.
- Risk-weighted regulation that acknowledges the realities of a community's infrastructure and user needs.
- Outcome-based regulation, such as performance-based criteria (rather than fixed, arbitrary caps on fleet sizes) for service providers.
- Regulatory sandboxes where the effects of micromobility solutions can be tested.

MPOs, TMAs, and micromobility companies can work together to standardize evaluation criteria for potential solutions such as adaptive speed controls, centralized park locations by block to reduce clutter, integrated charging infrastructure with local utilities, and common/centralized tax/fee structures for augmenting limited municipal budgets.

(Principles informed by (2019, April 22). Small is beautiful Making micromobility work for citizens, cities, and service providers. The Deloitte Center for Integrated Research)

Key Questions to Answer

1. Are common guidelines feasible, in practice, when community interests, infrastructure, and user needs vary widely?
2. How can micromobility service providers be involved 'from the ground-up' in this dialogue, without biasing the results?
3. How do we determine acceptable risks before risks are even known, and how do we factor social and environmental benefits into policymaking when the technology is developed and deployed faster than it can be evaluated?

Key Topic Areas (Highlighted)

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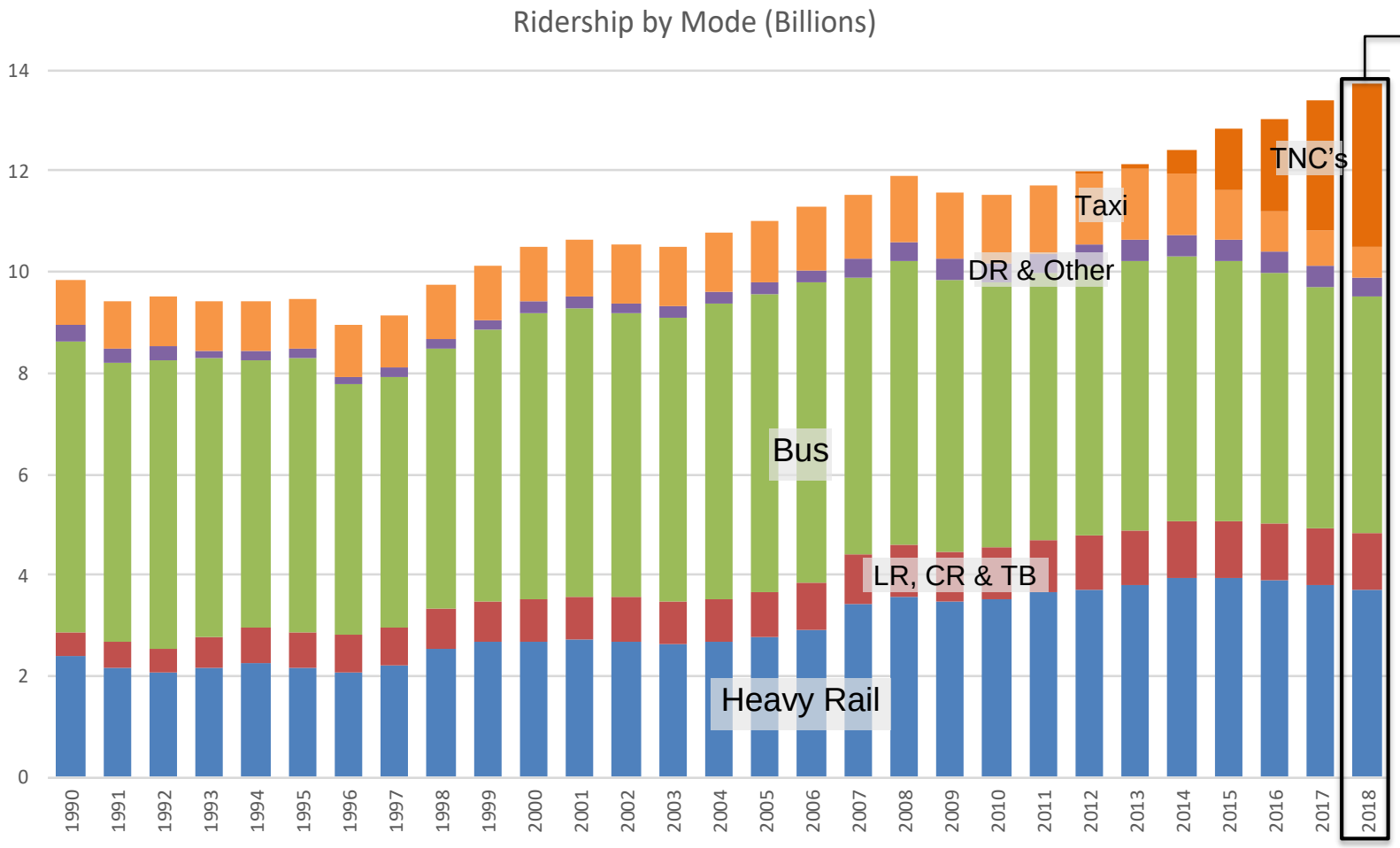
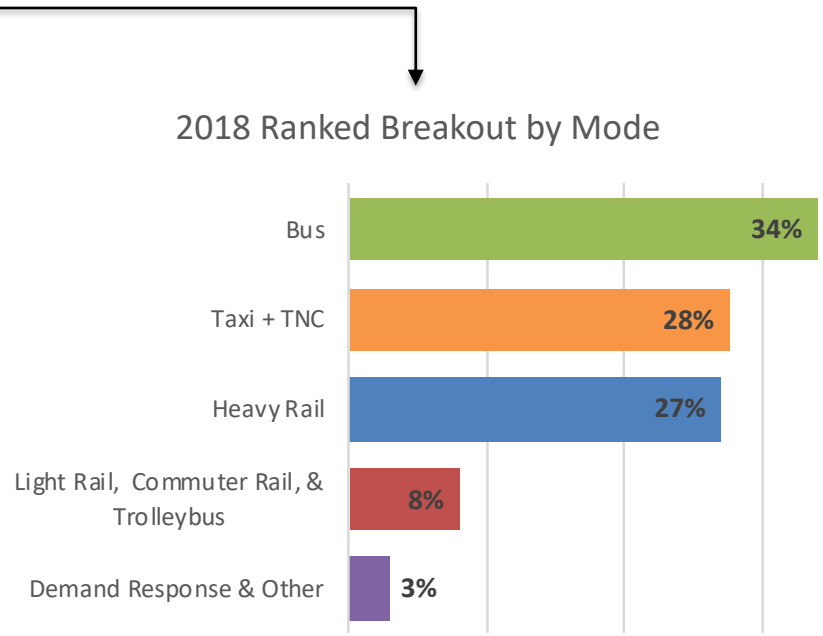
Key Stakeholders to Participate

