BROOKINGS

Report

Four ways to make wiser infrastructure investments

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Editor's Note:

This report was produced by the Brookings Center on Regulation and Markets.

America's public infrastructure, particularly its transportation [1] and water systems[2], is decaying, underperforming our nation's needs and goals. But the solution to our infrastructure problem is relatively straightforward. America, at all levels of government and in conjunction with the private sector, needs to: **Invest. More. Wisely**.

Each of these three words contains an idea and corresponding set of policies. This paper focuses mostly on the final idea: Wisely. At its core, 'wisely' means that whatever level of investment is chosen, it ought to be invested in the smartest manner possible. While straightforward in theory, the application of a wiser approach to infrastructure is more complicated in practice. There is generally a reason why sub-optimal choices that fail to maximize total social benefits or minimize total social costs are frequently made and often encouraged by problematic policy or outmoded regulations. Despite bipartisan recognition of the problem and proposals by both the Administration and Democratic leadership, Congress has yet to, and remains unlikely to, pass major new infrastructure legislation.

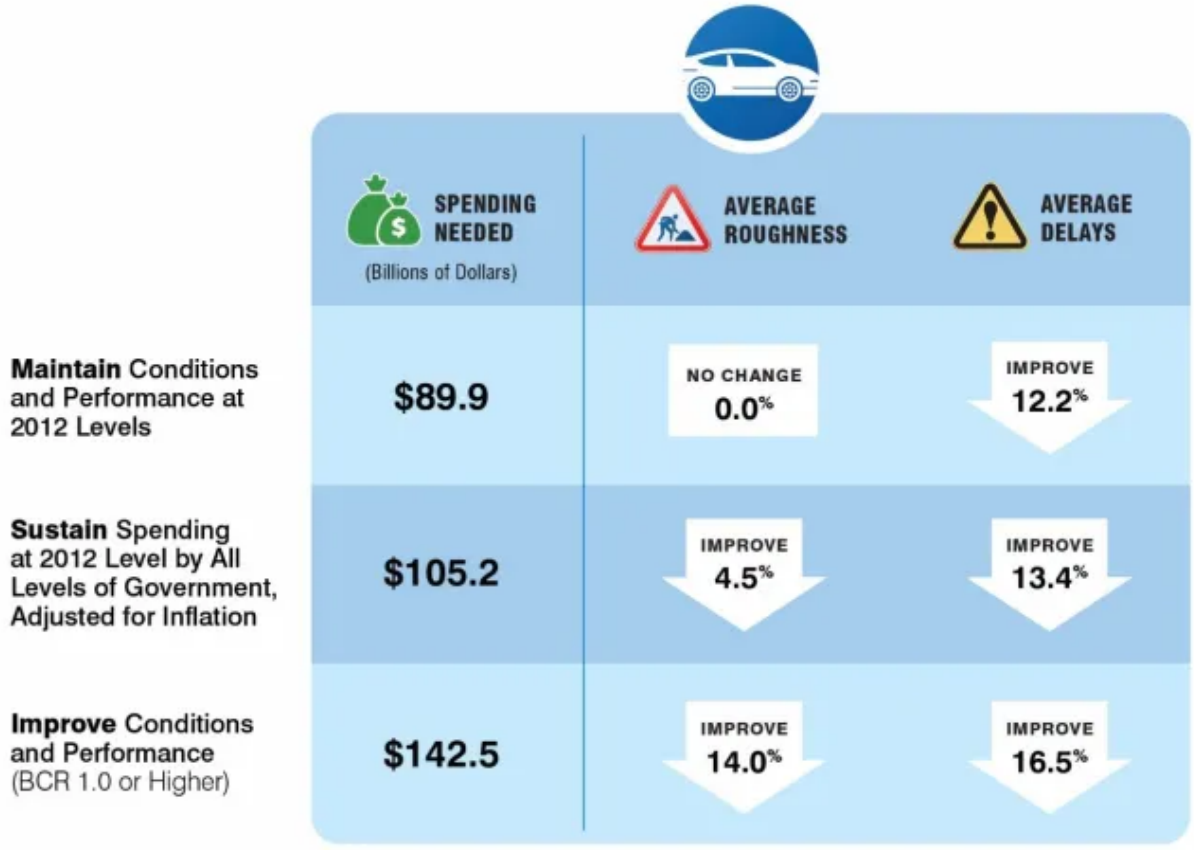
This paper explores a set of core ideas that can help America make wiser infrastructure investment choices. Changes are needed at all levels of government, especially the state and local levels including infrastructure authorities, where most infrastructure decisions are made. The federal government has an important, but limited, role in structuring these choices. The federal government's most impactful role is to promote wiser federal infrastructure investment choices and to incentivize wiser decision-making at the local level. Incentive programs, even small ones, from the federal government such as the

