

Lessons Learned from COVID-19 Related Street Reconfigurations: How DOT policies can facilitate resilient responses to system disruptions

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<p>16. Abstract</p> <p>During the COVID-19 pandemic, cities around the world responded to changing demands on public space by adapting their streets to support outdoor commerce, social activities, and active mobility. Such changes were instrumental tools for sustaining local economies, yet they were relatively uncommon and slow to emerge in North Carolina relative to peer states.</p> <p>Previous research has identified four preconditions necessary for timely, effective local responses to disruptive events such as the pandemic: (1) relevant plans and knowledge to guide decision-making, (2) access to necessary resources to act on those decisions, (3) a culture of trust among agencies, and (4) support from higher levels of government, particularly state DOTs. Through surveys and interviews with senior staff in 27 NC towns, this study determined that these preconditions were absent from many NC towns during the pandemic.</p> <p>Building on knowledge developed in this study and in prior research, we advance a set of recommendations that, if adopted and supported by NCDOT, will ensure NC towns are better able to implement timely, effective responses to future disruptive events. These recommendations are detailed in this final report and in a standalone research brief.</p>					
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Acknowledgment

Hurricane Helene struck the North Carolina mountains as we were finalizing this report. Helene's impacts have devastated communities across the region, including several that participated in this research. These communities' staff provided invaluable information and insights into their needs and their visions for how to leverage transportation networks to create a more resilient future. We dedicate this report to them.

We also hope—and believe—that the knowledge these planners, engineers, and city managers helped build will prove useful to NCDOT's efforts to support their recovery and rebuilding.

Executive summary

Adaptive Streets are temporary, low-cost changes to street space, typically intended to meet changing demands on the use of street space during disruptions. During the COVID-19 pandemic, adapting streets by reallocating space and operations to favor non-driving uses emerged as a particularly effective mechanism to support local economies, address safety issues, and create space for more active uses. These adaptations, referred to in the literature as “COVID streets,” had documented positive impacts on active mobility, safety, and local businesses and economic development.

Many of the cities that reacted fastest and most effectively to the pandemic were in states that also reacted quickly to support local responses. Studies have pointed to these state programs as playing critical roles in those faster and more effective responses. In North Carolina, COVID streets were rolled out less frequently, slower, and less robustly than much of the rest of the country. Unlike many peer states, NCDOT did not have a formal COVID streets support program in place during the pandemic, presenting an opportunity to learn from peer states and start developing plans and programs now—tailored to the North Carolina context—so that our communities are ready to respond quickly and effectively during the next disruptive event.

This research achieves three objectives: (1) identifies state level factors in peer states that supported local efforts to implement timely, robust, and effective responses to changes in demand for street space, (2) assesses the applicability of those factors to the North Carolina context, and (3) develops recommendations for NCDOT to ensure North Carolina towns are better prepared for future disruptive events.

Peer state findings

Communities in two peer states—Colorado and Massachusetts—had swift, robust responses to the pandemic. These responses were supported by state DOTs in several important ways. Colorado DOT’s Revitalizing Main Streets program offered grants of up to \$2 million for safety improvements and \$150,000 for smaller changes. The program provided material support with minimal restrictions, giving communities significant autonomy in implementation. In Massachusetts, MassDOT’s \$50 million Shared Streets and Spaces program provided rapid-deployment grants and technical assistance, including grant writing support and consultant matching. The program enabled communities to accelerate existing plans and develop new pandemic-specific interventions.

North Carolina findings

The North Carolina portion of the study includes survey and interview data from senior-level transportation professionals in 27 NC towns, 12 of which implemented some sort of adaptive streets program during the pandemic. Study participants viewed the ability to adapt streets to meet changing demands an important part of their response to disruptive events, even in towns that did not implement adaptive streets during the pandemic. During the pandemic, the most common motive for adapting streets was to stabilize and support local economies. Some towns also looked for ways to expand opportunities for safe active mobility, but this was usually secondary to concerns over local businesses.

Key determinants of whether towns implemented adaptive streets—and the ultimate success of those that did—included local ownership and control over the streets, the availability of necessary equipment, and whether or not they had plans in place to guide their decision-making. Adaptive streets programs have led to permanent changes in NC towns' transportation planning practices, including changing policies and shifts in attitudes and perspectives about how to best use public street space.

The research revealed significant frustration with NCDOT. Interviewees almost universally reporting that they felt NCDOT was stifling local efforts to build resilience and remain economically competitive, through the pandemic and in general. Major barriers to local responses included lack of flexibility in regulations for state-owned roads, absence of clear guidance on allowable changes during emergencies, and limited budget lines for adaptive streets programs. Towns also struggled with insufficient knowledge transfer about safe street space reallocation and unclear permitting processes. A notable disconnect between central and division offices led to inconsistent responses.

Recommendations

The study identified key components necessary to maximize the chance of success in planning and implementing adaptive streets programs, including prior planning, clear chains of commands, jurisdictional authority over relevant streets, access to critical resources, public and agency support, and open lines of communication with NCDOT. North Carolina towns face several organizational and structural barriers that interfere with having these components in place. Our recommendations are meant to help overcome these challenges, framed around three main topic areas.

Mobilization

NCDOT should adopt a formal street hierarchy allowing various tiers of adaptations for different classifications of streets. This should be accompanied by a comprehensive guidebook outlining possible interventions for different street types, including automatically approved interventions and changes requiring additional review. The guidebook should provide clear communication channels for District and Division offices. To support implementation, interactive GIS maps should be developed to help review street classifications and allowable interventions.

Resources

To address resource constraints, NCDOT should leverage existing funds to offer grants for materials and create a 'lending library' of materials for towns to use during localized disruptions. Clear funding mechanisms for emergency street adaptations should be established to ensure communities can respond swiftly to future disruptions.

Communication and Training

Improved coordination through metropolitan and rural planning organizations is essential for future success. NCDOT should implement a webinar series highlighting successful North Carolina case studies and develop comprehensive training programs for local and state staff on using the adaptive streets guidebook. Regular fact sheets and e-blasts should be used to communicate benefits to public and business communities. Establishing consistent

communication protocols between central and division offices will be crucial for effective implementation.

