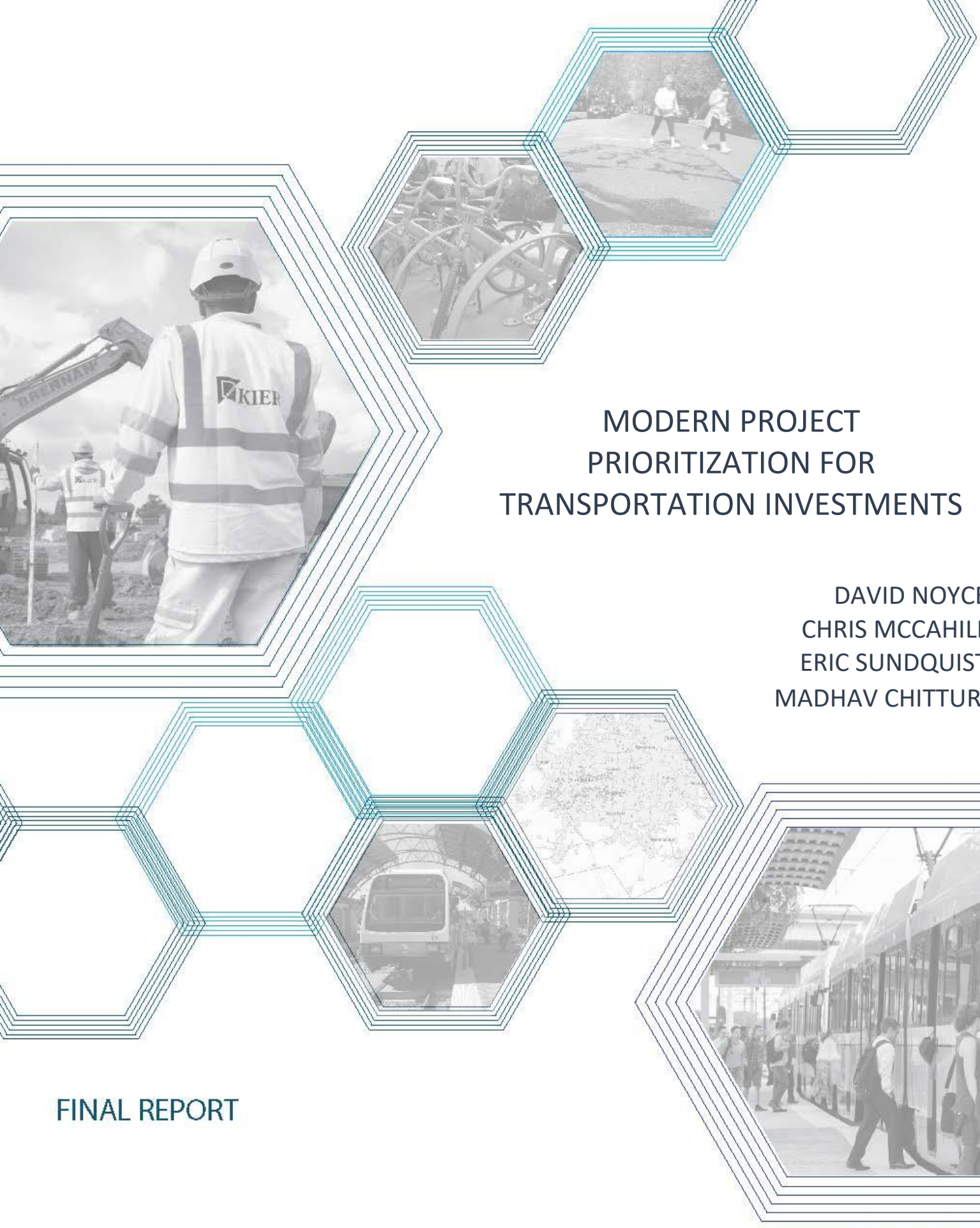

MODERN PROJECT PRIORITIZATION FOR TRANSPORTATION INVESTMENTS

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FINAL REPORT

CTEDD
Center for Transportation Equity, Decisions & Dollars

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FINAL PROJECT REPORT

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Abstract

Project prioritization among transportation agencies has always been an evolving practice. At its core, it means setting goals and aligning decision-making processes to meet those goals. This study is aimed at making that process easier. For this study, our team reviewed project prioritization programs at 21 transportation agencies, including 14 state DOTs and 7 MPOs, through a combination of interviews, online questionnaire, and publicly available written documentation. Some key lessons came from a case study of Virginia's SMART SCALE program, which has resulted in lower average project costs and funding for a broad range of multimodal projects. The main findings can be summarized in terms of three important opportunities in project prioritization: 1) establishing flexible funding programs, 2) evaluating key outcomes, and 3) maximizing benefits per dollar spent.

Chapter I: Introduction

Project prioritization among transportation agencies has always been an evolving practice. At its core, it means setting goals and aligning decision-making processes to meet those goals. For decades in the U.S., these goals focused overwhelmingly on building and expanding the nation's highway system to accommodate rising automobile use and outward growth from city centers. It was during that time that the transportation profession developed basic standards like level of service (LOS) to diagnose problems and evaluate solutions. The role of transportation agencies today, however, is more complicated. In addition to keeping the roads flowing smoothly, state and local departments of transportation (DOTs) are also responsible for maintaining aging infrastructure, ensuring access and safety for those who do not drive, and minimizing environmental impacts, all with limited resources. And yet, as this study shows, many transportation agencies still overwhelmingly prioritize investments in new road capacity.

There are many steps that agencies can take and best practices to follow to help ensure that limited resources are put to the best use in meeting their many goals. These include decision-making frameworks, data sources, analytic tools, and metrics—all documented in one study or another. These do not always translate into practice, however, often because agency leaders responsible for making hard investment decisions have limited capacity or they face political and logistical challenges. This study is aimed at making that process easier. Our team spoke directly with staff at state DOTs and metropolitan planning organizations (MPOs), surveyed others, and reviewed existing programs and related literature to arrive at a simple framework and set of recommendations for modern transportation project prioritization.

Chapter II: Background

This study is not the first to propose a "framework" for public transportation agencies to evaluate and prioritize investments. The Institute of Transportation Engineers (ITE), for instance, devotes a chapter to project evaluation and prioritization in its Transportation Planning Handbook (*1*). That guidance includes overarching frameworks for project prioritization (Figure 1) and performance measurement (Figure 2). It describes different performance categories—e.g., mobility, accessibility, safety, air quality, and cost—and goes into detail on monetary cost and benefit estimates. It also includes recommendations for performance criteria, derived from a review of best practices by Middleton (*2*). Similarly, a report published by the National Cooperative Highway Research Program (NCHRP) describes project prioritization specifically for active bicycle and pedestrian projects (*3*).