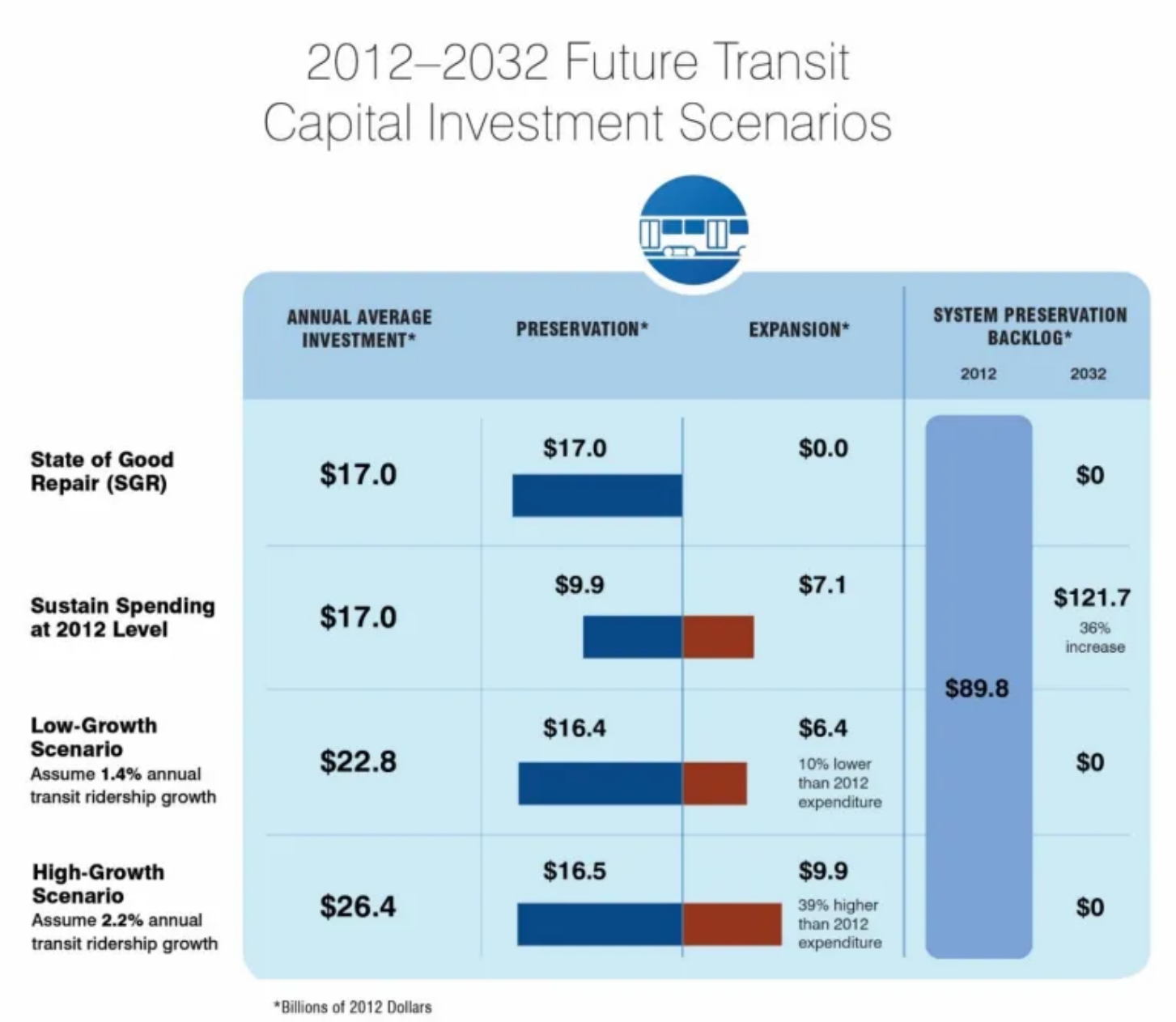
TIGER[3] competitive transportation grant program, or the Race to Top education program[4] have shown that "competitive programs have impact"[5] in promoting change at the state and municipal level.

Before turning to the core issue of wiser, a few brief words on the first two concepts, starting with invest. **Investing** involves shifting the common paradigm of 'spending' to that of 'investment'. Spending models focus on how much money is being thrown at a problem and track that spending. Investing takes a longer-term perspective, maximizing total economic return. An investing mindset encourages co-investment from non-governmental actors, both directly in the infrastructure asset and indirectly in the economic development associated with the project. Investing takes an inherently longer-term approach, correcting many of the problems associated with a spending mentality that can result in infrastructure that costs less to build, but far more to operate. Investing considers maximizing lifetime benefits while minimizing life-cycle costs for the infrastructure asset rather than minimizing the direct spending, aka, the cost of initial construction.

