



Reimagining infrastructure in the United States: How to build better

October 2020



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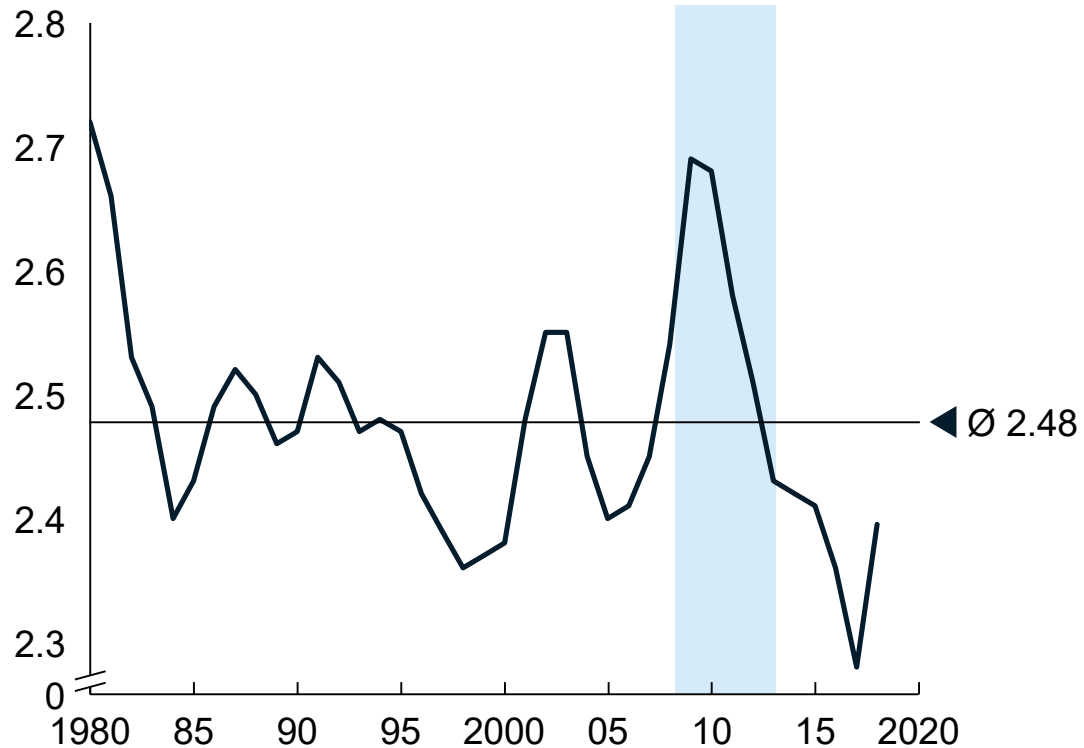
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Public infrastructure spending has fallen, and there is a \$2.1 trillion backlog

American Recovery and Reinvestment Act

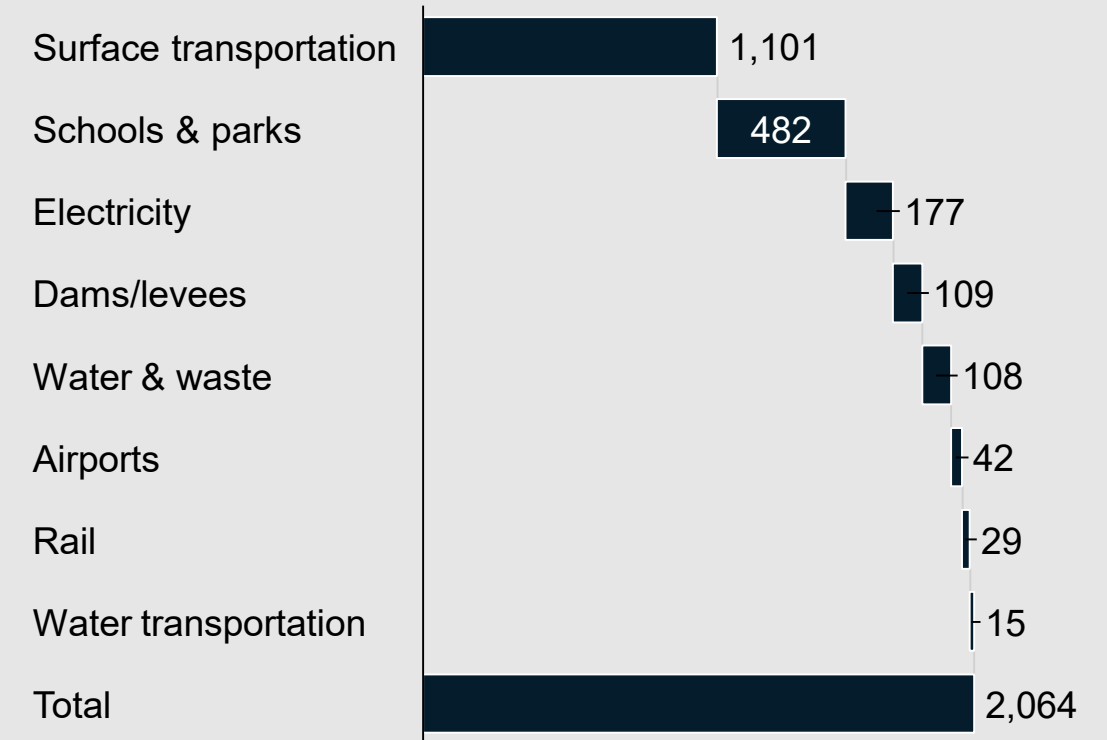
US public spending on water and transportation infrastructure, % of GDP, 1980-2018