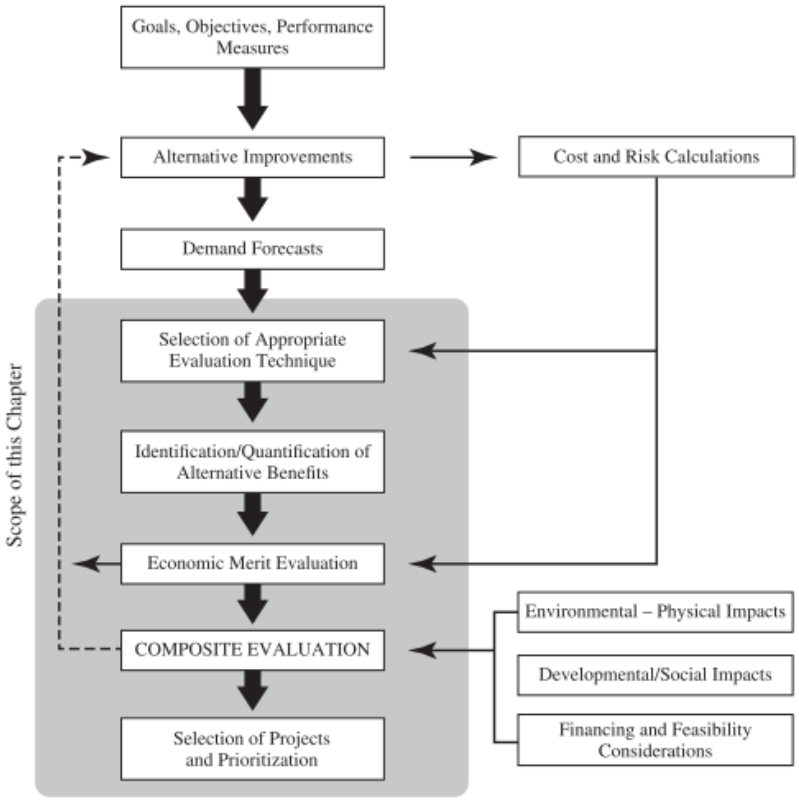

*Figure 1. Framework for project prioritization (*1*).*

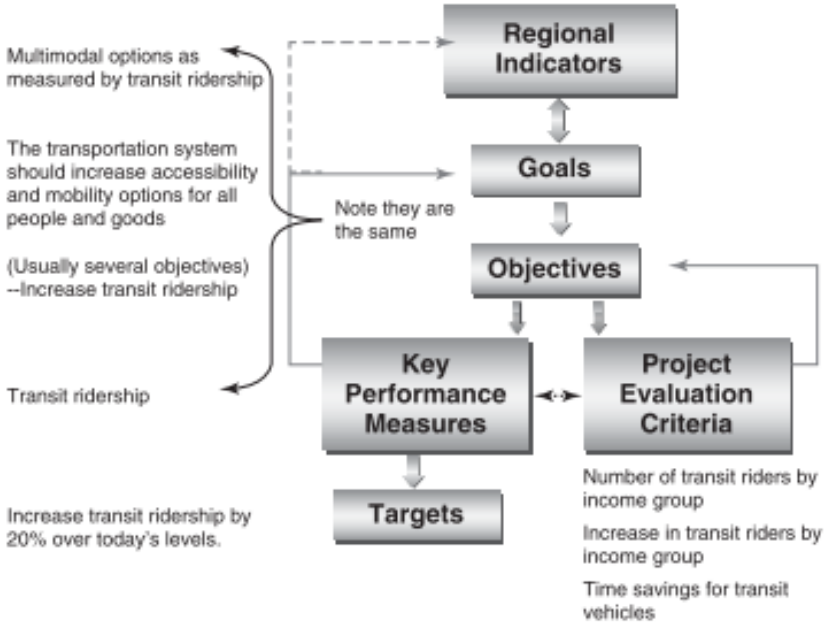

*Figure 2. Performance measurement hierarchy (*1*).*

Several studies look at various best practices in project prioritization among transportation agencies, such as the Kansas DOT (*4*) and the Vermont DOT (*5*), for instance. A peer exchange project, led by the North Carolina DOT in 2014, identified best practices and recommendations for cross-modal project prioritization based on lessons learned from three other DOTs (Oregon, Virginia, and Delaware) and two MPOs (Genesee Transportation Council and Metropolitan Transportation Commission) (*2*). That same year, researchers reviewed cross-mode project prioritization among state DOTs and MPOs for NCHRP (*6*). They surveyed 17 DOTs and 36 MPOs (with partial responses from another 70 agencies), interviewed eight DOTs and 15 MPOs, and assembled brief case studies of six DOTs and five MPOs. More recently, in 2018, the planning firm, Foursquare ITP, reviewed the project prioritization approaches in North Carolina, Massachusetts and Virginia, and offered some brief lessons learned, mainly from Massachusetts (*7*).

A number of other studies propose more quantitative methods, often developed by working directly with transportation agencies (*8*–*17*). Among state DOTs, Rezvani et al. (*8*) assisted the North Carolina DOT in using a cost-benefit analysis to prioritize rail crossing improvements, while Porras-Alvarado et al. (*9*) prioritized pavement projects in the Texas DOT's Austin District four-year plan. At the local level, a prioritization framework was developed for transportation projects in Manhattan following the September 11, 2001, terrorist attack (*15*). Outside the U.S., prioritization frameworks have been recommended for transit projects in greater Hamilton and Ontario, Canada (*16*) and for pavements projects in Mumbai, India (*17*).

Most data-driven approaches fall into several categories: benefit-cost analysis (BCA), cost effectiveness analysis, and multicriteria analysis (MCA) (*4*, *6*, *18*). BCA typically ranks projects in terms of their long-term return on investment, measured as a benefit-to-cost ratio or similar

economic measure. Benefits and costs can be construed narrowly or broadly. Cost effectiveness analysis, in contrast, ranks projects in terms of their total cost per unit of improvement over the lifetime of each project, where improvements can be measured in various terms. MCA (or goals-based approach) ranks projects based on various criteria associated with high level goals, often using a scoring function that assigns different weights to different criteria. This approach, in particular, has become more common for evaluating transportation projects in recent decades and often relies on the analytical hierarchy process (AHP) or similar methods for determining evaluation criteria and their weights (*18, 19*). The last widely recognized approach to project prioritization is process-based, which is not necessarily data-driven and relies on a governing body to make decisions about projects and investments.

The reality, however, is probably best described by Gunasekera and Hirschman for NHCRP (*6*):

> *Indeed, if any single theme emerges consistently from the surveys, it is that no single approach is "best"; as agency goals and operating conditions vary; agencies pursue prioritization processes that are flexible and appropriate to those goals and conditions, and that reflect multiple criteria. Given the preferences identified in the surveys and case studies, the overriding lesson is that a more nuanced "mixed" approach seems to offer the best solution to cross-mode prioritization.*

For instance, some consider BCA as a single criterion in a broader prioritization framework while others incorporate MCA-type methods into a larger cost effectiveness analysis. Projects can also be evaluated using a matrix that considers economic analysis on one axis and social indicators on another, as proposed by the World Bank . Moreover, political considerations can often take precedence over more quantitative processes.

And therein lies one of the key challenges to implementing data-driven, multimodal project prioritization. Transportation agency leaders are often forced to balance political pressures with longstanding internal practices and may not have the capacity or resources to restructure existing processes and systems. For instance, evaluation criteria like level of service (LOS) and traffic delay are common for prioritizing transportation investments, but they are inconsistent with many of the values and outcomes that agencies are often working toward (*22*). Meanwhile, states are accountable to the federal government for one-third of their highway funding, or upwards of 60 percent in states like Rhode Island, Montana, and Wyoming (*23*), and those funds are often committed to certain types of projects. State legislators also play a role—sometimes making reforms difficult and other times serving as the catalyst for new prioritization processes (*5*, *24, 25*).

These engrained decision rules and the political significance of "ribbon cutting" naturally gives priority to new highway capacity and larger projects in general. But transportation secretaries in states like Massachusetts and Washington have rejected the notion that DOTs can build their way out of traffic congestion, especially when facing tighter and tighter financial constraints (*26*, *27*). Moreover, Washington's secretary has argued that crashes cost Washington's economy more the three times as much as congestion, yet the Washington DOT spends almost 20 times as much on congestion relief than on safety (*28*).

With that imbalance in mind, many state DOTs and MPOs have broadened their policy goals to include not just conventional outcomes like mobility and safety, but also things like accessibility or connectivity, environmental stewardship, health and equity, among others. Long range plans (LRPs) are an important starting point for enacting those policy goals, but those plans do not always translate into project-level evaluation criteria (*29–31*). This includes not only in programming, but decisions made during project development and delivery, as stressed in Smart Growth America's Multimodal Development and Delivery technical assistance program (*32–34*).

This study, therefore, aims to fill a particular need among transportation agencies in achieving policy goals through data-driven decision-making—focusing on project prioritization within a larger decision-making structure. First, we learned from practitioners their specific challenges and needs. We then reviewed a number of existing programs, along with related literature, to identify best practices and frame them in terms of a few simple yet specific takeaways that apply broadly across agencies and programs.