- DRCOG
- TMAs
- RTD
- Municipalities
- Citizens / pedestrians / cyclists

Key Trends

1. TNC's are rapidly displacing other forms of transportation

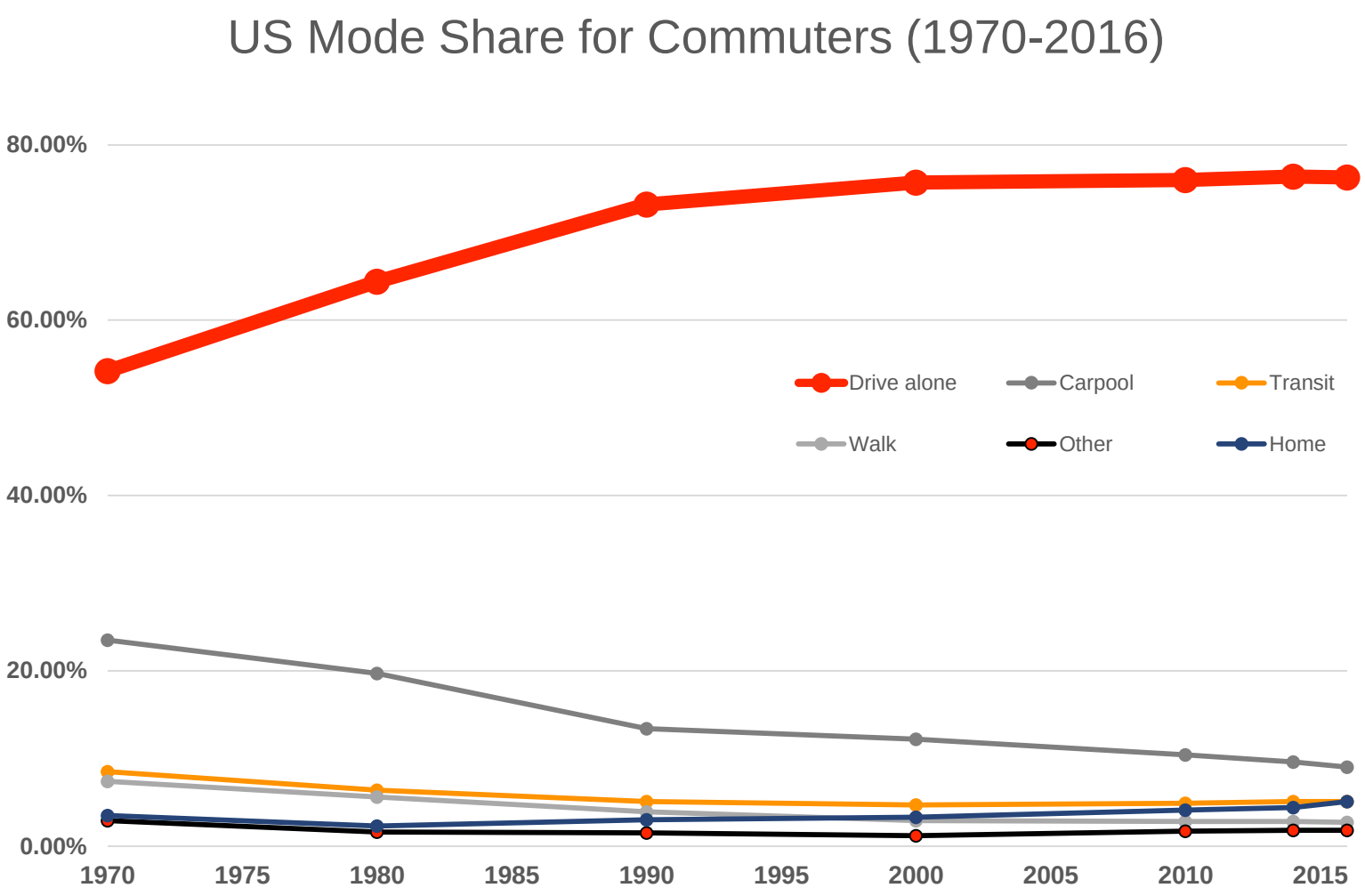




2012 - 2018 CAGR	
TNC	100.0%
Light Rail, Commuter Rail, & Trolleybus	0.6%
Demand Response & Other	0.3%
Heavy Rail	0.1%
Bus	-2.2%
Taxi	-13.2%

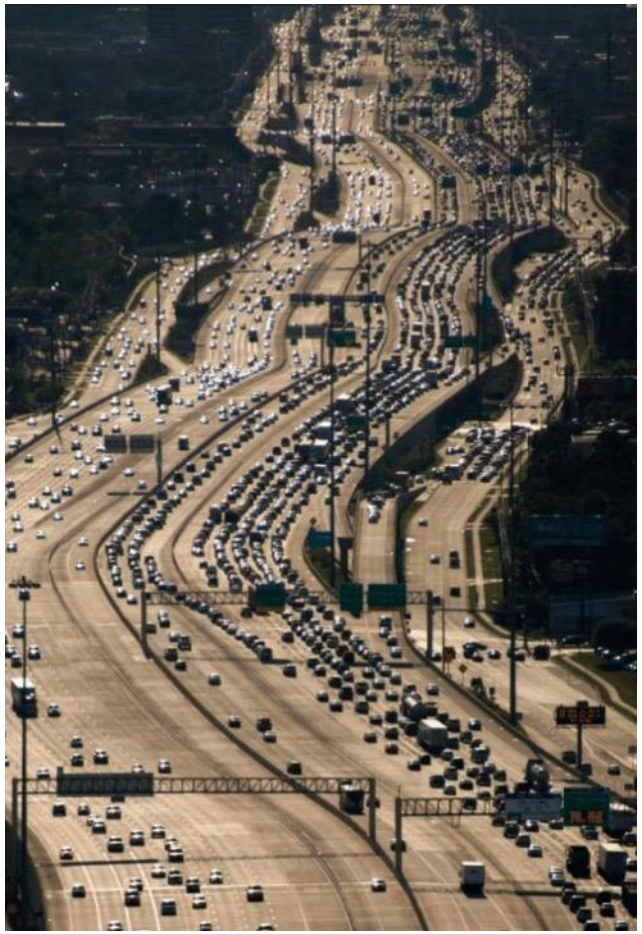
Sources:
Public Transit Ridership by Mode: APTA / The New Automobility: Lyft, Uber and the Future of American Cities. http://www.schallerconsult.com/rideservices/favfact1.htm

