White Papers for Right-Sizing Transportation Investments

Chandler Duncan
Michael Brown
Metro Analytics
Bountiful, UT

Naomi Stein
Economic Development Research Group
Pittsburgh, PA

David Rowe
Daniel Rotert
Burns & McDonnell
Kansas City, MO

Michael David Hurst
Vanasse Hangen Brustlin, Inc.
Tysons, VA

Tim Lomax
Texas A&M Transportation Institute
College Station, TX

Peter Hylton
High Street Consulting
Columbia, SC

Hugh McGee
Hugh McGee, LLC
Tysons Corner, VA

Anne Morris
Anne Morris, LLC
Columbia, SC

Contractor’s Technical Appendix for NCHRP Project 19-14
Submitted February 2019
# NCHRP

## Web-Only Document 263:

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Anthony P. Avery, Senior Program Assistant
Eileen P. Delaney, Director of Publications
Natalie Barnes, Associate Director of Publications
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Kathleen Mion, Senior Editorial Assistant

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Field of Administration—Finance

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Matthew K. Brady, California DOT, Eureka, CA
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Benjamin Hawkinson, FHWA Liaison
William B. Anderson, TRB Liaison
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White Papers for Right-Sizing Transportation Investments

1 Introduction to Research Assessment White Papers

This technical appendix includes three white papers developed as part of NCHRP Project 19-14, “Right-Sizing Transportation Investments.” The white papers were developed through the use document research, interviews with practitioners, and case examples to address key topics of relevance to right-sizing through an assessment of the current state of practice and research. The three white papers address:

1. The role of jurisdictional transfer in right-sizing.
2. Approaches to right-sizing through establishment of performance targets and consideration of performance trade-offs.
3. Right-sizing through project (and network) design.

While the research from these white papers has in some cases resulted in similar content in the final project guidance document, the white papers in their entirety can serve as an additional resource for readers interested in more in-depth findings and context not incorporated into the guidebook. The following sections of this chapter summarize takeaways from each of the white papers that are attached in full as subsequent chapters. Note that while there is some duplication of content, this chapter is intended to provide an overview of the more detailed content subsequently presented.

1.1. Findings Related to Jurisdictional Responsibility and Ownership

While not all right-sizing projects involve a change in jurisdictional responsibility and ownership, jurisdictional transfer can be a key tool for implementing right-sizing plans and agreements. Moreover, the inability to reach agreement about jurisdictional transfer, or appropriate practices to follow for transfers within the context of different right-sizing agreements can be an impediment to effectively right-sizing transportation investments. For these reasons, explicit treatment of state policies governing jurisdictional transfers is warranted. Insights from the application of state jurisdictional transfer policies to right-sizing scenarios can be organized into the following areas:

(1) Representing the potential need for jurisdictional transfer;
(2) Identifying and analyzing the transfer options;
(3) Implementation, including negotiations and costs to transfer; and
(4) Lessons learned and conclusions for right-sizing.
Understanding the above from practical examples of the current state of the practice is instructive for developing a roadmap of how agencies can and should approach the role of jurisdictional transfers within right-sizing scenarios. It is important to learn from both the successes and unresolved challenges of jurisdictional transfer policies to date from recognition of need, through evaluation and implementation.

### Three Instructive Examples

Three jurisdictional transfer policies are featured to highlight the opportunities, processes, and challenges of including a jurisdictional transfer in a transportation right-sizing solution. Each example demonstrates some aspects of lessons learned (how the process can be improved) as well as success factors (approaches known to work). These examples include:

- Caltrans: Jurisdictional Relinquishment as Right-Sizing
- MnDOT: Jurisdictional Realignment as a Means of Right-Sizing
- ADOT: Jurisdictional Transfer and Low-volume Roads

**Caltrans: Jurisdictional Relinquishment as Right-Sizing**

California’s State Highway System (SHS) is defined by Section 300 of the California Streets and Highways Code. In practice, Caltrans interprets the mission of the SHS as being oriented toward serving interregional travel and providing for longer-distance connections of statewide importance, rather than local-serving travel. Over time, however, the original purpose of certain parts of the SHS has evolved to be out of alignment with this overall statewide objective. Caltrans is aware of locations where road segments on the SHS are serving more as local arterials or main streets than as intercity highways. Addressing this mismatch, Caltrans has a series of processes in place to achieve relinquishment of portions of the SHS to applicable local governments. There are four formal types of relinquishments:

1. Legislative enactment (locality requests transfer through CALTRANS)
2. Superseded by relocation (state facility has new alignment; hence old facility is transferred)
3. Collateral facilities (state relinquishes a frontage/backage or supporting roadway)
4. Nonmotorized Transportation Facilities (bicycle, pedestrian, or equestrian facilities)

While jurisdictional transfers can always appear as right-sizing from the state’s point of view (matching the statewide resources to statewide needs), in many cases California’s relinquishment policy also supports local jurisdictions in fully embracing a local purpose by greatly streamlining the approvals and state design codes associated with complete streets, bike lanes or even in some cases restaurant seating in street right-of-way. The need for jurisdictional transfer may also occur when state ownership becomes an impediment to land development. For example, developers may face a dual permitting process with both local governments and the state when building new sidewalks or driveways that encroach onto a state highway segment. In these cases, the mismatch might be best addressed by changing the ownership status of the roads. There are also specific regulatory situations in which local ownership enables particular types of changes to the nature of infrastructure that would not be possible under state
ownerships. These include situations such as a park-and-rides adjacent to mixed-use development where regulations that apply to state facilities restrict how revenues can be raised and locals want more flexibility for development, as well as other situations that involve the generation of revenue on parts of the SHS.

In addition to an ongoing process of locally initiated transfers, in 2012, Caltrans undertook an overall program review effort aimed at being more strategic about how agency resources are used. One outcome of the review was a recommendation that the Caltrans develop a strategy to accomplish the relinquishment of designated routes no longer required as part of the State Highway System that remain Caltrans responsibility. Caltrans is saddled with many road segments that were once intercity trunk routes but that now serve as local arterials. These “stroads” – street-road hybrids – are problematic, because Caltrans frequently imposes auto-centric standards, e.g., by restricting curb bump outs or refuge islands that would improve pedestrian safety in an urban environment. They also require Caltrans resources for maintenance and rebuilding, even though they serve mostly local travelers. Caltrans is already categorizing such facilities to identify streets (some of which never leave city limits) that are good candidates for transfer.

Caltrans’ interest in relinquishment is two-fold: First, the agency is interested in reducing lifecycle cost responsibilities which would enable a shift of resources toward actions that are more in line with the DOT mission of serving interregional and statewide travel needs. Second, Caltrans wishes to facilitate, where appropriate, the better meeting of local needs and preferences in terms of the design and function of a road and its compatibility with the surrounding development context. This latter objective has increased in importance over time as Caltrans engages in a more focused manner in complete streets initiatives and associated goals of sustainability and livability, as well as in consideration of land-use transportation interactions. However, there is some anticipation at Caltrans that as the agency becomes more flexible in addressing complete streets type improvements, this may in fact reduce the local incentive for jurisdictional transfers, even when roads are more local serving.

When assessing requests for jurisdictional transfer, Caltrans considers factors such as:

- The history of the facility, including consideration of whether context-sensitive solutions would be supported by the transfer,
- Trends and forecasts in car and truck traffic volumes,
- Origin-destination patterns,
- Truck traffic,
- Destinations and trip purposes served,
- Local development plans or trends, and
- Costs associated with making the relinquishment operable when turned over (usually in the form of funding for the assuming entity or in the form of an in-kind project by the state prior to transfer).
The negotiation process for transfers centers on negotiation regarding the cost of relinquishments (and assumption of costs), with formal and legally binding Cooperative Agreements codifying the transfer agreement.

The Caltrans example shows how jurisdictional relinquishment is and can be a means of achieving a more right-sized transportation system, not only from the perspective of reducing a state’s lifecycle cost burden, but also – and more importantly – by enabling a better matching between local preferences and development contexts and infrastructure design and operations. The case is particularly instructive in pointing out how the frequency and extent of developers or municipalities challenging state design guidelines can be an indicator of a right-sizing situation that may involve a jurisdictional transfer. Furthermore, California’s proactive development of policies and opportunities for jurisdictional transfer demonstrates that jurisdictional transfer is increasingly understood as a matter of statewide investment strategy, and not simply a case-by-case occurrence.

**MnDOT: Jurisdictional Realignment as a Means of Right-Sizing**

Starting around 2011, The Minnesota Department of Transportation (MnDOT) embarked upon a jurisdictional realignment project the purpose of which was to “ensure that Minnesota roads are owned and operated at the right jurisdictional level.” Prior evaluations completed in the 1980s and 1990s began to describe the issue at a system level and define objectives for realignment but never achieved adequate closure in terms of a defining an actionable program that could then be incorporated into MnDOT’s work going forward. The most recent effort sought to close this gap by from a holistic perspective (a) defining the goals of realignment, and (b) determining what it would take (in terms of process as well as funding) to achieve this objective.

In effect, MnDOT’s effort views jurisdictional realignment as a means toward right-sizing in the sense that it brings agencies together to determine what best fits a specific context, and what best serves the public. The DOT outlines a series of indicators for misaligned roads including:

- Misaligned roads may not provide appropriate level of service for users in terms of both capacity and customer expectations such as safety, ride quality, and maintenance.
- Misaligned roads may use the wrong source of funding, which may not contain required funds for improvements. This may result in a lower service level than if the road was properly aligned/owned by the appropriate jurisdiction.
- Misaligned roads may lead to an “impaired” network of roads due to differing jurisdiction priorities (that is, the road conditions may change significantly while traveling and may not meet traveler’s expectations).
- Misaligned roads may not receive the priority for funding or improvements, and as a result, misaligned roads that are widely used may be underserved while others may be over-served.

Local government interest in acquiring a piece of state trunk highway stems from operational, design, and priority-related considerations. From an operational standpoint, local agencies can respond more quickly to maintenance needs (e.g., at a signal), whereas the state maintenance force may be an hour or two away. Aligning maintenance activity with a local agency provides a better level of service. If ownership is fragmented, MnDOT and localities may have different approaches to programming maintenance (such as seal coats) that can lead to inconsistencies across a route with respect to the ride quality experienced by the public. Ownership also has
direct implications for prioritization. For a facility that might not reach the top of a list when competing at the state level, local ownership can enable a higher priority. Finally, when it comes to design, urban and suburban governments (less so rural governments) see value in local decision making for things like access control, rather than being subject to a statewide standard. Local control offers local governments the flexibility to provide a level of service that is more uniform across the network in their jurisdiction. This is also important because from a user/customer perspective, complaints tend to be directed to the most local jurisdiction as drivers cannot “see” ownership.

Although some local agencies are willing to take on ownership of roads “as is,” there is typically a cost to implement a jurisdictional realignment. Funding for these types of improvements can occur through: (1) a specific allocation for jurisdictional transfers in the Highway User Tax Distribution Fund (the “Flexible Highway Account), (2) MnSHIP 2017, MnDOT’s 20-year fiscally constrained capital investment plan, which for the first time defined an investment category for trunk highway investment in jurisdictional transfers, (3) MnDOT’s “Investment Opportunity Plan,” which enables opportunistic funding if/when MnDOT releases funding contingencies out of programs/projects at the end of a funding cycle, or (4) in some cases simply by MnDOT transferring funds previously programmed for a project on the facility to the assuming jurisdiction.

*Overall, the MnDOT Jurisdictional Realignment Project demonstrates clearly how criteria can be established for jurisdictional transfers with specific objectives of enabling the right-sizing of facilities. The MnDOT example also demonstrates the importance of available streams of money to support jurisdictional transfers for such changes to be an integral part of the agency’s overall investment strategy. Those interested in assessing which level of government is best equipped and motivated to support the needs of a facility can benefit from Minnesota’s example. Finally, MnDOT’s practice of beginning the transfer discussion with functional requirements and objectives for the infrastructure, addressing funding only after the objectives of a transfer have been determined, is a promising element of strategy for other states.*

**ADOT: Jurisdictional Transfer and Low-volume Roads**

In 2017, the Arizona Department of Transportation (ADOT) published its first comprehensive planning study of low-volume roads. As defined by the agency, low-volume roads (LVR) include all roads on the state system that carry less than 400 AADT. As of 2017, there were 457 centerline miles of LVR on the Arizona state system (<10% of the total system mileage). The study addresses two potential avenues to more efficient operations from the perspective of the state: (a) potential for transfer of a route to another agency, and (b) other options for reducing ongoing costs for those LVR that do remain on the state system.
It is the policy of Board that the State Highway System consist primarily of routes necessary to provide a statewide network to serve the ever-changing environment with regard to the interstate, statewide and regional movement of people and freight.

In recognition that population and employment growth in Arizona and adjacent states will, over time, create demands for new transportation facilities and later the function of some existing transportation facilities, ADOT will develop and maintain a process for transferring certain state highways to local and tribal jurisdictions and conversely, transferring certain non-state highways to the State Highway System. Routes primarily providing land access and local movement of people and goods should be the responsibility of local governments.

The transfer of state highways will be carried out in accordance with the applicable transfer statutes A.R.S. §28-7046 and §28-7209.

Source: Arizona State Transportation Board Policies. 2015.

Arizona benefits from a formal jurisdictional transfer policy (shown above) that recognizes the relationship between network evolution and the need for an ongoing process of route transfers. In addition to the formal policy, ADOT's Route Transfer Handbook lists specific reasons that transfers might be needed, addressing situations ranging from a shift of trip purposes to serving local needs, to changes in route utilization, and other factors.

Arizona has a step-by-step process for both possible directions of route transfer (upwards and downwards). The policy encourages official Memoranda of Understanding between state and local parties to set the stage for subsequent steps. The MOU defines the limits of the segment in question, justification for the transfer, an anticipated timeline, and roles and responsibilities – including data collection and analysis – for the remainder of the process. In the process, Arizona’s route transfer handbook presents significant discussion of issues likely to come up in a transfer negotiation process such as rights of ownership, access control, permits, federal interest, federal-aid funds, conditions and maintenance, design standards, etc.

An interesting feature of the Arizona policy is the suggested benefit-cost analysis (from the perspective of both parties) of any elements that can be quantified within a timeframe such as 20 years. Suggests elements for consideration include:

- Right-of-way value
- Improvements / equipment value
- Access control value
- Revenue streams and anticipated grants
- Required capital investments
- Required maintenance and operating costs
- Law enforcement and liability costs

In an ideal transfer, the benefits to each party to the transfer would be greater than their respective costs.
ADOT’s handbook has many elements that can provide significant value in guidance for jurisdictional transfers in right-sizing situations. The checklists in ADOT’s manual offer a balance of flexibility and consistency in the structure of the transfer process which is very conducive to efficiently considering whether and how transfers may fit into a right-sizing scenario. Inclusion of factors related to land use and transportation relationships recognizes that there can be significant economic development benefits to a jurisdictional transfer. Furthermore, ADOT’s evaluation of low-volume roads for transfer potential as a potential source of cost savings is instructive as several states in the initial round of interviews raised the issue of lifecycle costs for low-volume roads as a right-sizing need. Additionally, the fact that the policy for jurisdictional transfer is codified at the level of the State Transportation Board is instructive regarding the potential role of executive bodies in establishing policies supportive of right-sizing. Finally, ADOT’s guidance on financial considerations for negotiation outlines a more complete set of factors than just a transfer of operating and maintenance burdens between agencies. This broader view of potential benefits and costs is important to the question of right-sizing and whether and how to determine if all parties emerge from a transfer with net positive outcomes.

1.2. Findings Related to Program-Level Performance Targets and Trade-Offs

One major area of right-sizing in transportation departments pertains to the issue of re-allocating resources from one program or performance area to another. The idea of right-sizing the distribution of revenue between facilities has been a focus of many statewide plans and is generally understood as a fundamental objective of many asset management systems. However, there is no consensus among states on how to justify the right-sizing of programs nor how to account for the potential implications of changing standards of condition and performance to arrive at a more efficient investment strategy.

Right-Sizing as an Investment Option: Conventional transportation program investment alternatives are typically categorized as either maintenance, repair/replacement, or expansion (meaning new roads or capacity increase). By contrast, right-sizing investment options, or alternatives, can incorporate a series of additional decision types, including deferment/do nothing, modify the design standard or performance target, decommission or eliminate the asset, reclassify the asset to change the applicable standards/targets, or change jurisdictions. Understanding when and how to invoke these options with respect to existing asset classes is a critical element of a right-sizing strategy. In addition, there remain challenges in the use of traditional “tools of the trade” such as pavement and bridge management systems in considering right-sizing options. At present, these tools do not incorporate such options into decision-tree frameworks, thus requiring an engineer to first identify the opportunity then analyzing it with the help of these systems.

Goal-oriented Strategic Investment or Disinvestment: Traditionally, agencies have often considered only investment when considering resource allocation, prioritizing facilities, and programs based on which investment appears to have the best payoff. However, this approach simply ignores those facilities or asset classes that never rise to the level of warranting such investment and how such “passive” or “unintentional” disinvestment may undermine the goals of investment. A right-sizing strategy improves on this paradigm, by enabling an agency to assess
both where (and to what degree) both investment and disinvestment are either tolerable or efficient. A right-sizing oriented strategic investment/disinvestment approach generally involves:

1. Clearly prioritizing transportation goals and objectives,
2. Identifying the projects and/or assets that are most important with respect to obtaining various goals as well as projects and/or assets that are the least important or least critical in obtaining those goals, and
3. Consciously defunding or reducing funding allocated to lower priority transportation assets and ideally reinvesting those savings into higher-priority assets.

### Three Instructive Examples

The experience of three states is instructive for how right-sizing approaches to statewide performance standards and programmatic investment strategies can contribute to overall decision making. These states include:

- Utah Department of Transportation (UDOT)
- Minnesota Department of Transportation (MnDOT)
- Vermont Transportation Agency (VTRANS)

**Utah Department of Transportation (UDOT): Temporary Disinvestment Due to Funding**

In Utah, prior to securing additional funding from Utah HB 362 Transportation Infrastructure Funding, the DOT lacked adequate revenues to properly fund the state system. Utah DOT (UDOT) therefore created Management Levels (Interstates, Level 1, Level 2) for prioritizing pavement investments in acknowledgment that current funding levels were not adequate to maintain the entire system. In response to funding constraints, UDOT made a conscious decision to temporarily de-fund the Level 2 roadways while meeting the needs of the interstate and Level 1 pavement. Level 2 roadways (approximately 1,875 miles or 32% of the total system) are defined by UDOT as having AADT less than 1,000 and truck volume less than 200.

Managers arrived at this decision by comparing the benefits and costs for several alternative programs and identifying the use of existing resources that would have the greatest benefit-cost ratio. Allowing Level 2 roads to temporarily deteriorate without preservation or maintenance activities allowed the DOT to focus on higher traffic roadways. Asset management data (through pavement management system analysis) reveal that conditions for interstate and Level 1 roadways have steadily improved over time while Level 2 conditions trend slightly downward. After the assessment of the additional funding from HB 362 in 2015, UDOT has worked to improve and adjust funding thresholds for Level 1 and Level 2 roadways accordingly – to properly fund the Level 2 roads again – allowing UDOT to subscribe to its asset management philosophy of “Good roads cost less.” Logically, the impact on performance measures (pavement condition in IRI of good/fair/poor) for Level 2 roads was negative during this period but justified because it enabled UDOT to maintain the overall condition for the other pavement categories. While this case does demonstrate trade-offs made by a DOT to reallocate funds from a lower priority to a higher-priority set of roads, it is nevertheless a temporary action that does not reflect a long-term determination of altered needs.
The Utah case is instructive as it demonstrates how a state can intentionally right-size its investment portfolio using time as a critical dimension of the equation. Instead of simply prioritizing facilities and letting low BCA projects go unfunded, Utah deliberately considered specific classes of roadway based on performance needs and characteristics, anticipating and preparing for the implications of this defunding in the near term. The Utah case suggests that states can benefit from right-sizing guidance pertaining to short-term versus long-term changes in needs and funding, as well as how considering funding and performance levels for asset classes can provide more leverage in investment decisions than simply prioritizing individual projects.

Minnesota: Right-Sizing Through Condition Targets

Much like Utah, Minnesota DOT made a conscious decision to respond to a revenue shortfall by disinvesting in certain parts of the state highway system to reinvest in the National Highway System (NHS) based on the need to match federal funds. However, in contrast to the Utah example where right-sizing was achieved through reclassification of facilities and reallocation of funds, MnDOT formally lowered the minimum pavement condition of non-NHS class of roads. The conversation began through a trade-off analysis to quantify the differences and options across state categories and assets. Analysis included the DOT management system and an iterative trade-off process following discussions between state planners and engineers. Once the non-NHS class was selected for the disinvestment, minimum pavement condition targets were incrementally increased to coincide with the lowered funding level. In this way, performance targets responded to an understanding of funding availability. In Minnesota, the ability to identify and communicate the outcomes of this type of right-sizing decision is closely tied to the use of performance measures. The measure for percentage of poor ride quality on the non-NHS system is forecast to increase from 7% to 8% in 2013 to 11% to 12% in 2023. This process of forecasting and trade-off analysis was presented to the public as part of an outreach campaign associated with the long-range transportation plan. However, the premise was difficult to articulate to the public. MnDOT decided it was more logical to communicate the need and investment in terms of ROI (return on investment) – an economic-based measure used to quantify growth compared to capital expenditure. The benefit-cost and lifecycle analysis is still present from the pavement system analysis, but ROI provided a more understandable measure for comparison.

The MnDOT case is instructive in that it demonstrates how a state can disinvest from a lower priority program or system while still maintaining some degree of minimum tolerable condition. The principle of testing and establishing condition and performance “floors” for disinvested systems over defined funding periods can enable the state to right-size its programs while still maintaining some degree of accountability for even the disinvested assets. A question raised by both the MnDOT and UDOT situations pertains to how the performance “floors” are set, how many funding periods it is responsible to disinvest in this way, and at what point longer term strategies such as jurisdictional transfers or re-designs become inevitable.

While states are financially motivated to disinvest in and accept lower performance from lower priority assets, the long-term sustainability of these methods are still questioned. Utah only kept the disinvestment for a short period until a new revenue source was implemented. Minnesota still has this in place in their 20-year plan as NHS roadways carry a larger economic importance for the state compared to non-NHS roads. Nevertheless, questions remain about the long-term implications of lowered standards:
Should the DOT and commuters adapt to the decreased performance in this tradeoff to ensure better (or maintain) performance on those higher AADT and VMT parts of the network?

Does this change truly reflect a right-sizing for the future, or is it a funding-driven decision, only?

What happens to the older pavement in the long run?

**Tennessee: Right-Sizing the Project Development Process**

Repurposing, redesigning, and rethinking of projects for context-sensitive and right-sizing techniques are a significant part of a 2012 Tennessee DOT (TDOT) study. TDOT, along with Smart Growth America, looked at the existing project process from planning to construction and developed improvements to the methodology and policies which regulate it. The project “aims to create a process within TDOT to enable and encourage flexible, lower-cost ways to increase capacity on the state’s transportation system while expediting job creation and economic development in Tennessee.” TDOT reviewed the existing strengths and weaknesses of current approaches to transportation project identification and development. From there, the team explored how to identify and analyze the investment strategies. A matrix of investment alternatives was developed, which assessed:

- Maximized job creation and economic development;
- Cost-saving potential;
- Applicability to capital improvements;
- Maintenance and/or operations;
- Stability and sustainability;
- Equity; and
- Ease of implementation.

Related performance measures were developed and tied to state principles for tracking and prioritization purposes. TDOT applied this matrix of investment alternatives to their existing State Transportation Improvement Program (STIP) projects in hopes of finding cost-conscious alternatives that also achieve the desired objective of the original solution.

After reviewing the first five projects, TDOT found a cost savings of over $171 million through right-sizing each project’s scope. The study found that many transportation projects could get 80-90% of the desired outcome needed with an improvement to the network that cost up to one-tenth of the initial proposal. All the while, during this process, the rideability performance measure for pavement condition (percent of IRI) was maintained above national standards for the state network. Thus, this effort allowed limited resources to be allocated across more assets without having to compromise the roadway performance measures, resulting in a significant potential gain to the DOT budget and the state budget overall.