Chapter III: Outreach and Program Review

For this study, our team reviewed project prioritization programs at 21 transportation agencies, including 14 state DOTs and 7 MPOs, through a combination of interviews, online questionnaire, and publicly available written documentation. Based on feedback from agencies, this study encompasses a range of programs, including long-range metropolitan area plans (LRPs), near-term transportation improvement programs (TIPs or STIPs for state-level programs), and sub-programs within TIPs, as shown in Table 1. We reviewed each program to understand its general scope and structure, and documented the evaluation criteria used, including their relative weights. Finally, we conducted a more in-depth, quantitative assessment of the Virginia DOT's SMART SCALE program, which is often recognized as a leading example of project prioritization among state DOTs (*2*, *7*).

Interviews

We initially interviewed technical advisors from five partner agencies (three state DOTS and two MPOs) to learn essential practices and key differences among the agencies. Each interview lasted approximately one hour and was semi-structured around five basic questions:

1. What is your role at the agency?
2. What comes to mind in terms of *project prioritization* (programs, funding sources, etc.)?
3. What example of project prioritization at your agency should we know about?
4. How would your agency like to improve project prioritization?
5. What are the major obstacles?

These discussions revealed wide-ranging interpretations of project prioritization and gave insight regarding the challenges and opportunities that agencies face, which helped inform the remaining scope of our study and frame our online questionnaire.

Online Questionnaire

A questionnaire was then developed and shared with partners and known contacts through email and word of mouth (for instance, our team convenes a meeting of CEOs from around 20 state DOTs each year). We received responses for 20 programs or sub-programs across 12 agencies. This questionnaire (available in the appendix) was not intended for statistical or quantitative analysis and instead focused on gaining access to documentation and program details, learning best practices, and gaining general insights about the varieties of programs in place.

For instance, the programs represented in our questionnaire most commonly apply to road and transit projects but not bicycle and pedestrian projects (Figure 3); they are often used to prioritize spending of state revenues and surface transportation block grants (Figure 4); and potential projects are often identified based on a grant or application process (Figure 5). Eight of the programs cover more than four projects types and eight of the programs incorporate more than four funding sources.

Table 1. Agencies and programs considered in this study (common abbreviations are defined in the appendix).

Agency	Interview	Program(s)	Questionnaire	Background review	Detailed review
BRMPO		TIP	✓		✓
Caltrans	✓	STIP [MONSTER]		✓	
DelDOT		6-year plan/STIP	✓		✓
DMAMPO		TIP [STP]	✓		✓
DVRPC		LRP/TIP [CMAQ]	✓		✓
H-GAC		TIP [STP]	✓		✓
HDOT		STIP [SmartTRAC pilot]			✓
KYTC		STIP [SHIFT]		✓	
MassDOT	✓	PSAC (2015) / STIP		✓	
MDOT		5-year plan/STIP	✓		
MnDOT		STIP [CIMS (2013)]		✓	
		STIP [TED]			✓
MTC		LRP	✓		✓
NCDOT		STIP	✓		✓
NHDOT		10-year plan	✓	✓	
NMDOT		STIP [CMAQ]	✓		✓
ODOT		STIP [TRAC]			✓
SACOG	✓	TIP		✓	
SCAG		TIP	✓	✓	
VDOT	✓	6-year plan/STIP [SMART SCALE]			✓
VTrans		STIP	✓		✓
WSDOT	✓	TIP		✓	

Brackets indicate specific subprograms.

Our questionnaire also gave us initial insight into the kinds of factors considered in project prioritization (Figure 6). Project cost was the most common, followed by infrastructure quality, mobility, and project readiness. Land use considerations and economic development are among the least commonly considered factors. A more detailed look at evaluation criteria is offered later in this report.

Additional responses are summarized as follows:

- *How much pressure is there to continue funding a project after initial planning or scoping is complete?* There is a lot of pressure in eight programs and a little pressure in just one program.
- *What happens if a project's costs increase or benefits are reduced after it is programmed for funding?* The budget would likely be increased in ten programs and projects would be reevaluated in seven programs. In one program, the awarded values rarely change. In another program, cost increases greater than 35 percent are flagged for review by a committee.
- *What happens to projects that are not funded in the current cycle?* Sponsors must resubmit projects in 11 programs and projects are automatically carried over in seven programs. One program carries some projects to the next cycle and requires others to be re-submitted.
- Nine of the programs were rated by the agencies as very transparent in most regards, which means making information about methods, scoring status, and final scores available online. For another nine programs, information is generally only available to applicants or upon request (one of those programs describes its methods online).

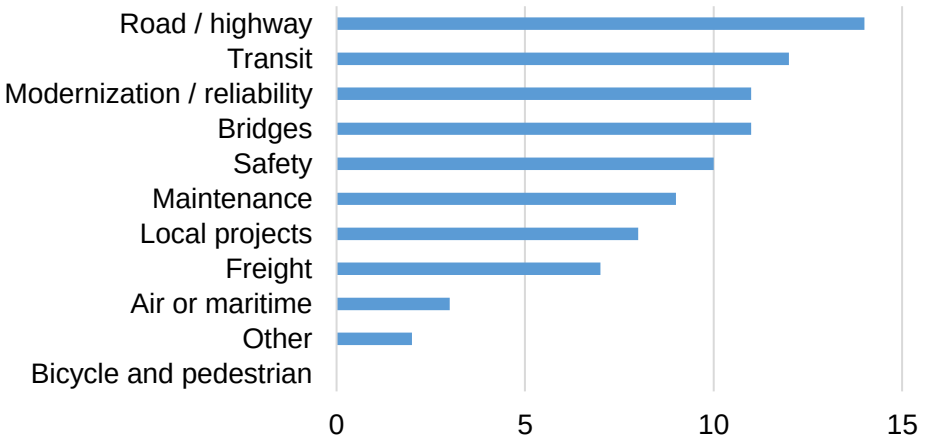

Figure 3. Project types based on questionnaire.

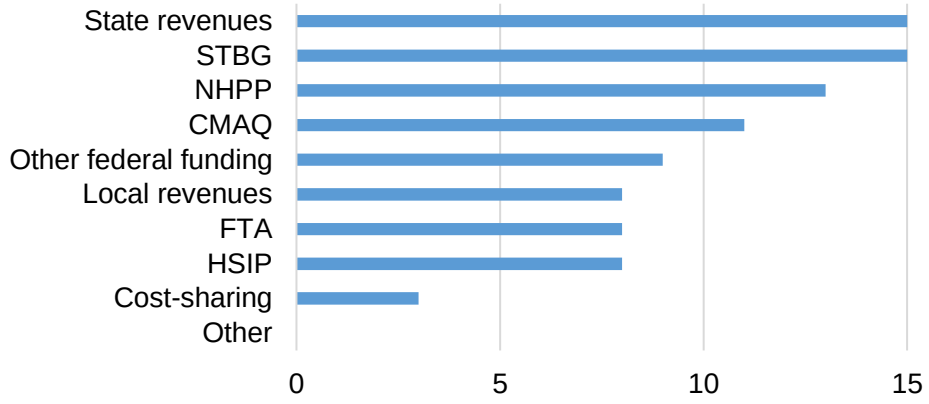

Figure 4. Funding sources based on questionnaire.

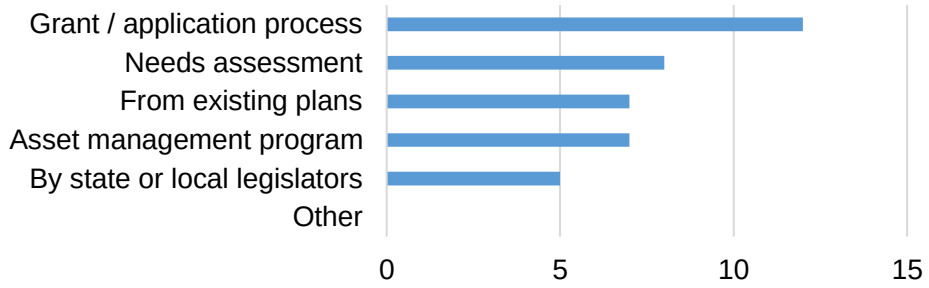

Figure 5. Source of project list based on questionnaire.