2. American's love their cars…more now than ever

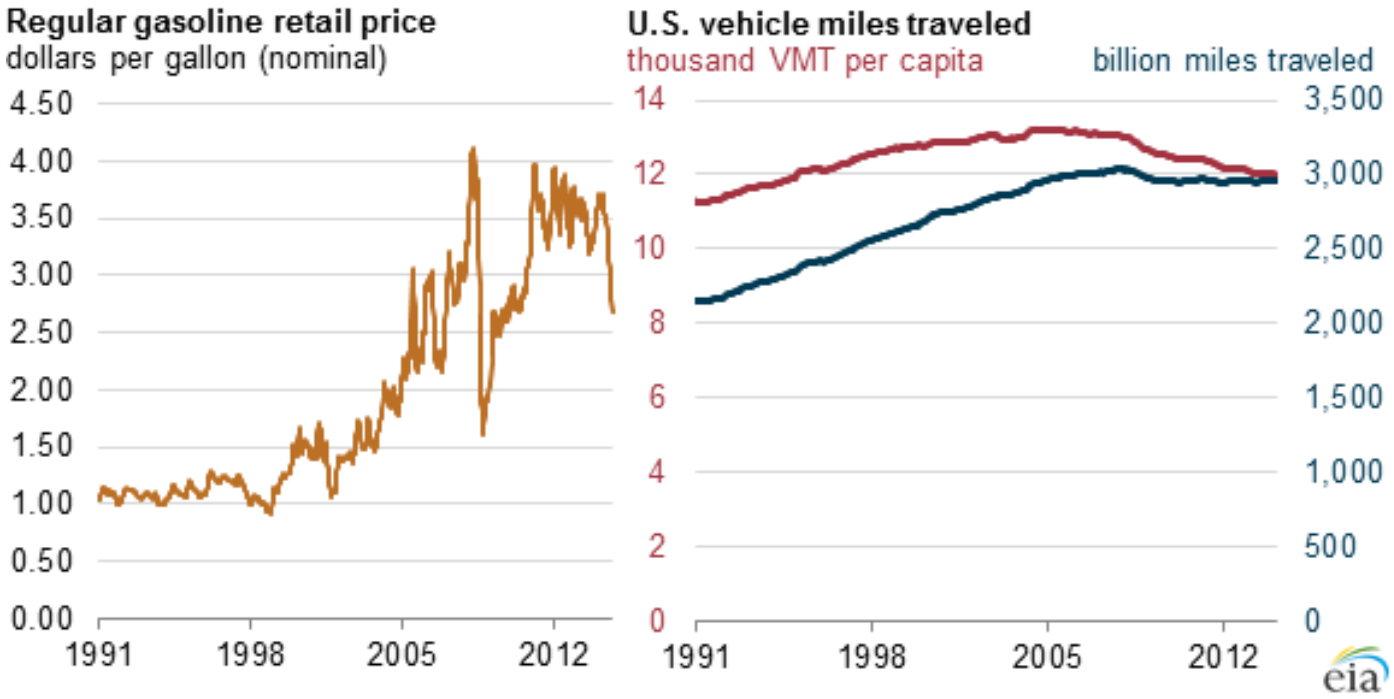


Source: US Census

Katy Freeway (I-10) in Houston (23-26 lanes with access roads)



3. Gasoline prices tend to have little effect on demand for car travel



Price elasticity measures the responsiveness of demand to changes in price. Almost all price elasticities are negative: an increase in price leads to lower demand, and vice versa. Air travel, especially for vacation, tends to be highly elastic: a 10% increase in the price of air travel leads to an even greater (more than 10%) decrease in the amount of air travel. Price changes have greater effects if the changes persist over time, as opposed to being temporary shocks.