The second idea is simple: **More**. Current levels of funding are inadequate to meet current needs. Estimates of the level of additional infrastructure investment needed range from $4.6 trillion for our entire infrastructure system by the American Society of Civil Engineers (who also give US infrastructure a grade of a D-) [2] to $3.4 billion over 20 years to just maintain and improve our nation's highway and transit systems according to the Department of Transportation.[6] Annual levels of total investment needed to maintain and improve highways and public transit as calculated by DOT are illustrated below.

2012–2032 Future Highway Capital Investment Scenarios





The need for more infrastructure investment is obvious enough that both political parties have embraced it. President Trump has proposed[7] generating $1.5 trillion in additional infrastructure investment over the next decade, including $200 billion via federal funds. Congressional Democrats have their own proposal[8] for an additional $1 trillion in new infrastructure funding.

Despite bipartisan political support for more, Washington has generally not delivered.

Despite bipartisan political support for more, Washington has generally not delivered. The lack of large scale new federal funding coupled with the reality that state and federal governments are the main sources of funds for infrastructure have resulted in increasing pressure on states to find more money. State governments have responded. For example, 20 states[9] have raised their gasoline tax over the last 25 years generally to maintain or increase their levels of infrastructure investment. This is in contrast to the federal government, which has failed to increase its gas tax (even to account for inflation) over the last 25 years.

Given a set amount of funds and hopefully an investment mindset, there are multiple ways to make wiser choices at all levels of government from Washington D.C. to state capitals, county seats, and the home offices of infrastructure operators. Here are four proposals to do that.

1) Pooled Procurement

America has a highly decentralized infrastructure system, particularly for surface transportation and drinking water systems. State and local governments combine with infrastructure operators to design, build, operate, and maintain almost everything. There are benefits and drawbacks to this decentralized system. One problem is the lack of coordination among our multiple infrastructure agencies in purchasing products. Solving this problem could reduce costs for many types of infrastructure and ensure a more stable set of jobs and production of infrastructure assets. Pooled procurement is a promising method to achieve these gains.

Pooled procurement is when two or more infrastructure operators agree to coordinate their procurement of like assets. Combining forces allows infrastructure purchasers to utilize economies of scale and achieve lower costs per unit of infrastructure purchased. This can also spread certain fixed costs of infrastructure procurement (contracts, due diligence, and delivery) over a larger number of buyers, lowering each one's share. These savings make the infrastructure cheaper or allow more to be built at the same price.

For example, take 20 bus systems scattered throughout the country, each wanting to buy 10 buses. Instead of negotiating 20 contracts, they would negotiate one large contract. The price per bus should be lower at 200 than at 20. The average cost per bus system of shopping, comparing, and negotiating the contract should also be lower. This could include maintenance, warranty, and repair contracts that could similarly spread risk and lower costs.

Pooled procurement can even exist in a single jurisdiction. Consider the state of Pennsylvania, where the state government wanted to raise a series of railroad bridges to accommodate double-stacked trains. Rather than try to bid each railroad crossing separately, the state worked with local officials to bundle the set of projects[10] for group bid.

Savings from pooled procurement can extend to the manufacturer or producer as well. Larger contracts with longer delivery times and more stable production rates allow for correspondingly smoother production schedules. This is especially the case when funding for infrastructure is correlated between purchasers. This criteria is met for most infrastructure programs that have large, periodic increases in federal funding, such as the surface transportation programs funded by the large, multi-year federal legislation most recently called the FAST Act and previously known as the TEA bills (ICETEA, TEA-21, SAFETEA).

For example, consider the transit systems of Washington D.C. (WMATA), Atlanta (MARTA), and the Bay Area (BART). All three systems were built at similar times and use similar rail cars. All three periodically get increases in federal funding when new federal legislation is enacted. If each system uses the increase in funding to buy new rail cars at the same time, this can make it difficult to provide those railcars, especially if they share the same

manufacturer (aside: transit systems usually require interoperability of new and old rail cars, hence they engage in long-term deals with one of very few rail car providers). This type of buyer competition can push up prices, having the opposite impact on procurement costs.

It can also hurt workers. Consider a factory with specialized workers that produce rail cars. Having the factory go back and forth between being idle and requiring three shifts is less efficient for workers and companies than having a steady two-shift production function. The better system can be achieved through a longer-term, pooled procurement system.

Pooled procurement is complicated in practice. The bus systems in the earlier example could face substantial search costs to find other systems with similar needs and procurement schedules. Purchasing a bus doesn't end with just delivery; there are maintenance contracts, warranties, and other longer-term contracts that would need to be coordinated and occasionally tailored to specific agency needs. The three subway systems mentioned have differing priorities within rail cars (e.g. passenger capacity) as well as similar coordination issues as the bus systems. Pooling resources can require sacrificing autonomy.