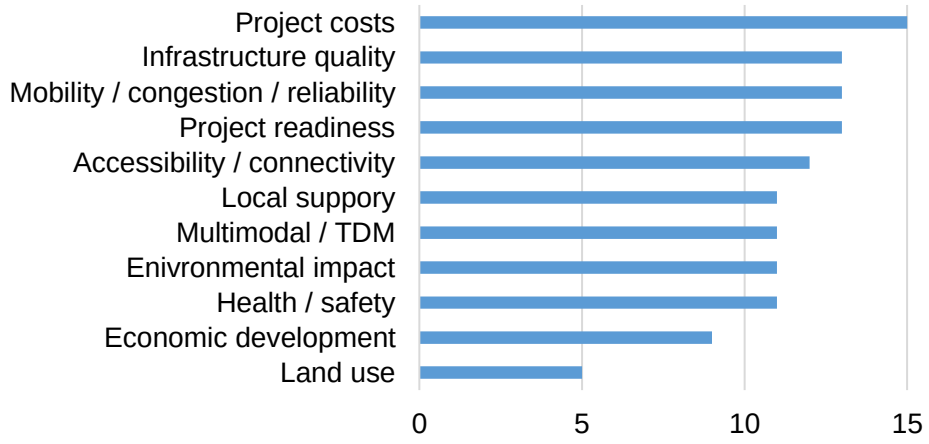

Figure 6. Factors considered in prioritization based on questionnaire.

Case Study: Virginia's SMART SCALE

In 2014, the Virginia legislature passed a law (HB2) requiring a statewide prioritization process for transportation project selection, which ultimately became the state's SMART SCALE program. At the time of this study, three rounds had been completed—approximately one every two years. The process is developed and approved by the Common Transportation Board and carried out by the Office of Intermodal Planning and Investment (OIPI) and the DOT. It applies to any capacity projects using discretionary funds in the Six-Year Improvement Program (the foundation of the four-year TIP). Each project is evaluated on up to six legislatively mandated factors—congestion mitigation, economic development, accessibility, safety, environmental quality and land use—then ranked based its benefit per dollar requested. Funds are split evenly between the High-Priority Projects Program (regional or statewide significance) and the District Grant Program (projects compete within districts).

SMART SCALE is often recognized as a leading example of project prioritization among state DOTs and the program is well documented by researchers and by VDOT itself (*2*, *7*, *25*, *35*). Some noted successes of the program include the following:

- The process is exceptionally transparent. Technical documentation is publicly available, scoring updates are available to project applicants via an online dashboard, and all final scores are posted at the same time, once scoring is complete (*25*).
- The process has improved over time. For instance, VDOT acknowledges its initial environmental impact measure advanced projects with relatively small benefits (*36*).
- VDOT cannot submit projects. This was initially controversial, but it has shown to ensure local support and buy-in for transportation improvements (*37*, *38*).
- The process focuses on the outcomes and benefits achieved by projects relative to their costs, rather than the magnitude of the problem being addressed (*37*, *38*).
- The program incorporates comprehensive, multimodal accessibility metrics, which evaluate how well transportation investments connect people to jobs and services, and let VDOT assess the specific impacts to disadvantaged populations (*25*, *35*).

This study builds on that knowledge by reviewing the program's results based on funding patterns over its first three rounds. For this purpose, our team analyzed the total number of projects and total spending in SMART SCALE and in the overall Six-Year Improvement Program (SYIP) by project type. This analysis includes three fiscal years of SMART SCALE project selection (2017, 2018, and 2020) and six fiscal years of total SYIP spending (2015 to 2020). All projects are classified in terms of "road system" (interstate, primary, secondary, urban, rail, public transit, enhancement, and miscellaneous) and SMART SCALE projects in 2017 and 2020 are also classified in terms of five types (highway, rail, bus, transportation demand management, and bike/ped). Projects in both datasets were matched by universal project codes (UPCs). The results are shown in the following figures and described below.

Results

Over the period 2015 to 2020, total spending in the SYIP increased from around $1.8B to $4.2B according to VDOT's project lists, with most of the increase going to interstate projects (Figure 7). Over that same period, however, the number of interstate projects stayed relatively flat,

meaning their average cost increased (Figure 8). Total spending on SMART SCALE projects (which may include additional funding sources) also ramped up beginning in 2017. This provides useful context for understanding the nature of SMART SCALE spending during a period marked predominately by large highway projects.

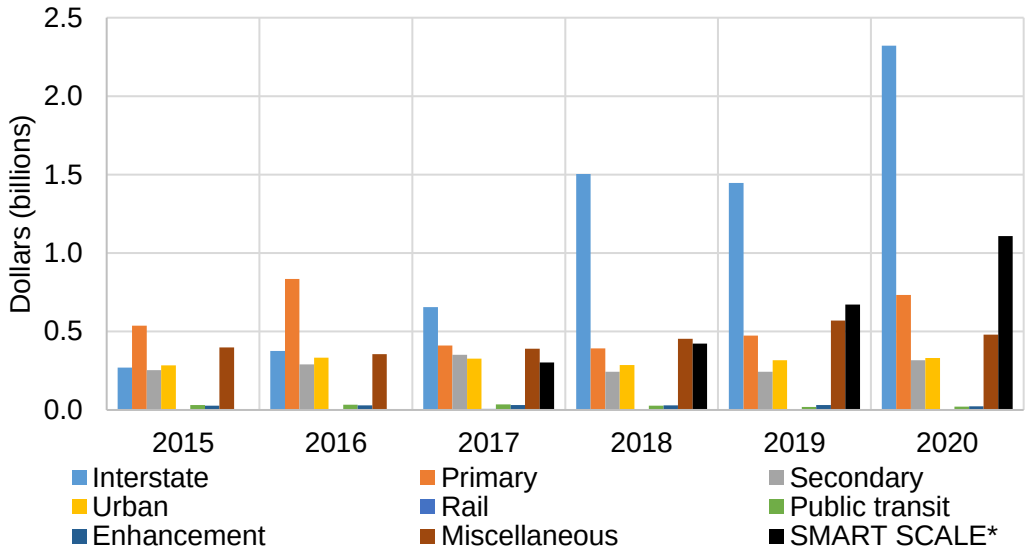

*Figure 7. Total spending in SYIP by road system (*includes all spending on SMART SCALE projects regardless of funding source).*

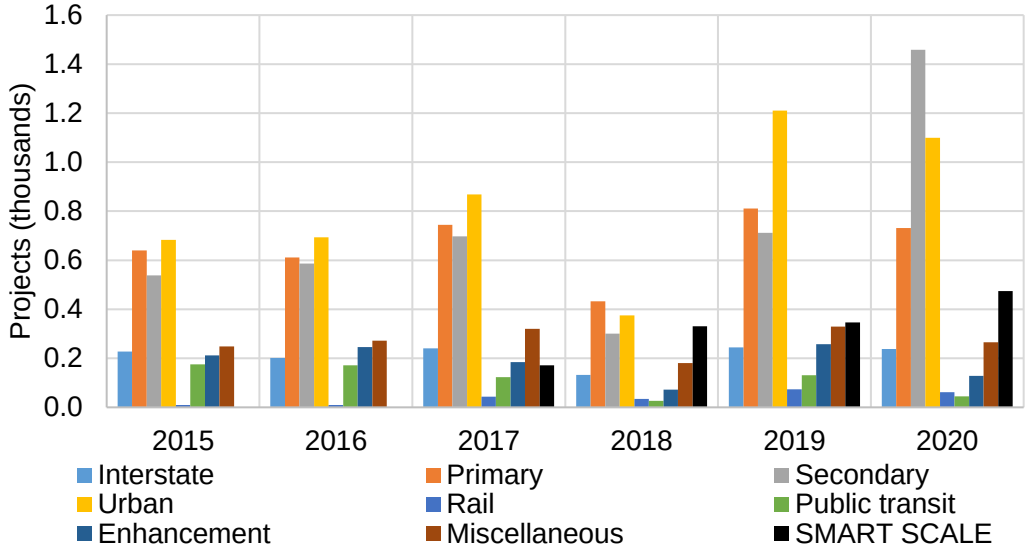

Figure 8. Total number of projects in SYIP by road system.