The TDOT example illustrates the importance of supplementing any programmatic right-sizing of budgets with specific project level design and engineering guidance for realizing the envisioned savings in the right-sizing program. It will be important for the NCHRP 19-14 guidance to recognize that when
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lower investment levels and performance standards are indicated as part of a statewide right-sizing investment/disinvestment strategy, practical ways to achieve optimal performance even at these lower thresholds is essential to realizing the envisioned savings and performance on the right-sized system.

1.3. Findings Related to Design and Re-Invention of Facilities

Among the most challenging and creative areas for right-sizing is its implementation in the design of specific facilities and corridors. Implementing right-sizing at the design level is difficult because almost every facility when built, was designed to what the designer at the time understood to be the “right-size” and never the “wrong-size.” Yet, the nation is rife with cases of infrastructure that does not match the world that has evolved around it.

Designers face a growing challenge of building and preserving billions of dollars’ worth of infrastructure for a population base which in some regions is growing very rapidly, while other regions have almost no growth, and sometimes negative growth. Yet one thing is common among nearly all areas – the cost of maintaining or developing the infrastructure investment footprint keeps growing whether the population is growing or not. That’s a problem for funding long-term maintenance. How do regions with negative population growth deal with the growing costs of maintaining and updating their investment footprint? Designers now revisiting projects near the end of their useful life realize that as yester-year’s “new and shiny” land uses and infrastructure deteriorate, businesses and residents sense the downward trajectory, and those with the means often move to the next “new and shiny” greenfield development. Thus, the areas they fled will deteriorate even faster because there is even less tax base for maintaining what is in place.

Therefore, the big picture of the challenges for designers in different environments to be solved by right-sizing efforts includes several angles:

1. Help emergent greenfields right-size the first time.

2. Looking beyond “size,” foster resilient design that will not be abandoned by adjacent uses, but instead will retain and increase the tax base that supports it.

3. Create retrofit strategies for corridors and areas that have deteriorated, so that the infrastructure they already have can compete anew for investment that would otherwise expand the infrastructure burden at the fringes.

Getting it Right the First Time

Today’s problems are easy to see and tend to consume a large proportion of resources in discerning the root causes and devising effective remedies. Nevertheless, in any location where greenfields are urbanizing, it is essential to apply best practices to solve tomorrow’s problems before they become problems.

To right-size Greenfield development, it is important for communities to understand that how they structure their background land uses and network connectivity will ultimately dictate the multimodal needs of the macro-level arterial network.
For example, a good rule-of-thumb published by the Institute of Transportation Engineers in the early 1990s recommended ideal network spacing of a modest-sized freeway every 5-miles, a principal arterial every 2-miles, a minor arterial every 1-mile, and a collector street at least every half-mile. Salt Lake County, Utah, applied that recommendation as part of a network analysis and arterial best practices effort to compare what they have – existing and planned – with that ITE guidance. The resulting “Scottish plaid pattern,” shown at right, is becoming iconic – used in presentations by MPO staff, UDOT, Envision Utah, and others to drive home the message that congestion exists largely because drivers have relatively few network options.

The next graphic (Figure 2) shows five common types of development. At one end is the tight-grid pattern, which dominated the American landscape prior to WW2, and is resurgent again, often as a curvilinear grid, within many New Urbanist planned communities. When most streets are through streets, arterials and collectors can often do fine with just one through-lane each direction, and can also accommodate on-street parking, lower speeds, etc. It is also possible to accommodate bikes, transit, and other needs on parallel streets – because there are parallel streets.

At the other end of the spectrum are suburban “super-grids” and more haphazard networks. Super-grids are common where farm access roads along USGS section-lines became the default “plan” for urban arterials, and everything in between was left to individual developers, who historically derived their maximum value from cul-de-sacs and discontinuous streets. The arterials that define super-grids become all-important, to all modes and most businesses, because they are the only streets available. Land uses along such arterials tend to degrade over decades but might be stabilized with certain techniques that can protect land values.
In general, the tighter the grid, the more adaptable the area is to changing conditions. However, there are still a great many greenfield areas emerging or likely to emerge with super-grids, and communities that want to or will emerge this way need to understand that right-sizing in these cases could mean protecting much larger right-of-way footprints, and/or more alignments, than their normal practice would dictate, in part for multimodal uses that have no other location available.

**Corridor-Level Best-Practice Patterns**

Ideally, new greenfield development would have tight local grids. But regardless of how the background grid may emerge, odds are most communities will create multi-lane arterial streets that will eventually carry 20,000 vehicles per day or more. Such arterials will continue to attract and be zoned for commercial and multi-family uses. A major problem with similar arterials from the 1950s through today is that development along them has only had access from the fronting arterial. Figure 3 highlights the disjointed, dendritic background streets traced from a real place.

A community would do well to protect its arterial streets more than this. For example, if they also had back-side access, as highlighted in yellow in Figure 2 above, it would greatly relieve the arterial and create flexibility for the future. Developers could have flexibility in the curvilinear nature of these back-side streets. Continuity is the key. When such streets meet with other arterials, perhaps right-in/right-out access would be required until signals are warranted. This pattern does not necessarily require any additional pavement beyond the previous. It just arranges it in a way that improves local circulation and creates a buffer between arterial uses and neighborhood uses.

Figure 4 zooms out to show how a square-mile of the pattern in Figure 3 might look. More significant arterials would be flanked with parallel backage roads, while interior collectors need not be. The crossing of significant arterials creates a grid for localized circulation at what is likely to be a significant activity node.

**Figure 3 Corridor Connectivity**

**Source:** Metro Analytics.

**Figure 4 Network connectivity**

**Source:** Metro Analytics.

Overall, right-sizing for newly developing areas can learn from the well documented experience of more mature areas by adopting a minimum standard of access density. Furthermore, experience suggests that allowing for flexible right-of-way standards may allow for more flexible designs in the long-term (including room for complete streets and related elements that may come to be needed over time). Finally, flexible design techniques like continuous backage roads for arterials and innovative intersection
designs are opportunities in newly developing areas that will give future designers optimal freedom to respond to unforeseen changes in the nature and volume of demand.

**Right-Sizing Existing Facilities**

Every right of way, when first built, was judged to be “right” by stakeholders for its time and context. So, what kind of changes in context can turn a right street into a wrong street? How can designers tell when the reasons to “right-size” start to outweigh the reasons not to? There are several analysis techniques that can help. Methods considered here include traffic volume analysis, safety analysis, modal demand analysis, trip length analysis, and tax-base analysis.

**Volume Analysis**

A significant opportunity for designers seeking to right-size an existing facility is identifying existing streets with excess capacity by considering critical volume thresholds. Table 2 depicts rule-of-thumb traffic volumes at which each facility-type tends to show signs of distress. As an example of how to use this, there are many cases where 7-lane highways, popular decades ago, currently carry only 25,000-35,000 vehicles per day. Yet, they could easily support up to 55,000 per day. In many cases, it would be easy to convert a lane to Bus-Rapid Transit or reorganize to allow on-street parking or other features that aid community objectives for livability and economic revitalization.

If the change facilitates mixed uses of land, such right-sizing solutions allow for the possibility that mixed uses emerging over the next 10-20 years result in shorter drives and greater use of alternative transportation modes. This enables the street to operate better in the long run than in the near term. Finally, the near-term implications of using right-of-way differently need not limit how designers envision uses in the long-term. Even if the change may cause an uncongested road to become noticeably more congested today, it is possible that stakeholders may value the modal choice, neighborhood quality and other outcomes that could result from differently using existing right-of-way.

**Forward-Looking Safety Analysis**

As areas urbanize and markets shift, designers confront the challenges of increased traffic density, concerns about access control needed to support high travel speeds, and safety issues associated with conflicts between vehicular and non-vehicular traffic. Safety analysis need not always wait for evidence of a problem to influence decisions. For example, an arterial may not yet have an apparent pedestrian safety problem because adjacent uses are heavily auto-oriented, blighted, or inactive. If uses are ripe for redevelopment and the community is encouraging a mix of uses at higher intensities than before, then it is easily predictable that a 45-mph highway will result in serious accidents if such uses materialize. Considering the crash rates associated with
different roadway types under different land development typologies and densities can enable designers to make decisions about integrating safety features such as sidewalks, crosswalks, traffic calming, and innovative intersections when right-sizing facilities in changing areas.

**Modal Demand Analysis / Trip Length Analysis**

As localities change, the nature of trips starts to change, and there may also be significant latent demand for alternative modes. An area may well have more cyclists and pedestrians than before, but if it is a tiny share of the total it can be easy to dismiss as irrelevant compared to the traditional task of unimpeded vehicular flow. Taking bikes as an example, surveys frequently suggest that while biking often represents less than 5% of a corridor’s overall volume, as many as 60% of respondents say they would bike regularly for recreation, exercise, commuting, and small errands if they felt protected from high-speed traffic. Communities that have invested heavily in such safety do in fact tend to see “build it and they will come” results that help justify the projects in retrospect.

To help determine how many may be eligible for active modes, it is useful to evaluate the likely trip lengths associated with emergent uses. Figure 5 below depicts two arterials, each with 30,000 vehicles per day. If the top arterial has a bedroom community anchoring one end, an employment center on the other, and little in between, the 30,000 trips on the arterial then will be heavily weighted toward longer-distance trips. In this context, the right-size could skew toward helping most travelers traverse long distances quickly. In the other scenario, there could be a significant mix of commercial and residential generators all along the corridor. At any point on the corridor there may still be 30,000 trips. However, much of that total is using the corridor only for a short distance, and thereby will be only minorly affected by speed changes. In the top case, installing premium features for active modes may attract relatively few patrons, because the overall length of typical trips is too far to walk or bike regardless. In the bottom case, a huge share of trips is short, and thereby likely to respond to premium treatment of active modes.

However, without this analysis, it could appear to traffic engineers that nothing has changed, and therefore they conclude it is best to leave the street at high speeds, assuming the majority are on long trips and will therefore value high-speed travel. Corridors with high shares of turning movements and increasingly high densities and usage types are good indicators that there may be significant latent demand that would respond positively to a new arterial context.

**Figure 5 Comparative Corridor Trip Lengths**

![Figure 5 Comparative Corridor Trip Lengths](source: Metro Analytics)
Tax-Base Analysis
One of the key objectives facing designers in right-sizing situations is the effort to avoid getting caught with more infrastructure than the economy can afford to maintain. In that context, it is helpful to identify districts that create more tax revenues than the same areas cost to maintain, vs. districts that cost more in the long run than they generate.

For example, a community may imagine that an ocean of big-box retail will be a financial boon, and each huge parcel will create more revenue than any small parcel, but in aggregate, the small parcels often create more revenue with less overall infrastructure burden.

In Figure 6, green areas are revenue positive, while red are revenue negative in a lifecycle analysis. Notice that in this case it’s the lower-income neighborhoods that are generating more revenue relative to their infrastructure burden, most likely because it is higher density. Some of the larger, lower-density parcels are also the costliest in the long run, despite being in affluent areas.

In summary, right-sizing design requires methods and processes for determining strategic right-sizing opportunities. Supporting analysis techniques include methods for identifying excess capacity and its potential uses based on changes in the transportation context, safety analysis that considers a range of potential crash rates based on emerging and envisioned land uses during the life of the project, as well as tax-base analysis considering the tax revenue base served by a facility in relation the long-term improvement or preservation cost of different levels of design capacity.

What Right-Sizing Looks Like in Practical Terms
All the previous analysis techniques can help identify when an existing or proposed design is “wrong” for the situation – or not a good fit for the emerging context. But what can be done to make it right? What elements will the final product have that will help property owners, active mode advocacy/user groups, city officials, engineers, and taxpayer watchdogs to all agree that the new plan is “right” for the emerging context?

Making the Most of the Cross Section
There are many angles to answering those questions, but a popular focal-point is the typical cross section of the street. The Institute of Transportation Engineers recently combined with the Congress for New Urbanism to produce a joint ITE/CNU best-practice guide called “Designing Walkable Urban Thoroughfares.” The guide includes a wide array of walkable design techniques,
but it also includes design criteria for a wide spectrum of contexts, from rural to suburban to heavily urban. The figure below considers three different ways of using the same right of 125’ right-of-way, by integrating different modal, aesthetic and livability elements and operational characteristics assuming different development typologies, planning scenarios and transportation market characteristics. Increasingly designers and planners have access to interactive cross-sectional design “scenario builders” for testing out the size extent and composition of a cross section in comparison to different values and emerging characteristics. These interactive tools can be used by designers working with planners and stakeholders to consider different mixes of desired operating characteristics and contextual variables through iterative processes to arrive at the “right-size” for each lateral element of the right-of-way.

Figure 7 Alternate Uses of Right-of-Way

Source: StreetPlan.net
**Right-Sizing Freeways**

Designers are often confronted with either an existing reality or forecast of freeway congestion, finding themselves caught in debates about induced demand and the risk of endless investment in freeway widening with no clear answer to when or where freeways find diminishing marginal returns. Some freeways are so popular that there is seemingly endless demand, and communities debate major double-decker projects, either below or above ground level to find space for ever expanding freeway capacity. On the other end of the spectrum, there are many less critical freeways that are nearing the end of their useful life. Many of those have more volume than can be managed easily on a single at-grade arterial, but nevertheless are at a level of usage that calls into the question the efficiency of replacing in-kind. Right-sizing freeways requires designers to be comprehensive in their accounting for context and options when determining whether more, less or simply different use of freeway right-of-way is in order.

The list of cities that have removed freeways is growing: Portland, Milwaukee, San Francisco, Rochester, and internationally in Seoul, Korea, and Madrid, Spain. Many others have been routed underground or relocated to less populated areas. In all cases, post-removal traffic congestion was not as bad as feared. Many more cities are in various stages of planning for removal or major alteration. The following are some factors that could make it worth exploring freeway removal or serious alteration:

**Central Business District (CBD) Mixed Uses:** Has the CBD come to exchange less traffic with the surrounding region due to increasing concentrations of housing or mixed-use development?

**Restore Urban Fabric:** Are there patterns of tight-grid development divided by freeways which if removed, would enable easier access between neighborhoods and other areas on each side of the current freeway?

**Under-Utilized or Secondary Freeway?** Is there enough redundancy that another existing freeway could serve the freeway function of a facility, freeing up the existing facility for a different and more economical use?

**One-way Couplets, Boulevards, and the Alternative Grid:** Could one-way couplets achieve similar traffic flow to what a low-volume freeway is currently carrying?

**Primary Throughway?** Is there sufficient through traffic in a highly developed area (and sufficient alternative use benefit) that re-routing through traffic (either through a bypass or tunnel or other alternative) would enable alternative use of existing right-of-way without the freeway?

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*When addressing right-sizing, designers should consider how to best apply development typologies and associated roadway cross-section features for different existing and future transportation markets. Interactive cross-section design and scenario builders for “mixing and matching” such features can be helpful in this context. Design right-sizing also can benefit considerably from practical indicators to assess conditions in which moving from freeway designs to non-freeway designs or alternative management strategies for freeways (such as congestion pricing or managed motorways) can limit the size, composition and extent of required long-term infrastructure.*
Jurisdictional Transfer as Right-Sizing

2.1. Introduction

This white paper summarizes findings from three case studies of state DOT practice for jurisdictional transfer: California, Minnesota, and Arizona. Each case example addresses the process and justification for jurisdictional transfer within the state DOT. Jurisdictional transfer is situated within the overall framework of right-sizing – meaning that jurisdictional transfer is considered as a potential avenue toward changing the size, composition and extent of the transportation system to arrive at a more efficient use of resources that better meets a current understanding of community and system performance needs.

Each case example is organized to cover the following areas:

1. Representing the need for jurisdictional transfer;
2. Identifying and analyzing the transfer option;
3. Implementation, including negotiations and costs to transfer; and
4. Lessons learned and conclusions for right-sizing.

Jurisdictional transfer is instructive to the broader issue of right-sizing in that it is perhaps the most formal existing framework in which DOTs engage with the communities they serve to understand:

(a) The implications of changing network composition and user demand,
(b) The nuances of different organizational capacities to deliver solutions to identified needs, and
(c) The trade-off between up-front costs and long-term costs and benefits involved in making a significant modification to the way a component of the transportation system is operated.

2.2. Caltrans: Jurisdictional Relinquishment as Right-Sizing

Material for this case example was gathered through document reviews, as well as through a semi-structured interview with staff at the Multimodal System Planning Office in the Division of Transportation Planning at Caltrans.
Representing the Need for Right-Sizing

Background: Relinquishment from the State Highway System in California

California’s State Highway System (SHS) is defined by Section 300 of the California Streets and Highways Code. This network was established in the early 20th century. The current legislatively defined purpose of the SHS is described as follows:

It is the intent of the Legislature, in enacting this article, that the routes of the state highway system serve the state’s heavily traveled rural and urban corridors, that they connect the communities and regions of the state, and that they serve the state’s economy by connecting centers of commerce, industry, agriculture, mineral wealth, and recreation.¹

In practice, Caltrans interprets this mission as being oriented toward serving interregional travel, and providing for longer-distance connections of statewide importance, rather than local-serving travel. Over time, however, the original purpose of certain parts of the SHS has evolved to be out of alignment with this overall statewide objective. This happens due to development growth along what were formerly mostly rural through-corridors, as well as the continual evolution of the network itself, where newer and better alignments might supersede old connections. In particular, Caltrans is aware of locations where road segments on the SHS are serving more as local arterials or main streets than as intercity highways.

Addressing this mismatch, Caltrans has a series of processes in place to achieve relinquishment of portions of the SHS to applicable local governments. There are four formal types of relinquishments:

1. **Legislative enactment:** These relinquishments are at present initiated by local governments interested in taking on a road segment from the state – typically because it has transitioned to a more local-serving use. They require a formal process overseen by the Office of Multimodal System Planning, which includes an evaluation by the state of appropriateness of relinquishment, as well as legislative action to remove from the SHS.

2. **Superseded by relocation:** These relinquishments arise from a project such as a bypass that has created a new SHS connection, therefore rendering an old alignment irrelevant from a SHS perspective. These relinquishments are dealt with as part of the overall project process that leads to them.

3. **Collateral facilities:** These relinquishments apply to collateral facilities such as frontage roads, service roads, or park-and-ride facilities. They are not core to the functionality of the SHS. Relinquishment of collateral facilities is also often the result of a specific project, and therefore dealt with within that process. However, in the case of park-and-ride facilities, there is also a process of evaluation overseen by the Office of Multimodal System Planning.

4. **Nonmotorized Transportation Facilities:** I.e. facilities primarily used by pedestrians, bicyclists, or equestrians. These can also be relinquished to local governments who wish to take them on.

¹ Section 300 of the California Streets and Highways Code.
Identifying the Need to Right-Size via Relinquishment

From the perspective of matching state resources to statewide objectives, all forms of relinquishment can qualify as right-sizing. However, from a broader societal perspective, relinquishment can do more than reduce the lifecycle cost burden carried by the state. It in fact enables a closer matching between infrastructure design and operating policies and local needs.

On a state highway segment that serves a main street or local arterial, local governments may be interested in a variety of complete-streets type improvements such as the addition of bulb outs to help with pedestrian crossings, specially design bike lane or sidewalk features, or even the introduction of restaurant seating into the street right-of-way. When a segment is owned by the state, each such change must be reviewed and permitted by the state. In some cases, desired modifications are rejected based on the application of statewide design codes. They might also be rejected based on the inability of the state to incorporate major modifications to its maintenance protocols and equipment (e.g., to enable the use of specialized pavers) — where a local government would not face similar barriers. In other situations, the modifications might be approved, but impose a process costs on locals as well as an additional exception management burden on the state. Similarly, developers can face a dual permitting process with both local governments and the state when building new sidewalks or driveways that encroach onto a state highway segment. In these cases, the mismatch might be best addressed by changing the ownership status of the roads.

There are also specific regulatory situations in which local ownership enables particular types of changes to the nature of infrastructure that would not be possible under state ownerships. These include situations such as a park-and-rides adjacent to mixed-use development where regulations that apply to state facilities restrict how revenues can be raised and locals want more flexibility for development, as well as other situations that involve the generation of revenue on parts of the SHS.

Relinquishment Within the DOT Business Process

Relinquishment at Caltrans is an ongoing process that at present is typically initiated by an expression of interest by local governments. Legislative enactment and park-and-ride relinquishments begin with preparation of a Relinquishment Assessment Report (RAR) by district planners. The RAR is then submitted to the Caltrans Division of Transportation Planning (Headquarters) for determination of whether or not relinquishment is in the interest of the state. If it is, the process moves forward according to rules defined in Chapter 25 of the Caltrans Project Development Procedures Manual. Relinquishment determinations based on the RAR are made explicitly within the context of the overall long-range system planning process – in recognition of their relationships between relinquishment and overall system planning to fit the evolving needs of the state and agency, as documented in the RAR guidelines.2

In addition to the ongoing process, Caltrans has in the last five years been taking a closer look at relinquishment as a potential issue of strategic importance to agency operations.

In 2012, Caltrans undertook an overall program review effort aimed at being more strategic about how agency resources are used. The review was motivated by declining transportation funding, changes in the role of local transportation partners, and increasing expectations for efficiency and accountability. It also occurred within the context of new leadership in the governor’s office and related organizational efforts within the agency. One outcome of the review was a recommendation that the Caltrans:

- Develop strategy for accomplishing the relinquishment of designated routes no longer part of the state highway system that remain Caltrans responsibility. Fully scope this effort, starting with a comprehensive listing of those routes, and fiscal information from maintenance on their current management costs.

This program review was closely followed by an external assessment by the State Smart Transportation Initiative (SSTI), which included the following recommendation regarding relinquishments:

- Caltrans should find ways to transfer local-serving roads to local government. Caltrans is saddled with many road segments that were once intercity trunk routes but that now serve as local arterials. These “stroads” — street-road hybrids — are problematic, because Caltrans frequently imposes auto-centric standards, e.g., by restricting curb bump outs or refuge islands that would improve pedestrian safety in an urban environment. They also require Caltrans resources for maintenance and rebuilding, even though they serve mostly local travelers. Caltrans is already categorizing such facilities to identify streets (some of which never leave city limits) that are good candidates for transfer. CalSTA and stakeholders should support Caltrans’ efforts, which may require funding to induce local governments to take on new responsibilities.

Following these recommendations, Caltrans undertook an internal evaluation effort (2014) to start considering the issue from a more strategic statewide perspective and to assess the scope of the relinquishment need within the agency. The internal effort solicited suggestions from each of the 12 districts of relinquishment candidates. Districts were given guidance to offer segments that had or were likely to get local support for relinquishment and that no longer serve an interregional travel need but act more like a local arterial. In addition, Caltrans suggested that districts start with consideration of links within urbanized areas or incorporated cities, based on the assumption that local political will and resources are more likely to exist there. However, rural highways were still considered if they served as main streets and were likely to garner strong local support. The internal process compiled a list of candidates and organized them into three tiers of priorities, based on expected ease of relinquishment. Ultimately, results were not published as the agency did not have the funding necessary to tackle relinquishment at a system-wide level and starting the conversation without that would create unnecessary political

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risk. If a larger program of funding becomes available, this process could be continued by taking the preliminary list out for vetting with local partners and further refining from there. That would entail a more disaggregate engagement process than is typical for the DOT, which tends to work through MPOs and Regional Transportation Planning Agencys (RTPA), as jurisdictional relinquishment must be enacted at the level of individual local governments.

Caltrans interest in relinquishment is two-fold: First, the agency is interested in reducing lifecycle cost responsibilities which would enable a shift of resources toward actions that are more in line with the DOT mission of serving interregional and statewide travel needs. Second, Caltrans wishes to facilitate, where appropriate, the better meeting of local needs and preferences in terms of the design and function of a road and its compatibility with the surrounding development context. This latter objective has increased in importance over time as Caltrans engages in a more focused manner in complete streets initiatives and associated goals of sustainability and livability, as well as in consideration of land-use transportation interactions.