Some of these challenges can be addressed through a more active role by the federal government in promoting pooled procurement. It can efficiently serve[11] as a platform and hub to bring together distinct infrastructure operators. It can create and provide information regarding the benefits of pooled procurement. Recognizing this, Congress has created several pooled procurement pilots such as SAFETEA[12], MAP-21[13], and FAST Act[14]. The GAO has encouraged this, stating that, "the coordination of transportation services—through pooling resources [...]—has been found to improve the cost-effectiveness and quality of service."[3]

However, individual infrastructure operators still lack enough incentives to overcome operational barriers, costs of organizational cooperation, and information asymmetries. Much more can be done. Specifically:

- The U.S. Department of Transportation can read every state, urban area, and major infrastructure operator's strategic plans (often required by federal law) with an eye to find areas of common purchasing needs. Subsequently, the Department of Transportation can invite agencies with commonly identified needs to coordinate with each other.

- State Departments of Transportation can undertake similar activities at the state level. For example, each State Secretary of Transportation can promote pooled bus procurement within each transit operator for that state.

- The U.S. Department of Transportation can establish a competition to identify wise pooled procurement arrangements, providing technical assistance, financial benefits, and/or recognition to winners.

2) Open Source Material Competition

Strong quality standards are necessary for wise infrastructure. Cheaply built infrastructure risks high maintenance costs, sudden collapse, or chronic safety problems. Reliability and stability are highly important features for infrastructure. However, technological advances in material design, construction, and usage continue to occur. Advancements in new technology occasionally run into conflict with existing standards that predated these changes. A failure to modernize standards will result in the inability to incorporate new technologies to produce better, cheaper, and higher quality infrastructure.

Open source material competition occurs when there are no restrictions for procurement, or in other areas, that require specific materials be used. Restricted competition through specifying materials often dates back to an era when only one material was commonly available. It is sometimes a proxy for a specific standard of performance. If a specific level of output is desired, that ought to be the specification for the procurement. This enables innovation and competition among materials providers to reach desired levels of performance. The goal is performance, not specific materials.

The U.S. Department of Agriculture's Rural Utilities Services general policies and guidelines clearly enunciates a logical goal. They state[15] "All procurement transactions, regardless of whether by sealed bids or by negotiation and without regard to dollar value, shall be conducted in a manner that provides maximum open and free competition. Procurement procedures shall not restrict or eliminate competition." Yet unfortunately, this principle is not always followed, especially at the state and local level, often in procurement policies that require specific materials.

Using a cost justification analysis, the National Taxpayers Union estimated[16] a $371 billion reduction in costs to taxpayers nationwide if municipalities transitioned to open source contracting for their water systems—savings roughly equal to one out of every six dollars spent. Three-quarters of these savings occur beyond the initial 25 years of investment, indicating the need to conduct long-term analysis when comparing the value of different materials in construction. This serves as an important reminder that a wiser approach to infrastructure is often coupled with an investor mindset. Yet, we know that clear water will be as much a necessity for life over the next century as in the past, so if there were ever an infrastructure asset where one should take the long view it would be water (as opposed to certain forms of transportation which do evolve over time).

Water infrastructure choices are generally made at the municipal level. Local governments can be resistant to changing established protocols and contracting services for a variety of reasons. The U.S. Conference of Mayors conducted an in-depth analysis of why many municipalities continue to engage in closed material procurement. One factor they found was habit. Habit was particularly problematic when there were problems with corrosive soil in areas, which were often not previously considered during procurement areas. Failing to update thinking for new environmental problems resulted in poor decision-making. As the Conference of Mayors report[17] found, "the habituation factor is at full play here. By not considering comparative costs of pipe-type in corrosive soils with additional corrosion control costs included, the common practice of choosing metallic pipes without a full financial evaluation continues to dominate procurement decision making."

Wise decisions build confidence for infrastructure. Unwise choices do the contrary.

Continuing closed material procurement can undermine public support for infrastructure. Wise decisions build confidence for infrastructure. Unwise choices do the contrary. Mayors and local officials situated most closely to the constituents they represent and the infrastructure systems that serve them should be most incentivized to engage in this change. As the Conference of Mayors report concludes: "Closed procurement processes lead to unnecessary costs, and may diminish public confidence in a local government's ability to provide cost effective services."

Open source contracting promotes competition and innovation. Transparency in the material selection process is important to maximize these goals. The complex analysis required to optimize every material solution maybe beyond the scope for every jurisdiction. However, transparency in procurement selections and integration of widely used and easily measured levels of performance is a realistic goal for infrastructure providers.

Solutions in this space are straightforward. A Competitive Enterprise Institute's report states: "Opening up the bidding process under the principle of 'may the best technology win' will go a long way to improving the quality of the nation's underground water infrastructure in a cost-effective fashion[18]." Specifically:

- Infrastructure projects should be bid using open materials to the maximum extent practical. This may involve updating procurement manuals or standard operating practices as suggested by the Conference of Mayors report. It may involve passing federal legislation such as the Municipal Infrastructure Savings and Transparency Act[19] that empowers engineers to determine eligible construction materials.