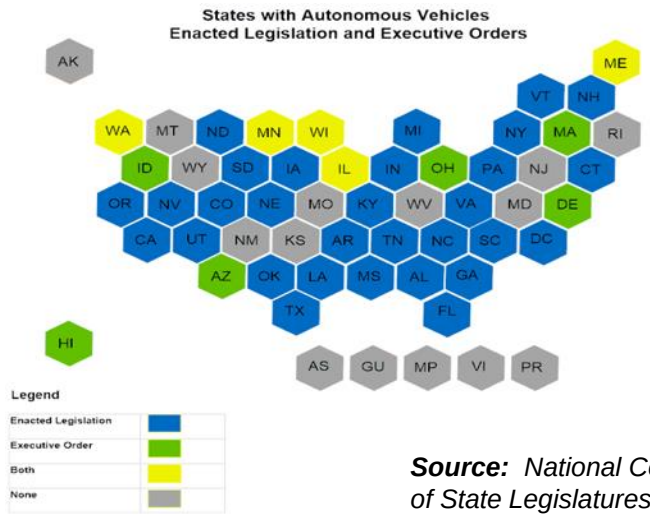
Automobile travel in the United States is much less elastic, and its price elasticity has fallen in recent decades. The price elasticity of motor gasoline is currently estimated to be in the range of -0.02 to -0.04 in the short term, meaning **it takes a 25% to 50% decrease in the price of gasoline to raise automobile travel 1%.** In the mid 1990s, the price elasticity for gasoline was higher, around -0.08, meaning it only took a 12% decrease in the price of gasoline to raise automobile travel by 1%.

December 17, 2014 (https://www.eia.gov/todayinenergy/detail.php?id=19191)

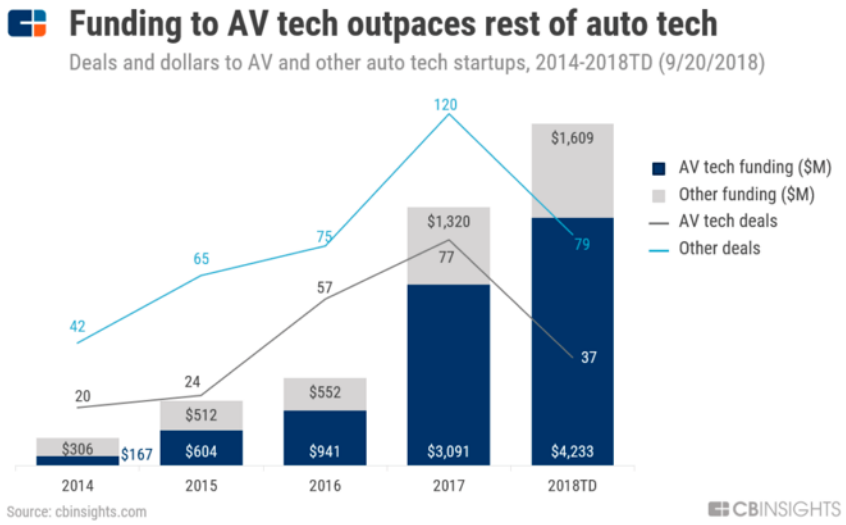
Source: *U.S. Energy Information Administration, based on Federal Reserve Bank of St. Louis*