Identifying and Analyzing Right-Sizing Options

**Determination of Relinquishment Appropriateness: Evaluation in the RAR**

The RAR is the first formal step in the relinquishment process⁶ and determines whether or not from the State Highway System/State DOT perspective, a state route or park-and-ride should be relinquished.

The report is prepared by district planners, then submitted to Headquarters Division of Transportation Planning. It is intended to ensure a consistent and coordinated statewide process. There is a template that districts must use, organized into the following six sections (for routes; park-and-rides are very similar):

1. Description of Route and Basis of Request for Relinquishment
2. Route or Corridor Concept and Recommendations for Route Development
3. District coordination with RTPAs
4. Coordination with State, Federal, and Tribal Plans and Programs
5. Internal District Coordination
6. Map and Photos

Section 1 provides basic information about the route, as well as a discussion of who is requesting relinquishment and why. Specifically, districts are asked to:

   Explain the issues and history including request for encroachment permits and issues with approving or denying requests. Include district/local jurisdiction local development

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⁶ Some relinquishment types do not require an RAR. These include: relinquishment of a state route by superseding with a new state route, relinquishment of collateral facilities (excluding park-and-ride facilities), relinquishment of non-motorized transportation facilities.
discussions, comments, and issues. Document context-sensitive solutions efforts and what could and could not be resolved under state ownership of the route. Explain how the relinquishment benefits local planning and community design and circulation considerations.7

Section 2 goes into more detail regarding projected future traffic volumes, origin-destination travel patterns, and the role played by the segment in supporting interregional or major regional trips. Districts are asked to describe major destinations served (e.g., a regional mall, industrial park, airport, etc.) as well as the primary users of the route (e.g., recreational, commuter, freight). The districts are also prompted to discuss any negative effects that relinquishment might have on truck access, including intermodal transfer activities, as well as the degree to which relinquishment might cause rerouting of traffic and therefore create a need for additional capacity elsewhere on the state system. Any prior planning efforts related to the relinquishment are to be documented and the district is specifically required to document the position of local agencies, including inter-jurisdictional coordination efforts.

Section 3 addresses coordination with the RTPA and/or Metropolitan Planning Organization in the area, and Section 4 similarly addresses coordination with state and federal entities. Section 5 defines district responsibilities for the relinquishment process, and Section 6 requests maps and photos of the relevant segment.

### Example RAR Evaluation: State Route 74, Between Interstate 15 and the City of Perris, CA (8.4 miles)

The following excerpts from a recent RAR illustrate how the document is used to define and evaluate a relinquishment need. The relinquishment in question would be of portions of State Route 74 (SR-74) to the City of Lake Elsinore and to the County of Riverside.

On relinquishment as a means toward more logical network definition:

Relinquishment of SR-74 as proposed will eliminate a stub route condition resulting from a previous relinquishment of SR-74 to the City of Perris.

On relinquishment to meet needs emerging from local development plans:

Equally important, this SR-74 segment is deemed to be a crucial component of a major, sub-regional transportation corridor currently under joint, conceptual development by the County of Riverside and the City of Lake Elsinore. Tentatively called the “Ethanac-SR-74-Nichols Corridor” this major local expressway is being developed to utilize existing roadway alignments that will accommodate travelers more efficiently to attract and serve local development activity.

Documenting shifts in the local development context that precipitate the need for relinquishment:

The interregional functionality of SR-74 has declined recently as local development has converted formerly vacant or rural acreage to suburban residential and neighborhood commercial areas.

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Local development uses planned within the City of Lake Elsinore and its sphere-of influence (SOI) territory includes future business professional zones and additional commercial acreage.

For the County of Riverside, local development adjacent to SR-74 is presently limited to the Colinas del Oro Specific Plan No. 364 proposed at Ethanac Road. Build-out of this specific plan will include medium-to-high density residential areas as well as commercial zones and open space.

Presenting information on current and projected future truck traffic, and discussion of potential effects of relinquishment on truck movements.

The truck traffic is not expected to change as a result of the relinquishments. The major movements focus on local truck traffic and the improvements by the local agencies will ensure the facility improvement performance which should benefit truck travel.

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</tbody>
</table>

Analyzing origin-destination travel patterns:

While SR-74 once served as a link between Riverside and Orange Counties, this interregional access has been displaced by Interstates 15 and 215 over the last several decades.

The overall RAR process has been in place for quite some time but was previously under a different name (Transportation System Analysis and Evaluation (TSAE) report). Caltrans did streamline the RAR in the last few years and establish a more well-defined template to better provide for uniformity of evaluation across the state.

**Relevance of Tools and Data to the Relinquishment Evaluation Process**

Most of the relinquishment evaluation process is based on qualitative analysis, and consultation with planning partners regarding their transportation and development plans. However, there are some tools and data that are relevant to the relinquishment evaluation process. Namely, Caltrans staff indicate that it is important to analyze who is on a particular piece of highway and the nature of their trip (whether long-distance or local). Apart from relying on local knowledge, this can be most readily achieved through use of the statewide model, which incorporates information from constituent MPO/RTPA models. In particular, data on freight movements can be particularly valuable.

Note that while there can be issues resolving statewide and regional model perspectives, in practice this does not tend to be a major source of disagreement in the relinquishment process – given that it is currently driven by local desire to take on ownership of highways.

**Cost to Relinquish and Analysis of Agency Cost Outcomes**

Statutorily, Caltrans is under no obligation “to put a facility into a state of good repair, construct improvements or betterments, or incur a financial obligation of any kind to relinquish a state...
highway to a local agency by legislative enactment. Nevertheless, while this is the initial premise of any discussions with local partners, Caltrans does at times recognize the value of putting money toward the relinquishment and recognizes that facilities need to be safe and operable when they are turned over. The three options for a relinquishment by legislative enactment are a) no cost, b) financial contribution only, or c) capital project. If either funding is to be transferred to the local government or a capital project is to be delivered prior to relinquishment, then the state’s project development policies require a formal relinquishment agreement between Caltrans and the receiving local government. Except in no cost cases, Caltrans must prepare a benefit-cost analysis, as defined in the Project Development Procedures Manual:

The benefit-cost analysis will compare the costs to maintain and operate the road with the cost to relinquish over a ten-year period utilizing an assumed interest rate based on the escalation rate used in the State Transportation Improvement Program (STIP) and SHOPP, and appropriate costs and benefits specific to the portion of the state highway segment in question.

State of good repair is required for cases of a state highway that has been superseded by relocation type of relinquishment. This does not include capacity increases or other betterments.

In the course of their 2014 internal evaluation effort, Caltrans did seek to estimate a ballpark cost to relinquish identified highway segments. To do so, staff used generalized calculations and produced a range of costs, including an assessment of basic preventative maintenance costs, more substantial pavement rehabilitation and reconstruction costs, and ADA upgrade costs associated with bringing highway facilities in compliance with Americans with Disabilities Act requirements. They also estimated average annual savings from relinquishment. These figures were not ultimately published but were intended to grant an internal understanding of the scope of the need. In the end, Caltrans determined that the cost was at that time too great to pursue systematically without some sort of additional (possibly dedicated) funding and that currently available resources would be best spent elsewhere, or on case-by-case relinquishments pursued within the existing process.

Implementing and Tracking Outcomes

Negotiating Costs and Relinquishment Agreements

Caltrans districts are responsible for negotiating the cost to relinquish, if any, of legislative relinquishments with local governments. These are then codified in relinquishment agreements. The decision as to whether the cost terms negotiated represent a good business decision for Caltrans is mainly based on the benefit-cost analysis results. There are cases where local governments are willing or desirous of taking on a highway, but their requests in terms of funding or improvements are too great to be implementable, at least within current levels of funding. Funding for legislative relinquishments currently competes with other operations and

preservation activities inside the State Highway Operation and Protection Program (SHOPP). If an agreement is successfully reached with local government and SHOPP funds are indeed available, the relinquishment is enacted through a California Transportation Commission (CTC) Relinquishment Resolution. There are a series of conflict resolution procedures in place if agreement cannot be reached, with the CTC serving as the final arbiter of terms. Note that at present, Caltrans does not pursue legislative relinquishment without local government support, making available funding rather than conflict of terms the most salient issue for implementation.

Caltrans also has a chapter in its Project Development Procedure Manual on developing Cooperative Agreements. These are legally binding contracts that enable the “exchange of effort, funding, or materials between Caltrans and a public entity regarding the planning, design, or construction of an improvement or facility on the State Highway System” – of which relinquishment agreements are one type. Caltrans headquarters also provides standard templates to assist in the process.

**Tracking and Reevaluation**

At present, there is no framework in place for cyclical reevaluation of relinquishment potential or needs in California. Districts proceed based on expressed local interest and the procedures set up by Caltrans for implementation on a case-by-case basis. While the internal evaluation effort pursued by the agency did have the long-term goal of establishing and maintaining a statewide relinquishment list, this is currently not the case because of insufficient funding. Again, without sufficient funding, the opinion of the DOT is that defining any sort of list creates political risks that outweigh any gains available from strategic planning.

The situation in California with respect to systematic relinquishment may change with the recent passage of California Senate Bill 1, a major transportation funding package. The bill increases the SHOPP program, through which relinquishments are currently funded, by approximately $1.9 billion per year over the current approximately $2.5 billion per year program of projects.

**Lessons Learned and Conclusions for Right-Sizing**

The following lessons learned are gleaned from the materials provided by Caltrans and discussion with Caltrans staff. Some are derived insights from the discussions above, while others were offered directly by Caltrans staff in response to an interview question about key conclusions for the research.

- Jurisdictional relinquishment is and can be a means of achieving a more right-size transportation system, not only from the perspective of reducing a state’s lifecycle cost burden, but also – and perhaps more importantly – by enabling a better matching

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between local preferences and development contexts and infrastructure design and operations.

- While data on traffic volumes, mixes, and origin-destination patterns can offer valuable insight into the appropriateness of relinquishment, qualitative data collection and collaborative discussion with local partners is key to determining the nature of the right-sizing need.

- Caltrans clearly recognizes a range of broader societal benefits of relinquishment. However, current analysis procedures are restricted to comparing maintenance savings over time with up-front cost to relinquish negotiated with local governments.

- Caltrans finds that it can be hard to make the case based on a very long payback period of maintenance savings compared to up-front costs to relinquish. This is particularly true in a constrained funding environment when the choices faced by the agency is between addressing poor conditions on a relatively larger portion of the system or implementing a handful of relinquishments. This equation might feel different if relinquishments were competing with one another rather than with other maintenance projects, or if there were better ways of documenting the societal benefits of design and operational changes enabled by relinquishment (e.g., supporting local development, livability benefits).

- When considering taking on a portion of the state highway system, local governments tend to consider their ability to afford upkeep, their desire to implement things that are impossible or burdensome under state regulation, and their ability to manage additional legal liability. This latter issue is more important than one might expect a priori. Whereas the state is a large organization with the wherewithal to handle legal action that can result from accidents, local governments have fewer resources and may not feel similarly capable.

### 2.3. MnDOT: Jurisdictional Realignment as a Means of Right-Sizing

Material for this case example was gathered through document reviews, as well as through a series of interviews with MnDOT staff.

**Representing the Need for Right-Sizing**

*Background: MnDOT Jurisdictional Realignment Project*

Starting around 2011, MnDOT embarked upon a jurisdictional realignment project, the purpose of which was to “ensure that Minnesota roads are owned and operated at the right jurisdictional level.”¹¹ The project developed and then applied a methodology to identify “misaligned” roadway segments that are candidates for jurisdictional realignment (state to local or local to state). Motivation for the project was both “bottom up” and “top down.” Interest in realignment was expressed on an ongoing basis by local jurisdictions and while there was already a process in place to achieve this, MnDOT recognized the need to assess realignments from a more

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programmatic perspective. At the same time, interest in jurisdictional realignment came from within MnDOT's more centralized planning process. Minnesota's 50-year vision (Minnesota GO) defines a goal to “better align the transportation system with what Minnesotans expect for their quality of life, economy and natural environment”12 and emphasizes consistency and collaboration across jurisdictions and sectors as a means to achieve this goal. In fact, one of the guiding principles of the effort speaks directly to right-sizing:

**Strategically fix the system:** Some parts of the system may need to be reduced while other parts are enhanced or expanded to meet changing demand. Strategically maintain and upgrade critical existing infrastructure.13

According to MnDOT staff, one avenue toward this is trying to ensure that the right agency is empowered to make the right decision. MnDOT was additionally looking to enhance its “financial effectiveness” in the context of a 20-Year State Highway Investment Plan that projected a $12 billion funding gap over 20 years.14

Discussions of misalignment in Minnesota has been long in the making. Prior evaluations completed in the 1980s and 1990s began to describe the issue at a system level, and define objectives for realignment, but never achieved adequate closure in terms of a defining an actionable program that could then be incorporated into MnDOT's work going forward. The most recent effort sought to close this gap by from a holistic perspective (a) defining the goals of realignment, and (b) determining what it would take (in terms of process as well as funding) to achieve this objective.

**Identifying the Need to Right-Size via Jurisdictional Realignment**

MnDOT views jurisdictional realignment as a means toward right-sizing in the sense that it brings agencies together to determine what best fits a specific context, and what best serves the public. The DOT outlines a series of problems with misaligned roads, as shown in Table 3.

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13 MnDOT. Minnesota GO 50-Year Vision for Transportation.
Table 3 Key Issues with Misaligned Roads According to MnDOT

- Misaligned roads may not provide appropriate level of service for users in terms of both capacity and customer expectations, such as safety, ride quality and maintenance
- Misaligned roads may use the wrong source of funding, which may not contain required funds for improvements. This may result in a lower service level than if the road was properly aligned/owned by the appropriate jurisdiction
- Misaligned roads may lead to an “impaired” network of roads due to differing jurisdiction priorities (that is, the road conditions may change significantly while traveling and may not meet traveler’s expectations)
- Misaligned roads may not receive the priority for funding or improvements, and as a result, misaligned roads that are widely used may be underserved while others may be over-served


Local government interest in acquiring a piece of state trunk highway stems from operational, design, and priority-related considerations. From an operational standpoint, local agencies may be able to respond more quickly to maintenance needs (e.g., at a signal), whereas the state maintenance force may be an hour or two away. Aligning maintenance activity with local agency would provide better level of service. With respect to things like ride quality, MnDOT and localities may have different approaches to programming maintenance (such as seal coats) that can lead to inconsistencies across a route experienced by the public, if ownership is fragmented. Ownership also has direct implications for prioritization. Whereas a road might not reach the top of a list when competing at the state level, local ownership can enable a higher ranking of a road (including through road class designation). Finally, ownership also relates to design standards. Urban and suburban governments (less so rural governments) see value in local decision making for things like access control, rather than being subject to a statewide standard. Local control offers local governments the flexibility to provide a level of service that is more uniform across the network in their jurisdiction. This is also important because from a user/customer perspective, complaints tend to be directed to the most local jurisdiction as drivers cannot “see” ownership.

In addition, MnDOT staff noted that agencies at different levels of government have tailored their in-house expertise to specific types of projects or development contexts. MnDOT has built up in-house capacity to very effectively design and operate high-speed high-volume roadways. Counties and cities, on the other hand, can be more effective at managing mid-to-low-volume roads, including dealing with CBD issues in terms of design and operations. Therefore, a county might be better set up to deliver certain types of improvements (e.g., a roundabout or a turn lane in an urban area) and might actually be able to deliver better outcomes in terms of cost and on-time delivery. Similarly, emerging practices such as Complete Streets, which are increasingly being recognized as part of “right-sizing” infrastructure, may be incorporated into agency practice more rapidly at a local level, than within a state DOT.

Changes Contributing to the Need for Right-Sizing

In Minnesota, the need for jurisdictional realignment comes up in both a project and a more general context. In the project development process, it is likely to come up with respect to the state permitting process. For example, if a local agency wishes to change access or add turn lanes to a state-owned trunk highway, they will apply and in some cases MnDOT will deny certain
design aspects of the request. This will then trigger thinking at the local level along the lines of, “this would be much easier if this were a local road.” In a more general context, there are obvious mismatches between road classification and agency ownership that accumulate on the system over time as the result of changes in the development context and/or network configuration. One example was a state trunk highway that once led to a state facility such as a health care facility. However, at some point the state facility closed. Subsequently, the route designation might be changed to “local” to reflect its changing function, but the state ownership stays in place, meaning that the state is left with the responsibility to maintain a local road. This is an example of a more systemic need to “clean up the system” in response to changes over time. Another frequent example is the construction of a new highway that supersedes an old route in terms of function. Unlike in some states (such as Wisconsin), there is no automatic process for a superseded route to be returned to local jurisdictions. However, such a change in the network does often precipitate discussions of a jurisdictional realignment. Interestingly, this can also happen in the reverse direction, although it is less common. For example, there was a case in Minnesota where a county built a significant new alignment just a few miles parallel to an existing trunk highway. Over the years the parallel new county alignment became the public’s choice in terms of volume and the state trunk highway was used less. Eventually, the state and county decided to swap ownership.

Identifying and Analyzing Right-Sizing Options

Identifying Misaligned Segments System Wide

MnDOT’s jurisdictional realignment project resulted in guidance document on how to identify misaligned segments in a systematic way, statewide. Some of the steps outlined were already achieved within the scope of the project, while others depend on continued work in partnership between jurisdictions. The first step involves classifying the entire network into three tiers based on their “probability of misalignment” by “cross-referencing the route system and functional class.” Misalignment in this process is identifiable by a mismatch between the mission or goals of the owning agency and the function of a roadway:

The project team used the overarching goals of each agency to cross-reference the route system and functional class. For example, MnDOT’s key goal of mobility means that routes with a functional class of principal arterial and many minor arterials and major collectors should be owned by MnDOT. Roads with a functional class of minor collectors and local roads are primarily intended to provide access to homes, businesses, and farms—and should be owned by local agencies.

Figure 8 presents the results of the cross-referencing and Figure 9 summarizes the potentially misaligned mileage identified by MnDOT, organized by jurisdictional ownership.

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Based on this segmentation, the MnDOT project team then developed a “misalignment register” focused specifically on a subset of the network, with additional refinements and vetting of “Tier 1 segments that are either owned by MnDOT or functionally classified as principal arterials and Tier 2 segments that are owned by MnDOT.”

misaligned segments is finalized, next steps include further engagement regarding the likely benefits of addressing misalignment as well as potential timing and funding.

Table 4 Parameters Defined by Mn dot for Analyzing Potentially Misaligned Segments

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road system continuity preferences</td>
<td>Road begins or ends with another jurisdiction, or the primary purpose is misaligned with the goals of the owning jurisdiction</td>
</tr>
<tr>
<td>System spacing</td>
<td>The road network is relatively too dense or too sparse in the vicinity for the owning jurisdiction</td>
</tr>
<tr>
<td>Location</td>
<td>The segment is located within/outside specific boundaries inconsistent with the owning jurisdiction</td>
</tr>
<tr>
<td>Length of segment/road</td>
<td>Segment is short, with other jurisdiction owning most of the road from the start/end point or intersection</td>
</tr>
<tr>
<td>Truck traffic volume</td>
<td>Higher truck traffic volume than surrounding roads</td>
</tr>
<tr>
<td>Site of national, state, or local interest</td>
<td>Site of national, state, or local interest that requires being owned by a particular jurisdiction</td>
</tr>
<tr>
<td>Road restrictions</td>
<td>Any restrictions for travel on the road that may guide jurisdictional responsibilities</td>
</tr>
<tr>
<td>Traffic volume</td>
<td>Relative traffic volume is inconsistent with other roads owned by the jurisdiction in the vicinity</td>
</tr>
<tr>
<td>Intermodal facilities</td>
<td>Segment serves an intermodal facility and is of statewide importance</td>
</tr>
</tbody>
</table>


Process for Establishing Misalignment Criteria and Buy-in

The overall jurisdictional realignment project (that resulted in the process outlined above) proceeded in two phases of iterative analysis and refinement to arrive at a set of agreed-upon and tested criteria for identifying misalignments (Figure 10). The process was initiated by the project team (consultant, MnDOT planning director, state aid staff), then gradually expanded the circle of consultation to include district engineers, and ultimately pilot applications of the process with three counties.
Implementation

Jurisdictional Realignment Funding

Although some local agencies are willing to take on ownership of roads “as is,” there is typically a cost to implement a jurisdictional realignment – whether in the form of a project delivered by MnDOT or local government, or in the form of a transfer of funds along with road infrastructure to the receiving local government. Funding for these types of improvements is secured in several ways. First, Minnesota has a specific allocation in their Highway User Tax Distribution Fund called the “Flexible Highway Account” that is “apportioned to individual agencies for the restoration of former trunk highways that have been turned back to the municipalities or counties and designated state aid.”\(^{18}\) This program was in 2017 funded at $54 million. However, according to MnDOT staff, this level of funding is a “drop in the bucket” compared with the need, thus contributing to a backlog of realignments that might have proceeded if additional funding was available. Beginning to address this backlog, MnSHIP 2017, MnDOT’s 20-year fiscally constrained capital investment plan, for the first time defined an investment category for trunk highway investment in jurisdictional transfers. While the amount is small ($90 million over 20 years, or 0.4% of the total capital highway investment planned), it allows transfers to be a part of the discussion when resources are being distributed.\(^{19}\)

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In addition, jurisdictional realignments can in certain cases be funded through MnDOT’s “Investment Opportunity Plan.” This plan includes projects that were not achievable through the standard programming process, but that can be opportunistically funded if/when MnDOT releases funding contingencies out of programs/projects at the end of a funding cycle. Finally, there have been cases where MnDOT has a specific project already programmed for a roadway and rather than delivering that project, agrees to transfer the associated funds to the receiving local government who takes over responsibility for improvements (see example below). Realigned segments can also remain eligible for flexible highway account funds for a period of 15 years after the actual realignment, which offers additional flexibility.

**Negotiating Costs and Agreements**

The following two agreements are presented as illustrative examples of the nature of jurisdictional realignment negotiations in Minnesota.

**TRANSFER OF A PORTION OF TRUNK HIGHWAY (TH) 212 FROM MNDOT TO CARVER COUNTY, MN**

**Background.** This agreement covers a seven-mile section of TH 212 in Carver County, MN. The section was no longer needed on the state system as it had been functionally replaced by a new limited access highway.

**Cost to Transfer.** As part of the agreement, MnDOT agreed to pay Carver County a lump sum amount of $5.4 million. This amount represents the cost of “current roadway rehabilitation and maintenance repairs, including but not limited to, full width pavement mill and overlay, sign replacement, guardrail repair and replacement, and culvert repair and replacement, that the state will not be performing on that portion of Trunk Highway No. 212 prior to its release to the jurisdiction of the county.”\(^{20}\) This $5.4 million represents that cost of immediate repair needs already programmed into the MnDOT district’s allocation of funding. The section of highway is also made eligible for flexible highway account funding in a period following the agreement, for longer term improvement needs.

**Insights from the Process.** MnDOT staff report that the negotiation and management process for this realignment was not entirely straightforward and offers lesson learned. The fact that the realignment was not bundled with the project development process for the new replacement highway led to inefficiencies. It removed some of the leverage the state otherwise might have had in negotiations with the county. In addition, the relatively long period of anticipation for the realignment (based on the knowledge of the new highway project) resulted in decisions to defer maintenance on the MnDOT side of things in favor of other higher-priority needs. This likely resulted in higher overall lifecycle costs for the highway than would have occurred otherwise. It also made the $5.4 million up-front funding critical to convincing Carver County to accept the roadway that was in need of immediate repairs.

\(^{20}\) MnDOT. Agreement No. 93384, “State release to the County of that portion of T.H. 212 from C.S.A.H. 11 to the Carver/Hennepin County line,” 2009.
Transfer of a Portion of TH 5 from MnDOT to Washington County, MN

Background. This agreement covers an 8.3-mile section of TH 5, also called Stillwater Boulevard North, northeast of downtown St. Paul, MN. The section was superseded functionally by parallel routes on the state trunk highway network, namely I-94 and MN-36.