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Source: Congressional Budget Office Public Spending on Transportation and Water Infrastructure, 1956-2017; American Society of Civil Engineers 2017 Infrastructure Report Card, Economic Impact

Estimated 10 year infrastructure funding gap by asset type, \$ billion, 2016-2025



AS OF JUNE 30th 2020

Infrastructure investment can support economic recovery but requires re-prioritization and new funding models

1. Construction Industry Hit Hard by the Coronavirus Pandemic – US News & World Report, May 27th, 2020

2. "Construction Jobs Rise By 464,000 Jobs But Remain 596,000 Below Recent Peak; Association Calls For Infrastructure Funds To Stem Losses, Aid Economy" -Associated General Contractors of America - June 5th, 2020

Source: <https://www.fhwa.dot.gov/policyinformation/statistics/2018/sf1.cfm> : U.S. Bureau of Economic Analysis, Total Vehicle Sales [TOTALSA], retrieved from FRED, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/series/TOTALSA>, June 6, 2020, https://www.fhwa.dot.gov/policyinformation/travel_monitoring/tvt.cfm, <https://inrix.com/blog/2020/06/covid19-us-traffic-volume-synopsis-14/>; <https://policy.transportation.org/wp-content/uploads/sites/59/2020/05/Caltrans-Direction-Omishakin-Letter-to-US-Senator-Harris-re-AASHTO-Request.pdf>; <https://www.mckinsey.com/industries/public-sector/our-insights/covid-19-and-jobs-monitoring-the-us-impact-on-people-and-places>; saportareport.com;



COVID-19 has exacerbated already-constrained DOT and municipal infrastructure budgets; DOT revenues are down by ~10%, or ~\$5bn in the states with greatest highway budgets; as a result, DOT budgets are being cut



These budget cuts will cause capital projects to be delayed and capital maintenance work to be cut or delayed



These deferred or cut projects will mean less jobs and a significant impact on the economy (the national construction unemployment rate has almost quadrupled from 4.7% in April 2019 to 16.6%² in April 2020 with a net loss of ~600K³ construction jobs nationwide since March) **and a degradation of critical infrastructure**