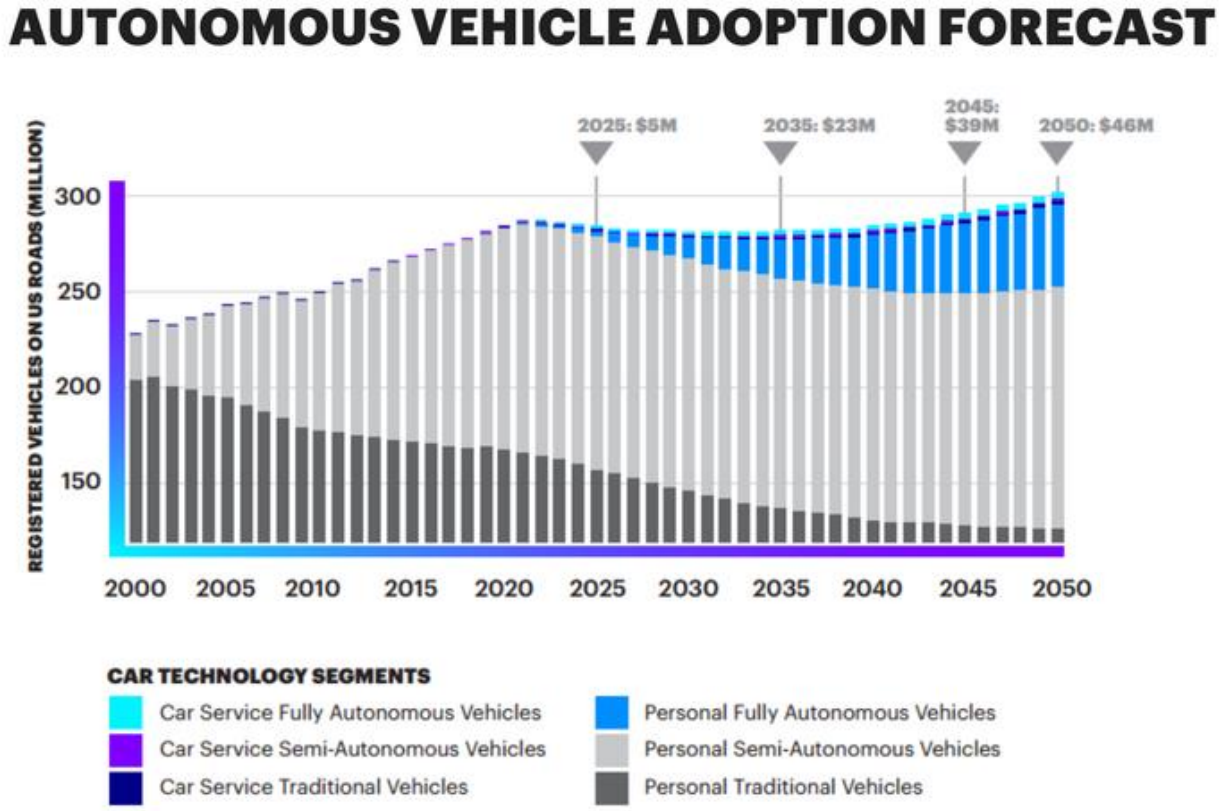
Note: *VMT is vehicle miles traveled. Per capita figures reflect U.S. population age 16 and over. Vehicle miles traveled figures are 12-month rolling averages.*