Cost to Transfer. $22 million in funds were transferred from the state to Washington County as part of the agreement. The amount of funding negotiated represents a middle ground between short-term repair needs that would have been programmed by the state and the cost of longer-term reconstruction needs identified by the county. The funding itself was secured through the investment opportunity plan – i.e., funds leftover at the end of MnDOT’s biennium.

Insights from the Process. The jurisdictional realignment was implemented in an opportunistic manner, based on groundwork that had been laid previously by local planning and through cooperation between the state and the county. Prior to the funding becoming available, and the final agreement, there had been a memorandum of understanding in place between the state and county since the 1990s identifying roads that ultimately should be transferred to local ownership. This MOU did not define funding requirements but did establish a goal to be mutually worked toward. In addition, the roadway had been identified as a target for realignment in the county transportation plan—a component of the comprehensive plan. With the prior planning and understanding in place, the realignment had a level of readiness that enabled the use of redistributed contingency funds. The agreement was finalized in a matter of months before the available funding expired.

Program-Level Planning for Right-Sizing via Realignment

Another part of the jurisdictional realignment project was using planning-level cost information to calculate costs to transfer all misaligned segments—as a means of assessing the scope of the need. These cost estimates reflect what would be required to bring roads and bridges “up to good condition and design standards.” The analysis employed the following information:

- Statewide unit costs, from the MnDOT pavement and bridge management systems, for four types of treatments: mill and overlay, pavement rehabilitation, bridge re-decking, and bridge and pavement reconstruction.
- Conditions data, also from the MnDOT pavement and bridge management systems.
- Input from state aid engineers and county engineers regarding compliance with design standards.

Treatment plans were defined based on conditions thresholds from the management systems, with revisions based on stakeholder feedback (state aid engineers, county engineers, and others). Most revisions were made in relation to non-compliance with design standards (i.e.,

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21 MnDOT. Agreement No. 1000677, 2015.
recommending reconstruction for a road that does not meet standards, despite average conditions).

Ultimately the project identified 1,181 centerline miles as misaligned. The total cost identified for these miles is $1.44 billion, or $542,000 per lane mile, including bridges. The misaligned mileage was then further broken down into tiers, based on anticipated complexity of the transfer (a function of prior conversations with jurisdictional partners, as well as current segment condition).

For MnDOT, next steps are two-fold: First, the agency will continue to support districts and local planning partners who wish to pursue jurisdictional realignments as opportunities arise in the form of consensus and available funding. To maximize the effectiveness of existing jurisdictional transfer funding, MnDOT staff emphasize the need to anticipate transfer opportunities well in advance of project scoping, and to work toward coordinating transfers with regularly programmed preservation projects, supplemented by the new MnSHIP jurisdictional transfer program dollars. Second, MnDOT staff are continuing to work toward defining and implementing a realignment program, alongside discussions of potentially securing additional funding. Part of that conversation will involve expressing the scope of the need in terms of opportunity costs – i.e., because MnDOT is still managing and investing in segments that could be better managed by other jurisdictions to meet local needs, there are other needs on the state system that are going unmet. This, according to MnDOT staff, is the accumulated cost of not having a “right-sized” system.

**Lessons Learned and Conclusions for Right-Sizing**

The following lessons learned can be offered based on MnDOT’s experience with jurisdictional realignment as a right-sizing issues, including responses offered directly by MnDOT staff in response to interview questions about key takeaways.

- In a very broad sense, jurisdictional realignment addresses right-sizing in that it is a response to changing needs and composition of the transportation network, and presents a forum for different levels of government to negotiate priorities and needs at different levels.

- Jurisdictional realignment also represents an avenue toward right-sizing in part because it can enable a more efficient use of different types of agency capabilities and expertise to meet emerging needs of transportation system users. In some cases, local governments are better equipped to deliver certain types of improvements such as complete streets enhancements.

- The ability to apply a decision process in a consistent and therefore equitable manner is critical to success at the program-level. As MnDOT staff put it: “people talk.” It is very likely in any situation that the details of a transfer agreement will be shared across agencies. Therefore, trust and transparency are paramount. The DOT needs to be able to demonstrate a clear relationship between circumstance (i.e., infrastructure condition and need prior to transfer) and the agreed-upon solution (i.e., level of funding or nature of project agreed upon as part of the transfer). MnDOT has learned this in part the hard way, after facing legal action in this arena.

- Money is tricky. Sometimes money can help the discussion, and sometimes it can derail everything. When assessing misalignment at the system level, MnDOT made a conscious
decision to leave funding off the table until later in the process. This was to ensure a focus on defining shared objectives and criteria that are reflective of the realignment/right-sizing need. Similarly, in the specific case of Washington County, money was not on the table when the initial MOU established a shared goal of transferring a segment of TH 5 from the state to the county. On the other hand, in the case of Carver County, the realignment discussion would never have proceeded at all without discussing funding to address immediate needs on the road. MnDOT staff also emphasize that cost to relinquish discussions should start with defining needs, not simply naming monetary sums.

- Finally, it cannot be escaped that—at least within the legislative framework MnDOT operates in—jurisdictional realignments will always be to a degree opportunistic. While there is clear value in planning to anticipate funding needs, ultimately transfers only happen when there are two partners at the table. This reemphasizes the importance of long-term relationships and trust, as well as a thoughtful process that understands network composition as a continually evolving endeavor to be undertaken by the DOT along with its local planning partners.

### 2.4. ADOT: Jurisdictional Transfer and Low-Volume Roads

This case is based in part on materials previously gathered by the author in support of the forthcoming NCHRP on Investment Prioritization Methods for Low-Volume Roads, which included an interview with ADOT staff, as well as subsequent additional document review.

**Representing the Need for Right-Sizing**

*Background: ADOT Study of Low-Volume Roads*

In 2017, ADOT published its first comprehensive planning study of low-volume roads. Low-volume roads (LVR), as defined by the agency, include all roads on the state system that carry less than 400 AADT. As of 2017, there were 457 centerline miles of LVR on the Arizona state system (<10% of the total system mileage). The study was motivated by the changing role of a specific LVR that serves a copper mine and conversations regarding its rerouting. This in turn “inspired a broader look at low-volume road facilities on the state system, with the objective of providing a basis for subsequent prioritized activities for the future management of each LVR.”23 The study addresses two potential avenues to more efficient operations from the perspective of the state: (a) potential for transfer of a route to another agency, and (b) other options for reducing ongoing costs for those LVR that do remain on the state system.24

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study also emerged within a broader context of increased attention paid to LVR because of funding limitations.

The LVR study represents an instance of system-wide evaluation of jurisdictional transfer potential. ADOT also has a very well-defined process for evaluating and implementing individual jurisdictional transfers. Both are discussed in this case example.

**Identifying the Need to Right-Size via Jurisdictional Transfer**

ADOT defines the reasons for jurisdictional transfer in a manner that directly responds to the changing nature of demands placed on the transportation system:

As the road system in Arizona grows and changes to meet land development demands and population growth, the functions of the roads adapt to the needs. Roads that serve primarily local trips may be more suitable to be transferred to the local road system. Conversely, local roads that primarily serve regional and statewide through trips or connect to state roadway facilities may be candidates for transfer to the State Highway System. In both cases, a transparent and cooperative process is needed to determine which agency is best suited to provide long-term ownership and management of the road.

This perspective is formally codified in policy from the Arizona State Transportation Board, as shown in Table 5.

### Table 5 Arizona State Transportation Board Policy 16. Transfer of State Routes Policy

- It is the policy of Board that the State Highway System consist primarily of routes necessary to provide a statewide network to serve the ever-changing environment with regard to the interstate, statewide and regional movement of people and freight.
- In recognition that population and employment growth in Arizona and adjacent states will, over time, create demands for new transportation facilities and later the function of some existing transportation facilities, ADOT will develop and maintain a process for transferring certain state highways to local and tribal jurisdictions and conversely, transferring certain non-state highways to the State Highway System. Routes primarily providing land access and local movement of people and goods should be the responsibility of local governments.
- The transfer of state highways will be carried out in accordance with the applicable transfer statutes A.R.S. §28-7046 and §28-7209.


In addition, ADOT’s Route Transfer Handbook lists specific reasons that transfers might be needed and reasons they can in some cases facilitate more appropriate management of roads to meet local needs. These precipitating causes are listed in Table 6. The handbook emphasizes the relationship between local ownership and the ability to “maintain the road consistent with local objectives.” ADOT also acknowledges in some cases transfers are needed from a local government to the state (see reasons outlines in Table 7).

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Table 6 Reasons Defined by ADOT for Considering Transfer of a State Highway Segment to a Local or Tribal Government

- The roadway carries vehicle trips that are mostly local in nature-for shopping, local business, and recreation
- The roadway function has changed and no longer provides higher-capacity continuity in the State Highway System
- A new state highway bypasses a city, and the route through the city is no longer needed as part of the State Highway System
- Highway realignment leaves a remnant portion of a state highway that is useful primarily for local access purposes
- Having only one government making access management, maintenance, and operations decisions on a roadway might result in greater efficiency, support economic vitality, and improve community responsiveness
- The local or tribal government wants to have improvements, permit accesses, or maintain the state route in a way that is different from ADOT
- The highway no longer provides interstate, intrastate, or regional system connectivity


Table 7 Reasons Defined by ADOT for Considering Transfer of a Local or Tribal Road or Highway to the State Highway Segment

- Long-range planning indicates that the road will serve a regional or statewide function
- The road may connect to a planned state route
- The local road currently serves a statewide or regional function. Examples include a major urban arterial that serves mainly through traffic, or a rural route that has statewide economic importance
- The road is a connector between two interstates or state highways, or between a state highway and an interstate route


Identifying and Analyzing Right-Sizing Options

Transfer Process

ADOT’s Route Transfer Guidebook has a step-by-step process for both possible directions of route transfer (upwards and downwards). These are illustrated in Figure 11 and Figure 12. The processes are very similar except for the initiating party and the type of State Transportation Board resolution required for making the transfer. While the guidance is very systematic, the document also recognizes that each transfer situation is unique and therefore allows for flexibility in actual implementation. The transfer process involves multiple phases of evaluation and clearly demonstrates the importance of buy-in. Primary participants include ADOT District Engineers and local jurisdiction or tribal government directors or managers. There are also provisions for public involvement such as through hearings. The handbook suggests the use of a memorandum of understanding (MOU) between state and local parties to set the stage for subsequent steps. The MOU would define the limits of the segment in question, justification for the transfer, an anticipated timeline, and roles and responsibilities — including data collection and analysis — for the remainder of the process. It is also at the point of developing the MOU that
MPOs/COGs are also informed so as to facilitate their transportation planning responsibilities. The handbook provides a template MOU.

The process then goes through a series of data collection and evaluation steps that results in the development of preliminary feasibility evaluation, a route transfer report, and ultimately an intergovernmental agreement. Criteria used for analyzing the jurisdictional transfer option at each phase in the process are discussed in the following section.

**Figure 11 Transfer from the State Highway System to a Local or Tribal Government**

![Decision Making Process for Cooperative Permanent Route Transfer from State Highway System to a Local or Tribal Government](source)

Figure 12 Transfer from a Local or Tribal Government to State Highway System

Route Transfer Evaluation Criteria Applied on a Case-By-Case Basis

Pre-Process Evaluation Checklist

For use before even entering the process, the Route Transfer Handbook provides a simple checklist with which to evaluate whether a route is a good candidate. Questions from the checklist address trip character (who uses a route, and for what types of travel), highway function (importance to statewide or regional connectivity), the influence of other projects on the network, and consideration of maintenance and operations and capabilities, as shown in Table 8.
### Table 8 Initial Checklist Questions for Jurisdictional Transfers

<table>
<thead>
<tr>
<th>Consideration</th>
<th>State to Local (Seeking “Yes” answers)</th>
<th>Local to State (“Seeking Yes” answers)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trip Character</td>
<td>• Does the route primarily serve local travel needs?</td>
<td>• Does the route primarily serve statewide or regional travel needs?</td>
</tr>
<tr>
<td></td>
<td>• Are vehicles trips primarily local in nature, for shopping, local business, and recreation?</td>
<td>• Are vehicles trips mostly regional or statewide in nature?</td>
</tr>
<tr>
<td>Highway Function</td>
<td>• Is the route considered non-essential for statewide or regional system connectivity?</td>
<td>• Is the route needed for statewide or regional system connectivity?</td>
</tr>
<tr>
<td></td>
<td>--------------------------------------------------------------------------------------------------------</td>
<td>• Do local or regional plans treat the highway as a statewide facility favoring mobility, as determined by highway classification and access management?</td>
</tr>
<tr>
<td>New or Major Construction</td>
<td>• Is the route affected by a new state highway that bypasses or duplicates the route?</td>
<td>• --</td>
</tr>
<tr>
<td>Maintenance and Operations</td>
<td>• Does a receiving agency (local or tribal jurisdiction) have the ability to maintain and operate the highway?</td>
<td>• Are route maintenance requirements more efficiently provided by the state?</td>
</tr>
</tbody>
</table>

*Source: Adapted from ADOT. Route Transfer Handbook. 2012.*

### Feasibility Evaluation

The preliminary feasibility evaluation happens after an initial meeting between involved parties and the development of the MOU. It employs a more detailed list of evaluation questions to determine appropriateness for transfer. For each question, the handbook outlines a response and analysts are asked to determine whether each is “true”, “false,” or “neutral” with respect to the corridor. At the end of the evaluation, a preponderance of “True” responses mean the segment is a likely candidate for transfer. A sample of considerations addressed in this evaluation are shown in Figure 13. The evaluation criteria have also been implemented within an excel tool.

The feasibility evaluation is in fact quite extensive, but nevertheless relies on questions stated in relatively straightforward language. While the guidebook outlines data that can be used to address these questions, the process requires qualitative judgment.

The full set of categories addressed in the evaluation are:

- Transfer objective
- Right-of-way ownership status
- Trip character (trip purpose, multimodal transportation needs/conditions)
- Highway function (including consideration of continuity and connectivity, state highway system functionality, frontage roads, parallel routes, and new or major reconstruction affecting the segment)
• Land use
• Access management (e.g., driveways/access points, access management features, intersection/interchange access, and frontage roads)
• Future needs
• Jurisdictional interest (expressed interest and desire for different standards of service by local governments)
• Other non-statewide routes (addressing special designations such as evacuation of freight routes), and
• Maintenance and operations (including potential for discontinuities affecting O&M, and ability and efficiency of O&M at each level of government).

The framework tends to point locally-serving roads with greater levels of bike/pedestrian/transit service, and fewer access control measures toward a determination of more appropriate ownership by local governments. It recognizes the implications of transfers for operations and maintenance efficiencies, acknowledging that certain maintenance requirements may be more efficiently provided at a local level. It also addresses the possibility of benefits from having land use and transportation decisions within the same entity:

Consolidation of government decisions for land use and access management decisions would provide greater efficiency, economic development potential, and community responsiveness.

**Figure 13 Route Transfer Considerations**

<table>
<thead>
<tr>
<th>Category</th>
<th>Transfer Considerations</th>
<th>Considerations for Transfer to Local or Tribal Government</th>
<th>Considerations for Transfer to State Jurisdiction</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Transfer Objective</strong></td>
<td>What is the main objective or goal that is anticipated through completion of the proposed transfer?</td>
<td>A local or tribal government desires increased control of improvements, maintenance, access decisions, and financial responsibility.</td>
<td>ADOT desires to gain or maintain control and/or financial responsibility.</td>
</tr>
<tr>
<td><strong>Right-of-Way</strong></td>
<td>Does ADOT or the local or tribal government have full title rights to the candidate roadway?</td>
<td>Route transfer evaluation and negotiations require that all roadway owners (e.g., federal, state, tribal, easement) are participants in the process.</td>
<td>Route transfer evaluation and negotiations require that all roadway owners (e.g., federal, state, tribal, easement) are participants in the process.</td>
</tr>
<tr>
<td><strong>Trip purpose</strong></td>
<td>Does the road or highway serve statewide, regional, or local travel needs?</td>
<td>Route primarily serves local travel needs. Vehicle trips are primarily local in nature, for shopping, local business, and recreation.</td>
<td>Route primarily serves regional or statewide travel needs, vehicle trips are mostly regional or statewide in nature.</td>
</tr>
<tr>
<td><strong>Multimodal transportation</strong></td>
<td>Do alternate modes of travel (bicycles, pedestrians, public transit, and school buses) that primarily serve local trips, significantly impact the function of the roadway?</td>
<td>Trips made by local transit, bicycles, and pedestrians have a significant impact on the function of the route. This does not pertain to regionally-oriented transit such as Express Bus or other high-capacity transit.</td>
<td>Local transit, bicycles, and pedestrians do not have a significant impact on the function of the route. This does not pertain to regionally-oriented transit such as Express Bus or other high-capacity transit.</td>
</tr>
<tr>
<td>Is there a desire by the local or tribal government for significant investment in multimodal facilities, such as sidewalks, shared use paths, crosswalks/pedestrian signals?</td>
<td>Significant multimodal infrastructure is needed to accommodate locally-oriented users of the roadway, including bicyclists, pedestrians, and transit users.</td>
<td>There is not a desire or need for significant locally-oriented multimodal infrastructure.</td>
<td></td>
</tr>
<tr>
<td>Does the route connect to regional multimodal facilities, such as airports or rail stations?</td>
<td>Route does not connect to significant regional multimodal facilities.</td>
<td>Route connects to significant regional multimodal transportation facilities.</td>
<td></td>
</tr>
</tbody>
</table>

If the segment passes the feasibility evaluation, the findings are then documented in a route transfer report that then provides the basis for subsequent negotiation processes.

**Planning Study Criteria – System-Wide Assessment of LVR**

In the context of the 2017 planning study evaluation of LVR, ADOT evaluated 22 state routes for transfer potential by assessing the markets they serve and the types of access provided, as shown in Figure 14. Routes that provide access to facilities of regional or statewide importance, or that or are essential for regional system connectivity were more likely to be considered as warranting the State Highway designation. The process was guided by the statement that “In general, low-volume roads should not be designated as state highways unless they serve a specific state or national purpose within the transportation system.”

This evaluation of transfer potential is particularly interesting from the perspective of right-sizing because it was undertaken alongside consideration of other potential “right-sizing”/cost-saving options including (a) changes to operations and maintenance policies, (b) consideration of road closure, and (c) consideration of the appropriateness of implementing design exceptions to achieve cost savings within a performance-based practical design framework.

**Figure 14 Low-Volume Roadway Characteristics Evaluated in 2017 Planning Study**

![Figure 14 Low-Volume Roadway Characteristics Evaluated in 2017 Planning Study](image)

*Source: Arizona DOT. Low Volume State Routes Study.*

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## Implementation

### Issues for Negotiation

The Route Transfer Guidebook presents significant discussion of issues likely to come up in a transfer negotiation process. A summary of these considerations can be found in Table 9. Aspects of particular interest from the perspective of right-sizing have been underlined and italicized below.

### Table 9 Transfer Negotiation Issues

<table>
<thead>
<tr>
<th>Issue</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ownership</td>
<td>Rights to ownership are complex. The process must determine the conditions under which the current road owner is legally empowered to transfer road rights-of-way to another owner.</td>
</tr>
<tr>
<td>Access Control</td>
<td>The handbook states that access control is a public asset with value in the negotiation process and that “Responsibility for access control needs to be explicitly addressed in the route transfer agreements.” For transfers to local governments, ADOT has to determine its willingness to relinquish responsibility for access control, and the Handbook suggests that this willingness has a value that should be considered in financial negotiations.</td>
</tr>
<tr>
<td>Existing Permits, Encumbrances, and Agreements</td>
<td>These may affect future development potential and therefore must be disclosed. “Encumbrances on the rights-of-way, such as utility easements, might also be a negotiation issue for jurisdictional transfers.”</td>
</tr>
<tr>
<td>Federal Interest</td>
<td>There are regulations governing the treatment of rights-of-way originally acquired using Federal-aid Highway Program Funds.</td>
</tr>
<tr>
<td>Roadway Condition and Maintenance</td>
<td>To facilitate negotiation requires a clear understanding of roadway condition and maintenance, as it directly affects the maintenance burden being transferred. The Handbook recommends that an estimated annual maintenance costs be included in Route Transfer Report used in the negotiation process.</td>
</tr>
<tr>
<td>Roadway Improvements and Design Standards</td>
<td>“A transfer of responsibilities should not leave the accepting jurisdiction in a position of significant liability.” Therefore, the segment should be reviewed for standards compliance and an estimate developed to bring the road up to standards. Safety is a key consideration in this process.</td>
</tr>
<tr>
<td>Rail Crossings</td>
<td>“The terms and transferability of existing railroad agreements and licenses should be a consideration for any jurisdiction considering accepting responsibilities for a road with railroad crossings. A meeting should be held with the railroad(s) and parties to the jurisdictional transfer to determine the conditions for transferring the agreements and licenses.”</td>
</tr>
<tr>
<td>Route Signage</td>
<td>For users of the system, road signage is important for avoiding confusion, and must be sorted out as part of a transfer.</td>
</tr>
<tr>
<td>Traffic Signals and Lighting</td>
<td>Maintenance and operational responsibilities for traffic signals, lighting, and pedestrian facilities must be sorted out as part of a transfer. In some cases, transfers may even be limited to things like pedestrian facilities rather than a whole roadway. This negotiation is also important because it addresses underlying “philosophical issues” or differences that may exist between the state and locals – e.g., whether signals are intended to ensure smooth throughput or to reduce speeds and thereby “increase safety or attract attention to adjacent development.”</td>
</tr>
<tr>
<td>Landscaping</td>
<td>Similar to the above, ADOT and local jurisdictional may have different visions for landscaping in terms of purpose, safety, cost, and aesthetics. These have to be sorted out alongside responsibilities.</td>
</tr>
<tr>
<td>Transfer Time Frames</td>
<td>Here it is important to define realistic expectations and intermediate milestones. These can be defined early on in the MOU to keep the process moving.</td>
</tr>
</tbody>
</table>
“The most critical post-transfer responsibilities are those associated with safety, such as signal operations, signing, striping, lighting, emergency response, and law enforcement. Other post-transfer responsibilities will include items such as roadway and landscape maintenance, utility payments, capital improvements, access permitting, and completing the legal and administrative aspects of the transfer. These post-transfer responsibilities should be clearly delineated in the transfer agreements and follow-up meetings should be conducted periodically with all participating agencies to assess performance and address any unanticipated consequences of the transfer.”

The Handbook suggests a benefit-cost analysis of any elements that can be quantified, within a timeframe such as 20 years. Suggests elements for consideration include:

- Right-of-way value
- Improvements / equipment value
- Access control value
- Revenue streams and anticipated grants
- Required capital investments
- Required maintenance and operating costs
- Law enforcement and liability costs

“In an ideal transfer, the benefits to each party to the transfer would be greater than their respective costs.”

The Handbook also suggests consideration of hard to quantify outcomes: “For example, a local agency may realize benefits associated with local control of the roadway such as enhancing economic development potential for adjacent properties and generating additional property and sales taxes. In addition, local control may allow for temporary road closures for special events, enhanced aesthetic treatments, and/or higher levels of maintenance that all benefit the community.”

Source: Based on material included in the ADOT Route Transfer Handbook (2012). All quotes directly from the Handbook.

**Program-Level Planning for Right-Sizing Via Jurisdictional Transfer**

With the completion of the Low Volume Routes (LVR) Study, ADOT is now determining on a route by route basis, how to move forward with some of the LVR recommendations based on the Route Transfer Handbook guidance.

**Lessons Learned and Conclusions for Right-Sizing**

The following observations can be made based on the findings of this case example:

- ADOT’s handbook is an example of a very well-defined process that is nevertheless cognizant of the need to be flexible. Although supported by data, the process depends on judgment and works to ensure key factors are accounted for through the use of checklists and specific guidance on potential issues to anticipate.

- ADOT’s study of low-volume roads emphasizes that lower-volume facilities may represent a sort of “frontline” of the right-sizing conversation. Their approach is also notable
because it incorporates consideration of transfer in the context of other cost-saving or right-sizing options.

- ADOT benefits from clear policy guidance from its State Transportation Board regarding the intended nature of the state highway system, as well as the need for continual evolution of the road network in response to changing usage patterns and development trends.