Conclusion

While North Carolina faces unique challenges in implementing adaptive streets programs, there are clear opportunities for improvement. The experiences of peer states demonstrate that strong state support can enable swift, effective local responses to disruptions. By addressing the identified barriers through improved mobilization, resources, and communication, NCDOT can better support local communities in building resilience to future disruptions while maintaining necessary oversight of state-owned infrastructure.

Table of Contents

1. Introduction.....	10
2. Background and literature.....	12
2.1. Evolution of pandemic-induced adaptive streets.....	12
2.2. Benefits of adaptive streets.....	13
2.3. Support for adaptive streets among North Carolina municipalities.....	16
3. Lessons learned from successful adaptive streets programs.....	18
3.1. Colorado	18
3.2. Massachusetts	21
4. Methods	25
4.1. Methods overview and timeline.....	25
4.2. Instruments and data collection	25
4.3. Participant identification and recruitment	26
4.4. Analysis	26
5. Findings	27
5.1. Summary	27
5.2. Action municipalities	29
5.3. Non-action municipalities	39
5.4. Critiques of NCDOT	42
6. Discussion and recommendations	44
6.1. Summary of findings from North Carolina	44
6.2. Comparison of NC findings with other states	44
6.3. Recommendations to support timely, effective responses to future disruptive events ...	46
7. Conclusions.....	50
7.1. Summary findings.....	50
7.2. Summary recommendations	51
9. Cited References	52
10. Appendices.....	56
10.1. Screening survey	56
10.2. Interview guide for action municipalities	62
10.3. Interview guide for non-action municipalities.....	64

List of Tables

Table 1. Municipalities involved in the study	28
Table 2. Breakdown of surveyed municipalities by action/non-action status	28
Table 3. Basic characteristics of key actions.....	30
Table 4. Main constraints to adaptive streets planning and implementation	31

1. Introduction

The COVID-19 pandemic disrupted travel patterns in cities around the world. Local transportation agencies in hundreds of municipalities responded by reconfiguring streets and roadways in order to ensure residents had safe places to walk, cycle, and socialize and that businesses were able to remain open. The newfound tolerance for rapid, demand-responsive deployment of flexible, low-cost, temporary facilities, in concert with growing recognition of the positive role of non-car modes in fostering social and economic resilience during disruptive events suggests a readiness for new practices among transportation professionals (Combs & Pardo, 2021).

These “COVID-19 streets,” as they are often called, were rolled out in some North Carolina municipalities, but they tended to appear later and were smaller in scale than in peer states. As we emerge from the pandemic, North Carolina municipalities are looking to experiences from the past four years, both locally and from other municipalities across the world, for guidance on how to respond to future disruptive events. Having policies, supports, and knowledge in place to quickly adapt transportation networks to accommodate changes in travel demand—as might be expected during natural disasters, economic slow-downs, fuel shortages, or future disease outbreaks—is critical to ensuring a resilient, equitable, and competitive future for North Carolina municipalities (Borowska-Stefańska et al., 2022). This research identifies state-level factors that support municipalities’ efforts to respond quickly and effectively to changes in mobility demand, and assesses the transferability of successful state Department of Transportation (DOT) supports from other states to the context of North Carolina.

Through structured interviews with local officials in a sample of North Carolina communities both with and without pandemic-related adaptive streets programs, supplemented by interviews with state and local officials involved in successful adaptive streets responses in two other US states (Massachusetts and Colorado), we addressed the following questions:

- What roles have state DOTs played in enabling local agencies to respond to sudden changes in travel demands and/or needs for alternative uses of public street space?
- What programs, policies, and resources can NCDOT put in place to better prepare North Carolina municipalities to respond to future transportation disruptions safely, effectively, equitably, and quickly?

We achieved our research objectives by first summarizing the impacts of state-level responses on local changes in Massachusetts and Colorado, which we have identified as leaders in state-supported local adaptive streets responses in prior work (Combs, Morin, et al., 2024), and then by conducting and analyzing structured interviews with upper-level transportation planning and engineering staff in a sample of North Carolina municipalities. Based on our findings, we have developed recommendations for programs, policies, and resources through the lens of the unique roadway ownership structure in North Carolina.

This report is organized as follows: Chapter 2 provides background on the rise of pandemic-induced adaptive streets, and motivates the study by providing evidence on beneficial impacts of flexible adaptive street space programs as described in the literature. We also briefly summarize

the interest in adaptive streets programs in North Carolina as reported by local planning, public works, and engineering staff interviews in support of the current research.

In Chapter 3, we summarize findings from a recently completed study on adaptive streets programs in two other states—Massachusetts and Colorado. These two states have been recognized for introducing state-level support for local adaptive streets efforts early in the pandemic. Information from local and state officials in these states provides examples and lessons for North Carolina.

We detail our research methods in Chapter 4. Chapter 5 provides a summary of the municipalities included in our study along with detailed results from analysis of surveys, interviews, and questionnaires completed by director-level planning, public works, and engineering staff in 26 North Carolina municipalities. We discuss the implications of our findings and provide recommendations to support improved responses to future disruptive events in Chapter 1. Chapter 1 concludes the report, followed by an implementation plan, references, and appendices.

2. Background and literature

2.1. Evolution of pandemic-induced adaptive streets

Since the outset of the COVID-19 pandemic, demand for safe spaces for walking, cycling, and outdoor commerce has skyrocketed. This increase was spurred by a variety of factors, including transit service reductions, closings of schools and recreational facilities, and dramatic reductions in driving (Abdullah et al., 2020; De Vos, 2020; Mitra et al., 2020; Slater et al., 2020; Tirachini & Cats, 2020).

As the concept and urgency of pandemic-adapted streets spread around the world, transportation professionals were pushed to experiment: rather than strict adherence to conventional roadway planning and design processes, they were asked to find creative, inexpensive, and speedy ways to carve new, if temporary, facilities from existing infrastructure. As a result, pedestrian and bicycle projects that would ordinarily have taken years if not decades to plan, fund, and build were now moving from idea to installation in a matter of weeks or even days.

Research is emerging around the world about the positive impacts of municipalities' efforts to adapt street space to meet the pandemic's demands for safe spaces for walking, cycling, and outdoor commerce. While variations exist, the available evidence shows that the interventions were heavily used and largely welcomed by individuals, businesses, and local agencies alike (e.g., Buehler & Pucher, 2022; Conrow et al., 2021; Francke, 2022; Kraus & Koch, 2021; Noland et al., 2023; Salon et al., 2021; Shirgaokar et al., 2021).