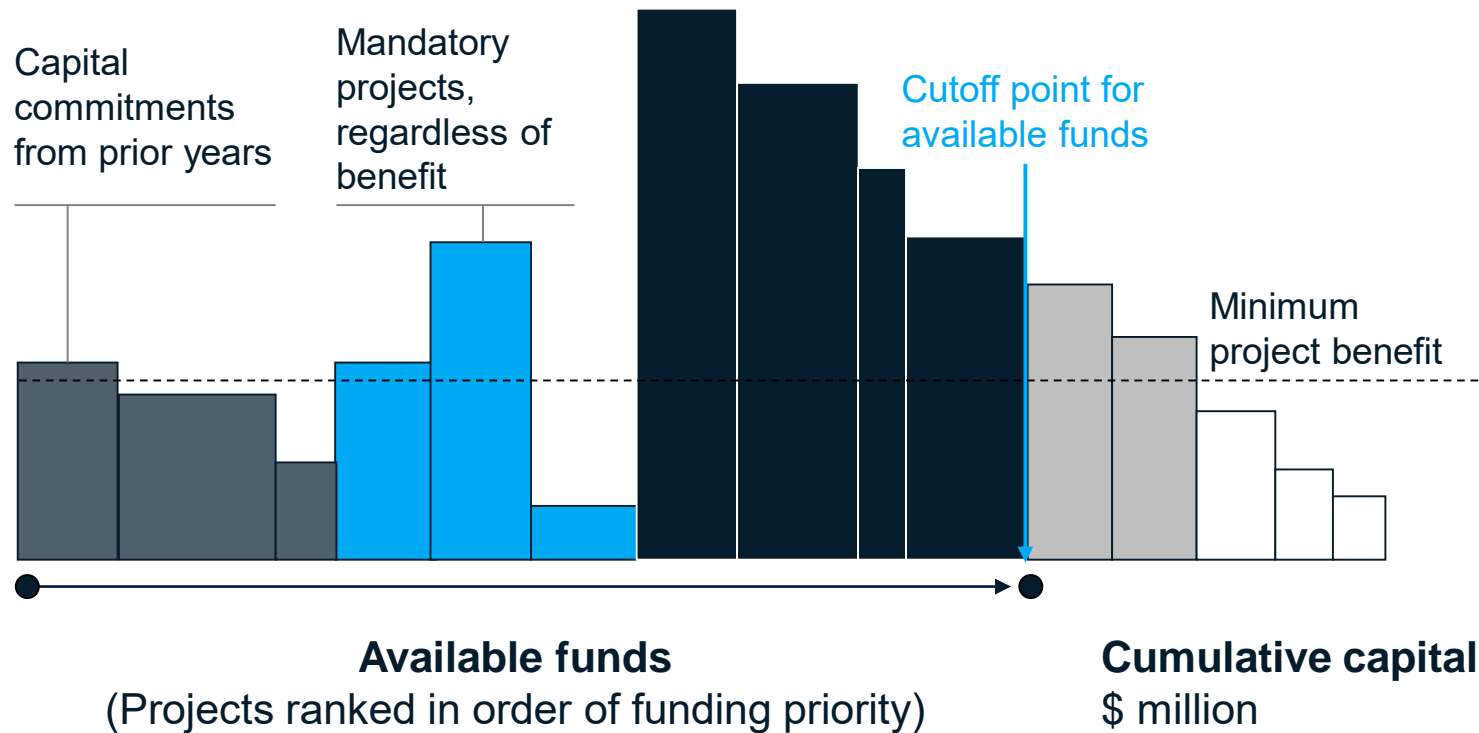
To prevent the deferral of critical infrastructure projects and maintenance, states need to find billions in funding; there is the possibility to borrow, but debt is only part of the solution



To do so, new funding models can be developed and leveraged to support infrastructure investment now – there is an opportunity to bring in private funding, filling the budget gap and allowing critical infrastructure projects to continue