- Also, relevant to right-sizing is the specific confluence of land use and transportation considerations in ADOT’s approach to jurisdictional transfer. ADOT recognizes that there can be benefits — in terms of efficiency, economic development, and responsiveness to community needs — from having only one entity control both a road and the surrounding development environment.

- Finally, ADOT’s guidance on financial considerations for negotiation outlines a more complete set of factors than just a transfer of operating and maintenance burdens between agencies. This broader view of potential benefits and costs is important to the question of right-sizing and whether and how to determine if all parties emerge from a transfer with net positive outcomes.
3 Right-Sizing Through Performance Targets and Trade-offs

3.1. Background and Purpose

Strategic reinvestment and disinvestment is not an entirely new concept when determining strategies to manage and fund the maintenance, repair, and rehabilitation of transportation assets. In 2015, the National Cooperative Highway Research Program (NCHRP) released a research synthesis providing a road map to transportation disinvestment. The synthesis defined the strategic disinvestment paradigm, provided background information on tools that can be used to evaluate disinvestment decisions, and discussed various case studies of disinvestment across federal, state, and local agencies. A substantial number of state departments of transportation were surveyed to assess their experiences with disinvestment decision making as part of the synthesis. The state-level case studies provided real-world examples of how different states prioritized transportation funds for projects that best fit their strategic plans and goals.

This study builds on the prior synthesis by profiling how states can consider asset management standards and techniques to make right-sizing decisions about their overall program investment levels. The paper reviews the performance standards and trade-off analysis efforts involved in right-sizing methods.

3.2. Define Right-Sizing for Performance Standards

Right-sizing alternatives. Conventional transportation investment alternatives are typically categorized as either maintenance, repair/replacement, or expansion (meaning new roads or capacity increase). Alternatively, right-sizing projects, or alternatives, can incorporate a series of decisions types, including deferment/do nothing, modify the design standard or performance target, decommission or eliminate the asset, reclassify the asset to change the applicable

28 Duncan, C. and G. Weisbrod, NCHRP Synthesis 480: Economic and Development Implications of Transportation Disinvestment, Transportation Research Board of the National Academies, 2015.
standards/targets, or change jurisdictions. This NCHRP study will cover all of these in multiple ways, but this whitepaper will review them in the context of performance standard impact.

**Goal-oriented strategic investment/disinvestment.** Decision-makers need to consider both the conventional and right-sizing alternatives for a comprehensive solution whether to invest or disinvest. Strategic investment/disinvestment generally involves\(^{29}\):

1) clearly prioritizing transportation goals and objectives,

2) identifying the projects and/or assets that are most important with respect to obtaining various goals as well as projects and/or assets that are the least important or least critical in obtaining those goals, and

3) consciously defunding or reducing funding allocated to lower priority transportation assets and ideally reinvesting those savings into higher-priority assets.

**From performance measurement to management: establishing the groundwork for right-sizing decisions.** Georgia Department of Transportation (GDOT)\(^{30}\) has put a significant amount of research into performance measures and analysis related to effective asset management. Performance measures are defined as indicators of system effectiveness and efficiency, and thus can be supportive in effort to right-size. Based on their research, GDOT defines best practices for selecting performance measures and standards as shown in the list of guidelines in Table 10.

**Table 10 Guidelines for Selecting Performance Measures and Targets**

| 1. Performance measures should flow directly out of an agency’s mission and objectives. |
| 2. Performance measures should provide a balanced picture of an agency’s business and utilize input, output, outcome and productivity or efficiency measures in an appropriate manner. |
| 3. An effective performance measurement system will have a few, well-defined measures tied to a handful of clear goals to be achieved within specific time frames. |
| 4. Performance measurement systems should be periodically evaluated in an iterative process. |
| 5. Performance measures should use reliable and available data that the agency can collect without straining its resources. |
| 6. Performance measurement reporting and communication should be clear and easy to understand. |
| 7. Comparative performance measurement, also known as benchmarking, has been recognized as important among state DOTs. |


8. Customer satisfaction, environmental quality and sustainability are increasingly important outcome measures.

9. Performance targets should be set in relation to achieving the agency’s strategic goals, considering policy guidance and public input, funding availability, benefits, costs, risks and trade-offs (or opportunity costs of setting various targets). Scenario analysis is a useful analytic tool when setting targets.

10. A growing number of agencies are using formal performance frameworks to select performance measures. Performance frameworks are structured processes that provide guidance for selecting performance measures, e.g., the Balanced Scorecard Framework.


Right-sizing strategies that include changing performance targets, altering design standards, and/or reclassifying assets may also prove to be effective. Changing performance targets, standards, and measures can be a difficult process, but can lead to revised ways of addressing the transportation network and allocation of limited funds. Many states have committed to using performance measures, but the maturity of the measurement systems and measures themselves can vary. As performance measurement has evolved, there has been a shift in focus from performance measurement to performance management which entails using the data collected to make budget allocation decisions that result in the achievement of strategic goals. This paper provides example and recommendations to show how different agencies use these performance indices in decision making for right-sizing of projects. The guidelines from this research reflect where some DOTs are currently with integration of performance measures to the decision-making process and highlight efforts being made by other DOTs in this direction.

### 3.3. Current Efforts in Right-Sizing

This section includes documentation of current right-sizing or right-sizing related practices within state DOTs. Information was collected through a series of practitioner interviews, as well as through supporting document research.

**Utah: Funding-Driven Temporary Disinvestment**

In Utah, prior to the additional funding from Utah HB 362 Transportation Infrastructure Funding, the DOT lacked adequate revenues to properly fund the state system. Utah DOT (UDOT) needed to determine priorities and a justifiable balance of needs and existing resources. The decision made was to un-fund the Level 2 roadways while meeting the needs of the interstate and Level 1 pavement. Level 2 roadways (approximately 1,875 miles or 32% of the total system) are defined by UDOT as having AADT less than 1,000 and truck volume less than 200. UDOT has created these Management Levels (Interstates, Level 1, Level 2) for prioritizing the pavements in acknowledgment that current funding levels are not adequate to maintain the entire system. These levels consider the needs of the network as a whole and provides information for a statewide program in an effort to optimize funds over the entire system. Managers compare the benefits and costs for several alternative programs and then identify the program and budget
that will have the greatest benefit-cost ratio. Allowing Level 2 roads to deteriorate without preservation or maintenance activities allowed the DOT to focus on higher traffic roadways. Asset management data (through pavement management system analysis) reveal that conditions for interstate and Level 1 roadways have steadily improved over time while Level 2 conditions trend slightly downward. After the assessment of the additional funding from HB 362 in 2015, UDOT has worked to improve and adjust funding thresholds for Level 1 and Level 2 roadways accordingly – to properly fund the Level 2 roads again – allowing UDOT to subscribe to its asset management philosophy of “Good roads cost less.” In the short term, however, UDOT decided that temporary disinvestment of low traffic roadways was tolerable. Logically, the impact on performance measures (pavement condition in IRI of good/fair/poor) for this class of roads was negative during this period but justified because it enabled UDOT to maintain the overall condition for the other pavement categories. While this case does demonstrate trade-offs made by a DOT to reallocate funds from a lower priority to a higher-priority set of roads, it is nevertheless a temporary action that does not reflect a long-term determination of altered needs.

**Minnesota: Right-Sizing Through Condition Targets**

Similarly, Minnesota DOT (MnDOT) disinvested in the state highway system to reinvest in the NHS based on the need to match federal funds. This was also triggered by a shortfall in revenue. In contrast to the Utah example, where right-sizing was achieved through reclassification of facilities and reallocation of funds, MnDOT formally lowered the minimum pavement condition of non-NHS class of roads. The conversation began through a trade-off analysis to quantify the differences and options across state categories and assets. Analysis included the DOT management system and an iterative trade-off process following discussions between state planners and engineers. Once the non-NHS class was selected for the disinvestment, minimum pavement condition targets were incrementally increased to coincide with the lowered funding level. In this way, performance targets responded to an understanding of funding availability. In Minnesota, the ability to identify and communicate the outcomes of this type of right-sizing decision is closely tied to the use of performance measures. The measure for percentage of poor ride quality on the non-NHS system is forecast to increase from 7% to 8% in 2013 to 11% to 12% in 2023. This process of forecasting and trade-off analysis was presented to the public as part of an outreach campaign associated with the long-range transportation plan. The premise was difficult to articulate to the general public. MnDOT decided it was more logical to communicate the need and investment in terms of ROI (return on investment), which is an economic-based measure used to quantify growth compared to capital expenditure. The benefit-cost and lifecycle analysis is still present from the pavement system analysis, but ROI provided a more understandable measure for comparison.

While states are financially motivated to disinvest in assets and accept lower performance from those assets, the long-term sustainability of these methods are still questioned. Utah only kept the disinvestment for a short period until a new revenue source was implemented. Minnesota

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still has this in place in their 20-year plan as NHS roadways carry a larger economic importance for the state, compared to non-NHS roads. Nevertheless, questions remain about the long-term implications of lowered standards: Should the DOT and commuters adapt to the decreased performance in this tradeoff to ensure better (or maintain) performance on those higher AADT and VMT parts of the network? Does this change truly reflect a right-sizing for the future, or is it a funding-driven decision, only? What happens to the older pavement in the long run?

While the previous two examples discuss system-level decision making, MnDOT has also addressed what might be considered right-sizing at the level of overall roadway design. For example: a state road through an urban area in Minnesota began in the 1970’s as a 2-lane road with diagonal parking slips. In the past decade, the parking has changed to parallel parking spaces on the roadside. This opens the lane width, but not enough for additional lanes (though this road does not require more capacity). The roadway is due for a reconstruction to rebuild the base of the pavement. During this time, MnDOT will look to taking the extra pavement area and design the cross section of the corridor to provide wider sidewalks and/or bike lanes, while still retaining the 2-lanes of traffic and parallel parking. This is a result of local and state engineers and planners recognizing an issue and right-sizing a solution. The outcome will provide an economic return to the downtown area by way of wider sidewalks and potential streetscaping plan, but will also lessen the maintenance burden of the state because of the reduced pavement surface area. The performance outcome, as measured, will be moot since the state measure is ride quality by travel lane and not pavement area. However, efforts to right-size road projects such as this example will result in being able to stretch the available funds and improving more miles. This would have a positive impact of the state’s ride quality measure.

**Vermont: Right-Sizing Motivated by Disaster Recovery**

Vermont used right-sizing methods to evaluate replacement bridges after tropical storm Irene in August 2011\(^32\). The storm was a major rain event in Vermont, bringing flood levels unseen since the 1926 floods. Tropical Storm Irene severely damaging more than 500 miles of state roads and 200 bridges, isolating 13 communities. The bridges suffered serious damage because of scour. Scour, caused by swiftly moving water, can scoop out holes in the bridge supports, compromising the integrity of a structure. Vermont, through the Vermont Agency of Transportation (VTrans), set out to replace the damaged bridges to help facilitate the post-disaster recovery. Access to isolated town was the priority here as mobility was returning to the network. VTrans and the Vermont natural resources department worked together to replace the bridges – one agency focused on transportation mobility on the bridge and the other concentrated on permitting and fish passage under the structure. The redesign process looked to propose resilient structures with longer spans between pilons. Resizing of the bridges (including the option to downsize) was also reviewed as part of this to ensure capital funds were used effectively. There were limitations to this, however. If Federal Emergency Management

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Agency (FEMA) funds were used, since this was a catastrophe response effort, the bridge had to be replaced with a similar structure in scope and design. Nevertheless, this single event sparked a thought process around right-sizing infrastructure at VTrans. This thought process has not yet been extended to more routine planning.

**Tennessee: Right-Sizing the Project Development Process**

Repurposing, redesigning and rethinking of projects for context-sensitive and right-sizing techniques are also part of a 2012 Tennessee DOT (TDOT) study. TDOT, along with Smart Growth America, looked at the existing project process from planning to construction and developed improvements to the methodology and policies which regulate it. The project “aims to create a process within TDOT to enable and encourage flexible, lower-cost ways to increase capacity on the state’s transportation system while expediting job creation and economic development in Tennessee.”

TDOT reviewed the existing strengths and weaknesses of current approaches to transportation project identification and development. From there, the team explored how to identify and analyze the investment strategies. A matrix of investment alternatives was developed, which assess:

- maximizes job creation and economic development;
- cost-saving potential;
- applicability to capital improvements;
- maintenance and/or operations;
- stability and sustainability;
- equity; and
- ease of implementation

Related performance measures where developed and tied to state principles for tracking and prioritization purposes. TDOT applied this matrix of investment alternatives to existing state transportation improvement program (STIP) projects in hopes of finding cost-conscious alternatives that also achieve the desired objective of the original solution. After reviewing just the first five projects, TDOT found a cost savings of over $171 million through right-sizing the scope of work. The study found that many transportation projects could get 80-90% of the desired outcome needed with an improvement to the network that cost up to one-tenth of the initial proposal. All the while, during this process, the rideability performance measure for pavement condition (percent of IRI) was maintained above national standards for the state.

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network. Thus, this effort allowed limited resources to be allocated across more assets without having to compromise the roadway performance measures, resulting in a significant potential gain to the DOT budget and the state budget overall.

**Right-Sizing/Cost Reduction Strategies for Vehicle Fleets**

**Self-Evaluation Approach.** The US Department of Energy\(^{35}\) explains a helpful process that could be used to right-size vehicle fleets as a management tool. Several steps are suggested in building and maintaining sustainable, fuel-efficient fleets:

1. Self-evaluation questions – suggests a series of questions for fleet managers to begin an evaluation of their existing vehicle fleet. Such questions ask about vehicle mileage, tasks, size, etc. and question whether such conditions are both optimal in operation and cost efficiency

2. Driver Input – can be received through face-to-face conversations/interviews or surveys to get a consensus of how the fleet is used on a day-to-day basis

The agency has the option to reassign, replace or eliminate each of their fleet vehicles so a business case per fleet vehicle must determine how each would reduce gas and maintenance costs in relation to impacts on fleet activity.

3. Define Evaluation Criteria – the business cases can be established through defining criteria for evaluation like fuel efficiency, miles traveled, etc.

4. Rank – each fleet vehicle relative to its counterparts finally considering an option to make smart vehicle purchases like transitioning to smaller more efficient engines, lighter vehicles, or alternative fuels and vehicles

**External Auditing.** Some agencies like Oregon Department of Transportation (ODOT) have made efforts in right-sizing their vehicle fleets in this case through external auditing. The initial audit was performed to assess overall operations, including organizational structure, decision making, communication methods, and external relations as well as an efficiency and optimization assessment of fleet and operation. The efficiency and optimization assessment (which solicited information similarly as suggested above through recent department data and interviews) indicated the fleet’s reliance on informal systems and workarounds, kept it from maximizing efficiency. Based on ODOT’s further recommendation, they have plans to conduct an efficiency study to establish where vehicle fleet reductions can be made.

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Right-Sizing to Addressing Changing Societal Needs

In addition to right-sizing efforts that arise from a recognition of funding limitations and the need to more efficiently use existing resources, right-sizing decisions can also be motivated by recognition of new or emerging needs.

Policies that Address Multiple Modes and Managing Demand

Complete streets policies\textsuperscript{36}, set at the state, regional, and local levels, promote the inclusion and mobility of all roadway users from pedestrians to buses and everything in between. Some approaches to complete streets include a road diet, narrowing the roadway and reducing the number of lanes to reduce travel speeds, promote safety, and improve overall traffic operations.

As of December 2012, Seattle had installed 34 right-sizing road projects since 1972.\textsuperscript{37} Thirteen of them have been more recently installed, since 2007. The following are the planner’s factors of importance for right-sizing:

1. Help 16\% of the city’s households that lack a car
2. Improve safety
3. Improve access for:
   - Seniors
   - Youth
   - Transit riders
   - Those getting to and from cars

The Seattle DOT begins identifying roadways as candidates for right-sizing based on a number of ways:

1. Bicycle and Pedestrian Master Plans
2. Planned road capital projects
3. Community requests to implement Neighborhood Plans

Once preliminary candidates are identified, Seattle DOT uses a series of “Guidelines for Road Diets”\textsuperscript{38} (applying to a four-lane or five-lane to three-lane conversion) which considers

\textsuperscript{36} United States Department of Transportation (USDOT), Complete Streets, USDOT, Washington, DC, 2015.


\textsuperscript{38} Seattle Department of Transportation, Rightsizing Streets: The Seattle Experience, Seattle DOT, Seattle, WA, 2013.
performance factors like vehicle volumes, critical lane approaches level of service (LOS), corridor LOS, and increase in travel time to guide decisions to implement a road diet on a particular roadway. Though they are just guidelines and no roadway is inherently alike, specific roadway attributes and safety concerns for its users are always additionally considered.

Parking and Transportation Demand Management (PTDM) Ordinance\textsuperscript{39} is a national model implemented in cities like Cambridge, MA, to formalize efforts to regulate and control atmospheric pollution from motor vehicles by reducing vehicle trips and traffic congestion within the city and improving mobility and access. Participation in the ordinance is required when a non-residential property owner proposes additional parking beyond the approved registered number of parking spaces. Projects subject to the ordinance may not obtain necessary permits for their parking infrastructure until an approved PTDM plan is established. TDM measures often proposed in the PTDM plan include transit subsidies, free shuttle bus service, bus shelters, market-rate parking fee to employees or patrons, bicycle parking, car/vanpool matching, etc. These measures have shown to disincentives patrons and employers from taking single occupancy vehicle trips while making other modes more attractive, reducing congestion, and vehicle trips in the city.

Both Cambridge, MA, and Boulder, CO, have created similar ordinances that right-size both their city’s parking infrastructure as well as reducing vehicle trips, consequently putting less wear on existing roadways and creating opportunity to invest in alternative modes.

\textit{Changing Expectations of Environmental Impacts}

Natural disaster and climate change often spark conversation within DOTs about the need for repair and maintenance on existing infrastructure. Though infrastructure deteriorates from normal wear, natural disasters create uncontrollable, widespread damage to existing infrastructure while climate change does just the same in a more gradual impact.

Connecticut Department of Transportation’s (CTDOT) Walk Bridge Replacement Project is a prime example of acting before such environmental impacts make a bigger problem than already exists. CTDOT’s Walk Bridge is critical to Northeast Corridor rail service. It operates as a swing bridge, allowing marine traffic through it on average 20-30 times a month. Rising temperatures have caused failing closures of the swing bridge after opening for marine traffic about 10 percent of the time and this is anticipated to occur three times more frequently due to rising temperatures by 2050. Each time the bridge closure fails, it causes significant rail backup and if a significant failure occurred due to hurricane damage the traffic would have to go elsewhere, putting more congestion on the roadways. CTDOT has chosen a full replacement of this bridge rather than the initially proposed 25-year rehabilitation plan.

\textit{Signs of the Time: Right-Sizing for Safety}

While the majority of examples presented in this paper reference pavement and bridge assets, CTDOT also recently found a right-sizing example for another asset through a safety initiative. The

\textsuperscript{39} City of Cambridge, Chapter10.18 Parking and Transportation Demand Management Planning; Parking Space Registration, City of Cambridge, Cambridge, MA, 2017.
DOT is moving overhead signs to roadside location for new signs and replacement efforts. The initiative was sparked by safety regulations to increase the sign face area for NHS roadways. A decision was made by CTDOT management to move signs from their overhead location to the roadside where available. The reason for this move was a concern over pole arm replacement needs to accompany the increased sign sizes. The driver for this was financial as total replacement costs were expected to increase because of redesign and construction. While the initial reason was monetary, the decision to move signs to the roadside locations also resulted in:

- Safety to maintenance workers – The roadside locations are easier to access and inspect for the maintenance crews, meaning a safer field experience and a decreased cost for traffic control on the maintenance task since they do not have to block travel lanes of the road.

- Safety to drivers – A direct replacement of overhead signs with a larger sign would likely have resulted in an increase of hits. The new sign locations meant reduction of those collisions and resulting damage to other commuters from the aftermath of debris.

- Saving on maintenance – CTDOT has had a limited maintenance budget for the past three to four years. This means the maintenance department has prioritized its work and left work requests related to lower-profile assets (i.e., signs) unresolved. This sign policy effort has multiple cost savings implications. First, the roadside post construction is a cost savings compared to the overhead arms. Second, fewer sign collisions means less emergency request and unexpected labor expenditures for the maintenance department. Finally, the savings are also routine labor and equipment savings on maintenance and inspections of the roadside location as these activities are far less intense than with overhead signs.

This brand of right-sizing was ultimately implemented for both limited access roadways and also secondary system signs. CTDOT extended their policy of sign review to the secondary system, not because of overhead sign requirements, but in order to reevaluate signs for relevance. If the state determined the sign was not justified or unnecessary because of changing demand or surrounding land use, the sign was removed from the inventory. Historically CTDOT would replace in-kind, but this policy sparked a process to review the need and purpose. The resulting right-sizing directly impacts the maintenance needs and resource allocation for signs in the state. While the overall budget is not comparable to roads or bridges, CTDOT expects this effort to have a positive impact that will evaluated in coming years.

**Hidden Issues in Current Efforts to Right-Size**

**Inadequate Accounting for Lifecycle Cost Implications of Deferred Action**

Deferment of action, as shown in UDOT with Level 2 roadways, is a relatively passive disinvestment strategy that takes advantage of the time element of investment decision making. Delaying the improvement actions allows a continued deterioration of that asset, without the routine maintenance associated with normal business practices at a DOT. In some ways, simple deferment of action may be easier process-wise than other approaches to disinvestment such as
intentionally modifying the performance targets of a corridor or asset to justify the increased time between maintenance actions taken by the agency. However, simply deferring action without defining a new (lower) acceptable condition level can lead to problems downstream, and a situation that cannot properly be described as right-sizing. Planners within DOTs are not necessarily anticipating how failure to perform routine maintenance could lead to escalated asset deterioration and asset impairment — resulting in increased risk and failure of the asset. Nor are they necessarily addressing what the long-term target condition of an asset is.

Recently, California Department of Transportation (Caltrans) emphasized the need for long-term transportation funding since deferred maintenance and winter storm-related emergencies have accelerated the deterioration of the state highway system. California has about $6 billion in annual, unfunded maintenance needs. Deferred maintenance needs lead to a “worst-first” improvement strategy and runs counter to classic asset management practices. Deferring maintenance, when unchecked, can also have a negative impact on analysis through management systems because of the additional deterioration caused by extreme weather events. Such events can cause exponentially more deterioration than the models can account, resulting in poor decision making from the systems. It also has a negative overall impact on resources as the improvements undertaken after a period of ignoring regular maintenance needs are often more costly than what the agency would have spent simply doing the maintenance work.

Missouri, like most states, has a mounting issue with deferred maintenance. Missouri Department of Transportation (MoDOT) will begin to underfund the non-National Highway System (NHS) roadways in coming years as its $325 Million annual investment will focus primarily on roads and bridges on the NHS. Missouri has forecast the costs of this deferment strategy, assuming roads will ultimately be brought back in line with current conditions standards: The estimate of deferred costs on the secondary roadway system shows that over the next 10-years costs would reach $2.8 billion — $1 billion more than the cost if funds were available for annual maintenance. Again, this is due to the pavement deteriorating at an accelerated rate requiring more extensive and costly repairs down the line.

Safety and Accessibility Measures in Right-Sizing

The right-sizing process must also have a way of recognizing issues of critical importance of society, so as to ensure that any right-sizing alternative pursued does not impose unacceptable costs to society as a whole. Specifically: Right-sizing improvements need to consider access to critical services (i.e., access to hospitals and police / fire services). This should be an aspect of planning and design, but attention given to area land use and the traffic on an asset may be specific enough to warrant an individual strategy. For instance, the ability for a fire engine to turn at major intersections may limit the project(s) planned for that corridor or change the bridge design to account for oversized vehicles — even if the asset is a low-utilization facility. As safety is

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40 Caltrans (California Department of Transportation) April 14, 2017.
41 Missouri Highways and Transportation Commission, “View from the Chair” newsletter, March 26, 2015.
often a key performance measure and project criteria within agencies, right-sizing projects should make sure the trade-off analysis is comprehensive to all users of the asset, routine and non-routine. For example, Seattle DOT has right-sized a four-lane roadway down to a three-lane roadway. The three-lane road accommodates the lane of traffic in each direction and has the turn lane in the center. For those emergency times, though, the design allows emergency vehicles to travel hindrance free in the center lane, improving response time even during high congestion periods.