Over 250 US municipalities enacted either physical changes to road space (taking space that had been reserved for motor vehicle through-traffic and reallocating it to other modes and/or uses), operational changes to road use (using traffic calming strategies to de-prioritize motor vehicle traffic in favor of walking, bicycling, and recreation), or both in the first year of the pandemic (Combs & Pardo, 2021). The kinds of changes implemented varied over time with the progression of the pandemic, reflecting both an evolving understanding of the virus' transmission as well as changing needs for mitigating the economic and social impacts of the pandemic (Buehler & Pucher, 2021). Data on these changes also reveal spatial differences in the timing of the responses; municipalities outside the southeastern US tended to respond to COVID-related changes in mobility demand earlier, more robustly, and with more varied and innovative approaches than southeastern municipalities did. Furthermore, the most widespread and enduring changes appear to have been clustered in a handful of states, including Massachusetts, Washington, Colorado, and Connecticut. In each of these, state DOTs moved quickly to provide technical, regulatory, and/or financial support to their municipalities to facilitate adaptive street changes. In contrast, only a handful of municipalities in southeastern states such as North Carolina have documented changes, and most of those changes lagged behind those of peer municipalities in other states and occurred on a smaller scale. These data suggest that the timing, nature, scale, and ultimate impacts of these responses were influenced not just by pandemic pressures but also by regional and state-level factors (Combs et al., 2020; Combs & Pardo, 2021).

Emerging research on the characteristics of municipalities that acted quickly and robustly to address the pandemic’s myriad impacts on travel behavior, quality of life, and/or economic stability suggests that pre-pandemic plans, programs, and policies played a significant role in shaping local responses (Glaser & Krizek, 2021; Kamargianni et al., 2022). Having relevant policies, programs, or plans to support adaptive use of street space in place—even if lacking specific implementation details—appears to be a critical precondition for timely responses to system disruptions at the local level.

This report builds on an earlier project by the research team, which examined the extent to which state-level initiatives also influenced local COVID-streets responses in two states with successful adaptive street support programs, Massachusetts and Colorado. In the research detailed in the current report, we applied an explicit North Carolina lens to our research, assessing the applicability of the most innovative state-level supports found elsewhere to the North Carolina context.

2.2. Benefits of adaptive streets

There are substantial documented benefits of adaptive streets policies. Adaptive streets respond to changes in travel demand and provide timely adjustments and accommodations to facilitate safe areas to walk, cycle, be social, and support businesses. In this section, we summarize some of the key benefits of implementing policies of adaptive streets and transportation networks:

- **Transportation:** response to changing travel demands, and increasing active transportation and safety through more pedestrian and cycling infrastructure
- **Public Perception and Well-Being:** positive response to adaptive streets policies and potential for more accommodation of accessibility needs of all ages
- **Economic Outcomes:** increased spending by pedestrians and cyclists, some businesses benefit more than others but there is a lack of negative impact on revenue, and supporting local business is a priority for enacting street changes

2.2.1. Transportation

As we continue into the ‘new normal’ of the post-pandemic world adaptive streets can help municipalities respond to changing travel demands and behaviors. Work-from-home and hybrid work environments have led to a significant shift in travel demand (Salon et al., 2021). In a survey of US residents in 2020, Salon and colleagues. (2021) found that most respondents indicated they wanted work-from-home or hybrid work options going forward, and as such, it is unlikely that commuting patterns will bounce back to pre-pandemic levels. It is estimated that this shift could result in a decrease in car commute distance by approximately 15 percent. In addition to potentially altering patterns of departure time, travel mode, vehicle ownership, and non-commute trips, research shows that working from home induces more active transportation and physical movement (Wang et al., 2023).

Adaptive streets enable more pedestrian and cycling infrastructure which leads to increased use of active transportation and improved safety (Buehler & Pucher, 2023; Rérat et al., 2022; Salon et al., 2021). The pandemic lockdowns and subsequent drop in travel demand led to governments reallocating streets as safe spaces for walking, cycling, and socially distanced socializing by

quickly installing temporary infrastructure. One study analyzed bicycle counter data from over one hundred European cities and found that cycling counts increased between eleven and 48 percent on average when temporary bike infrastructure, an adaptive streets policy, was in place (Kraus & Koch, 2021). Similarly, after the Filipino government implemented over 500 kilometers of cycling infrastructure, there was a surge in cycling in Manila and nearby areas (Buehler & Pucher, 2023). These rising patterns of cycling were seen across the US, specifically with increases of 29 percent on weekends and ten percent on weekdays between 2019 and 2020 (Combs, Nordback, et al., 2024; Rérat et al., 2022). This weekly trend reflects an increase in active transportation for recreation and exercise rather than getting to work or school. North Carolina's cycling trends during the early pandemic followed these patterns, with the most growth in cycling happening on greenways (Kearns & Wright, n.d.; Rérat et al., 2022).

Implementing low-stress cycling and pedestrian infrastructure, such as off-road greenways or protected bike lanes, is important for making active transportation more accessible and inclusive for participants who are particularly concerned with safety (Buehler & Pucher, 2023). Safety and public health were top priorities for Los Angeles' Slow Streets program, which included traffic calming measures and street space reallocation (Garces, 2021). While the effectiveness of the interventions is dependent on the local context, studies indicate that Slow Streets programs and their traffic calming measures can improve safety, especially when incorporated into a larger strategy that includes community engagement and policy alignment. With significant effort being put forth to facilitate safe and socially distanced outdoor recreation throughout the pandemic, the prioritization of safety and the use of active transportation not only improved, but residents reported enjoying their walks and cycling during the pandemic and intend to continue (Kraus & Koch, 2021; Salon et al., 2021; Shirgaokar et al., 2021).