4. Legislation + investment is driving a path to autonomous vehicles



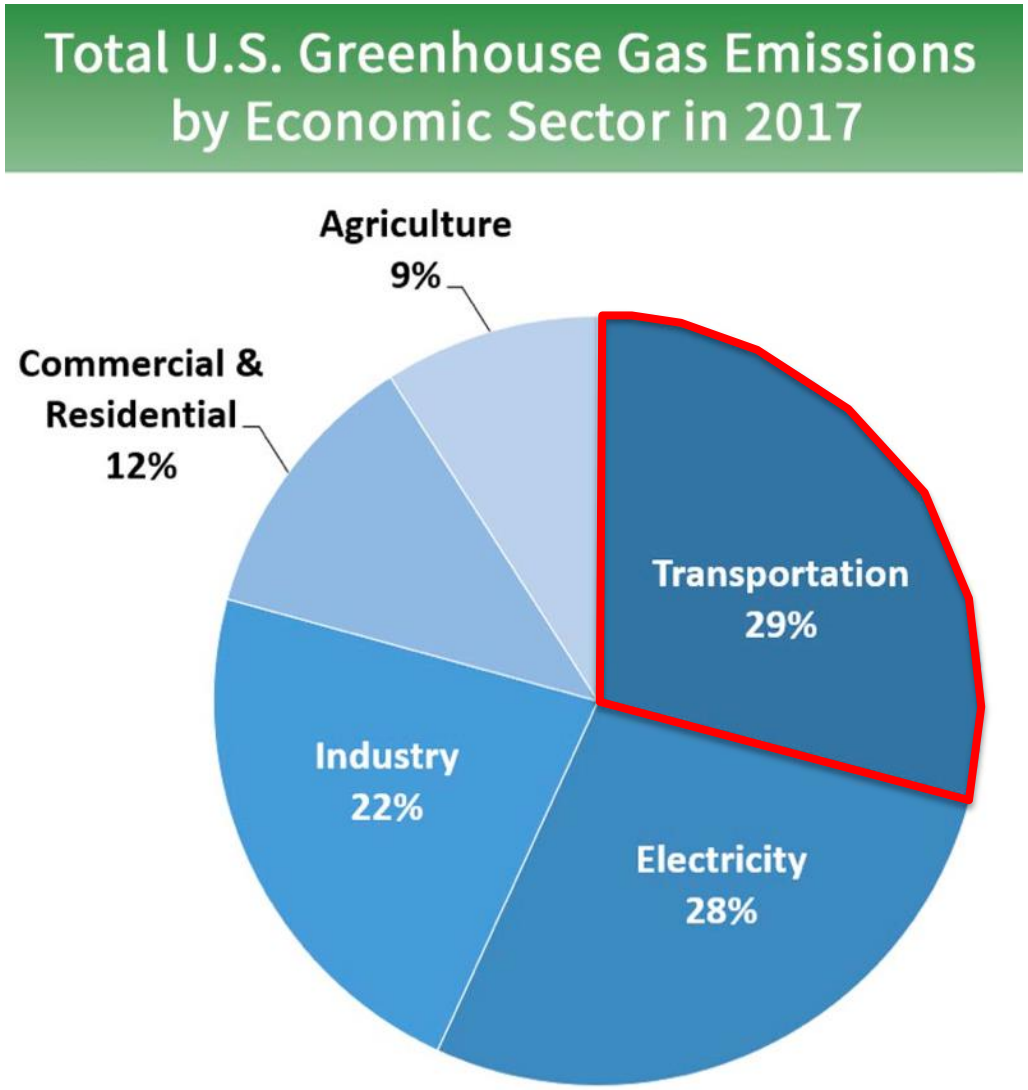
Source: *National Conference of State Legislatures (2019)*