- Infrastructure bids should be evaluated along consistent methodology that allows for financial comparisons between different materials. This should include life-cycle analysis of both construction and maintenance. It should also take into account environmental factors, including reasonable predictions regarding future environmental changes.

- Federal, state and local lawmakers should remove legacy language that requires specific technology and instead adopt broader language articulating performance goals.

3) Eliminate or Sharply Reduce Street Parking in Congested Areas

The evolution of language for automobiles has given rise to false and inaccurate terminology. The classic example is the term freeway. Freeways are not free, but require maintenance and investment, just like toll roads. Another mistake is the term 'free parking'. Even if the user of free parking does not have to pay, the use of the space has substantial costs. A wiser approach to infrastructure would drastically increase the cost of urban street parking, potentially pricing it out of use, or eliminating it all together.

Street parking in urban areas can cost more than the average vehicle occupying the space. The full cost of a street parking spot in Los Angeles, including construction and land costs, is over $31,000.[20] Local officials routinely give this parking spot away for free for hours or days at a time, yet the same local officials do not let people borrow cars that cost less than the parking spot for free.

The full cost of on-street parking spots is higher in denser urban areas, where increased traffic congestion results from use of the spot. Consider the common experience of driving through a four-lane road in which two lanes on each side are set aside for street parking. Lane capacity could be doubled if that parking was eliminated. Traffic congestion could be reduced even further given that the addition of a second lane provides some relief for left turns or other actions that reduce traffic flow. Additional capacity may induce more demand, which would reduce congestion benefits that should be incorporated into any estimates.

‘Rush hour’ parking restrictions often remain tied to antiquated hours of perceived rush.

Urban planners appreciate the value of the additional capacity as they often restrict parking during rush hour to promote usage. However, urban congestion continues to increase while the traditional rush hour times stay constant. In many urban areas, congestion levels only seen during rush hour a generation ago are the norm today. The hours of congestion in the Portland area increased 13.6 percent[21] from 2013 to 2015. Time travel reliability decreased significantly due to rush hour traffic lasting for six hours or more on key roads in Portland. As the Department of Transportation found: “Traffic congestion in the Portland region can now occur at any hour of the day, including holidays and weekends. It is no longer only a weekday peak hour problem.” This is the case in many cities throughout the country, yet ‘rush hour’ parking restrictions often remain tied to antiquated hours of perceived rush.

There may be better uses for the suboptimally used ‘free’ or low-cost parking than just additional lane capacity. The city of Seattle is exploring the idea of a ‘flex zone’[22] for the area that is adjacent to the sidewalk. Uses of this space include boarding public transit, private ride sharing, dedicated bike lanes, commercial vehicle loading zones, and more. Regardless of the ultimate best use, the current system of radically underpricing this important resource should be ended.

A wiser approach to the use of parking spaces would incorporate the insights from the Coase Theorem, a Nobel prize winning tenant of land-use economics, put forward by University of Chicago professor Ronald Coase in 1960. In his paper, The Problem of Social Cost[23], Coase writes: “The cost of exercising a right (of using a factor of production) is always the loss which is suffered elsewhere in consequence of the exercise of that right –

the inability to cross land, to park a car, to build a house, to enjoy a view, to have peace and quiet or to breathe clean air." Even in 1960, Coase was highlighting that parking a car has economic consequences.

Consider the Coasean thought experiment on what those costs are, calculating one metric in one circumstance: the additional time lost due to parking on a busy street once a rush hour time restriction is lifted (imagine 6:30pm). That parked car requires an entire lane to merge. If this results in 1,000 passengers each losing 20 seconds that totals to just over 5 hours and a half hours of lost time. To quantify that, consider the average wage of users of that road. The average hourly wage for non-supervisory workers in the U.S. is just over $22.50[24], however, that figure is likely to be higher in congested urban areas. Traffic will also likely include some supervisory workers and other higher paid individuals. To be conservative, assume an average wage or value of time at $25 an hour. The cumulative value of the time lost due to that single parked car is over $135. If the person parking was forced to pay for the full cost of the externality caused by their decision, would they? There are not many examples of people paying $135 to park.

Professor Donald Shoup delved into this topic in detail in his book 'The High Cost of Free Parking[25]. He begins with the observation that traffic delays caused by curbside parking occur even before the car is parked: "A driver who intends to park at the curb starts decelerating before reaching the vacant space, and this starts a chain reaction. The vehicles following the decelerating vehicle also decelerate to maintain a safe headway distance from the preceding vehicle. Slight changes in the flow are propagated through the traffic flow as "shock waves" that quickly reduce speeds. Similar disturbances occur when a parked vehicle leaves the curb and enters the traffic flow. " Significantly, he finds that: "A 10 percent increase in the number of parked cars reduces the speed of traffic by 1 percent."