2.2.2. Public Perception and Well-Being

There has been generally positive reception to adaptive street policies throughout the pandemic. Mitra et al. (2023) studied the public use and opinions of the new bike lanes in Canadian municipalities during the pandemic and found that 42 percent of respondents were in favor of continued operation and maintenance of the facilities. Respondents who were young adults, women, had received higher education, or had used the facilities were more inclined to support the continued operation and maintenance. While there is a mix of opinions about the cycling infrastructure long term that is dependent on local contexts, generally more respondents supported its permanence than those who did not. A study that analyzed New Jersey residents' perspectives on street reallocation, primarily for outdoor dining and active transportation, found that 40 to 45 percent of respondents held a supportive view (Noland et al., 2023). Those who held a negative view, roughly 35 percent of respondents, cited the blockage of walkways from curbside dining and increased congestion. However, the notable support and favorability is primarily attributed to the increased walkability and the energetic activity in the central urban areas. Smeds and Papa (2023) studied how residents of three European municipalities (London, Munich, and Bologna) regarded 'street experiments,' which include street space reallocation in the form of plazas and parklets. Their research demonstrated that residents valued the reallocated street space for its communal and social benefits, namely the enhanced aesthetics,

accommodation of other activities (such as playing and socializing), and ability to host local engagements.

Adaptive streets can accommodate more residents' needs, such as the accessibility needs of children and older adults. Russell and Stenning (2021) assert the importance of street space reallocations attending to children and community by accommodating how children engage with spaces and places. During the pandemic in England, communication about outdoor recreation catered to adults and left parents with ambiguous recommendations for children's outdoor space. Although it is viewed as a core component of communities, children's play—which includes exercise, wandering, learning, and more—is not always considered. Decision makers should prioritize street space for children and play because “we can be fairly sure that they [playful activities] create moments where life feels better, moments of connection and mutual support” (Russell & Stenning, 2021). Prioritizing children's and teenagers' needs within streets and public spaces can foster a sense of belonging and right to the space, which is especially important because they do not have the power to make such decisions.

Urban planning and policies should consider accessibility to all ages, particularly for the most vulnerable residents, which often includes children and older adults (Guida & Carpentieri, 2021). There is increasing attention being paid to the quality of life of older people as the number and proportion of the population that is 65 years old or older grows. Guida and Carpentieri developed a proxy to measure elderly people's quality of life by evaluating their access to medical services. Applying their methodology to Milan's elderly population, they found that in pandemic and non-pandemic times, older adults' access to medical services is very lacking, particularly in suburban areas. In addition to measures of access, studies such as Menezes and colleagues (2023) describe the lived experiences of older adults in urban environments, detailing their perspectives on mobility, access, aging in place, public space, and the right to the city. Adaptive street policies can help by creating flexibility and opportunities to plan for the needs of residents of all ages.

2.2.3. *Economic Outcomes*

Studies show that pedestrians and cyclists spend more money and adaptive street policies can serve to incentivize more spending. Establishing pedestrianized streets in central business districts and commercial areas can affect buyer behavior through both their transportation mode choice and the shopping environment (Andersen et al., 2023). Research indicates that the mode shift prompted by pedestrian streets may induce increased spending. Several studies found that cyclists and pedestrians are higher monthly spenders than their driver counterparts, though only two reports found this difference to be statistically significant. One study in particular examined average spending by mode and business type, with results showing that transit riders, cyclists, and pedestrians were higher spenders across all categories aside from supermarkets. Pedestrianizing streets modifies the retail surroundings which affect the consumer experience and behavior. Pedestrian streets can create more attractive, pleasant, and less congested retail environments that can induce more frequent retail engagements.

Some businesses may benefit more from adaptive street policies, but studies indicate there is not a negative impact on revenue. Anderson and colleagues' study found that food and beverage retailers and entertainment (museums and galleries) businesses described having the most

positive impacts and most support of pedestrianized corridors (Andersen et al., 2023). These businesses appreciated the outdoor space afforded to them and viewed it as notable support to their operations. Shirgaokar and colleagues (2021) studied tweets about street changes in the early pandemic, finding that curbside pickup was promoted by many types of retail businesses – from pet services to car shops – in addition to restaurants. Some businesses reported negative effects of street changes, mostly due to the need for on-site parking for older or disabled patrons, which is an important consideration for the siting of street reallocation projects (Andersen et al., 2023). Nevertheless, many businesses appreciated the liveliness, energy, and foot traffic created by the outdoor dining spaces and how it led to restaurant goers to stop by and shop at other nearby businesses (Andersen et al., 2023).

Supporting local businesses was a priority for local governments who utilized state grant funding programs during the pandemic to implement adaptive street changes. In 2020, the Massachusetts DOT (MassDOT) began the Shared Streets and Spaces program which aimed to provide grants to projects that could be implemented quickly (Combs, Morin, et al., 2024). MassDOT has evolved the specific categories of projects to fund throughout the multiple cycles of this grant funding program, from reconceptualizing main streets to outdoor programming. Municipalities took action aiming to meet many objectives, including safety, simulating public space, traffic calming, and many others. Combs and colleagues found that the most common impetus for pursuing the MassDOT grant program was to help local businesses, particularly restaurants and eateries, by reallocating space for outdoor dining. Similarly, the Colorado Legislature launched the Revitalizing Main Streets program in March 2021 with the aim to facilitate economic development and safe transportation through grant funding. Municipalities in Colorado utilized these programs to support local businesses by allocating space for dining and business, promoting economic stability, and maintaining tourism in destination towns, among other goals. The Colorado DOT (CDOT) primarily served to provide financial and material support to local municipalities to implement adaptive streets changes that addressed a context-specific balance of public health, safety, transportation, business support, and economic stability.

2.3. Support for adaptive streets among North Carolina municipalities

The present study has found a variety of ways in which North Carolina municipalities have demonstrated their interest in adaptive streets policies and flexible transportation networks in both disruptive events and normal operations. While these will be detailed later in the report, we summarize interviewed professionals' support for adaptive streets program here:

- **Increased flexibility:** Director-level planners, engineers, and other professionals expressed a desire for more flexibility with NCDOT's policies and processes, especially during disruptive events. The agency's bureaucracy was often seen as a barrier to implementing street space changes on state-owned roads.
- **Timely communication:** Municipalities expressed a need for more timely responses and open communication with NCDOT particularly during disruptive events.
- **Specific guidance and support:** Local agencies have demonstrated interest in NCDOT guidance on implementing street changes through policy examples and what programs are

available. Municipalities are interested in specific guidance from NCDOT during disruptive events and emergencies including best practices, easing NCDOT processes, and communicating which policies will be flexible in emergencies. Municipalities want the support of NCDOT for sidewalk and transit, pilot programs, and access to critical resources during emergencies.