Among projects selected in SMART SCALE, however, the trend is quite different (Figure 9 and Figure 10). The amount of SMART SCALE funding committed to interstate projects and primary roads dropped considerably, and the largest increases were for urban roads and public transit. Some projects, especially those selected in 2018, were not yet assigned road system classifications based on the available data.

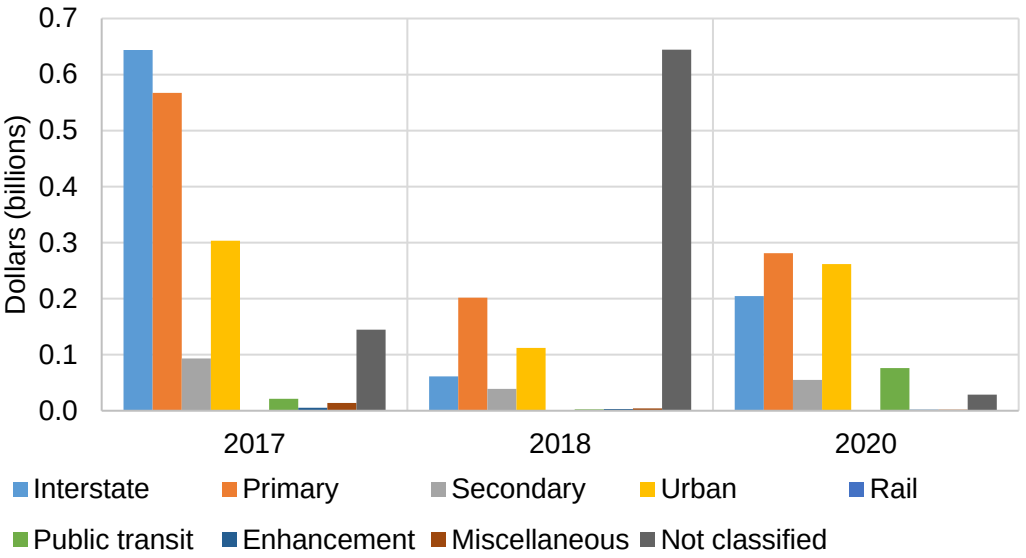

Figure 9. Total funding committed to projects selected in SMART SCALE by road system.

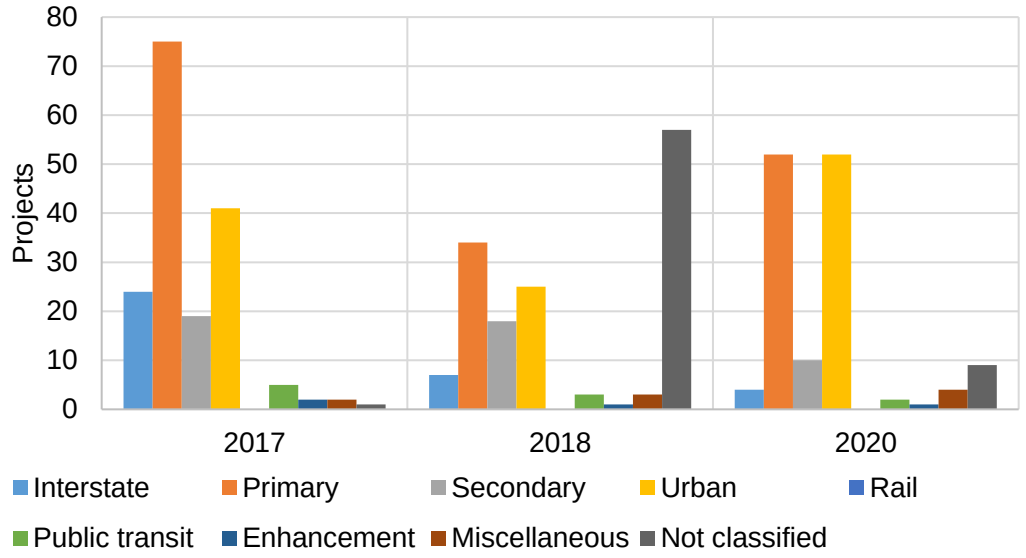

Figure 10. Total number of projects selected in SMART SCALE by road system.

The SMART SCALE process uses a different classification scheme than the SYIP, which tells a similar story but gives further insight (Figure 11 and Figure 12). Despite most SMART SCALE funding still going to highway projects, the number of projects and the total funding committed both dropped, while considerable gains were seen among bus and active transportation projects. In fact, more highway projects were submitted in 2020 than in 2017 (372 versus 271) but the success rate of those project dropped from 49% to 23%. Meanwhile the number of active transportation projects more than doubled, even as the available SMART SCALE funds dropped by about half.

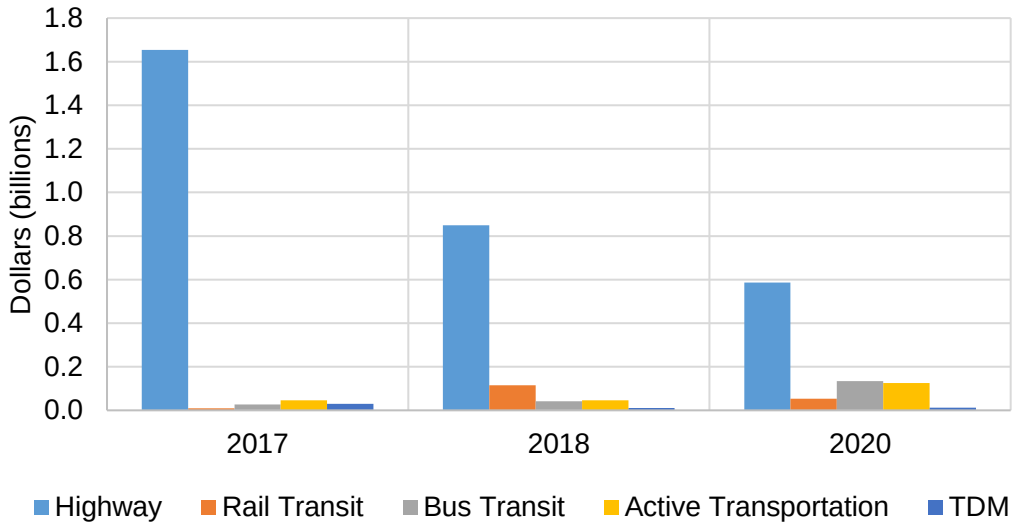

Figure 11. Total funding committed to projects selected in SMART SCALE by project type.

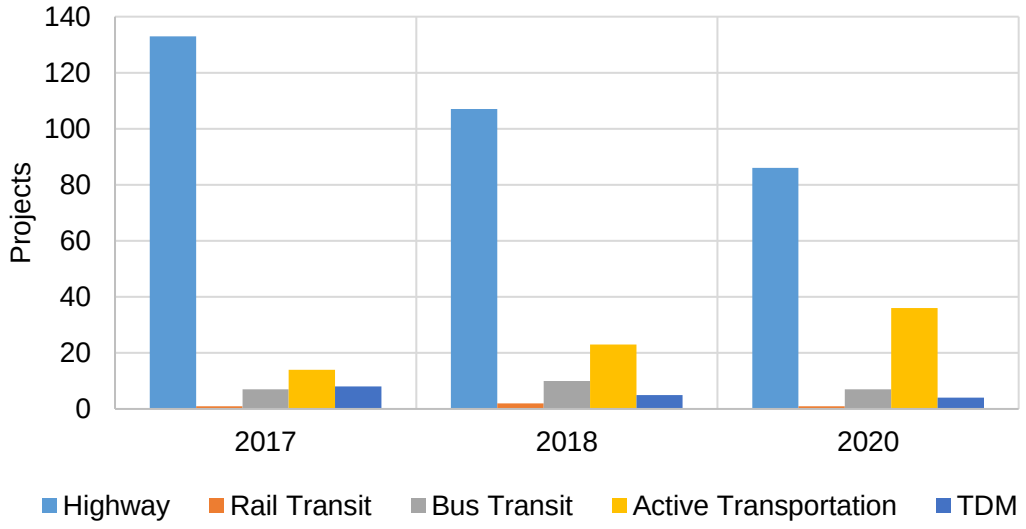

Figure 12. Total number of projects selected in SMART SCALE by project type.