Source: *Accenture 2017*

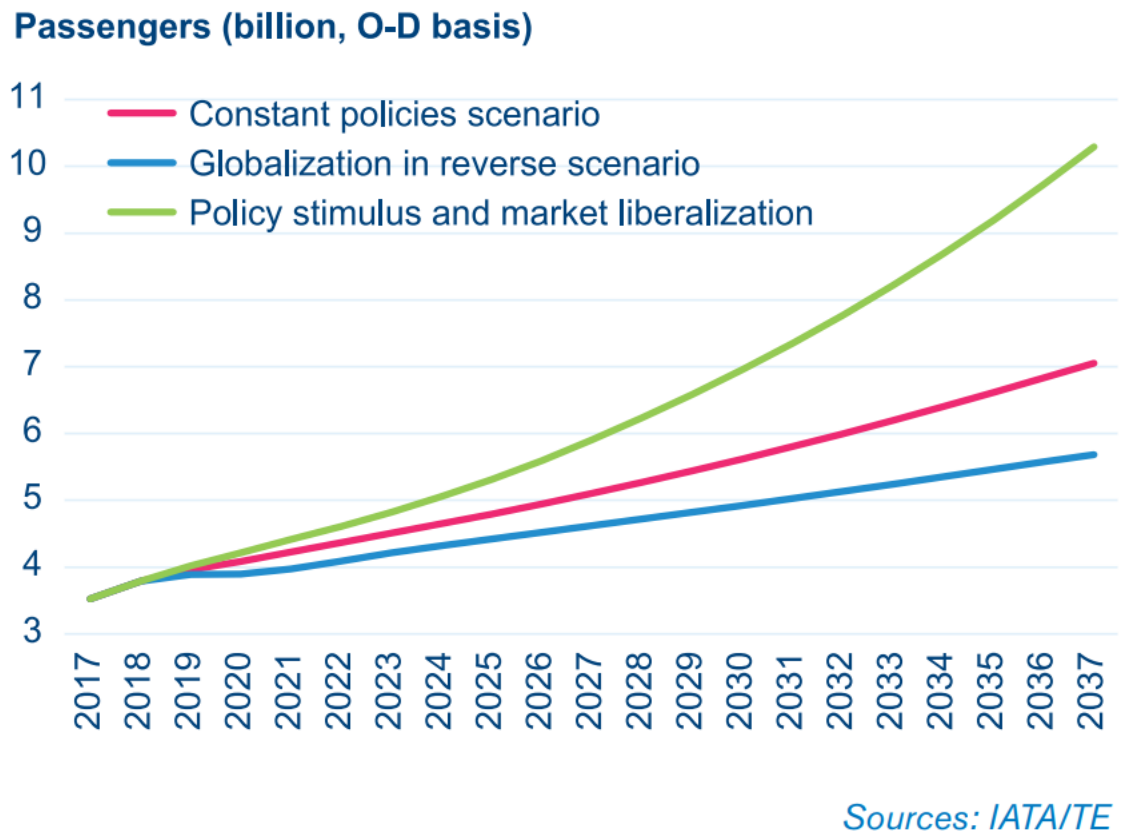
5. The transportation sector generates the largest share of greenhouse gas emissions