- **Understanding of local needs and goals:** Local governments expressed a desire for NCDOT to support street space changes, enable placemaking on state-owned roads, accommodate context-specific needs, and have accountability to local plans and objectives.
- **Support wanted even with lack of demand:** While some local governments did not pursue street space changes during COVID-19 due to lack of demand or appropriate context, most municipalities were unaware of existing NCDOT policies that could support future efforts during disruptive events. Even if there was a lack of demand, many municipalities are interested in NCDOT support, guidance, and communication during disruptive events.

3. Lessons learned from successful adaptive streets programs

This research capitalizes on our efforts in a prior study, in which we sought to understand the role state DOTs played in supporting local efforts to adapt streets in response to the COVID-19 pandemic. That study identified the states of Colorado and Massachusetts as leaders in developing guidance and funding streams to assist local communities' adaptive streets efforts. We conducted interviews with state and local officials in Colorado and Massachusetts; findings from detailed analysis of these interviews are published elsewhere (Combs, Morin, et al., 2024). Below, we summarize the pandemic-related supports provided by state DOTs in both states, and how those supports were used by a sample of municipalities that undertook some form of street space adaptation in each state. The municipal-level data include motivations for action, enablers and barriers to action, how state DOT support affected local action, local recommendations for future state support, and ways in which the municipalities' experience with adaptive streets has influenced practice including preparedness for future disruptive events.

As with North Carolina municipalities, we asked respondents in these other states to discuss what they believed was the most impactful of their municipalities' transport-related COVID-19 responses. What is reported in this section should thus not be interpreted as an exhaustive accounting of these municipalities' efforts.

3.1. Colorado

In March of 2021, the Colorado State Legislature announced \$30 million in funding for the initial phase of the Revitalizing Main Streets program (Colorado Department of Transportation, 2021). The program was created as part of the Colorado Recovery Plan with the goal of promoting economic development and safe transit options for individuals during the COVID-19 pandemic.

There were two types of grants within the Revitalizing Main Streets program:

- Larger safety infrastructure grants – Up to \$2 million for safety improvement projects along arterial streets or main street corridors.
- Small multi-modal and economic resiliency grants – Up to \$150,000 per project to support infrastructure projects to improve mobility, community activities, and economic development.

There were several initiatives that the Colorado Department of Transportation (CDOT) undertook with the implementation of Revitalizing Main Streets:

- Using active transportation to help revitalize economic conditions
- Activating and re-activating outdoor areas
- Meeting the needs of low-resource communities

CDOT provided technical assistance for applicants, as well as provided suggestions and recommendations on street choices for projects. There were also dedicated funds to revitalize main streets. The Revitalizing Main Streets program was a sister program to the Colorado Main

Street program, a pre-existing state-level program that supports main street economic development across the state.

During the pandemic, the program was primarily funded through a combination of state-allocated funds and funds from the American Rescue Plan Act of 2021 (ARPA). The program is ongoing, but because of the restrictions and limitations of federal funding, the program has switched to only using state funding to avoid federal red tape and to allow for a quicker implementation of the projects. The program has given out 273 grants totaling almost \$150 million.

We conducted interviews with representatives from five small-to-medium-sized municipalities in Colorado; findings from these interviews are summarized below.

3.1.1. Main motivations for action

Providing support for local businesses, safeguarding public health, and improving safety and mobility for road users were the main motivations for adaptive streets efforts in the Colorado municipalities we studied.

All five municipalities sought to help keep local businesses afloat by providing outdoor space for dining and commerce. Municipalities that rely heavily on tourism also looked for ways to maintain attractive and vibrant outdoor spaces. Two of the five towns explicitly mentioned the need to protect their tax base and maintain economic stability as motivations for their COVID-19 streets programs. Safeguarding public health and providing space for physical distance was a secondary concern in these municipalities, represented through their efforts to provide for outdoor dining, commerce, and tourism. None of the representatives discussed programs focused on the safety and mobility of road users. It is important to keep in mind, however, that we asked respondents to discuss what they felt was their municipality's most impactful COVID-related intervention, so it is possible other interventions took place specifically addressing public health, safety, and/or mobility.

3.1.2. Key factors enabling actions and facilitating rapid implementation

Key factors that enabled adaptive streets efforts and facilitated their rapid implementation in the Colorado municipalities included external financial support, political, institutional, and community support, and previous crisis experience.

All of the municipalities in the Colorado study mentioned using federal funds, particularly ARPA money, which provided crucial financial support for rapid implementation. Two of the five municipalities mentioned strong backing from elected officials, which allowed for quick decision-making among program staff. All five municipalities also noted strong community support for their COVID-19 streets interventions, reflected in data collected via task forces and surveys. One municipality's efforts were expedited through the help of emergency powers. Another municipality's representative spoke in detail about the role of prior crisis experience in the success of their COVID-19 responses. Specifically, they noted the importance of coordination among local and state agencies, strong communication networks, and public confidence and trust in emergency management decision-making.

3.1.3. Main constraints or barriers:

The Colorado municipalities reported a wide range of barriers, but generally found ways to overcome them, thanks in large part to flexible state funding. The constraints discussed varied across municipalities and included: limited staff capacity (especially challenging for smaller towns), lack of internal funds (again, more an issue for smaller towns), concerns about the impacts of reduced parking availability (particularly among municipalities dependent on tourism), a need to maintain aesthetic appeal (again important to tourism-based economies, with the representative noting that the temporary materials available were unattractive and inappropriate for a historic downtown setting), internal regulatory hurdles (with municipalities needing to navigate building codes and pass new ordinances), and challenges coordinating with CDOT for programs in or near state-owned rights-of-way. Interestingly, one municipality's retail business community pushed back on their outdoor dining program because it did not also include provisions for other forms of outdoor commerce. Winter weather was also noted as a constraint, but one that carries less relevance for North Carolina.