3.4. Who Is Involved in Right-Sizing?

This question is both easy and difficult. The simple answer is to include everyone to provide input on the process. However, time and scheduling likelihood make this unlikely. Therefore, right-sizing conversation needs to occur with the planners and engineers. Most decisions that affect project outcomes are made in the first three phases of a project development process – planning, environmental, and design. TDOT recommends the following composition of a review group:

- An engineer or roadway designer from the Design Division;
- A planner from the Long-range Planning or Project Planning Divisions;
- An environmental planner from the Environmental Division; and
- A project manager from the Project Management Office.

Optional = partners from MPOs, RPOs, and/or local governments.

Involving individuals across these areas will not only help identify right-sizing potentials, it will also help the funding conversation at the programmatic level and into construction and properly implementation of the project. Other states could similarly review who needs to be involved in right-sizing type decisions and consider whether there needs to be a review team within the DOT to orchestrate multi-discipline review of projects.

The right-sizing process is supported by existing policy efforts from management and executive levels within an agency. As discussed in the previous section, these policies can help dictate who and how people should be involved. These policies and efforts can also shape the goals and objectives of the agency, and ultimately performance measures, which are guiding the choices made by the personnel. Policies also provide transparency to the DOT process and allow stakeholders to understand how and why decisions are made. The public should be involved at some level of every process as they are the end user of the roadway system – whether as a grassroots effort to initiate a specific improvement or to gauge support for a DOT design.

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3.5. Tools of the Trade

There are many tools that could potentially be used for analysis and consideration while attempting to determine the impacts and trade-offs of right-sizing projects and programs. This section will review generic categories to provide some context of their capabilities and purpose.

Pavement Management

Pavement is the most visible of all assets and typically the most costly to build and maintain for a DOT. The performance of just this asset can largely dictate how an agency is viewed by stakeholders. For this reason, many DOTs have pavement management systems to help with the decision making for their roadway network. According to NCHRP Synthesis 501, 49% of the DOTs have customized, proprietary pavement management software in place. While there are multiple software programs available for purchase, and some DOTs have internally developed their own management system other times, the premise of the pavement methodology is similar:

1. Inventory road segments with length, material, and class.
2. Evaluate each segment for condition (quantifiable rating).
3. Forecast deterioration of the road segment condition per historical averages or national expectations.
4. Identify the segments that will have deteriorated beyond a desired condition for the analysis period.
5. Apply pre-established treatment strategies given the severity of the road condition.
6. Constrain the decision per available funding or material resources
7. Review with engineering logic to establish a road improvement program.

In a basic pavement management approach, the above process would be done by a technician annually after some survey check of roadway conditions (every few years) and input of any improvements or new roads from the last year. Benefits of roadway improvements can be quantified also within the model to provide a benefit-cost comparison to assist in the prioritization of improvement and maintenance tasks on the road network. This will be a familiar process with all forecasting and predictive models for assets. Benefits can be calculated in several different ways, but routinely involve user costs such vehicle maintenance and value of time. More mature models evaluate both the long-term benefits (for selection) and short-term (for prioritization).

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The benefit of these analytical capabilities to the DOT is readily apparent – quantify the future needs of the pavement network in a defensible and repetitive process. As highlighted by AASHTO, the variety of benefits of pavement management systems may include:

- The effective use of available resources to improve pavement performance.
- The ability to justify funding needs.
- An understanding of current and projected pavement conditions and needs.
- Improved access to pavement information throughout the agency.
- Increased accountability and transparency in the decision process.
- Objective decision making based on data.

With respect to right-sizing, pavement management systems can help identify those candidate roads that are due for strategic improvement, yet the unit cost is higher than normal (example: the MnDOT urban roadway) or help assess the impact of deferred maintenance on a roadway. PMS can also determine the proper improvement while showing and quantifying for the user how an alternative improvement will fare worse or result in the same performance at a greater cost.

However, there are certain aspects about the current use of these systems that would have to be modified to anticipate the results of lowering conditions or performance standards. First, all DOTs should have a management system for pavement in order to replicate this analysis effort. Second, many PMS have a direct analysis capability to evaluate and forecast need (as mentioned above) yet do not have a way to allow performance as a scenario target. Meaning, DOTs need the capabilities to analyze a target-oriented objective rather than just a budget-constraint forecast scenario. Pavement management system look to optimize benefit-cost per area of a segment rather than the linear mile (centerline or lane-mile). Third, and the most difficult, is tying right-size alternatives into the PMS repair alternatives decision tree to allow for analysis on a system-wide level and not a project-by-project case. The issue here is two-fold: fuzzy logic for the system to choose a right-size alternative and connectivity of the segments for a corridor. Pavement Management Systems, unlike travel demand models, do not see pavement segments as a connected system, rather as individual pieces of roadway with a length and a width and a condition. Thus, an engineer must assess candidate segments and assign them into a final program after determining is adjacent segments should be included in an overall project. Both instances will require human intervention in the near term to help make decisions and ensure the comprehensiveness of the corridor is maintained.

Bridge Management

All state governments gather bridge inventory and inspection data in conformance with the national bridge inspection standards (NBIS). Nearly all state DOTs also routinely perform element-level maintenance inspections in accordance with the AASHTO Manual for Bridge

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Element Inspection. Asset management for bridges apply this basic data to enable proactive agency decision making and stakeholder communications. Some of the most important objectives are the following:

- Communicate past, present, and future bridge performance across the DOT, in a manner that is readily understood and is compatible with pavements and other assets.
- Use forecasts of performance to help ensure that agency decisions have desired outcomes.
- Develop the feedback loop that confirms that planned projects are reliably delivered, expected outcomes are achieved, and planning metrics are evaluated and improved.
- Build a partnership with outside stakeholders via communication and negotiation, wherein the agency is accountable for realistic performance goals, based on agreed funding levels.

Nearly all state DOTs have licensed the AASHTOWare™ Bridge Management software (BrM), formerly Pontis, as their management system for bridge and use it in varying degrees. There are many other customizable off-the-shelf (COTS) systems which states can use also. Bridge management software focuses on the complete bridge management cycle, including inspection, inventory data collection, and analysis, recommending an optimal preservation policy, predicting needs and performance measures, and developing projects to include in agency capital plans. Bridge Management Systems, while data rich with the bridge element information, do assess overall system-wide benefits better than pavement management systems and have adopted performance measures more easily as both are based on an area unit of measure. Nevertheless, as is the case with pavement, bridge systems are not set up in a way that can consider a right-sizing alternative within a decision-tree logic to automatically choose the correct project type. The tool has no way to differentiate when/how a right-sized project may be applicable. Rather, this will again require engineers to identify and input those “potential” right-sized bridge replacements into the system for analysis. Right-sizing will continue to be a human interaction with the tool and an iterative process. We can use the tools to help assess the investments, but this cannot be an automated process right now.

**Maintenance Management Systems**

Maintenance management systems (MMS) began in the 1950s with research into management of maintenance operations in Connecticut and Iowa. The idea of applying management principles to highway maintenance gained popularity as the systems were better defined. At its core, MMS collect the activities of the maintenance department in costs and effort. The systems are valuable when management practices are applied to the computerized MMS to help plan, budget and monitor activities to accomplish a pre-determined level of service. In analysis, data within a MMS can begin to reflect the negative impact of inaction or deferred maintenance of an asset. Alternatively, MMS can also help quantify the savings of changing a roadway or bridge through right-sizing, because of the potentially smaller number of lanes, road width, or structure size.
Trade-off Analysis Tools

Cross-asset resource allocation is a relatively new area of activity for DOTs. There are few agencies currently implementing any tools related to the practice and standards are still formative. NCHRP Report 806: Guide to Cross-Asset Resource Allocation and the Impact on Transportation System Performance (and subsequent implementation study) reviewed practices and outline the guidance for cross-asset trade-offs. While this is a “new area,” the effort of trade-off analysis in scenario analysis and planning has been going on for years. The capabilities to relate performance to cost—a prerequisite for trade-off analyses—are now available in many modern pavement and bridge management systems and certain maintenance management tools. However only a few states have a structured consideration of trade-offs. The purpose of these tools is to allow transportation agencies to better analyze and communicate the likely impacts of system performance across multiple investment types to essentially make good on performance targets. This is a data-driven and performance-based framework to allocate resources between multiple asset types to provide the best programmatic mix for the DOT.

There are multiple challenges in establishing and implementing such tool—namely legislative mandates, department silos, intense amounts of data, and comparable criteria across the multiple asset types—but much progress has been made in recent years. Ultimately, the trade-off analysis tool can provide decision techniques to score projects on a level playing field and optimize their selection for programming based on their anticipated benefits and the relative importance of those benefits to the decision maker. This will reinforce scenario planning within a financially constrained world and help achieve the performance targets for the DOT. This final point is what makes it so useful for right-size analysis. The ability to seamlessly compare project alternatives between assets (primarily roads and bridges) in a single scenario application.

Fleet Management

Fleet management and right-sizing of vehicle fleets is a growing operation through many industries as vehicle technology grows and agencies begin to see the long-term savings of investing in more fuel-efficient fleets and being intelligent about how vehicles are used. The Vehicle Allocation Methodology which was developed by the US General Service Administration (GSA) is an evaluation framework used by federal agency fleets to ensure cost-effectiveness and the optimization of the number of vehicles. The Office of Energy Efficiency and Renewable Energy45 provides access to the latest information, applications, and resources that can be used in improving your fleet’s efficiency.

Federal fleet managers and other stakeholders may learn about these many tools which help federal agencies manage vehicle fleets and increase the use of alternative fuels. The USDOE and GSA has developed a downloadable matrix where the tools are overviewed and categorized by agency, outputs, inputs, etc.

3.6. DOT Guideline Takeaways

The literature indicates that DOTs have right-sized their infrastructure and investments for many reasons including:

1. Revenue Shortfalls
2. Infrastructure Maintenance Needs
3. Recognition of Agency Inefficiencies (sometimes triggered by audits)
4. Policy implementation
5. Environmental impacts (current or anticipated)

In some cases, these factors individually have triggered a right-sizing event, while in other cases more than one factor works in conjunction to precipitate the recognition of a right-sizing need. Those cases that involve revenue shortfalls and infrastructure maintenance needs supplemented by another factor provide the greatest potential of right-sizing as in these cases strategic investments can correct or address multiple aspects simultaneously.

Following such occurrences, the agency finds the direction of their next efforts by considering agency mission, vision, and goals and long-range plans and how they influence their decisions. The goals of an agency (i.e., safety) influence the options the agency may consider and who is involved in this process. Often included are the following individuals or groups, at varying capacities:

1. Engineers/Planners
2. Corporate Stakeholders
3. Public

Performance measures and targets are evaluated using tools of the trade to estimate how modifying these standards and targets influences transportation assets and their allocation, safety, performance, operations etc. Various right-sizing options and their trade-offs of implementation are considered before a right-sizing solution is identified. The agency can now quantify how the right-sizing solution influences many other areas and assets of the agency both when implemented and in the years following.

The following are guidelines to consider in right-sizing analysis pertaining specifically to performance measures:

The first key step is to identify the method for evaluating and comparing different investment options:

1. Review of projects and their variables.
2. Determine what is anticipated to change.
   (i.e., adding lanes should cause a reduction in congestion measures).
3. Perform a scenario with the standard project design, current condition (baseline), and right-sized project alternatives.

4. Compare the various measures of the project.

5. Select the project.

The performance measures should be tied to strategic goals and objectives of the agency.

When assessing the tradeoff between a “normal” engineering improvement and a right-sized improvement, the performance criteria needs to be something related and measurable between the projects. Many of the national performance measures are not specific enough to show variations between improvements. Evaluation through these could be telling but may not be comprehensive or granular enough to assess the difference between types of improvements. States must develop or adopt their own measures for use in this area. For example, IRI can potentially change with any project, thus the classic measures for monitoring, as outlined by FHWA, likely do not apply to this conversation for pavement. However, a right-sizing measure such as lowering the future maintenance cost per lane mile worked ($/mile) would start to reflect a decrease in forecasted burden on maintenance for the upkeep of the pavement system – either through a lowering of the overall maintenance budget or increase in lane miles improved – due to more available funding because of right-sizing savings.

As performance measurement has evolved, there has been a shift in focus from performance measurement to performance management which entails using data collected to make budget allocation decisions that result in the achievement of strategic goals. GDOT\textsuperscript{46} discusses the maturity model of states as the DOTs related to measures and goals in terms of successive “generations”:

- Generation 1 – several measures not integrated with overall strategic goals
- Generation 2 – streamlined measures strategically selected to assess progress toward agency strategic goals
- Generation 3 – adaptability to respond quickly to external demands to create responsive performance measurement and management

Generations 2 and 3 are necessary for a DOT to understand performance management and quantify the measure with useful data in a logical method to use in project evaluation between project types. This evolution of capabilities is likely to coincide with the maturity of asset management tools and policies associated with right-sizing as well. However, this is not a prerequisite, as DOTs may press forward with performance management ahead of procurement efforts for analysis tools. For example, an agency may begin by using a volume-to-capacity ratio, as defined in the Highway Capacity Manual, but subsequently come to recognize that the singularity of its focus on traffic service would require multiple additional measures to be evaluated. Similarly, as expressed previously, IRI is a classic pavement assessment measure, but

may not properly reflect the potential change. Defining comprehensive measures to compare projects and programs will be more likely to exist in the agencies with more mature performance management. This is a characteristic found in Generations 2 and 3 agencies and would demonstrate that a DOT is more prepared for right-sizing conversations and analysis.

Assessing the project(s) potential for future traffic growth, economic return, or a change in ownership of the corridor is always an option to assist in right-sizing. The decision criteria for whether to invest or not should be more comprehensive than simply picking between two project types based on a single measure that may not reflect the impact completely. When a project is identified, it usually centers around a reason for the improvement, such as safety or mobility. However, staying within this narrow definition of objectives limits the logical comparison between projects. Rather, choosing to invest in an asset at all can encapsulate many factors and be both short-term and long-term in outlook. The following performance measures are examples of those that can be used to compare potential projects in a more holistic manner:

- **Level of Service (LOS)** is a qualitative measure that relates the quality of the transportation service. LOS is used to categorize the network assets by their levels of performance measure like speed, density, condition, etc. It can serve as a guide for consistency in planning, performing and evaluating programmatic activities with the funds available. LOS can be associated with quantitative ranges and the common A to F scale is easily communicated to stakeholders. The power and issue with this measure is the flexible to change the unit of measure for each asset. LOS of A for traffic congestion means free flow speeds, while for pavement rutting it may equate to < 2.5 percent of the feature being deficient. Both are LOS A but the conditions measured and units of measure are different.

- **Network Robustness Index (NRI)** is a performance measure that can be used to evaluate the relative importance of a specific roadway component, for example a bridge, with respect to the component’s contribution to the overall performance of the roadway network. The NRI incorporates the increase/decrease in vehicle-hours traveled into the measure which shows the criticality of the corridor to the network. The higher the measure, the more critical the component.

- **Critical Closeness Accessibility (CCA)** is a link-focused performance measure that quantifies the “accessibility”. Here, accessibility is defined as the ease with which services and facilities can be reached while using the road network. This definition shows both movement and the travel time related to the component. Designed to assess the emergency services access in an area, it could be used in a more general form to demonstrate mobility and importance of the segment or bridge.

- **Return on Investment (ROI)** is a performance measure used to evaluate the efficiency of an investment or to compare the efficiency of across an investments program. DOTs are increasingly familiar with ROI when evaluating projects for inclusion in plans and programs as this is an economic measure used to reflect some benefit to the cost of a project or program. How a DOT defines the cost and benefit within the calculations,

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depending on their maturity and data available, will directly relate to the sensitivity of the measure. This can also refer to Return on Asset (ROA) is singling out a specific project or asset type.

As mentioned previously, the measures and project goals – aligned with agency goals – can also utilize the potential cost savings (or increase funding needs) of maintenance and operations for a comparison. Pulling this information from MMS, the agency can see, for example, the short-term savings of doing nothing to a bridge, but also can assess the long-term deterioration impact through other tools like pavement and bridge management system’s predictive capabilities.

### 3.7. Record of Interviews

Interviews were conducted with staff at Minnesota, Connecticut, Virginia, and Utah DOT in support of this white paper:

Additional informal discussions were also held with other practitioners that helped in the collection of relevant research and identification of issues.
4 Right-Sizing Project Design

4.1. Introduction

This white paper addresses the topic of right-sizing through a series of reflections on the paradigms, tools, and approaches that contribute design-level project outcomes. The paper addresses the question, “How does an agency arrive at the most efficient project scope and functional design representing the appropriate size, composition, and extent of a transportation facility in a situation where the need for the infrastructure either has significantly changed since the facility was originally built, or is anticipated to change significantly during the project life?”

4.2. Highway Design Paradigms and Right-Sizing

**Review of Design Paradigms**

The term “design” is used here to include:

1. **functional design**, which establishes broad design elements (e.g., fully-controlled freeway vs at-grade intersections type road), general alignment (for a new road) or realignment, user (vehicles, pedestrians, bicyclist) design parameters, and the like;

2. **preliminary design**, which establishes more specific design elements, such as cross-section, design speed, etc.; and

3. **final design**, used for construction.

NCHRP Report 839, *A Performance-Based Highway Geometric Design Process*,\(^4\) chronicles 10 alternative design paradigms or concepts that have become part of design practice. Those that would seem to be integral to Right-sizing transportation investment are enumerated below with their stated goals:

- **The complete streets** concept focuses on creating roadways and related infrastructure that provides safe travel for all users. Its stated goal is to consider all transportation modes in the design of urban and suburban arterials, with explicit consideration of bicycle and pedestrian needs. (More information on this concept can be found at [https://smartgrowthamerica.org/program/national-complete-streets-coalition/](https://smartgrowthamerica.org/program/national-complete-streets-coalition/))

- **The context-sensitive design (aka solutions)** concept places priority on assuring that highway projects fit the context of the area through which they pass, puts project needs as well as the values of the highway agency and community on a level playing field, and considers all trade-offs in the decision making. Its stated goal is to assure that each

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The project is designed in a manner consistent with the context of the roadway, advocating strong consideration of community, neighborhood, and environmental values. (More information on this concept can be found at http://www.ite.org/css/)

- The concept of **practical design** focuses on addressing only those improvements that are needed – to fulfill the purpose and need statement – and eliminating those improvements that are not absolutely essential, thereby reducing the overall cost of a project, with savings made available more projects within a fiscal budget. The stated goal of practical design is, where appropriate, to relax design criteria, within the allowances of design flexibility, to minimize project costs, consistent with achieving other stated goals. (More information on practical design can be found at http://www.trb.org/Publications/Blurbs/168619.aspx)

- The concept of **performance-based design** incorporates a design process that explicitly considers performance measures, typically those related to operations and safety, in the decision-making process. (More information on PBPD can be found at https://www.fhwa.dot.gov/design/pbpd/)

- The concept of **value engineering** is a systematic process of project review and analysis by multi-disciplinary team to provide recommendations for improving the value and quality of the project. The goal is to improve the project value (as determined by defined criteria) by modifying any aspect of the design that would result in an increase in value. Value engineering has goals similar to practical design seeking the same (or better) project performance at lower cost, but also better project performance, even at somewhat higher costs. (More information VE can be found at https://www.fhwa.dot.gov/ve/)

- The concept of **Designing for Resurfacing, Restoration, and Rehabilitation** includes a set of geometric design criteria for 3R projects that are less restrictive than those used for new construction and reconstruction. This design guideline is an example of practical design and the application of design flexibility, based on risk assessment, that seeks to achieve equal (or, at least acceptable) performance to that achieved by full AASHTO Green Book design criteria at lower cost.

- The concept of **Designing for Very Low-volume Local Roads** (≤ 400 ADT) recognizes that very low-volume local roads represent a different design environment than higher-volume roads. Similar to 3R project design, it too applies design flexibility commensurate to the risk assessment.

While these alternative design paradigms are labeled in NCHRP 839 as “concepts,” they are more appropriately labeled as approaches, as they are indeed being followed by states in their project development.

**The Importance of Project Purpose and Need**

A “prime mover” of any transportation project is the Purpose and Need statement, as it defines the transportation deficiency or problem – the Need – and the set of objectives that will be met to address the deficiency – the Purpose. (While the “need” is defined first, the “purpose and need” phrase is the terminology most commonly seen in statues and regulations, and it is more...
commonly used in case law, guidance, and general practice.) The project Purpose and Need statement drives the process for alternative consideration, in-depth analysis and ultimate selection. For projects requiring an environmental impact statement, it is required, and even if not, it should be publicly stated. Furthermore, it should be developed in concert with stakeholders as early as possible during the project planning phase and, if need be, modified based on more current data and citizen input up through the final design.

The need for the project can be some deficiency related to safety, congestion, level of service, connectivity, access, pedestrian/bicyclist accommodations, or other conditions. It could also be recognition of a change in user characteristics, land use, or other conditions that are no longer served by the existing road facility.

The purposes (or often stated as objectives) are design options that address these needs to varying solution levels. These design options could be considered right-sizing alternatives – developing the project to meet changing needs.

From a highway design perspective, right-sizing alternatives can cover the gamut of design plans from simple, relatively low-cost projects, to multi-year, multi-faceted and consequently expensive projects. A relatively low-cost project could be a so-called road diet for a road section whereby the cross section is reset to accommodate pedestrian and/or bicycle users to reflect a change (increase) in non-motorist user demand – a right-sizing scenario. (See Table 11 below on the IOWA DOT program for Statewide Lane Reconfiguration for one state’s approach to identifying candidate sites for such a program.) An example of a higher-cost project would be the ‘right-sizing’ of Buford Highway just outside of Atlanta, GA. As profiled by Duncan and Morris49, the entire corridor was re-purposed with design features such as paved sidewalks on both sides, count-down signals at intersections, signalized mid-block crossings and overhead and pedestrian lighting.

**Table 11 Example: Iowa DOT Statewide Lane Configuration Screening**

| The IOWA DOT is embarking on a program to identify sites with the potential for lane reconfiguration from a four- to three-lane – an example of a road diet. In the example illustrated below, one of the travel lanes is removed allowing for a reconfiguration of the cross section for other modes, i.e., pedestrians and/or bicyclists. |

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The DOT has found that reallocation of the space in the right locations can increase the safety and operation of the corridor, and, provide local agencies an opportunity to grow their network of bike and pedestrian infrastructure and align with existing complete streets. Within the DOT’s business process, a number of factors are usually considered to determine the feasibility of converting a four-lane roadway to a three-lane roadway, those being:

- Roadway function and environment
- Overall traffic volume
- Level of operational service
- Turning volumes and patterns
- Frequent-stop and/or slow-moving vehicles
- Weaving, speed and queues
- Crash types and patterns
- Pedestrian and bike activity
- Right-of-way availability, cost and acquisition impacts
- General characteristics: parallel roadways, offset minor street intersections, parallel parking, corner radii, and at-grade railroad crossings.

These factors are usually analyzed at a corridor level and require significant data gathering and analysis to determine feasibility. Iowa DOT concluded that such an analysis was impractical to perform at a statewide level, and so developed a more streamlined approach to identify potential sites. The approach leans heavily on the use of existing roadway data bases and geographic information systems for screening.

The implemented approach was as follows:

- **Querying of Data:** “identify all roadway segments within the state that had four through lanes, no median, and were open to two-way traffic”
- **Filtering and Calculations:** Exclude segments with an AADT above 18,000 and classify remaining segments into three tiers, by volume: Low (0-6,000 AADT), Medium (6,000-
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12,000), and High (12,000-18,000). Additionally, calculate access density for each link (summation of business and private entrances, divided by length), and identify all signalized intersections within 1/8th mile of each other.