Scenario 1: Portfolio optimization with stimulus funding

Project benefit



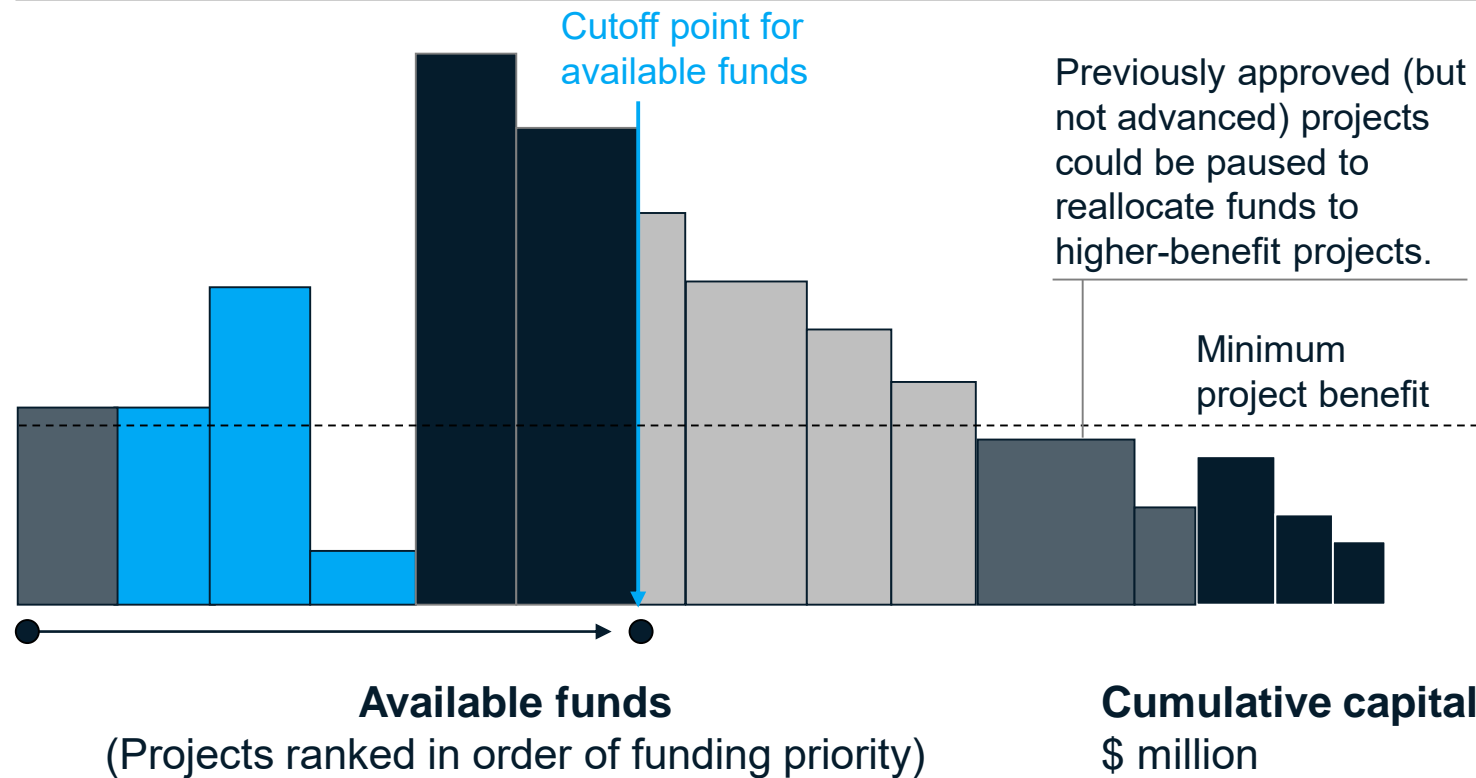
- Approved projects** – Previously allocated funding
 - Fully funded and authorized
 - Underway, with expenditures to date
- Compliance projects** – Required regardless of project benefit
 - Regulatory compliance or safety related
 - Often has non-financial return
- Funded projects** – Highest benefit projects for capital
 - Candidate for full funding allocation
 - Delivers maximum public benefit for available funds
- Unfunded projects** – Next projects to receive capital
 - Not funded at this time
 - Top candidate if additional capital becomes available
- Eliminated projects** – Projects not meeting benefit thresholds
 - Not pursued unless benefit increased
 - Removed from capital plan

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Source: McKinsey Capital Projects and Infrastructure Practice

Scenario 2: Portfolio optimization without stimulus funding

Project benefit



- Approved projects** – Previously allocated funding
 - Fully funded and authorized
 - Underway, with expenditures to date
- Compliance projects** – Required regardless of project benefit
 - Regulatory compliance or safety related
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Three factors that this year has magnified in evaluating investments in transportation



Sustainable Business Models

COVID-19 has put pressure on historical transportation funding resources and usage-based revenues; agencies are re-evaluating their business model in line with anticipated user demand and expectations, disruptive technology and organizational capacity and capabilities



Climate & Resiliency

“Once-in-a-lifetime” climate events are becoming increasingly frequent; incorporating climate risk and asset resiliency into risk-based planning and capital portfolio optimization is a growing practice



Equity

Many transportation agencies are reaffirming their equity commitments through changes to their operations and capital investment criteria to ensure equity of access and outcomes (e.g., social justice, geographic parity across rural and urban performance)

4 areas
underpin a
“**reimagining**”
of
transportation
agency
business
models



**Enhance the
user experience**

Modernize service provision and customer experience to reshape user demand and better manage future capacity needs