Further proof of the value of free street parking comes from the experience of MonkeyParking, an app created to allow people to sell their street parking to others. Created in 2014, the app started to go viral in San Francisco, a city know for parking difficulties. Touted as part[26] of the new 'sharing economy', MonkeyParking was quickly sued[27] by the City's District Attorney and forced to shut down. A similar experienced

occurred in Santa Monica where the city's parking administrator stated[28] that the app was "No different from a street bum [who] stands on a space, waves someone in and asks for a tip." However, the fact that people were willing to pay each other for what was provided as 'free' is proof that there is substantial value being given away.

The quick legal action by city officials highlights another angle to street based parking: city revenue. Parking meters are often deployed, but can charge rates far below comparable private market parking. One study in Boston[29] found that parking rates charged by street meters were roughly **$10 per hour less** than the comparable cost of a garage. One result is that it becomes rational for people to spend time hunting for street parking, particularly those who are likely to park for longer periods of time. Some estimates are as high as one-third of traffic generated in downtown urban areas is from drivers looking for parking spaces[29].

Down the road, self driving cars could eliminate much of the need for on-street parking. One can easily imagine being dropped off at your desired location, sending your car to a holding lot and wait to retrieve you. In the absence of a low cost waiting zone, it would be unfortunate if self driving cars wandered around the block for hours waiting to pick passengers back up.

Cities and local governments should take the following actions to more wisely use existing infrastructure:

- Further restrict and potentially eliminate on-street parking in congested areas. City officials should work more closely and in a more publicly transparent manner with existing traffic data, including new data produced by Google and Waze to determine streets that are congested during times where parking is allowed and should eliminate such parking.

- Extend no-parking times during rush hours to more adequately match traffic flows. Traffic restrictions should match observed traffic.

- Increase on-street parking costs to more closely match observed private costs. There are reasons why the two may not be completely equal, but differences on the order of

over $1 to 2 an hour can be hard to explain.

Cities may be reluctant to eliminate parking spaces with meters for fear of revenue loss. This can be real money. For example, San Francisco earned approximately $50 million a year[30] in parking meter revenue (and more including fines). However, the recommendations if done collectively could be done in a revenue neutral manner for the municipality through the combination of eliminating some spots, while increasing costs in other. Residents and drivers will benefit from reduced congestion, whether it is captured on municipal budgets or not.

The U.S. Department of Transportation could create a pilot study, offering a city federal funds to compensate for reduced parking revenue, while also measuring changes in traffic congestion and improvements in reduced vehicle travel time, wasted gas, and reduced pollution. Quantifying those savings, potentially in a pay for success program—in which the DoT pays localities that reduce congestion through eliminating unwise street parking—is a promising path to take.

Similar to the new pay for success program launched by the U.S. Treasury for localities to create projects that result in measurable "positive social outcomes and federal savings[31]," the DoT could create their own pay for success program where it pays localities that reduce congestion by eliminating unwise street parking.

4) Dig Once

The provision of infrastructure is bifurcated by type or mode. Bifurcation exists at all levels of government, often the result of the origins and historical norms prevalent when that infrastructure was first adopted. The federal government created a Department of Transportation in the 1960s in part to centralize the bifurcated modal programs that were operating throughout the government. The federal process of integration remains incomplete. There is no Department of Infrastructure; water infrastructure programs exist in the Army Corps of Engineers, the Environmental Protection Agency, and other agencies.

Modal bifurcation without coordination inevitably leads to inefficiency. An example is when road repairs are made according to a highway schedule, without regard to the scheduled work of the water agency. If the road is repaved in the spring only to have the water company dig it up in the summer for scheduled pipe work, then the highway department's work has been wasted. The inefficiency of digging twice could have been eliminated had the schedule of work been coordinated. As Under Secretary for Transportation Derek Kan stated[32]:

"If a state decides to tear up a road to lay broadband and then they separately, another agency, wants to tear up a road to lay new transmission or duct and trench work for a transmission line, well, if they're digging up the same road at a pretty similar time in the same construction season, I have an idea. Why don't we dig once? That's a second example of just basic things that the federal government really hasn't driven and encouraged states to do."

In an ideal world, the promise of efficiency alone would be enough to incentivize bifurcated local officials to better coordinate. However, the costs involved with synchronizing schedules, deferring to other agencies, and difficulty in negotiating how to split the savings from combined efforts may be substantial. Additional benefits of avoiding negative externalities from traffic congestion generated by duplicative work will not be directly accounted for by the agencies making these decisions.

To overcome these problems policy makers have an important role to play.

- A federal pilot program could be created to provide two avenues of relief for infrastructure providers who work together to only dig once. First, joint permitting should be provided to reduce costs for each agency to achieve the necessary federal and state permits for the work. Second, funding should be enhanced. As Klein-Krueger-Altman[10] proposed: "To the extent that federal grants or funds are used for such a project, at a minimum, there should be no penalty for the dual use of those funds, while there should be a creative exploration of methods to provide additional funding for coordinated work that reduces costs." This pilot program would build on a 2012 Executive Order that encouraged closer coordination for broadband deployment

with the Federal Highway Administration (FHWA) reviewing its Dig Once policy[33]. It would expanded beyond broadband to include municipal water systems and other joint infrastructure.