- **Geoprocessing and Aggregation:** Aggregate continuous corridors to a minimum length of ½ mile. Exclude any shorter corridors from analysis. Then, calculate an aggregated corridor-level crash rate and “obtain the total number of severe injuries for each potential candidate site.”

- **Quality Control:** Visual inspection and manual corrections to address any discontinuous corridors or other improperly selected segments.

Iowa DOT applied this approach to both urban and rural road segments, ½ mile or greater in length, including those owned by both the state and local governments. The result was a set of 223 candidates, groups into High (72), Medium (99), and Low (52) volume groups. The data set has not as of yet been analyzed, but was constructed to include key variables that can help in identifying more likely candidates for lane reductions, namely:

- **AADT.**

- **Access Density:** “Four-lane corridors with higher access densities stand to benefit the most from a conversion to three lanes. A greater number of accesses results in a greater number of left turns. The addition of a continuous center turn-lane provides a safer means of accommodating left-turning vehicles by separating them from the through traffic.”

- **Signalized Intersections:** Corridors with at least one signalized intersection were flagged to indicate that “at traffic flow in the three-lane configuration may be enhanced through a more in-depth analysis of signal operations.”

- **Crash Rate:** “Reducing the number of lanes from four to three can have a substantial effect on the number of crashes on a roadway.”

Source: Iowa DOT. Statewide Screening for Potential Lane Reconfiguration. https://iowadot.gov/systems_planning/pr_guide/Safety/StatewideScreeningforPotentialLaneReconfiguration.pdf

**Connecting Design Paradigms to Right-Sizing**

Each of the design approaches has relevancy to right-sizing, as defined for this project as “... fundamentally changing the size, composition, and extent of the transportation system from what it would otherwise be to arrive at a more efficient use of resources than would otherwise be the case.”

There are a few commonalities across these approaches that are instructive for an agency considering how to incorporate “right-sizing” into their design practice. First, it is notable that the application of these alternative design concepts oftentimes requires the use of **design flexibility.** As stated in NCHRP 839, “In practical terms, design flexibility means that designers have choices not mandates. Choices relate to the level of transportation service provided for all modes, the inclusion or exclusion of specific features (e.g., lanes by type and usage, medians by type, on-street parking), treatments (intersections versus roundabouts, types of intersections, types of interchanges), and dimensions for each element.” In choosing how to implement
flexibility, a designer should select features that are compatible with the project “purpose and need,” and developed under a performance-based practical design process, meaning that an analysis should be made of the impacts of primary design elements using measures of safety, operations, access and other criteria established by the agency and stakeholders.

It is also worth noting from these design approaches that certain aspects of a right-sizing mindset can be set up so as to become “standard operating procedure.” Interviews conducted with KDOT in support of this white paper, in addition to interviews with five other states conducting during the preparation of NCHRP Synthesis 443, Practical Highway Design Solutions, found this to be the case. Through these approaches, states are designing projects to meet the project “purpose and need” clearly developed with input from stakeholders – partner agencies, local agencies, and the public. In so doing, they are developing design options that satisfy the objectives and not to a standard design. They feel this is “right-sizing.”

4.3. Design, Development, and Infrastructure Burdens: The Big Picture

The population base in some regions is growing very rapidly, while other regions have almost no growth, and sometimes negative growth. Yet one thing is common among nearly all urban areas – their urban footprint and aggregate infrastructure keep growing whether their population is growing or not. That’s a problem for funding long-term maintenance. Why do regions with negative population growth continue to expand their urban footprint? One major reason is that as yester-year’s “new and shiny” land uses and infrastructure deteriorate, businesses and residents sense the downward trajectory, and those with the means often move to the next “new and shiny” greenfield development. Thus, the areas they fled will deteriorate even faster, because there is even less tax base for maintaining everything.

Thus, the big-picture design and development problem to be solved by right-sizing efforts includes several angles:

1. Help emergent greenfields right-size the first time.
2. Looking beyond “size,” foster resilient design in greenfields that will not be abandoned by adjacent uses, but instead will retain and increase the tax base that supports it.
3. Create retrofit strategies for corridors and areas that have deteriorated, so that the infrastructure they already have can compete anew for investment that would otherwise expand the infrastructure burden at the fringes.

4.4. Right-Sizing for Greenfields: Getting it Right the First Time

Today’s problems are easy to see and tend to consume a large proportion of resources in discerning the root causes and devising effective remedies. Nevertheless, in any location where
greenfields are urbanizing, it is essential to apply best practices, and thereby solve tomorrow’s problems, before they become problems.

In many rapidly-growing areas, there is often pressure to pursue “greenfield” development. Such development usually occurs on undeveloped parcels not surrounded by existing development, or on large parcels surrounding partially developed areas or undeveloped areas.\(^{50}\) In metropolitan areas, greenfields available for development are frequently located on the outer fringes of the existing urbanized area. Such developments often require significant investment in roadways and other transportation infrastructure to support the mobility needs of their residents and businesses. To right-size greenfield development, it is important for communities to understand that how they structure their background land uses and network connectivity will ultimately dictate the multimodal needs of the macro-level arterial network.

### Understanding the Implications of Road Network Configurations

In the early 1990s, the Institute of Transportation Engineers (ITE) published a useful guideline that recommended ideal network spacing of a modest-sized freeway every five miles, a principal arterial every two miles, a minor arterial every one mile, and a collector street at least every half-mile.\(^{51}\) Salt Lake County, Utah applied that recommendation as part of a network analysis and arterial best practices effort to compare what they have, existing and planned, with that ITE guidance. The resulting “Scottish plaid pattern,” shown in Figure 15 is becoming iconic – used in presentations by MPO staff, UDOT, Envision Utah, and others to drive home the message that congestion exists largely because drivers have relatively few options.


\(^{51}\) [https://www.ite.org/css/online/DWUT03.html](https://www.ite.org/css/online/DWUT03.html).
Not surprisingly, throughways in the sparse areas are overwhelmed with congestion, serving long-distance freight and commutes, while also serving local trips, such as shuttling kids to soccer games. They are also in high demand as bikeways and transitways – because they are the only pathway these modes have available. One can debate the merits of so many freeways, but clearly the more extensive the arterial/collector system is, the more able it is to support alternative modes and evolving uses, and the less pressure there is for more and wider freeways.

“Right-sizing” in many communities often means downsizing under-utilized pavement in order to upsize other uses. But in cases where through streets are infrequent, right-sizing could mean a certain type of upsizing for all modes. Communities in Utah are getting the message and starting to revamp plans for remaining greenfields to show more collector and arterial streets where still feasible.

Figure 16 shows five common types of development. At one end is the tight-grid pattern, which dominated the American landscape prior to WW2, and is resurgent again, often as a curvilinear grid, within many New Urbanist planned communities. When most streets are through streets, arterials and collectors can often do fine with just one through-lane each direction, and can also accommodate on-street parking, lower speeds, etc. It is also possible to accommodate bikes, transit, and other needs on parallel streets – because there indeed are parallel streets.
At the other end of the spectrum are suburban “super-grids” and more haphazard networks. Super-grids are common where farm access roads along USGS section-lines became the default “plan” for urban arterials, and everything in between was left to individual developers, who historically derived their maximum value with cul-de-sacs and discontinuous streets. The arterials that define super-grids become all-important, to all modes and most businesses, because they are the only streets available. Land uses along such arterials tend to degrade over decades but might be stabilized with certain techniques that can protect land values.

In general, the tighter the grid, the more adaptable the area is to changing conditions. However, there are still a great many greenfield areas emerging or likely to emerge with super-grids, and communities that want to or will emerge this way need to understand that right-sizing in these cases could mean protecting much larger right-of-way footprints, and/or more alignments, than their normal practice would dictate, in part for multimodal uses that have no other location available.

Starting from the top-level “Scottish Plaid,” zooming in to the next level can be insightful. While Census-defined blocks are of course much smaller, the “travel shed” to streets that have potential for trips of one mile or more can become extremely large.
Figure 17 displays a selection of streets in Salt Lake County. Near downtown, South Temple divides the “Avenues” district, which has three-acre blocks, from the rest of downtown which has famously large 10-acre blocks. (For comparison, Portland, Oregon has 200-ft, one-acre blocks). The image also shows a square-mile selection with “300-acre blocks” in West Jordan, very typical of its area. While Census-defined blocks are of course much smaller, the “travel shed” to streets that have potential for trips of one mile or more can become extremely large.

**Figure 17 Salt Lake County Network and One-mile Square Area of Downtown Salt Lake City**

![Image of Salt Lake County network and one-mile square area of downtown Salt Lake City.](image)

*Source: Metro Analytics*

**Grid-Spacing and Right-of-Way Usage Analysis.** Figure 18 provides a spacing and right-of-way usage analysis of the above areas. Row 4 shows the Avenues have 13 grid streets per mile of width, and Row 6 shows accumulated pavement width of 590 feet (used for parking as well as traffic). Salt Lake’s 10-acre blocks result in seven grid streets per mile of width, but most streets also have two lanes each direction, for an accumulated pavement total of 390 feet. Daybreak is a large New Urbanist planned Community currently under development, with blocks very similar to Downtown Salt Lake. The suburbs that emerged between WW2 and 2000 more typically have just 1.7 grid streets per mile of width, and a paltry 120 feet of accumulated pavement.

Row 8 shows the urban density pattern that can be easily supported by the grid style. While the Avenues are not a “CBD,” the grid underlying it can easily support CDB-like densities. Salt Lake’s 10-acre blocks started out at less-than-suburban densities and are now supporting it’s CBD. However, it is not an ideal grid for supporting double or triple its current density. And finally, the suburban grid can often be inadequate even for suburban densities, and traffic/multimodal management can be extremely challenging when the market wants to or starts to increase those densities.

When comparing Row 5 with 1,000 feet of through-street right-of-way per mile on one end, vs 150 feet on the other end, it might appear the suburban model is more efficient because it involves less overall infrastructure and therefore less maintenance. But that is not necessarily the case, as there could easily be the equivalent of 1,000 feet or more of pavement.
accumulated on windy, dendritic interior streets. The difference is that dendritic streets offer very little utility to alternative modes or to drive trips much beyond half a mile.

**Figure 18 Analysis of Spacing and Right-of-Way in Various Salt Lake County Environments**

<table>
<thead>
<tr>
<th>Description</th>
<th>Avenues</th>
<th>SLC</th>
<th>Daybreak</th>
<th>Typical Suburbs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space between grid streets (miles)</td>
<td>.08</td>
<td>.15</td>
<td>.13</td>
<td>.60</td>
</tr>
<tr>
<td>Space between grid streets (feet)</td>
<td>400</td>
<td>790</td>
<td>660</td>
<td>3,200 ft</td>
</tr>
<tr>
<td>Grid streets per mile</td>
<td>13</td>
<td>7</td>
<td>8</td>
<td>1.7</td>
</tr>
<tr>
<td>Total ROW per mile width (±10%)</td>
<td>1000</td>
<td>840</td>
<td>600</td>
<td>150</td>
</tr>
<tr>
<td>Grid pavement per mile, all streets</td>
<td>590</td>
<td>390</td>
<td>370</td>
<td>120</td>
</tr>
<tr>
<td>Green/ped space per mile, all streets</td>
<td>410</td>
<td>450</td>
<td>230</td>
<td>30</td>
</tr>
</tbody>
</table>

*Source: Metro Analytics*

**Corridor-Level Best-Practice Patterns**

Ideally, new greenfield development would have tight local grids. But regardless of how the background grid may emerge, odds are most communities will create multi-lane arterial streets that will eventually carry 20,000 vehicles per day or more. Such arterials will continue to attract and be zoned for commercial and multi-family uses. A major problem with similar arterials from the 1950s through today is that development along them has only had access from the fronting arterial. Figure 19 below highlights the disjointed, dendritic background streets traced from a real place.

**Figure 19 Illustrative Example: Disjointed Access Along an Arterial**

*Source: Metro Analytics*

A community would do well to protect its arterial streets more than this. For example, if they also had back-side access, as highlighted in yellow below (Figure 20) it would greatly relieve the
arterial and create flexibility for the future. Developers could have flexibility in the curvilinear nature of these back-side streets. Continuity is the key. When such streets meet with other arterials, perhaps right-in/right-out access would be required until signals are warranted. This pattern does not necessarily require any additional pavement beyond the previous. It just arranges it in a way that improves local circulation and creates a buffer between arterial uses and neighborhood uses.

**Figure 20 Illustrative Example: Front and Back-side Access to Relieve Arterials**

![Illustrative Example: Front and Back-side Access to Relieve Arterials](image)

*Source: Metro Analytics*

The next graphic zooms out to show how a square-mile of the above pattern might look. More significant arterials would be flanked with parallel backage roads, while interior collectors need not be. The crossing of significant arterials creates a grid for localized circulation at what is likely to be a significant activity node.

**Figure 21 Illustrative Example – Arterials with Backage Roads, Broader View**

![Illustrative Example – Arterials with Backage Roads, Broader View](image)

*Source: Metro Analytics*
Summary of Right-Sizing for Greenfields

- Adopt a minimum standard for continuous streets, ideally ¼ mile to ½ mile.
- Avoid rigid right-of-way standards such as “84 feet for minor arterials, and 110 feet for principal arterials.” Instead evaluate each street within its network context, desired use typology, and include Complete Street elements from the beginning, or have a plan for including them later.
- If your grid is defaulting to Haphazard or Suburban Super-Grid, encourage flexible, adaptable design techniques, such as continuous backage roads along the arterial, and innovative intersection designs, discussed in later sections.

4.5. Identifying Opportunities to Right-Size Existing Streets

Every right-of-way, when first built, was judged to be “right” by stakeholders for its time and context. So, what kind of changes in context can turn a right street into a wrong street? How can we tell when the reasons to “right-size” start to outweigh the reasons not to? There are several analysis techniques that can help. These include traffic volume analysis, safety analysis, modal demand analysis, trip length analysis, and tax-base analysis, as discussed in the next sections.

Volume Analysis

A big part of the opportunity for change lies in identifying streets with excess capacity. There are cases where a major highway was effectively replaced by a nearby freeway, or where a once-popular auto-oriented corridor is no longer popular, as reflected in roadway volumes as well as tax-base analysis, and rejuvenation could depend on reorganizing right-of-way. Whatever the case, understanding critical volume thresholds is helpful. Table 12 depicts rule-of-thumb traffic volumes at which each facility-type tends to show signs of distress. As an example of how to use this, there are many cases where seven-lane highways popular decades ago currently carry 25,000-35,000 vehicles per day, yet they could easily support up to 55,000 per day. In many cases, it would be easy to convert a lane to Bus-Rapid Transit, or just reorganize to allow on-street parking or other features that can aid community objectives for livability and economic revitalization.
Table 12 Rule-of-Thumb Traffic Volumes at Which Facilities Tend to Show Signs of Distress

<table>
<thead>
<tr>
<th>Lanes</th>
<th>Freeways</th>
<th>Arterials</th>
<th>Major Collectors</th>
<th>Minor Collectors</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>-</td>
<td>13,000</td>
<td>11,000</td>
<td>4,000</td>
</tr>
<tr>
<td>3</td>
<td>-</td>
<td>20,000</td>
<td>15,000</td>
<td>8,000</td>
</tr>
<tr>
<td>4</td>
<td>80,000</td>
<td>28,000</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>-</td>
<td>40,000</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>120,000</td>
<td>49,000</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>-</td>
<td>55,000</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td>160,000</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>10+</td>
<td>200,000</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Source: Metro Analytics, derived from Florida-based research and microsimulation assuming 10% of AWDT occurs in PM peak hour.

As another example, suppose a four-lane arterial (no center-turn lane) currently carries 22,000 – well below its 28,000 ability – but a “road diet” to change it to three lanes could result in significant congestion, as three-lane highways are challenged much above 20,000. Since it is close to the margin, it may well work if you can account for what will happen to the extra volume that won’t fit easily. Are there parallel paths that could absorb some spill-over? Since capacity is usually constrained by intersections, would roundabouts or other high-efficiency designs help boost a three-lane section to carry 22,000 or higher? Would multimodal improvements enabled by the change attract enough away?

If the change facilitates mixed uses, would the mixed uses that emerge over 10-20 years result in shorter drives and more use of alternative modes that the street will operate better in the long run than it might in the near term? And lastly, these need not be red-lines. Even if the change may cause an uncongested road to become noticeably more congested, maybe that doesn’t matter much to stakeholders in light of the benefits obtained for other goals and objectives.

Safety Analysis

As exurbs transitioned to suburbs, the rural highways that connected them suburbanized. Because speeds had been high before, there is usually an effort to maintain speeds as high as possible, so “right-sizing” at the time of first transition often means access control and signal spacing every half-mile or more, combined with additional lanes and speed limits of 40-50 mph. But regardless of design features, a 40-50 mph arterial will see conflict hot-spots emerge. In the beginning, these are often car-on-car accidents, but as the area intensifies, or sees demographic changes that include high shares of citizens dependent on walking or biking, then accidents can skyrocket, and the societal costs of accidents can begin to exceed the societal benefit of time saved at 45 mph vs 35 mph.

Safety analysis need not always wait for evidence of a problem to influence decisions. For example, an arterial may not yet have an apparent pedestrian safety problem, because adjacent uses are heavily auto-oriented, or blighted and inactive. If uses are ripe for redevelopment, and if
the community is encouraging a mix of uses at higher intensities than before, then it is easily predictable that a 45 mph highway will result in serious accidents if such uses materialize.

However, it is also possible that a decision not to change the typology to a 30-35 mph design will impede the market for the community’s land-use desires, and hence there will continue to be no apparent pedestrian safety problem because there remain few pedestrians. This is a matter of trade-offs between speed for drivers vs. other performance objectives that each situation must assess in any right-sizing debate. However, it may be possible to achieve win-win through design that reduces maximum speed without inhibiting average traverse speeds, in part through use of alternative, innovative intersection design strategies, discussed later.

**Modal Demand Analysis / Trip Length Analysis**

As localities change, the nature of trips starts to change, and there may also be significant latent demand for alternative modes. An area may well have more cyclists and pedestrians than before, but if it is a tiny share of the total it can be easy to dismiss as irrelevant compared to the traditional task of unimpeded vehicular flow. Taking bikes as an example, surveys frequently suggest that while biking often represents less than 5% of a corridor’s overall volume, as many as 60% of respondents say they would bike regularly for recreation, exercise, commuting, and small errands if they felt protected from high-speed traffic. Communities that have invested heavily in such safety do in fact tend to see “build it and they will come” results that help justify the projects in retrospect.

To help determine how many may be eligible for active modes, it is useful to evaluate the likely trip lengths associated with emergent uses. The illustration in Figure 22 depicts two arterials, each with 30,000 vehicles per day. If the top has a bedroom community anchoring one end, an employment center on the other, and relatively little between, then the 30,000 trips on the arterial will be heavily weighted toward long-distance trips, and arguably “right-size” in this context could skew toward helping this majority traverse long distances quickly.

In the other case, say there are a significant mix of commercial and residential generators all along the path. At any point on the path there may still be 30,000, but much of that total is using the corridor only for a short distance, and thereby will be only minorly affected by speed changes.

In the top case, installing premium features for active modes may attract relatively few patrons, because the overall length of typical trips is too far to walk or bike regardless. In the bottom case, a huge share of trips are short, and thereby likely to respond to premium treatment of active modes.

However, without this analysis, it could appear to traffic engineers that nothing has changed, and therefore they conclude it is best to leave the street at high speeds, assuming the majority are on long trips and will therefore value high-speed travel. Corridors with high shares of turning movements and increasingly high densities and usage types are good indicators that there may be significant latent demand that would respond positively to a new arterial context.
Another interesting angle to trip length analysis is that 30,000 could be 30,000 – or it could be 60,000. In the top example, if all 30,000 trips go from one anchor to the other, then there are truly 30,000 unique trips. In the bottom example, notice each unique path has 10,000 vehicles, and there are six unique paths. Thus, there are 60,000 actual vehicles utilizing the corridor, although just 30,000 can be counted at any given point. This means an increase in corridor trip generation due to more intense uses does not necessarily mean traffic along the corridor will increase much, if at all.

**Figure 22 Illustrative example: how trip length relates to right-sizing opportunities**

![Diagram showing trip lengths and traffic generation](image)

*Source: Metro Analytics*

### Tax-base Analysis

One of the most relevant topics in right-sizing is the effort to avoid getting caught with more infrastructure than the economy can afford to maintain. In that context, it is helpful to see districts that create more tax revenues than the same areas cost to maintain, vs districts that cost more in the long run than they generate.

For example, a community may imagine that an ocean of big-box retail will be a financial boon, and each huge parcel will create more revenue than any small parcel, but in aggregate, the small parcels often create more revenue with less overall infrastructure burden.
Figure 23 Illustrative comparison of development and taxes generated

<table>
<thead>
<tr>
<th></th>
<th>ASHEVILLE WALMART</th>
<th>DOWNTOWN MIXED-USE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land Consumed (acres)</td>
<td>34.0</td>
<td>00.2</td>
</tr>
<tr>
<td>Total Property Taxes per Acre</td>
<td>$6,500</td>
<td>$634,000</td>
</tr>
<tr>
<td>Retail Taxes’ per Acre to City</td>
<td>$47,500</td>
<td>$83,600</td>
</tr>
<tr>
<td>Residents per Acre</td>
<td>0.0</td>
<td>90.0</td>
</tr>
<tr>
<td>Jobs per Acre</td>
<td>5.9</td>
<td>73.7</td>
</tr>
</tbody>
</table>

Walmart taxes: $221,000
Downtown Taxes: $128,000
Source: Urban3 and Strong Towns

In Figure 24, green areas are revenue positive, while red are revenue negative in a lifecycle analysis. Notice that in this case it’s the lower-income neighborhoods that are generating more revenue relative to their infrastructure burden, most likely because it is higher density. Some of the larger, lower-density parcels are also the most costly in the long run, despite being in affluent areas.

Figure 24 Illustrative tax base analysis

Source: Urban3
4.6. What Does Right-Sizing Look Like?

All of the previous analysis techniques can help identify when an existing or proposed design is “wrong” for the situation – or not a good fit for the emerging context. But what can you actually do to make it right? What elements will the final product have that will help property owners, active mode groups, city officials, engineers, and taxpayer watchdogs to all agree that the new plan is “right” for the emerging context?

There are many angles to answering those questions, but a popular focal-point is the typical cross section of the street. The Institute of Transportation Engineers recently combined with the Congress for New Urbanism to produce a joint ITE/CNU best-practice guide called “Designing Walkable Urban Thoroughfares.” The guide includes a wide array of walkable design techniques, but it also includes design criteria for a wide spectrum of contexts, from rural to suburban to heavily urban.

The next section discusses hypothetical stakeholder processes that seeks to change an existing “wrong street” into something they can all agree makes more sense within a budget they can justify.

**Illustrative Right-Sizing Example (Downsizing)**

**Design Responding to Changing Development Context**

Figure 25 follows a hypothetical right-sizing evolution where a stakeholder’s group interacts with engineers to arrive at a project they can all agree on. The top image is existing conditions, the middle represents the community’s first iteration, which traffic engineers in this case find unacceptable, and the last image becomes acceptable to traffic engineers due to the introduction of high-efficiency Alternative Intersections. Imagine the story unfolds as follows:

Suppose a stakeholders group convenes for a corridor study, and uses an interactive visualization platform to sketch their existing conditions, and several alternatives until they arrive at their preferred alternative. Their “existing conditions” (the top image in Figure 25 below) are very typical of many large suburban intersections, with two through lanes, double-left lanes, and right-turn pockets. The overall space is 125 feet, but the pavement for managing traffic is 101 ft, which leaves just 12-feet on each side for a modest sidewalk and a buffer strip. Such a highway may be appropriate for many suburban contexts, with 45 mph travel.