**Transform
operations**

Use advanced analytics, digital investments, and flexible labor models to reduce life-cycle costs, increase asset productivity, and improve operational agility



Improve delivery

Take advantage of lower interest rates and accelerate projects to benefit from reduced asset utilization



**Consider new
revenue models**

Look into alternative delivery mechanisms to unlock new revenue streams and consider the use of public–private partnerships to stretch funding

Refocusing on evolving priorities & improving operational resiliency

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Focus for roads



Enhance the user experience

Make low-cost roadway modifications, such as sidewalks and bike lanes. Optimize curb space according to use and time of day to improve system efficiency – such as allowing nighttime freight delivery and instituting dynamic park & outdoor dining areas



Transform operations

Implement advanced analytics and remote monitoring systems to provide targeted predictive-maintenance interventions and manage congestion



Improve delivery

Accelerate quick-to-repair maintenance projects, such as filling potholes and repaving, to take advantage of a favorable contracting market and lower traffic levels



Consider new revenue models

Implement demand-based pricing systems that capture the cost of low-density travel modes, such as congestion pricing and managed lanes

Climate risk can take three forms



Physical risk drivers

Acute

Acute physical climate change risks materialize through **higher frequency and severity of extreme weather events**. There are 6 acute risks:

- Floods
- Droughts
- Heatwaves
- Coldwaves
- Wildfires
- Hurricanes

Chronic

Chronic physical climate change effects materialize through the **sustained shift of ecosystems** over time. There are 3 chronic risks:

- Temperature
- Precipitation
- Sea-level rise

Transition risk drivers

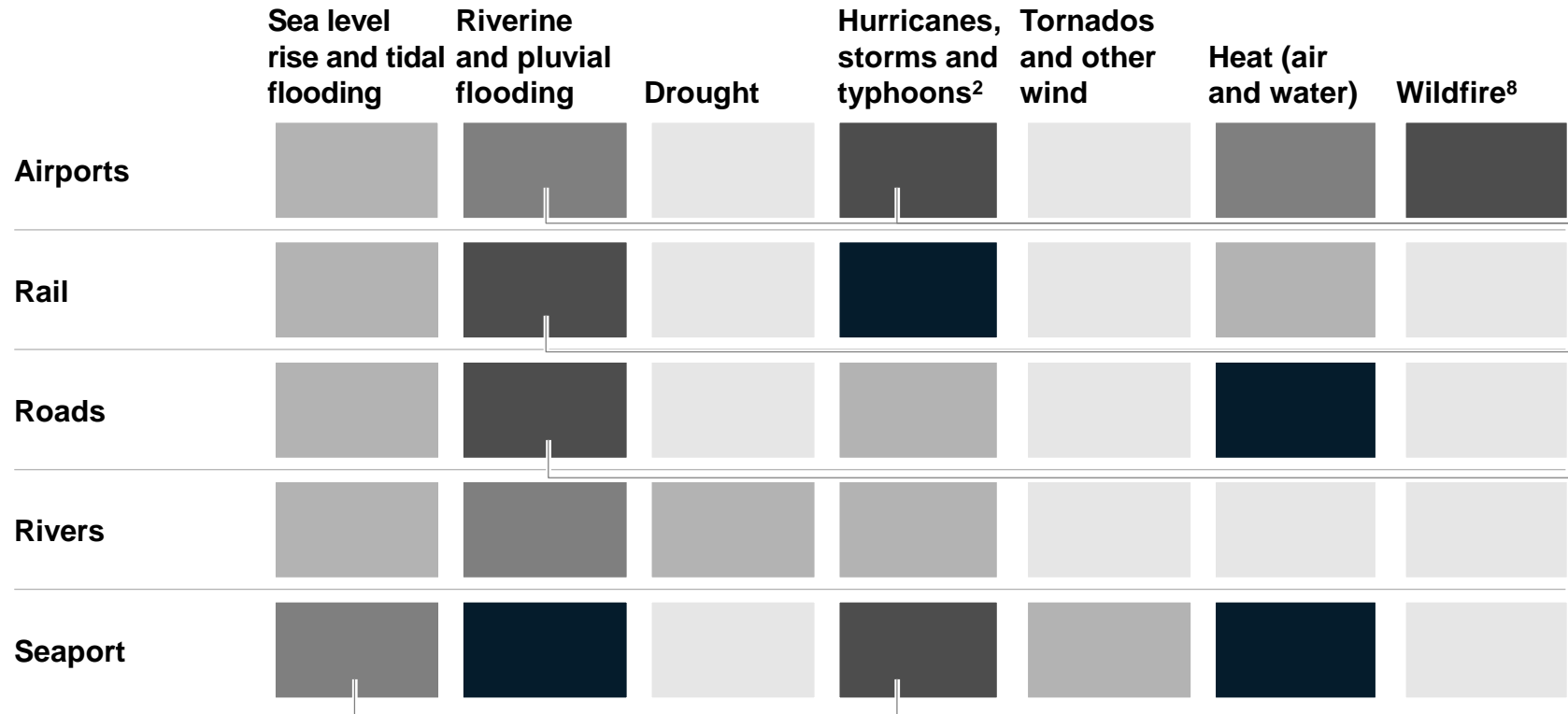
Climate change will **push regulators, legislators, and consumers** to make decisions as economies evolve, supply and demand shifts, and governments and private companies adapt. There are 4 categories of these human-induced transitional risks:

- **Policy/regulatory** – change in regulatory regime
- **Legal** – claims arising from third parties based on climate-related events
- **Technological** – change of technological standard e.g., development of new transport technology
- **Societal** – change in customer behavior and options e.g., dramatic reduction in meat consumption

Example heatmap for infrastructure assets - Transportation

Little to no risk Low risk Moderate risk High risk

Risk is defined as potential future losses⁹ as a result of typical exposure to climate hazards by 2030



Airports are frequently located close to the sea, increasing their risk to precipitation flooding and storm surge from hurricanes. 25% of the world's 100 busiest airports are less than 10m above sea level, and 12 — including hubs in Shanghai, Rome, San Francisco and New York — are less than 5m². Only a few millimeters of flooding is necessary to cause disruption

Rail is at risk of service interruption from flooding; signal assets in particular have powerful knock-on effects. Inundation of 7% of the UK's signalling assets would disrupt 46% of passenger journeys. Damage can occur by erosion, shifting sensitive track alignments⁷

Roads require significant flood depths/flows to suffer major damage, but incur ~30% speed limitations from 0.05m inundation and become impassable at 0.3m. Compounding effects of road closures can increase average travel time in flooded cities 10-55%³

Seaports, by definition, are exposed to the risk of all types of coastal flooding. Typically, seaports are resistant and can more easily adjust to small sea level rise. However, powerful hurricanes are still a substantial risk. Katrina destroyed around 30% of the Port of New Orleans⁴

1. Including both rain and wind impacts; GSM Association (2018); 2. Xi H. (2016); 3. Pyatkova (2019); Praelenato (2019); Pablo 2005; 4. New York Times (2006); 5. 6 Federal Communications Commission (2016); 7 Dawson et al (2016); 8. Wildfire is a derivative risk primarily driven by drought; 9. Losses are considered any form of operating interruption, damage or destruction

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Example: Climate risk taxonomy for roads identifies flooding as the most critical risk to take into account