Another important trend is the share of project costs covered by SMART SCALE, which dropped from 54% in 2017 to just 18% in 2020. This drop was most notable among highway and bus projects, while active transportation and TDM projects are generally 80% covered by SMART SCALE and the share of costs for rail projects increased considerably (Figure 13). Moreover, the average amount of funding requested from SMART SCALE for each selected project dropped by about one third.

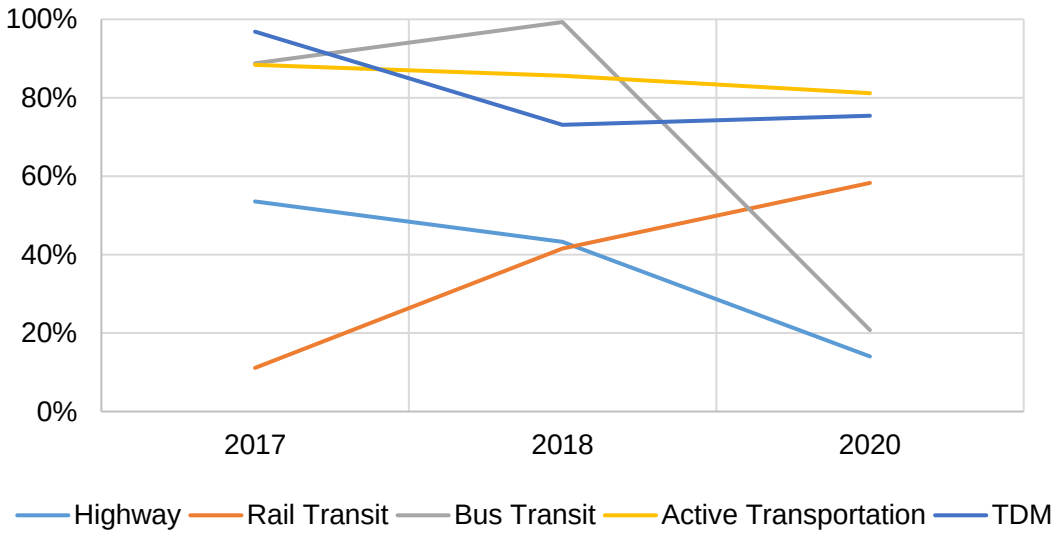

Figure 13. Total share of project costs covered by SMART SCALE by project type.

In summary, the outcomes from the first three rounds of SMART SCALE suggest the program has changed not only the way projects are funded, but the types of projects that can successfully compete for funds. These changes are partly the result of how SMART SCALE is administered—for instance, some measures have been improved and changes have been made to the number of projects that applicants may submit and the window for submitting projects—but they are also inevitably because applicants have come to understand the process better and change the types of projects they submit. Based on the drop in average project costs and the increase in cost-sharing, applicants seem to be using the available funds more efficiently and leveraging other available resources to make projects successful. Most notably, the program appears to allow for a broad range of multimodal projects, including bicycle, pedestrian and transit investments, to compete on equal footing with more traditional highway projects.

Chapter IV: Findings and Recommendations

Our review of literature and best practices revealed several lessons and key opportunities for project prioritization among state DOTs and MPOs, described below. In some cases, however, these extend beyond what typically constitutes the project prioritization process, to include planning and project development. For instance, like high-level policy goals, the recommended evaluation criteria in this study are intended to apply to decision points throughout the planning, programming, and project delivery process, as shown in Figure 14. The ultimate aim of these recommendations is to better align project outcomes with those high-level goals, while making the most efficient use of limited resources.

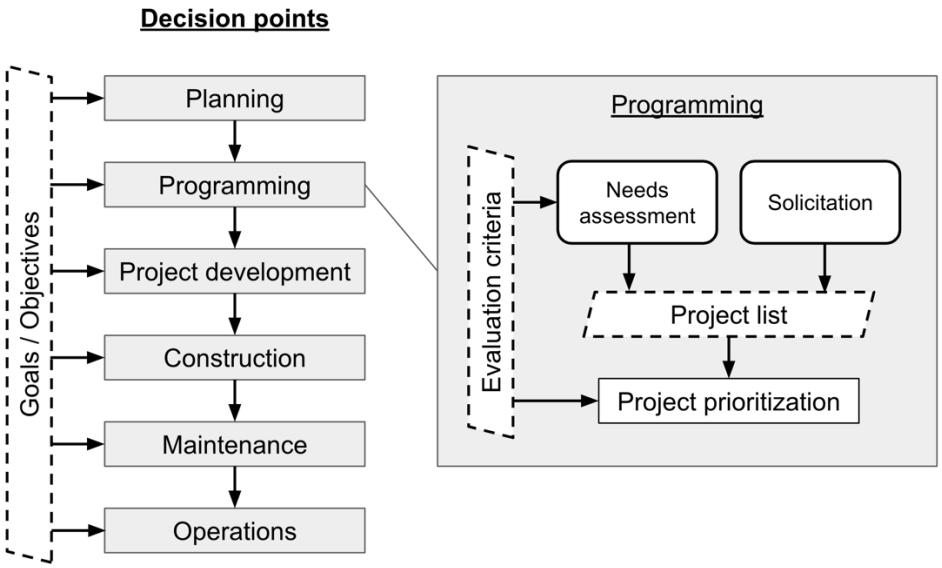

Figure 14. Project prioritization within a broader decision-making framework.

Lesson 1: Establish Flexible Funding Programs

Agencies often maintain separate funding streams for different types of projects (e.g., highways versus transit). This is partly due to dedicated funding streams at the federal and state level, which makes combining those funds complicated. However, this also makes it particularly challenging for agencies to advance wide-ranging goals or programs, especially those that do not have sufficient dedicated funds (e.g., intelligent transportation systems or active transportation projects). The federal Transportation Alternatives program, for instance, makes up less than two percent of federal transportation funding even as cyclists and pedestrians make up nearly 20 percent of all traffic deaths.

This study points to several approaches for providing flexible funding and leveraging available revenues to advance multiple goals. The Massachusetts and Virginia DOTs, for instance, each

dedicate around 45 percent of discretionary funds to maintenance, reserving the remainder for multimodal capital investments. In Massachusetts, those capital investments are divided in two groups: modernization (28%) and expansion (16%). Modernization includes most projects that improve existing facilities beyond basic state of good repair and expansion includes new facilities. In Virginia, the remaining funds are allocated entirely through its data-driven prioritization process, Smart Scale. The North Carolina DOT established flexible funding through three separate programs: 1) statewide mobility (40%), 2) regional impacts (30%), and 3) division needs (30%). Projects that do not qualify for the first program may be funded through subsequent programs.

Lesson 2: Evaluate Key Outcomes

Some transportation agencies have moved toward more quantitative scoring methods for prioritizing investments. These processes typically involve high level scoring categories with predetermined weights and associated evaluation criteria within each category. These frameworks resemble the outcomes of an analytical hierarchy process (AHP) and other forms of MCA but they generally lack the rigorous analytical methods that make these approaches ideal for balancing many competing goals in decision-making. These comprehensive scoring frameworks with many nested evaluation criteria lead to each criterion that count for small portions of the final score—often less than five percent—regardless of how important or difficult measure it is.

Another common practice, which a formal MCA process would help guard against, is that agencies tend to cross-classify evaluation criteria under different categories or goals, meaning the final weights may not reflect the original intent. For instance, several agencies in our study have mobility-related scoring categories with predetermined weights, but they include additional mobility-related measures like travel time savings and travel time reliability under categories like accessibility, economy or benefit-cost analysis. This means the benefits of highway capacity improvements are often counted more than once. Moreover, freight-related criteria like truck volumes or designated freight routes can give highway capacity projects additional points, whether or not they improve freight movement.