3.1.4. Role of the Colorado Department of Transportation (CDOT):

Overall, CDOT's role was largely supportive but indirect, mainly through funding and occasional material support, while allowing municipalities significant autonomy in their local street programs. Most municipalities reported minimal or no direct involvement from CDOT in their street reallocation programs, largely because the programs were implemented on local streets, not state-owned roads. CDOT's Revitalizing Main Streets program provided funding assistance, which municipalities used to pay for materials for an outdoor dining program and to improve pedestrian and bicycle connections to commercial areas. CDOT also provided material support, including traffic barriers used to block traffic from one pedestrianized commercial area. CDOT's support came with few strings; one municipality's representative noted that CDOT's lack of restrictions and interference made their emergency response much easier and quicker.

3.1.5. Additional supports from the state that could help future preparedness efforts

In general, municipalities appreciated the state's supportive but hands-off approach during the pandemic and wanted to see this continue, with additional emphasis on rapid, flexible funding and improved communication channels for policy discussions.

One community in particular stressed that money needs to flow as quickly as possible with as few restrictions as possible during emergencies and disasters; this representative appreciated the state's support for local decision-making during the pandemic and hoped this approach continues beyond the pandemic. Relatedly, another municipality wanted to see greater representation in state policy-making activities by small towns, which have limited ability to lobby on their own behalf.

Representatives also expressed interest in state-level support for local public engagement efforts during emergencies, streamlined processes for approval and resource allocation during emergencies. They called for continued CDOT support for local economic development and multimodal access after the pandemic, essentially asking for an institutionalization of the Revitalizing Main Streets program.

3.1.6. Incorporation of pandemic experiences into new practices, plans, or programs:

Colorado municipalities have incorporated their pandemic experience into new practices, plans, or programs in an impressive variety of ways.

Two municipalities have permanentized their street closures and outdoor dining programs, announcing plans to bring them back on a seasonal basis after the pandemic. One of those municipalities has also formalized new leasing protocols and ordinances to improve the process for businesses to apply to use outdoor public spaces. The representative from one municipality mentioned now having a stockpile of materials on hand to assist with future events and street closures, during both emergency and non-emergency times.

One municipality is implementing a variety of pilot programs, including micromobility for first and last mile transit connectivity, traffic calming, and intersection redesigns. micromobility pilot programs. They have also introduced new performance measures for pedestrian, bicycle, and traffic counts to monitor the impacts of their pilot programs. Another municipality is working to expand pedestrian and bicycle access to regional transit and area trailheads (having recognized the benefits of being able to attract tourism from larger municipalities), and is developing more robust post-pandemic programming for their downtown marketplace area.

3.1.7. Effects on municipalities' ability to prepare for and respond to future disruptive events

Based on their adaptive streets experiences during the pandemic, Colorado municipalities reported improved resilience in many ways, including better interagency coordination and regional collaboration, strengthened community partnerships, increased confidence in their ability to handle future crises (including tangible improvements in emergency preparedness), and more streamlined decision-making protocols for emergency situations. Several municipalities also noted better data collection strategies and expanded ability (and willingness) to test new ideas and programs through experimentation, which they feel will improve their ability to adapt quickly to rapidly changing conditions during future disruptive events.

3.2. Massachusetts

In June 2020, the Massachusetts Department of Transportation (MassDOT) launched the Shared Streets and Spaces program to offer rapid-deployment grants for enhancing various municipal infrastructure elements. These improvements targeted sidewalks, curbs, streets, and both on-street and off-street parking areas. The program's objectives were to bolster public health, ensure safer mobility (with a particular focus on school zones), and stimulate economic recovery during the summer and autumn months of 2020 (Massachusetts Department of Transportation, 2024). The program awarded grants between \$5,000 to \$300,000 for temporary or permanent solutions (Massachusetts Department of Transportation, 2020b). The program is described as a quick-launch and quick-build program, meaning that the projects should be able to be rapidly implemented. The five categories that projects could fall into were:

- Main streets – reimagine main streets so that they are people centric
- Reimagined streets – prioritize safe streets for pedestrians and cyclists
- Better buses
- Shared mobility

- Investment in the future – converting temporary and pilot shared streets programs into permanent projects

MassDOT recognized capacity constraints in providing technical assistance to applicants, and therefore, they contracted with the Barr Foundation to provide this service (Barr Foundation, 2022). The state and the Barr Foundation conducted webinars with the Metropolitan Area Planning Council of Boston, along with other regional planning agencies to increase awareness of the program and its goals and promote familiarity with the application process. The program team also conducted outreach to municipalities and media outlets for press events announcing new rounds of the application.

The first press release was distributed in early July announcing the award of over \$1 million grants to municipalities for this program (Massachusetts Department of Transportation, 2020a). By the end of July, four rounds of this application cycle had been announced and almost \$3 million was awarded. The projects included typical COVID-19 projects such as changing road and parking space into public dining and outdoor shopping and creating more public spaces that could be accessed at a safe social distance. Other projects were more forward thinking, such as the creation of a designated bus lane at a high-delay intersection.

In total, over \$50 million was awarded to over 400 different grantees in over 60 percent of the state. The funds for these grants came from both state and federal COVID-19 funds. The projects ranged from main street revitalization to speed management, pedestrian and bicycle infrastructure, bus infrastructure, and bike share programs.

MassDOT has continued this program, however, the type of projects funded has changed. For example, in the most recent application, the four categories of projects are

- Bikeshare Equipment
- Bicycle and Pedestrian Infrastructure
- Transit Supportive Infrastructure
- Outdoor Programming

We conducted interviews with representatives from four municipalities in Massachusetts, and received survey data from another four municipalities, including several in the metro Boston area. Findings from these interviews and surveys are summarized below.

3.2.1. Main motivations for action

Like in Colorado, the main motivations for adaptive streets efforts in the eight municipalities studied in Massachusetts were providing support for local businesses, safeguarding public health, and improving safety and mobility for road users.

Supporting local businesses was the most common motivation across all municipalities, and was the primary goal—particularly regarding providing increased outdoor dining capacity—in four of the eight municipalities. Facilitating social distancing was a key motivation in several municipalities as well, which they accomplished by providing space for outdoor commerce, socialization, and recreation. Many MA municipalities addressed the pandemic by building new

pedestrian and bicycle infrastructure, engaging in robust traffic calming to support shared streets, and creating dedicated bus lanes (which both improved transit reliability and decreased on-vehicle crowding).

3.2.2. Key factors enabling actions and facilitating rapid implementation:

In Massachusetts, state support, pre-existing programs, and a culture of adaptability were key enabling factors for adaptive streets.