NON-EXHAUSTIVE

Most critical
 Not applicable

		Acute					Chronic			Transition			
		Heat/ Cold-waves	Floods	Droughts	Wildfires	Hurricanes, storms and typhoons	Temperature	Precipitation	Sea-level rise	Policy & Legal	Regulatory	Technology	Societal
Impact type	Asset condition	<ul style="list-style-type: none"> Sudden cold or hot temperatures cause stress in extension joints, heat makes asphalt deteriorate quicker 	<ul style="list-style-type: none"> Flooding can increase soil erosion of the roadbase and washout of road, tunnel and bridge support 	<ul style="list-style-type: none"> Drought combined with hot temperatures can cause roads to warp, buckle, crack and shift 	<ul style="list-style-type: none"> Heat from fire can damage road infrastructure 	<ul style="list-style-type: none"> Storm surge / floods can increase coastal erosion of the roadbase and washout of road, tunnel- and bridge support Extreme winds can damage bridge infrastructure 	<ul style="list-style-type: none"> Thawing permafrost in northern latitudes cause road collapse or subsidence 	<ul style="list-style-type: none"> Increased precipitation requires investment in new, permeable asphalt to avoid slipping 	<ul style="list-style-type: none"> SLR can increase coastal erosion of the roadbase and washout of road, tunnel- and bridge support 	<ul style="list-style-type: none"> Mandatory strengthening / protection of high-priority road infrastructure at-risk, may raise costs 		<ul style="list-style-type: none"> Next generation of technology (e.g. self-driving / electric cars) may request additional investments 	
	Continuity of activities	<ul style="list-style-type: none"> Interruption of use due to damage Interruption due to unsafe driving conditions on long, desolate roads 	<ul style="list-style-type: none"> Floods can temporarily inundate the road and diminish access 		<ul style="list-style-type: none"> Interruption due to blocked accessibility of infrastructure or poor air quality and presence of smoke 	<ul style="list-style-type: none"> Storm surges can temporarily or permanently inundate the road and diminish access Extreme winds can diminish access (e.g., on bridges) 		<ul style="list-style-type: none"> Interruption due to unsafe driving conditions 	<ul style="list-style-type: none"> SLR can permanently inundate the road and stop use 				
Input / Output		<ul style="list-style-type: none"> Interruption of accessibility to infrastructure connected with considered toll road 											
Economic ecosystem		<ul style="list-style-type: none"> Interruption of road accessibility or increased travel duration could impact <ul style="list-style-type: none"> Present tourism, discouraging future tourism and therefore use of toll roads Present employment and businesses, causing the absence of new or relocation of current businesses and decreasing future use of toll roads Present population, causing the absence of new or relocation of current population and decreasing future use of toll roads 							<ul style="list-style-type: none"> Increased taxes on road transport discourages car transport and toll road usage 	<ul style="list-style-type: none"> Regulations to increase toll road prices to discourage car transport could impact toll road usage 	<ul style="list-style-type: none"> Improved or newly emerging non-road transportation (e.g., rail, underground) reduce need for road transport 	<ul style="list-style-type: none"> Reduced car usage and need for road transport opportunities 	

Addressing racial inequities in customer experience can increase the effectiveness of public services where they are needed most



Public sector journey design impacts outcomes

Every day Americans access thousands of government services – from local public transportation, to state professional licensing, to filing federal taxes

Each of these experiences may be comprised of numerous steps, forms, applications, touchpoints with government employees, even visits to government offices

How these processes play out impacts not just trust in government, but also the greater outcomes these services are meant to achieve



Combat bias in journey design

Minorities disproportionately leverage public services, yet we see the experience of Black people with government services dramatically lags behind that of white people due to processes and systems designed with implicit and sometimes explicit bias (*survey exhibit on following page*)

Black outcomes across economic, criminal justice, and education systems lag outcomes for white people

Government services are a critical component of the experience and outcome in each of these areas