Finally, many of the evaluation criteria used by transportation agencies in project prioritization do not meet basic standards of being quantitative and outcome-oriented. Some agencies, for instance, rely on “checkboxes” or simple point systems that can swing the results of project scoring more than quantitative measures. Common checkboxes include criteria like “on a major route,” “in a downtown,” “in a disadvantaged area” or “connects to an activity center.” Many of these measures point to another common shortcoming, which is that they are not focused explicitly on the outcomes of investments. This is true of other common measures like traffic volume, volume-capacity ratio, and crash rates. Chad Tucker, the Program Manager of Virginia’s SMART SCALE program, explains their approach as, “not measuring the size of the problem but what is the benefit the public is going to see from the project?” (*37*).

This study also indicates common performance categories (Table 2). The most common is Economy, which appears in 11 of the 13 programs we reviewed and received a maximum weight of 0.45 in Minnesota DOT’s Transportation Economic Development Program (TED). Following that was Safety, which appears in 10 programs, Mobility, which appears in nine programs,

Environment and Preservation, which each appear in eight programs. It is worth noting that Accessibility is a common policy goal among many agencies but appears less often in project evaluation partly because formal accessibility analysis is still an emerging practice. Among the agencies in this study, only the Virginia DOT and MTC measure the accessibility impacts of projects using widely recognized best practices (e.g., access to jobs and services or logsum measures). Nonetheless, comprehensive accessibility measures that account for vehicle speeds during congested periods can potentially replace more conventional mobility measures, while also filling needs in other scoring categories like Multimodal, Land Use, Equity and Environment[1].

[1] Research has shown that multimodal accessibility measures are associated with outcomes like vehicle miles traveled (VMT) and emissions, meaning they can be useful in comparing the environmental impacts of different transportation investments and land use patterns.

Table 2. Review of performance categories among agencies' prioritization programs.

Performance category	Related themes	Freq.	Maximum weight	Maximum weight: agency
Economy	Economic development or vitality; revenue; job creation	11	0.45	MnDOT
Safety	Crashes; deaths or serious injuries	10	0.35	DelDOT
Mobility	Congestion; capacity; throughput; traffic volume; speed or delay; travel time reliability; functional classification	9	0.45	VDOT
Environment	Environmental impact or stewardship; emissions	8	0.20	DMAMPO, DVRPC
Preservation	Maintenance; state of good repair; infrastructure quality	8	0.40	VTrans
Accessibility	Access to destinations, opportunities or activity centers; connectivity	6	0.25	VDOT
Cost[1]	Benefit-cost ratio; return on investment; cost per unit	6	0.60	VTrans
Readiness	Project readiness or momentum; feasibility or workflow; available funding	6	0.50	DVRPC
Multimodal	Multimodal access, connections or infrastructure	5	0.20	DMAMPO
Other	N/A	5	N/A	N/A
Equity	Social impact; disadvantaged populations	4	0.12	DVRPC
Priority	Local, regional or state priority; local support	4	0.50	NCDOT
Land Use	Density; central location	2	0.20	VTrans[2], VDOT
Standards	Lane width; shoulder width	2	0.30	NCDOT
Freight	Truck volume; freight corridors	1	0.25	NCDOT

1. Virginia's SMART SCALE, Hawaii's SmartTRAC, and MTC's long range plan consider cost in more holistic comparison of costs and benefits, as opposed to an individual cost-related scoring category.

2. Our method combines two of the VTrans' bicycle and pedestrian project considerations under Land Use: 1) Land Use Density and 2) Designated Downtown or Village Center.

Based on these findings, there are several important steps that transportation agencies can take for improved project prioritization. First, they can adopt more robust forms of multicriteria analysis to ensure that complex scoring methods are in line with stakeholder interests and priorities. Alternatively, however, they could simplify their scoring frameworks to limit the number of scoring categories and evaluation criteria, while shifting their focus toward fewer, more comprehensive, outcome-oriented criteria. A simplified framework is easier to implement by agency staff and project sponsors and makes it easier to understand the connections between project attributes and final rankings.

Table 3 describes what this study suggests are the most promising scoring categories and best practices for evaluating each category. It is worth noting that some common categories do not appear in this table:

- Mobility is the third most common category in Table 2, yet mobility is a longstanding proxy for accessibility and the benefits of mobility improvements (i.e., congestion relief) can be captured through modern accessibility analysis. This marks a significant shift in thinking about highway projects, but one that already seems to be happening, particularly among long range plans. For instance, MTC's long range plan relies on accessibility analysis to estimate the travel time savings from transportation investments. Mobility remains a scoring category in the Boston Region MPO's long range plan, but its mobility-related criteria are multimodal and vehicle and truck mobility only account for a combined seven percent of project scores.
- Project readiness and priority can be addressed in the screening process prior to project prioritization, as discussed under Additional Opportunities. Local priority can also be addressed by letting local agencies drive the project application process, as in Virginia where the state DOT cannot submit its own projects but submitted projects must address a need identified by the DOT. Projects in Virginia must also meet minimum readiness standards to be eligible for funding.
- Standards are most commonly addressed in project development, rather than during project prioritization, as discussed under Additional Opportunities.
- Land Use can be properly accounted for using accessibility measures.

Table 3. Recommended scoring categories and evaluation criteria.

Category	Objective	Recommended criteria	Best practice examples	Other common criteria	Comments
Economy	Support economic activity	Economic impact (e.g., using TREDIS)	DelDOT; NCDOT; NOACA[1]	Job creation; serves activity center; gross state product	Note that transportation investments often simply relocate economic activities.
Safety	Limit fatalities and serious injuries	Reduction in fatal or serious crashes (i.e., using crash modification factors or modeling tools)	VDOT; DVRPC	Crash index; serious crash index; crash rate; road design standards	The U.S. Road Assessment Program (usRAP) offers a tool for predicting safety outcomes.
Environment	Limit the environmental impact of transportation	Change in environmental impacts (+/-)	BRMPO; VDOT; Caltrans[2]	Reduces vehicle hours of delay; improves streetscape; in green community	Emissions associated with change in VMT should be included.
Preservation	Maintain and strengthen existing infrastructure	Improves substandard infrastructure	BRMPO; DVRPC; MassDOT (PSAC)	Current infrastructure rating	Methods are well-established in asset management programs, but not always considered in prioritizing other investments.
Accessibility	Provide access to opportunities and basic needs	Change in multimodal access to jobs and services (+/-)	VDOT; MTC	Improves connectivity; improves travel times	Accessibility analysis can potentially help evaluate economic, environmental and equity outcomes.
Cost	Maximize return on investment	Total benefit per dollar spent	VDOT; MTC	Benefit-cost ratio; cost per length or unit	Benefit-cost analysis should be comprehensive, rather than a single criterion.
Equity	Benefit disadvantaged populations	Impacts to disadvantaged populations (+/-)	VDOT; MTC (both under accessibility)	Near disadvantaged population; in disadvantaged area	Equity can be incorporated into other scoring categories, rather than a single criterion.

1. The Northeast Ohio Areawide Coordinating Agency (NOACA) recently introduced a policy to evaluate the long-term, regional impacts of highway interchange projects, including negative impacts to nearby communities (*39*).

2. Under state law, Caltrans has recently begun evaluating environmental impacts of transportation projects in terms of VMT (*40*).

There are several important takeaways from Table 3. First, all of the recommended criteria focus on project outcomes, as opposed to existing conditions or immediate outputs. It is not enough to invest in a high-crash or high-volume location unless a project improves safety or access. It is not enough to build projects in disadvantaged areas if those projects do not provide direct benefits to nearby communities (or worse, expose them to higher traffic volumes and pollution). These outcomes can be difficult to measure, but experience has shown that building the necessary skills and resources can manifest other benefits and efficiencies, including greater trust and transparency.

Second, the recommend criteria can help guide decisions both up- and downstream of the project prioritization process. For instance, improved multimodal accessibility is both a high-level planning goal among many agencies and a lens for thinking about specific design decisions later in the project development process, and even in some maintenance and operations contexts. In contrast, high level concepts like mode shift and livability are more difficult to translate into project-level decisions, where the intent can easily get lost among competing interests and engineering judgement.