MassDOT's Shared Streets and Spaces program was crucial for many municipalities, providing both funding and technical assistance. This assistance (financial and technical) was listed as the key enabler in three of the eight municipalities and played a supportive role in four others. Several municipalities also took advantage of federal funds, including ARPA. A few municipalities had pre-existing plans or programs that they leaned on during the pandemic. One municipality expanded a pre-pandemic sidewalk and parklet dining program; another leveraged their Complete Streets Prioritization Plan to identify candidate roads to implement pedestrian and bicycle projects on; and a third rallied a pre-existing rail trail planning committee to kick-start conversion of a new rail trail. Finally, one municipality highlighted a culture of flexibility and adaptability as a critical element of their success.

3.2.3. Main constraints or barriers:

Massachusetts municipalities reported a wide range of constraints needing to be overcome. One municipality mentioned a lack of staff capacity, challenges coordinating across community departments and metro-area agencies, and strict limitations on how state funds could be used. Two municipalities struggled to balance competing needs, either between motorized and non-motorized road users or between business customers and employees. Another municipality grappled with engineering constraints with respect to the placement of bike lanes. Like with Colorado, winter weather was noted as a fairly insurmountable constraint on outdoor commerce programs.

3.2.4. Role of MassDOT

MassDOT provided essential funding and technical support through their Shared Streets and Spaces program. This included assistance with grant writing, matching (and paying) consultants with municipalities' specific design needs, and navigation around bureaucratic hurdles. Municipalities reported that this program enabled them to move quickly on pre-existing plans and, in a few cases, helped with the design and implementation of new, pandemic-specific interventions. Some municipalities praised the program's flexibility with respect to how funds could be used, but at least one respondent expressed frustration with the limitations on how the funds could be spent (specifically, they wanted to use the funds to support public engagement, which evidently was not an option in that case).

3.2.5. Additional supports from the state that could help future preparedness efforts

Respondents nearly universally expressed appreciation for MassDOT's technical assistance and flexible funding, with a desire for these supports to continue and expand. Specific types of support requested varied based on municipalities' unique needs. A few municipalities expressed a desire to see the technical support element of Shared Streets and Spaces continued beyond the

pandemic; others hoped the availability of consultants and contractors, particularly to help with rapid installations during emergency situations (when local staff may be stretched thin), would be maintained. Respondents also shared ideas for new supports, including funding for community engagement, better interagency coordination, and guidance on converting temporary installations to permanent ones.

3.2.6. Incorporation of pandemic experiences into new practices, plans, or programs

Massachusetts municipalities have incorporated their experiences with adaptive streets into new infrastructure (permanentization) and new policies and practices. They also note a shift in philosophies and attitudes about what street space means to their municipalities.

Several municipalities have permanentized their temporary installations, or are considering doing so, including a bus/bike lane project and a parklet program. One municipality is preparing a formal traffic calming policy to establish a consistent process for evaluating and prioritizing traffic calming measures. Another municipality reinstituted a traffic commission, charged with being more proactive in studying and addressing traffic and road safety concerns, and a third implemented new performance measures for pedestrian, bike, and traffic counts to monitor the impacts of street space adaptations and closures.

With respect to shifting philosophies about street space, one municipality reported an increased interest on the part of community leaders in making streets more walkable and bikeable following the pandemic. Another municipality has seen an increased interest in pre-existing outdoor dining programs, while a third has reportedly begun rethinking their objectives surrounding major roadways, with a focus on improving climate resilience.

3.2.7. Effects on municipalities' ability to prepare for and respond to future disruptive events

Municipalities reported increased adaptability, enhanced strategies for community engagement, strengthened inter-agency relationships, improved rapid response capabilities, greater openness to experimentation, better awareness of funding availability, and improved programs for measuring and tracking impacts of street changes.

4. Methods

4.1. Methods overview and timeline

We addressed our research objectives by supplementing the findings from Massachusetts and Colorado with thematic content analysis of surveys and structured interviews with director-level local officials in a sample of North Carolina municipalities. Brief screening surveys were distributed during the spring of 2024. We followed the surveys with interviews or written questionnaires (according to respondent preference) in June and July 2024. Thematic content analysis using narrative and manifest coding was conducted in July and August 2024. A detailed accounting of our research methods is provided below.

4.2. Instruments and data collection

We developed our data collection instruments—surveys and interview questions—based on our experience in our prior two-state study. These are provided in the Appendix. Potential respondents received an introductory email with a personalized link to a Qualtrics-based screening survey. The brief survey was designed to elicit basic information about the respondents' position and length of employment, whether their municipality implemented adaptive streets as part of their pandemic response, and why (or why not).

If the municipality did implement adaptive streets programs, respondents were asked to briefly describe the program(s) and their role (if any) in planning or implementing them. If the municipality implemented multiple programs, respondents were asked to identify and describe the one program they felt was most impactful. They were then given an opportunity to opt out of future correspondence with us regarding this study; those who did not opt out were contacted to schedule a follow-up interview or were emailed a written questionnaire, according to their preference.

For municipalities that did not implement adaptive streets programs, respondents were asked a few questions about reasons for not doing so and also given an opportunity to opt out of future correspondence from us regarding this study.

Respondents who did not opt out of future correspondence were asked to state whether they were willing to follow up with us via structured interview or emailed questionnaire. Interviews and questionnaires were much more involved, designed to elicit in-depth information about either the municipality's adaptive streets planning and implementation processes or its reasons for not pursuing adaptive streets.

Interviews were conducted over Zoom by either the project PI or a graduate student assistant trained in semi-structured interview methods. For municipalities that did implement adaptive streets, interviews took between 30 and 45 minutes; interviews with municipalities that did not implement adaptive streets were generally shorter, lasting 15 to 30 minutes. All interviews were recorded and transcribed using Otter.ai, with transcriptions checked by a member of the research team for accuracy.

Participants who preferred to complete follow-up data collection in writing were sent the same questions via email as both a Microsoft Word document and a link to a Qualtrics online form, and asked to return their responses in whichever format was most convenient for them.