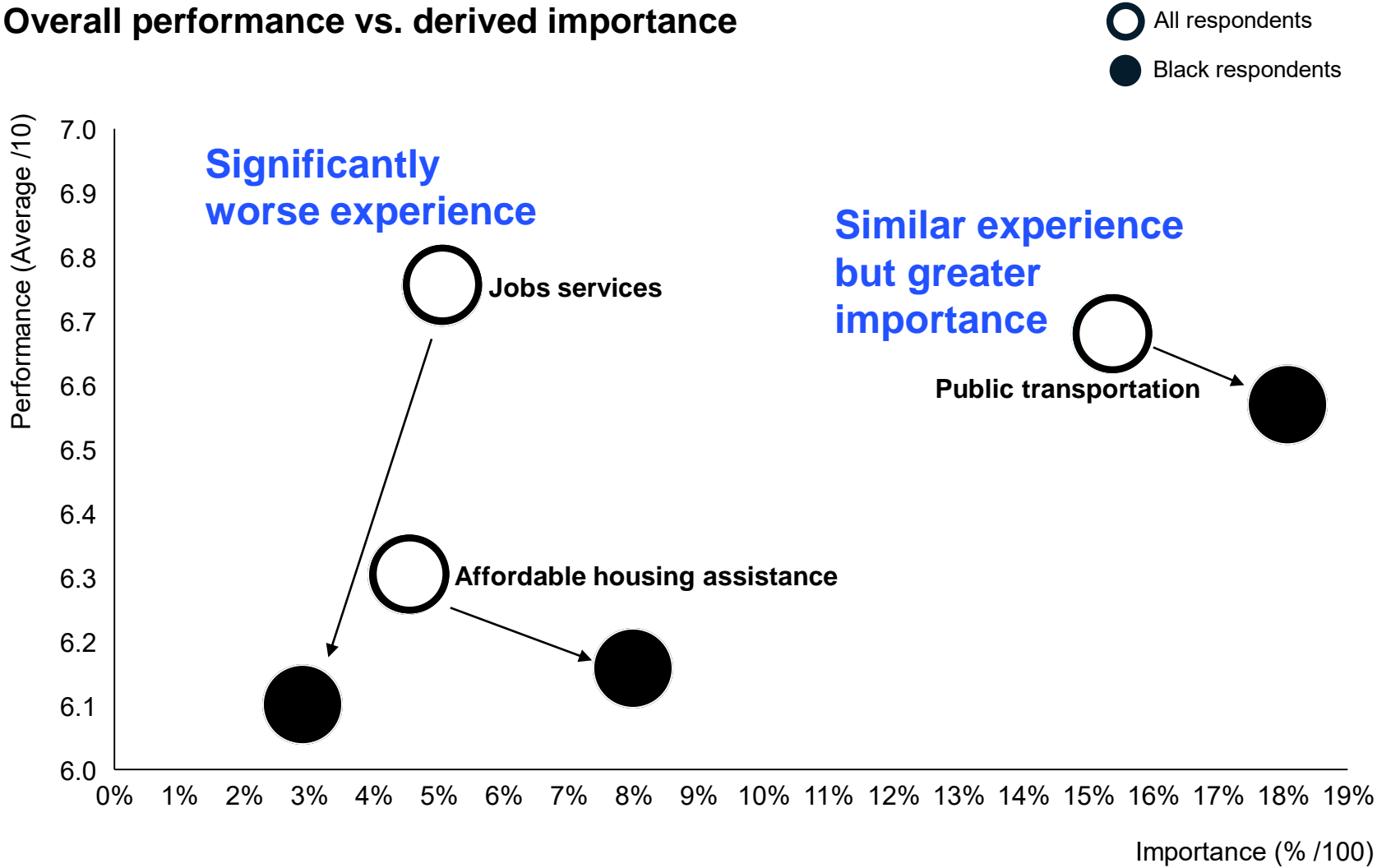


Data-driven transformation approach

- ① Use journey experience data to uncover gaps in experiences of people of color versus the broader population, as well as differences in the importance of the drivers of those experiences
- ② Apply inclusive design thinking and draw on a diverse toolkit of interventions during re-design of journeys prioritized as having the largest equity gaps and the largest potential to drive impact for communities of color
- ③ Leverage large-scale transformation frameworks and tools to manage and monitor interventions on hundreds of customer journeys cutting across numerous agencies and organizations

Survey data for one State reveals differences in experience by race

Overall performance vs. derived importance



Survey data from a sample state illustrates how different groups experience and value State services

Analyses like these illustrate critical experience gaps between groups, and highlight the services that are most important to groups that may be historically underserved by government

Source: 2018 State Pulse Survey; N = 1,702

Capital planning best practices and innovative operating models / public private partnerships can be used to address the challenge ahead

Involves private investment



Operating budgets



Debt management



New capital outlays



Funds for new economic initiatives

Situation

Unable to fund full range of annual maintenance and operations activities
Long-term shortfall, even as costs likely to continue to rise

Unable to fund annual interest and debt payments

Insufficient revenue to fund capital or debt needed for new projects

Fund new economic growth and recovery priorities
Bolster revenues/funds with new sources

Levers to pull

Cut spending for 2020/2021 or postpone maintenance

Restructure services contracts

Revisit private investment structures: management contracts, operating concessions, and privatizations/asset recycling to raise capital or postpone spending

Convert maintenance/capex to opex

Restructure debt under lower interest rate regime

Cancel or delay projects

Revisit construction concessions for more efficient/cheaper options

Revisit suitability of projects for PPP to supplement with private funds/capabilities

Bundle projects into larger scale program for cost synergies

Raise new debt e.g., green muni bonds

Apply for federal stimulus

New user fees or once-off special taxes

Raise existing taxes or fees
Monetize "hidden" public real estate value/wealth

Sell concessions to monetize future cash flows on existing tolled assets

Leverage stimulus funding to catalyze private capital and optimize limited budget

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