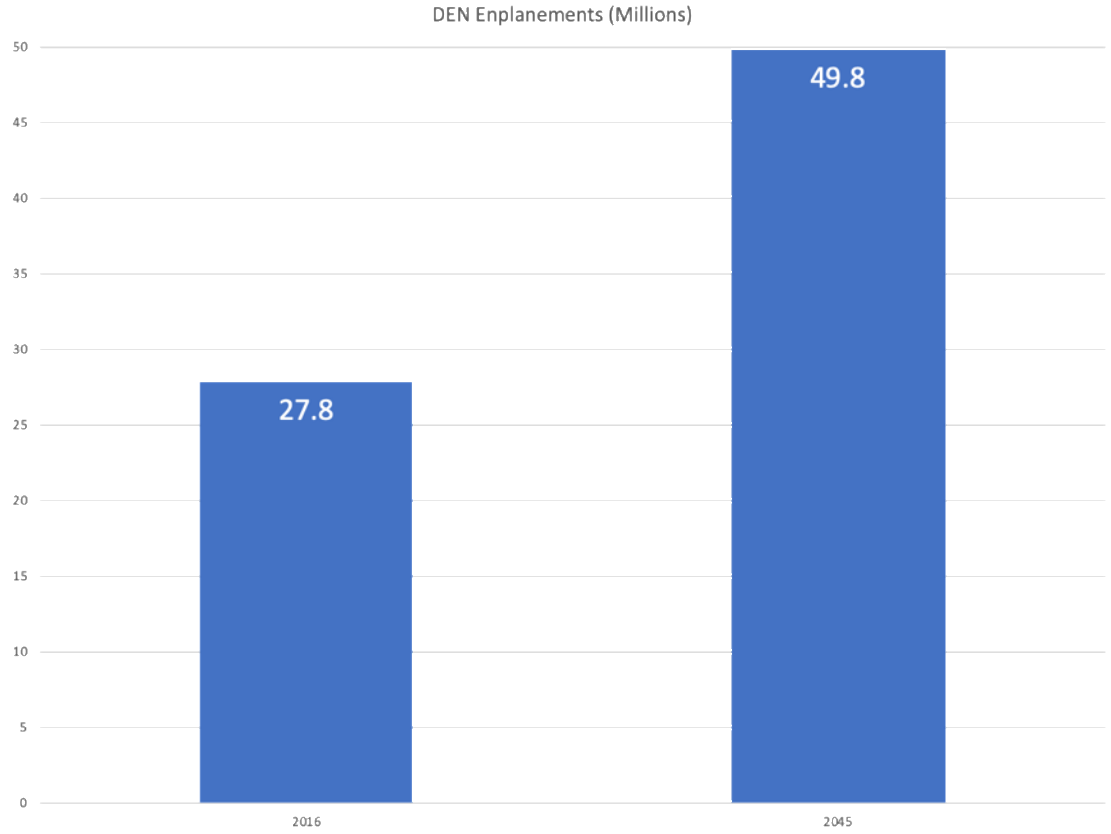
U.S. Environmental Protection Agency (2019). Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2017

6. North America will grow, carrying a total of 1.4 billion passengers, an additional 527 million passengers by 2037

Global Passenger Traffic Grows Significantly in all Scenarios



Almost an 80% increase in passengers at DEN by 2045



Source: *FAA Terminal Area Forecast: Fiscal Years 2017-2045*