Finally, each category does not necessarily stand alone. Equity, for instance, is best evaluated in terms of other related outcomes such as equity in accessibility, equity in safety, and equity in economic opportunities. Similarly, cost may be evaluated best in relation to the sum of benefits offered in all other categories, as discussed in the following section, rather than as a standalone consideration. Other important considerations like multimodalism and project readiness are reflected in the way other outcomes are measured and in the general structure of the prioritizing and selection process itself.

Lesson 3: Maximize Benefits Per Dollar Spent

Many prioritization programs incorporate a benefit-cost analysis, but the results are often just a single factor among many others (as shown in Table 2) and the analysis itself is often limited to benefits that can be easily translated into monetary values, such as travel time savings, injury and crash reduction, and job creation. Some agencies, however, are moving toward a more comprehensive view of return on investment, thereby investing almost entirely in projects that can accomplish the most with limited resources.

Minnesota's CIMS program in 2013 is one example. The short-lived program incorporated a comprehensive benefit-cost analysis that considered a range social, economic, and environmental factors and accounted for 60 percent of a project's score. Similarly, the Metropolitan Transportation Commission in the San Francisco Bay Area evaluates projects and programs for its long-range plan based on a matrix with comprehensive benefit-cost analysis on one axis and outcome-oriented targets on another. This makes clear which investments offer the greatest return on investment, which move the region farthest toward meeting its long-term goals, and which accomplish both.

Virginia's SMART SCALE program incorporates a simpler approach and served as a model for Hawaii's SmartTRAC pilot. Each project is first awarded points based on weighted goals and evaluation criteria, then its total benefit score is divided by its cost. Projects that earn the most points per dollar requested are awarded funding. This helps to ensure the maximum benefit per

dollar—although not necessarily in monetary terms—but also encourages project applicants to spend less in achieving those outcomes, as in the case study above.

Additional Opportunities

As noted in Figure 14, there are many decision points besides project prioritization that determine the outcomes of transportation investments. Some of these decisions are handled in the planning and screening of projects (before prioritization) and other decisions are handled in the development and delivery of projects (after prioritization). Considerations like priority and project readiness, for instance, can be addressed in the initial planning and screening phases. Virginia's SMART SCALE, for instance, requires planning studies, sketches and detailed project scopes before any proposal is eligible for funding.

Meanwhile, considerations related to minimum design standards, such as geometric features, materials and technologies, can often be addressed during project development and delivery. In fact, elements that were deemed important during project selection can often be lost later in the process if the right standards and procedures are not in place. For instance, the Massachusetts DOT recently implemented several new controlling criteria for project design—including paving and marking projects—focused on pedestrian, bicycle and transit provisions (known as Complete Streets Criteria). The Secretary must approve any project that does not meet these minimum criteria. Similar standards can apply in considering intelligent transportation systems (ITS) or broadband infrastructure, transportation demand management (TDM) and environmental mitigation. This means those features must be accounted for in cost estimates prepared during project prioritization, but it has the added benefit of advancing goals that are not tied to dedicated funding sources.

Another common concern in project prioritization—especially at the statewide level—is striking a fair balance between different districts or between urban or rural areas. This can be achieved partly through funding formulas that allow applicants to compete within their region for at least some portion of the available funds, as in Virginia, or by comparing projects only to those in similar place types, as in the Sacramento area. Other approaches include using different criteria weights for different place types (VDOT) or letting applicants choose from a list of scoring categories relevant to their project (SACOG). Simply scoring projects on a range of criteria, however, typically creates a more level playing field for projects of different types to compete—especially when smaller, less expensive projects have equal footing.

Finally, an added benefit of implementing more concrete, data-driven prioritization procedures among transportation agencies has been increased transparency and public understanding of funding decisions. About half of the agencies in this study post information about scoring procedures and updates online for the public. Several also provide data and tools for project applicants to use in developing their projects, such as the SACOG's Project Performance

Assessment (PPA) tool.[2] Similarly, the Virginia DOT made its accessibility analysis platform available to local governments during the third round of SMART SCALE.

[2] SACOG's PPA tool is available at https://www.sacog.org/project-performance-assessment

Chapter V: Conclusions

This study looks at existing literature and best practices in transportation project prioritization to gain insight into the needs and opportunities among state DOTs and MPOs. Background research includes interviews with agency staff, an online questionnaire and detailed program reviews spanning 21 agencies.

A close look at three rounds of project prioritization in Virginia's SMART SCALE program suggests that the best performing projects have become smaller (less costly) and more multimodal; meanwhile, cost-sharing has increased. Lessons from the implementation of SMART SCALE help inform the recommendations in this study.

Taken together, the evidence points to three overarching opportunities: 1) establishing flexible funding programs through which different project types can compete on equal footing, 2) choosing comprehensive, outcome-oriented evaluation criteria, and 3) maximizing the benefits per dollar spent. Details and best practice examples are described for each of these recommendations, including recommended evaluation criteria with broad applications throughout decision-making processes.

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Appendix A: Interview and Questionnaire Outline

General Interview Questions

- What is your role at the agency?
- What comes to mind in terms of *project prioritization* (programs, funding sources, etc.)?
- What example of project prioritization at your agency should we know about?
    - What programs/funding streams does it cover?
    - Are there resources available online?
- How would your agency like to improve project prioritization?
- What are the major obstacles?

Online Questionnaire

General information

- What is your agency's name?
- What is your agency's approximate annual budget?
- What office or bureau do you represent?
- Please list major funding programs that incorporate a robust prioritization process. You will be asked to give details for each program listed (approximately 5-10 minutes for each).

Program details

Please answer the following questions about [each program].

- What is the approximate annual budget or percent of total budget for this program?
- Check all that apply to this program.
    - Road / highway
    - Transit
    - Bicycle and pedestrian
    - Air or maritime
    - Bridges
    - Freight
    - Maintenance / state of good repair
    - Modernization / reliability
    - Safety
    - Local projects
    - Other
- How is the program funded (check all that apply)?
    - National Highway Performance Program (NHPP)
    - Surface Transportation Block Grant Program (STBG)
    - Highway Safety Improvement Program (HSIP)
      Congestion Mitigation and Air Quality Improvement (CMAQ)

  - Federal Transit Administration (FTA)
  - Other federal funding
  - State revenues
  - Local revenues
  - Cost-sharing
  - Other
- What projects are eligible?
- How are potential projects initially identified? Check all that apply.
  - Asset management program
  - Needs assessment
  - Grant / application process
  - By state or local legislators
  - From existing plans
  - Other
- What is the general prioritization process and how long has it been in place?
- What factors does this process account for?
  - Project costs
  - Project readiness
  - Mobility / congestion / reliability
  - Accessibility / connectivity
  - Health / safety
  - Economic development
  - Environmental impact
  - Multimodal / transportation demand management
  - Infrastructure quality
  - Land use
  - Local support
  - Other
- How much pressure is there to continue funding projects after initial planning/scoping is complete?
  - A lot
  - A moderate amount
  - A little
- What happens if a project's costs increase or benefits are reduced after it is programmed for funding?
  - Budget likely to be increased
  - Budget cannot be increased
  - Project is reevaluated before proceeding
  - Other
- What happens to projects that aren't funded in the current cycle?
  - Unfunded projects get higher priority in future cycles
  - All projects are automatically reevaluated in future cycles
  - Sponsors must re-submit projects in future cycles
  - Other
- How transparent is this process to the public? Options: Very (posted online); Somewhat (to applicants, etc.); Only upon request.

    - General overview
    - Scoring methods
    - Current status
    - Final scores
- Please provide a website link or contact information for details (or files may be uploaded below).
- Please upload any relevant documents (you upload multiple documents as a compressed ZIP file).

Metric details

If you have time, please describe any innovative approaches below. Otherwise, skip ahead.

- Briefly describe how [each] prioritization process accounts for **project costs**.
- Briefly describe how [each] prioritization process accounts for **project readiness**.
- Briefly describe how [each] prioritization process accounts for **accessibility/ connectivity**.

Final questions

- Are there any other noteworthy methods for aligning project outcomes with broad agency goals (coordination across programs, design standards, scoping documents, etc.)?
- Please list any other agencies or individuals we should reach out to.
- Please provide your name, title and contact information.

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