- State, local, and regional officials should bring together infrastructure providers to promote coordination in maintenance and building efforts. This can take the form of a conference dedicated to this issue, executive review of multiple agency budgets, or hearings before legislative bodies.

- States and localities can adopt formal 'Dig Once' policies. The Federal Government has found that[34] "there are very few states that have implemented a statewide *Dig Once* policy" but that that city of Boston which did adopt such a policy in 1994 it has "worked well" and "minimize[d] street excavation and expedite[d] the broadband deployment process."[34]

- Federal and state officials should consider creating Departments of Infrastructure that merge transportation and water programs. On a federal level, the Administration recently took a step in that direction proposing[35] to bring the Army Corp of Engineers into the Department of Transportation. This element of their proposal should be adopted and potentially broadened to include other federal infrastructure programs to eventually create a Department of Infrastructure.

Conclusion

Wiser infrastructure investment can reduce costs, increase efficiency, better utilize scarce resources, and increase public trust. Opportunities to make wiser choices abound at the federal, state, and local level. Policy makers at each level have options ranging from enhancing coordination to significantly altering existing resources such as street parking. Federal officials can mandate new approaches, eliminate mistaken ones, or provide small incentives for jurisdictions to experiment. Each of these roads would lead to wiser choices.

Report Produced by **Center on Regulation and Markets**

Footnotes

1. 1 Mattei, Norma Jean. U.S. Infrastructure Report Card 2017. Report. American Society of Civil Engineers. October 2017. https://www.infrastructurereportcard.org/ wp-content/uploads/2017/10/Full-2017-Report-Card-FINAL.pdf.
2. 2 Danby, Nick. "Drip Drop: America's Crumbling Water Infrastructure." Harvard Political Review The Evolution of Rap Comments. Accessed July 20, 2018. http://harvardpolitics.com/united-states/drip-drop-americas-crumbling-water-infrastructure/.
3. 3 Cavaretta, Amy. "Lessons Learned from TIGER Discretionary Grant Program." The Eno Center for Transportation, April 2013. https://www.enotrans.org/wp-content/uploads/2015/08/TIGER-paper.pdf?x43122.
4. 4 Howell, William G. "Results of President Obama's Race to the Top Win or Lose, States Enacted Education Reforms." *Education Next* Vol.15, no. 4 (Fall 2015). http://educationnext.org/results-president-obama-race-to-the-top-reform/.
5. 5 Siggerud, Katherine. *Many Federal Programs Fund Transportation Services, but Obstacles to Coordination Persist*. Report. United States General Accounting Office. May 1, 2003. https://www.gao.gov/new.items/d03698t.pdf.
6. 6 "2015 Conditions and Performance - Policy | Federal Highway Administration." U.S. Department of Transportation/Federal Highway Administration. Accessed June 28, 2018. https://www.fhwa.dot.gov/policy/2015cpr/.
7. 7 "Rebuilding America's Infrastructure: An American Budget." Whitehouse.gov. February 14, 2018. https://www.whitehouse.gov/wp-content/uploads/2018/02/FY19-Budget-Fact-Sheet_Infrastructure-Initiative.pdf.
8. 8 "A Blueprint to Rebuild America's Infrastructure Creating Over 15 Million New Jobs." Senate Democrats. https://www.democrats.senate.gov/files/documents/ABlueprinttoRebuildAmericasInfrastructure.pdf.
9. 9 Niquette, Mark, John McCormick, and Hannah Recht. "States Aren't Waiting for Trump to Seek Funds for Infrastructure." Bloomberg.com. March 09, 2017. Accessed June 28, 2018. https://www.bloomberg.com/graphics/2017-states-raise-gas-taxes/.
10. 10 "Wolf Announces New State Investments in Rail Projects." Governor Tom Wolf. May 05, 2017. Accessed June 28, 2018. https://www.governor.pa.gov/governor-wolf-announces-new-state-investments-in-rail-projects-supporting-375-jobs/.
11. 11 Altman, Roger C., Aaron Klein, and Alan B. Krueger. *Financing US Transportation Infrastructure in the 21st Century*. No. DISCUSSION PAPER 2015-04. Brookings Institution, 2015.
12. 12 "SAFETEA Summary Information." U.S. Department of Transportation/Federal Highway Administration. Accessed June 28, 2018. https://www.fhwa.dot.gov/safetealu/summary.htm.
13. 13 "A Summary of Highway Provisions - MAP-21 - Moving Ahead for Progress in the 21st Century | Federal Highway Administration." U.S. Department of Transportation/Federal Highway Administration. Accessed June 28, 2018. https://www.fhwa.dot.gov/map21/summaryinfo.cfm.
14. 14 "Fixing America's Surface Transportation Act or "FAST Act" A Summary of Highway Provisions." U.S. Department of Transportation/Federal Highway Administration. Accessed June 28, 2018. https://www.fhwa.dot.gov/fastact/summary.cfm.
15. 15 United States. Department of Agriculture. Rural Utilities Service. *PART 1780—WATER AND WASTE LOANS AND GRANTS*.
16. 16 Sepp, Pete. "Protect Taxpayers on State and Local Infrastructure Projects." National Taxpayers Union - Who Pays Income Taxes? February 06, 2017. Accessed July 03, 2018. https://www.ntu.org/publications/detail/protect-taxpayers-on-state-and-local-infrastructure-projects.
17. 17 Anderson, Richard F. *Procurement Process Improvements Yield Cost-Effective Public Benefits*. Report. Municipal Procurement, The United States Conference of Mayors. Washington D.C., 2013.
18. 18 Cohen, Bonner R. "Fixing America's crumbling underground water infrastructure." *Competitive Enterprise Institute* (2012): 6.
19. 19 Municipal Infrastructure Savings and Transparency Act, H.R. H.R.5310, 115 Cong. (2018).
20. 20 Cowen, Tyler. "Why Free Parking Comes at a Price." The New York Times. August 14, 2010. Accessed June 28, 2018. https://www.nytimes.com/2010/08/15/business/economy/15view.html