However, this group would like a Complete Street design to improve walking and biking and to encourage new mixed-use economic development. Engineers review “Designing Walkable Urban Thoroughfares,” published by the Institute of Traffic Engineers, and conclude that for the desired mixed-use context existing lanes and speed limits are excessive (hence labeled as red in the top). Instead, 10-11 foot lanes are recommended (green in the middle cross section). Because lanes are narrower for the new context, that creates opportunity to expand other uses of the right-of-way. Stakeholders also want to narrow the median to just one left turn pocket, to expand the pedestrian realm even more.
Many stakeholders are also pushing for speeds as low as 30 mph. However, the senior engineer in the room pushes back, noting this is still a congested corridor despite having lost much business, and downsizing to just one left-pocket, as well as a speed reduction from 45 to 30 mph, is simply unacceptable. Their analysis shows that to do so would reduce the average peak hour speed from today’s 17 mph to just 10 mph.

Win-win with Place-Making Alternative Intersections
Later, a junior engineer who attended the meeting informs his boss of some new alternative intersection techniques he heard of in college for rerouting left turns, with a likely result that traffic will flow better than before, because lefts are routed elsewhere. His boss asks him to simulate traffic under all three concepts, and together they conclude that not only can they accommodate stakeholder desires to reduce the median width, but they can also entirely remove lefts from the critical sections. Now stakeholders can have a planted median with a pedestrian refuge at the crosswalk (Figure 26). And because the technique reduces delay, they inform stakeholders they can now accept the 30-mph design speed for a few blocks just, and still get traffic through slightly faster than even the current double-left design. Stakeholders are elated by the news, but are cautioned that there may yet be many reasons why the proposal will not work. But at least now they all have agreement on a target to aim for.

Figure 25 Using visualization of street sections to consider right-sizing options

Source: StreetPlan.net
The previous example discussed right-sizing as downsizing. This example highlights an upsizing. In this case a similar arterial as before has just 100 ft available. However, the corridor is extremely congested, and the consensus is that it needs another traffic lane. However, plans also call for high-frequency bus routes, and transition to walkable design. How can so much be accomplished with just 100 feet of space?

There is often more space available than meets the eye. In this case existing buildings are setback an average of 60-feet from the right-of-way due to private parking on their sites. Converting the suburban arterial into an urban multi-way boulevard could double the right-of-way on some blocks – a seemingly prohibitive impact, but the biggest change is converting private parking to public. Many businesses recognize they will lose some stalls, but their neighboring businesses often have excess parking, and because it is public, their own customers should find spots within an easy walk of their site.

The new arrangement makes it possible to fit six through lanes, and the major Complete Streets investment boosts land values, making it easier for the market to justify the mixed uses the community was hoping to see.
4.7. Considerations for Right-Sizing Freeways

Figure 28 is a satirical rendering of where we could end up if we continue to try to build our way out of freeway congestion. It helps highlight how freeways tend to receive huge investment, while arterials tend to receive relatively little. Some freeways are so popular that there is seemingly endless demand, and communities are seriously debating major double-decker projects, either below or above ground level.

On the other end of the spectrum, there are many less critical freeways that are nearing the end of their useful life. Many of those have more volume than can be managed easily on a single at-grade arteria, but not that much more. Situations like this call into question the wisdom of rebuilding dozens of bridges at great expense for a divisive asset that may not be the best solution. This section explores when it makes sense to consider freeway removal. Then, for
When Freeway Right-Sizing Means Downsizing

The list of cities that have removed freeways is growing: Portland, Milwaukee, San Francisco, Rochester, and internationally in Seoul, Korea, and Madrid, Spain. Many others have been routed underground or relocated to less populated areas. In all cases, post-removal traffic congestion was not as bad as feared. Many more cities are in various stages of planning for removal or major alteration. The following are some factors that could make it worth exploring freeway removal or serious alteration:

**CBD Mixed Uses**: “Central Business Districts” were once exactly that – almost exclusively about business. Today, those same CBDs may have lost jobs or gained residents. Combine that with better transit access in many cases, and there is much less need to deliver as many autos downtown as before.

**Restore Urban Fabric**: Which came first, the city or the freeway? In suburbs, it was usually the freeway, but in many cases, blocks and blocks of tight-grid development were removed, and the urban fabric on one side or both sides of the freeway is seriously deteriorated.

**Under-Utilized or Secondary Freeway?** Many downtowns are surrounded by loops and extended, elevated ramps. While present volumes on these secondary routes may be higher than an at-grade street can handle, it may also be very likely much of that traffic would divert to alternative routes, times, or modes. If most trips on these facilities are to downtown rather than through, then they are virtually at their destination anyway and may be able to navigate at-grade.

**One-way Couplets, Boulevards, and the Alternative Grid**: Some freeways have been replaced by two-way boulevards but designing low-speed pedestrian-friendly one-way couplets may also be a good option. Couplets can handle higher volumes, and achieve excellent signal progression, which means traffic can travel faster than on a two-way street, even if its speed limit is slower. Network analysis can help reveal the ability of the at-grade system to absorb the change with one-ways, boulevards, and other available streets.

**Primary Throughway?** In cases where volumes are high, and a large portion of that volume is traveling through downtown, going at-grade for a mile or less may be ok if the network can handle it, but it will be politically challenging. If the benefits of removal are high enough, it may be worth exploring how many lanes are truly needed for through traffic, and route those lanes underground, or beyond downtown if a pathway is available.

**Low-Speed Expressway?** It is usually taken as a given that freeways must have 70+ mph design speeds, but grade-separation can be designed for speeds as low as 35 mph. Lower speeds allow for shorter weaving sections and more access points because merge/diverge lengths can be shortened. Such a paradigm shift for a short distance of a mile or so through a downtown would allow for multi-way boulevards where the center express-lanes “duck-under” key cross-streets with modest, context-sensitive bridges that have relaxed vertical and horizontal curvature.
requirements, and possibly even lower height clearance requirements. If there is significant through traffic, the choice need not be just between Big Dig tunneling to support 60 mph traffic underground or stop-n-go averaging 10 mph traversing stop-lights on boulevards. An in-between 35-45 mph free flow “by design” can be a good option.

Every few years, the Congress for New Urbanism updates its “Freeways without Futures” publication, highlighting the top 10 freeways in the country they believe have the weakest arguments for continued existence. I-345 in Dallas is presently on that list, in large part because credible alternatives are being seriously debated. I-345, an elevated freeway, is just over a mile in length, and nearing a decision-point as to whether to rebuild it at great expense or convert it to an at-grade boulevard at much lesser expense. There is an excellent historic grid in the area, and real estate professionals have estimated the removal would generate over $4-billion in real-estate investment over 15-years, with $110-million in property tax revenue to the city. I-345 presently carries about 160,000 vehicles per day, of which 75% are passing through downtown. If downsized to an at-grade arterial, some of that through traffic will continue to traverse the one mile from the end of one freeway to the beginning of the next, but much of it will divert to alternative routes. TxDOT is still working through its options, but there are strong arguments for major downsize modifications to this freeway.

**Figure 29 Example, Seoul, South Korea**

In 2001, Seoul elected Lee Myung-bak as mayor largely on his promise to remove the Cheonggye freeway and restore the creek, and 80% of residents backed his plan. The project result was so well received that he was elected president of South Korea, and they have since dismantled 15 expressways.

*Source: Seoul Metropolitan Government.*


54 [http://anewdallas.com/traffic.html](http://anewdallas.com/traffic.html)
Finding an End to Endless Upsizing

Equally challenging in the right-sizing debate is when freeways have little room left for additional lanes. They crawl along in stop-n-go conditions and projections show future traffic would easily fill any new capacity (if it were possible to create). In these cases, the typical reactions are to tolerate hours of stop-n-go, addressing it with projects that chip-away at the problem such as parallel transit or improvements to alternative routes, or build our way out once again, this time with a double-decker that will last for 5-10 years.

However, there is hope. Delaying expensive decisions by instead adopting politically feasible strategies can buy time for next-generation technologies and new political paradigms to materialize. Some such strategies are discussed below.
Managed Motorways: This is a technique that is proving politically possible today. It was pioneered in Australia and is likely to be implemented soon in the United States. To understand the strength of Managed Motorways, it helps to first appreciate what happens when freeways fail, as it is worse than just slow. Freeways can carry a flow rate of 2,200 vehicles per hour per lane— for about 10-minutes. In other words, they never actually carry their full potential for a full hour (a fact that is overlooked by a great many regional travel demand models). Instead, when there are no gaps for entering traffic, break-lights come on as new traffic attempts to fit. The result is a stop-n-go wave that causes throughput to drop from 2,200 to as low as 800 to 1,500.

Traditional ramp meters help organize flow, but do not prevent overload. Managed Motorways is a process of installing sensors, so computers can detect when the mainline is approaching overload, then automatically adjusting ramp meters upstream to create gaps. That ensures the system can “hover” permanently at 95% efficiency, instead of hitting 100% for a short time, only to then collapse to 40-70% efficiency. It is true that to accomplish this, average wait times at on-ramps will increase at 5-pm. That can be concerning to the public, until they realize an extra 5-minutes at the on-ramp can save them 30-minutes of stop-n-go delay. Some DOTs explain it with a visual experiment in public meetings, where they dump rice or pasta into a funnel all at once, vs. pouring it in slowly. If the rice comes in too fast, it plugs up, requiring finger-taps to get it going again. The metered side can finish far more quickly.

Congestion Pricing: When demand for freeways exceeds supply, we usually accept as fate that we must build more. But it is possible to match demand to supply through pricing—the same way demand is matched to limited supply at popular restaurants, sports arenas for championship games, and every other location in the economy where there are limits to what is available for consumption. So far, congestion pricing has not proven politically possible in the United States. HOT lanes and tolled facilities are the closest compromise. However, a need for new revenue sources, technology improvements, and wider discussion of public-private partnerships for infrastructure management, should cause congestion pricing to be explored as part of any “Big Dig” conversation. Pricing is often seen as a “double-tax,” but can in fact be shown as a lower overall tax, since it offsets the need to raise taxes for expansion projects. It can also be shown as a net gain to the economy, because the societal benefit and gain to the gross regional product of reliable high-speed mobility far exceeds the user-cost of pricing.

Automated Vehicles: It is hard to tell at this point whether automated vehicles will increase or reduce demand on freeways. There are credible scenarios where AVs could reduce demand, and governments will have some ability to influence that outcome. Scenarios that would increase demand reflect continued private ownership, where virtually everyone owns their own private AV. In such a case, long commute times would be less onerous, as the passenger could do productive things while riding. Even if sprawl is exacerbated due to associated induced demand caused by “drive until you qualify” for far-away housing, AVs will be able to shorten the safe following distance between vehicles, thereby boosting freeway capacity well beyond 2,200 vphpl.

Thus, congestion on freeways may not increase even if off-freeway regional infrastructure increases substantially.

However, AVs may well be employed in significant numbers to provide multi-passenger ride-share services where a single vehicle carries many passengers with similar origins and destinations.
Existing trends with the popularity of ride-share apps like Uber and Lyft, along with rising generations more inclined to use rental services of all kinds, and technologies such as managed motorways all portend that deciding now to continue super-sizing freeways could soon prove to be a great waste of resources that otherwise could have been used for improving other aspects of the transportation system.

**Curve of Diminishing Returns:** At a certain point, the cost per lane mile goes up exponentially, while incremental capacity gained is barely noticeable given inefficient lane utilization, weaving effects, and higher propensities for system-crippling incidents. For most freeways, that point occurs at 5-6 lanes each direction, if not sooner. Whenever models estimate future demand will exceed 6-lanes each direction, regions should explore investments in alternative routes, modes, and matching demand to available supply to begin breaking the cycle of dependency on increased vehicular capacity. Rather than investing a billion dollars to super-size the freeway and create more induced demand, a credible analysis could show the benefit of investing that money in an arterial street network and alternative modes.

**A Word About Models of Future Traffic:** Forecasting is challenging. Some modeling deficiencies or challenges are known, while others may not be recognized. Few models account for either induced demand or “reduced demand” that come from land-use changes associated with high-speed freeways vs. complete street arterial investments. Few consider changing demographics very well, and virtually none make any allowance for pending efficiency gains that could come from managed motorways, congestion pricing, or automated vehicles. There is reason to be skeptical of forecasts that show disastrous freeways in the future unless they are super-sized. Cities are resilient in ways that are not well understood and tend to adjust to their realities. It may well be possible to “just say no” to additional freeway expansion and focus instead on strategies to improve a situation without additional expansion.

### 4.8. Local Design Concepts for Right-Sizing

This section presents specific design concepts that address different types of right-sizing needs, primarily at the level of road networks serving different types of development.

**Right-Sizing Local Residential Streets**

Over built, single-family residential streets are a major long-term maintenance burden for local governments. Cities often mandate that new development have enough pavement for two vehicles to easily pass each other with vehicles fully parked on both sides of the street. However, on a huge number of streets, there are few, if any, parked cars. And while speed limits on such streets are usually 25 mph, speeds of 35+ are far more likely as wide views lead drivers to exercise less caution.
**Figure 31 Wide single-family residential street**

*Source: Metro Analytics*

**Two-Way Yield Street:** In Greenfield development, this can be improved easily with a “yield street” configuration as shown in Figure 32 and recommended in NACTO’s “Urban Streets Design Guide.” When two cars are parked across from each other, only one vehicle will fit through. But since parking will usually be less than fully utilized, it is easy for one vehicle to pull-over while the other moves through.

**Figure 32 Two-way yield street**

*Source: StreetPlan.net*

**Half-Parking, One-Way Residential:** It is also possible to minimize pavement even more by eliminating parking on one side of the road and making the street one-way to access the remaining parking. For many situations where sufficient off-street parking will be available, this will prove fine. For rare occasions, such as parties where all parking will be utilized, visitors may need to park a street or two away. That may be acceptable given the added expense of infrastructure and consumption of additional land for parking that is under-utilized most of the time.
Right-Designing with Tree Zippers: There are many depressed value, single-family neighborhoods where infill is desired. If these neighborhoods can be reinvigorated, it will deter the need for new infrastructure on the fringes. One excellent way to reinvigorate neighborhoods is to plant uniform street trees with canopies that will eventually shade the road. In cases where there is too much pavement and an insufficient park-strip for trees, a “tree zipper” concept can be created, as in the photo below. The concept is simple: remove the hard, compacted road base from the parking area, and replace it with soil for the root zone and pervious pavers and runoff channeling. This is also a great Greenfield treatment. Benefits include:

1. Shading which reduces heat islands and prolongs pavement life
2. Reduces top speeds and increases property values substantially
3. Spurs reinvestment in adjacent properties, curtailing infrastructure at the fringe
4. Maintains on-street parking, and creates a sense of “right-sized” for residential areas.
Right-Sizing School Zones and Pedestrian Zones

When a street is first built, the adjacent uses that emerge next can render the street “wrong” for the situation. For example, three-lane collectors with under-utilized shoulders are very common street types, and unfortunately it is also very common for public schools to be built adjacent to such streets. In this case, the regular speed limit is 40 mph adjacent to a school but drops to 25 mph just before and after school. Nevertheless, children fatalities can occur just outside of those hours. The situation calls for rethinking the design, since schools attract children and families on foot throughout the day.

Figure 35 Example right-sizing in a school zone

Source: StreetPlan.net

One option, shown in Figure 35, is to not change anything about the location of sidewalks, curb, and gutter, but install tree zippers with a planted median and pedestrian refuge through the most sensitive space instead. Lanes would be narrowed to 10-feet, and a raised, alternatively colored, table-top crosswalk would all help ensure compliance with a of 25 mph speed limit. The increased travel time is miniscule since only a block or so is affected. Such changes may also encourage parents to allow their children to walk or bike to school.
Right-Sizing with Place-Making Alternative Intersection Design

High-efficiency intersection design strategies are just starting to catch on nationally. Continuous flow intersections (CFI), roundabouts, and diverging diamond interchanges (DDI) are among the most popular. Designs like the CFI are inherently auto-oriented. While they may be the right choice for the situation, they lack ability to attract much infill development and may not offset new infrastructure at the fringes.

Other designs such as quadrant roadways, thru-turns, and town center one-way couplets are also high efficiency and have considerable place-making potential, but the few built so far aim solely to improve traffic flow, and thus have failed to take advantage of their place-making potential, and thereby their ability to offset fringe infrastructure. Here are some key things to know about innovative intersections.

**No Left Arrow = More Green Time:** Arterial lanes often measure about 700 vehicles per hour per lane (vphpl), while a freeway lane can serve above 2000 vphpl. Why such a huge gap? The single biggest factor is the amount of green time each movement gets at signalized intersections.

As two-way arterial streets increase in volume, traffic engineers install left turn arrows to safely cross oncoming traffic. However, left phases reduce efficiency, requiring more time for startup losses, yellow+red, and green time for minor movements.

The common thread between all “Innovative” or “Alternative” intersections is managing left turns in a unique way, which in turn reduces the number of signal phases in the primary intersection. The result is higher throughput with less delay.

![Figure 36 Capacity gained with alternative intersections](source: Metro Analytics)
The Place-Makers: Quadrant intersections, through-turns, and town center one-way couplets are the high-efficiency designs with the most place-making potential. This paper will briefly consider just the quadrant design. First imagine a typical, huge suburban intersection with double-left pockets on all approaches. The quadrant replaces that by routing left-turning traffic behind development using mid-block signals as shown here.

The previous double-lefts contributed to an inferior pedestrian environment, but now the median can be for transit stations and queue jumpers or be narrowed and landscaped to include pedestrian refuge. The two-way quadrant road, or “backage road,” doubles as access to parking, making it easier to control access near the main intersection, and eventually redevelop with shared-wall buildings. The increased visibility on the back side activates more parcels for mixed-use development, helping the node intensify to a more formal “activity center” that can support transit.

New mid-block signals would seemingly slow traffic, but they can usually be coordinated easily with the main intersection, and the reduction in congestion at the main intersection more than makes up for any increased delay at the mid-block sites. Mid-block signals also make it easier for pedestrians to cross, increasing the livability of the new activity center. While it is best to design such quadrant opportunities in the beginning, there are sites nation-wide near strip-malls and Big Boxes where such pathways are feasible.

Converting a “Stroad” to a “Livable Boulevard” with Quadrants

“Stroad” is a term coined by the popular StrongTowns.org to describe arterial streets that are “wrong-sized” for their situation. A stroad is both a “road” — attempting to serve long-distance trips at high speeds, and an economic generating “street” — attempting to serve short-trip localized economic activity, historically accomplished at low speeds in walkable environments. The term is intentionally negative, to point out that what started out as a noteworthy road function ends up as the default location for economic interaction. The situation becomes “wrong-sized,” as the arterial isn’t working well for long-distance, high-speed trips, nor is it working well as a place with ever-increasing economic value and livability.

Such stroads are a significant share of what citizens are unhappy with when they express a desire to right-size an arterial street. In high-traffic situations, many engineers aiming to right-size

55 Visit InnovativeIntersections.org for more information.
the situation find they cannot do much because they feel they must manage traffic and are unable to do so without “double-lefts” and other features that detract from livable environments.

Figure 38 is a depiction comparing the stroad intersection to the redesigned intersection that relies on the quadrant design. Both have the same through lanes and same right-turn pockets, but the narrower lanes and other features help ensure traffic will obey the reduced speed limit. There is considerably more space available for alternative modes, not only because lanes are narrower, but also because the double-left was reduced to a 12-ft, planted median with pedestrian refuge. Of course, a block or so away will be a single-left lane, which may well be able to handle all lefts that previously needed a double-left, because at a secondary intersection the lefts can get more green time.

Despite a reduced speed limit, it can be demonstrated in microsimulation software that the average traverse speed will likely increase (drive slower, travel faster). Showing a before/after simulation goes a long way toward public acceptance, not only because it’s clearly less congested, but also because increased walkability can catalyze mixed-use development.

**Figure 38 Illustrative right-sizing: innovative intersection v. “stroad”**

![Image of intersection comparison]

*Source: StreetPlan.net*

**Linkage Between Backage Roads and Quadrants**

Recall earlier a best-practice suggestion for right-sizing greenfield arterials is to help ensure they will gain continuous back-ways behind development that fronts the arterial. Figure 39 shows how two crossing arterials would look if each had continuous backage roads. Notice that near the main intersection, the backage roads form quadrant pathways, which can be used to reroute left
turns. The presence of backage roads does not require left rerouting, but they do make it possible to do so at any time.

**Figure 39 Linkage between Backage Roads and Quadrants**

![Linkage between Backage Roads and Quadrants](image)

*Source: Metro Analytics*

**Quadrant Case Example**

While quadrant pathways that could be used for rerouting left turns exist at thousands of locations, it is still very rare to see lefts intentionally routed on those paths and denied at the main intersection as a traffic management strategy. One of the first projects to do this was opened in March 2012 at SR-73 and US-21 in Huntersville, NC.

This design routes both WB to SB, and EB to NB left turns on the single quadrant shown here. The design was much cheaper than other solutions, but businesses in the area were very worried it would confuse drivers.

Peak hour delay had been over two-minutes at the primary intersection. The quadrant created three signalized intersections. Added together there was still less than one-minute of delay. One comment, typical of many, said, “I was opposed to this intersection when you were planning it, and I still don’t understand why you did it... but I want to let you know that it works!”

This design lacks many of the place-making features, but it did simplify the intersection and created additional signalized pedestrian crossing opportunities.

**The 7-D’s of Right-Sizing for Traffic**

There are at least seven focus areas of right-sizing for traffic that fortunately can all be described by a ‘d’ word. The traditional approach is the “direct” approach, or “build your way out” approach, which equates to increasing vehicle capacity directly on the facility in question. However, there
are other “d-strategies” to evaluate that can help reduce demand to make room for other things. And even when direct new capacity is a good idea, there are place-making methods for increasing vehicle capacity, as noted earlier, and these should be included for analysis to discern their applicability over more auto-oriented capacity solutions.

1. **Design** – Connected through streets in the background helps arterials work better.
2. **Divert** – When aiming for less traffic, look for opportunities to improve competing paths.
3. **Deduct** – Help people deduct themselves from traffic by improving alternative modes.
4. **Delete** – Delete vehicle miles traveled (VMT) by optimizing land uses; reducing speeds.
5. **Dynamic** – Technology dynamically guides to under-utilized streets, and other efficiencies
6. **Direct** – After pursuing previous strategies, increase capacity directly on the corridor
7. **Deal with it** – There is psychological benefit to “accepting things you cannot change.”

### 4.9. Additional Strategies for Right-Sizing Regional Infrastructure

Many regions are nearing crisis, with vast amounts of infrastructure nearing 3-5 decades in age, and insufficient revenue to maintain it. Much of the existing infrastructure serves at only at a fraction of its potential, and yet these same regions are building more at the fringes because their interiors are unattractive to new development. In many cases interior streets can be made attractive for new development at a fraction of the cost of new infrastructure at the fringe, but complete streets, street trees, and arterial rejuvenation are viewed as mere amenities, secondary to the more critical tasks of traffic management.

#### Learning from Utah’s 3% Strategy

Whole the above-mentioned improvements are amenities, they are also amenities with the potential to reduce regional infrastructure needs by billions of dollars. Envision Utah’s “3% Strategy” analyzed what would happen if 33% of the region’s future development occurred on just 3% of its most transit-accessible land. Without any additional investments in transit, they found it would reduce regional VMT by about 10%, which would translate into about $7-billion in reduced freeway and arterial street needs, and billions more in reduced local streets and associated infrastructure. This points to the potential benefits of investments that can encourage such land development patterns.

#### Redefining the “Billion-Dollar Project”

When a region decides to spend a billion dollars, it is often on a single project where virtually everyone understands the value, like a freeway expansion or rail project. By contrast, spending similar funds to enhance arterials with complete streets and local connectivity around would-be activity centers would support development with less exclusive reliance on vehicular travel, thus opening the possibility of saving many billions in offset infrastructure. Nevertheless, funding for such enhancements is usually small because the ability of such “amenities” to offset other infrastructure isn’t well understood, and because any given arterial project is too tiny to garner
region-wide political support. However, if you packaged dozens of arterials together into a single marketable “billion-dollar project,” this might create a situation in which everyone stands to gain something, and therefore funding can be secured. The case for such an investment package would have to show that they projects would make interior arterials flow well and be attractive for reinvestment offsetting new infrastructure at the fringe. Such an approach could be far more effective at helping regions manage their long-term commitments by not building vast amounts of new infrastructure and help respond to and further shape market forces interested in “greyfield” rather than “greenfield” development.