21. 21 Windsheimer, Rian, Kelly Brooks, Mandy Putney, Tim Wilson, and Chi Mai. *Portland Region 2016 Traffic Performance Report*. Report. Oregon Department of Transportation, Oregon.gov.
22. 22 Shepard, Meghan. "Flex Zone/Curb Use Priorities in Seattle." Seattle.gov. https://www.seattle.gov/transportation/projects-and-programs/programs/parking-program/parking-regulations/flex-zone/curb-use-priorities-in-seattle.
23. 23 Coase, R. H. "The Problem of Social Cost." *The Journal of Law & Economics* 3 (1960): 1-44. http://www.jstor.org/stable/724810
24. 24 "Real Earnings News Release." U.S. Bureau of Labor Statistics. June 12, 2018. Accessed June 29, 2018. https://www.bls.gov/news.release/realer.htm.
25. 25 Shoup, Donald. *The High Cost of Free Parking: Updated Edition*. Routledge, 2017.
26. 26 McMillan, Robert. "An App That Lets You Sell Your Killer Free Parking Spot." Wired. June 03, 2017. Accessed June 28, 2018. https://www.wired.com/2014/05/monkeyparking/.
27. 27 Maddaus, Gene. "Kicked Out of San Francisco, MonkeyParking App Plans a Fresh Start in Santa Monica." L.A. Weekly. April 02, 2016. Accessed June 28, 2018. http://www.laweekly.com/news/kicked-out-of-san-francisco-monkeyparking-app-plans-a-fresh-start-in-santa-monica-5080436.
28. 28 "Monkey Parking App's CEO Refuses To Halt Operations In SF, Despite Order From City Attorney's Office." CBS San Francisco. June 26, 2014. Accessed June 29, 2018. https://sanfrancisco.cbslocal.com/2014/06/26/monkey-parking-apps-ceo-refuses-to-halt-operations-in-sf-despite-order-from-city-attorneys-office/.
29. 29 Doyle, Patrick. "Why Parking in Boston Should Be More Expensive." Boston Magazine. February 07, 2016. Accessed June 28, 2018. https://www.bostonmagazine.com/2012/10/30/the-take-parking-in-boston/.
30. 30 "San Francisco Parking Meters: A $130MM Industry." Priceonomics. Accessed June 28, 2018. https://priceonomics.com/san-francisco-parking-meters-a-s130mm-industry/.
31. 31 "42 U.S. Code § 1397n-1 - Social Impact Partnership Application." LII / Legal Information Institute. Accessed June 28, 2018. https://www.law.cornell.edu/uscode/text/42/1397n-1#.
32. 32 Kan, Derek. "Trump's New Infrastructure Initiative." Speech, Washington, DC, March 16, 2018. The Brookings Institution. https://www.brookings.edu/wp-content/uploads/2018/03/es_20180316_better_infrastructure_transcript.pdf
33. 33 "Executive Order on Accelerating Broadband Infrastructure Deployment." U.S. Department of Transportation/Federal Highway Administration. Accessed July 20, 2018. https://www.fhwa.dot.gov/policy/otps/exeorder.cfm.
34. 34 "Executive Order: Accelerating Broadband Infrastructure Deployment." Policy Brief - Minimizing Excavation Through Coordination. October 2013. https://www.fhwa.dot.gov/policy/otps/policy_brief_dig_once.pdf.
35. 35 "Delivering Government Solutions in the 21st Century Reform Plan and Reorganization Recommendations." Politico. https://www.politico.com/f/?id=00000164-2324-dbdc-a96d-373e4e2a0000.