4.3. Participant identification and recruitment

We used 2020 Census data to identify the one hundred most populous incorporated cities and towns in North Carolina. We then consulted each of the one hundred municipalities' official websites to find names and official work email addresses for the directors of planning, public works, and transportation engineering (or roughly equivalent) departments in each municipality. Equivalent departments included, for example, 'streets,' 'traffic,' or 'economic development.' Not all municipalities separate their services in the same way, so we did not apply hard and fast rules; rather, we sought to find the three most senior officials who appeared to best represent the three professional domains of planning, public works, and transportation. If a municipality did not have at least two of these professional domains represented in some manner, it was removed from our sample.

Not all municipalities made official email addresses available for the individuals we sought; in these cases we attempted to find their official contact information via LinkedIn and Google. If we still could not locate relevant contact information, we used contact request forms as provided on the municipal websites.

After eliminating municipalities that did not have senior-level personnel employed in at least two of the relevant professional domains, we were left with a set of 179 potential participants employed across 68 municipalities.

We began reaching out to potential participants in April 2024. We made up to four attempts over a six-week period to reach each individual, briefly describing the purpose of the study and directing them to a personalized Qualtrics link to complete the screening survey. Individuals who did not respond to our requests—either by completing the survey, sending us an email to ask to be removed from the study, or providing an alternative contact—were removed from our participant pool.

We received at least one response from thirty of the 68 municipalities. Of that list of thirty municipalities, we received at least one valid survey response from 26. Participants from 18 municipalities also completed interviews or written questionnaires.

4.4. Analysis

We used narrative and manifest coding to organize the survey and interview transcript/questionnaire data, and then used thematic content analysis to identify and explore local- and state-level factors associated with decisions around adaptive streets programs. Coding and analysis were conducted in the document database program, Notion.so.

5. Findings

This chapter details the findings from our study on North Carolina municipalities, and is organized into the following sections: Chapter 5.1 provides a summary of the data collection process, including the number of municipalities invited to participate, response rates, and a breakdown of participating municipalities by division and whether or not they implemented some sort of adaptive streets program in response to the COVID-19 pandemic.

Chapter 5.2 contains an analysis of survey and follow-up interview or questionnaire data from municipalities that did implement adaptive streets, i.e., the ‘action group.’ This section includes overviews of each program (based on screening survey responses), followed by information about program planning and implementation, impacts of the program on planning practices, how the experience has influenced future preparedness, respondents’ knowledge of existing NCDOT programs or policies that could support adaptive streets, and factors that limited and enabled swift, effect program implementation (based on follow-up responses).

Chapter 5.3 summarizes screening survey results from ‘non-action’ municipalities, or those that did not implement any form of adaptive streets in response to the pandemic, and provides analysis from the follow-up data including reasons for not implementing adaptive streets, other COVID-19 response measures, and interests in potential NCDOT supports in the future.

Finally, in Chapter 5.4 we discuss a theme that emerged strongly from both the action and non-action groups: critiques of NCDOT, particularly focused on ways in which respondents felt NCDOT policies and practices prevented or undermined their COVID-19 response efforts.

5.1. Summary

Of the 68 municipalities contacted, we received responses from at least one professional in 30. Representatives from 26 of those 30 municipalities completed the screening survey, and 18 of those participated in follow-up interviews or questionnaires.

In most cases, only one of the two or more potential participants in each municipality completed our screening survey.¹ Three municipalities were represented collaboratively by two staff members, while another was represented by two individuals who responded to us separately to discuss two different programs their municipality had implemented. In four municipalities, staff responded by email to inform us they would not be able to participate in the survey.

¹ The recruitment email explained that we were reaching out to professionals from multiple domains in each municipality in the hopes of receiving multiple perspectives on adaptive streets. However, given the workloads on municipal staff, we suspect many staff members conferred among themselves and chose one of their staff members to respond.

Table 1 lists the number of municipalities that received invitations, responded, completed the initial survey, and completed the follow-up interview or questionnaire in each of NCDOT's 14 highway divisions.

Table 1. Municipalities involved in the study

NCDOT division	Invited	Responded*	Surveyed	Followed up	Response rate
1	1	0	--	--	0.00
2	6	1	1	1	0.17
3	3	1	1	1	0.33
4	5	3	3	2	0.60
5	9	6	5	4	0.67
6	3	1	1	1	0.33
7	6	5	3	2	0.83
8	5	4	4	2	0.80
9	3	0	--	--	0.00
10	9	5	5	3	0.56
11	5	2	2	1	0.40
12	6	1	0	--	0.17
13	5	0	--	--	0.00
14	2	1	1	1	0.50
TOTAL	68	30	26	18	0.44

** includes municipalities that responded but did not complete the survey*

The 26 municipalities from which we received a valid screening survey response ranged in population from under 5,000 to over 250,000, based on 2022 American Community Survey (ACS) data. Thirteen municipalities—half of the sample—had moderate population densities of between 1,000 and 2,000 persons per square mile. Three municipalities had fewer than 1,000 persons per square mile, and the remaining ten had more than 2,000 persons per square mile.

Eleven of the 26 municipalities reported having implemented some sort of physical street change in response to COVID-19. One municipality was represented by two respondents, each identifying a different adaptive streets program to focus on in their survey and follow-up, bringing our total number of adaptive streets programs studied to 12. The remaining 15 screening survey responses were from municipalities that did not implement any sort of adaptive streets during the pandemic. The breakdown of action vs. non-action municipalities by NCDOT highway division is shown in Table 2.

Table 2. Breakdown of surveyed municipalities by action/non-action status

NCDOT division	Action	Non-action
2	0	1
3	0	1
4	2	1
5	2	3
6	0	1
7	2	1
8	2	2
10	1	4
11	1	1
14	1	0
TOTAL	11	15

Finally, we received follow-up information (via interview or questionnaire according to respondents' preferences) from eight of the eleven municipalities that implemented adaptive streets programs (representing nine separate programs) and from ten of the 15 'non-action' municipalities.

5.2. Action municipalities

This section provides an overview of programs identified as most impactful by each municipality's representative(s), including the type of program, whether it was implemented on local or state streets, funding sources, current status, basic program logistics, and program goals. This is followed by an analysis of follow-up data on program planning and implementation, potential impacts of the program on future planning practices, ways in which adaptive streets experiences have helped municipalities prepare for future disruptions, respondents' awareness of existing NCDOT programs or policies that could be leveraged to support local street space adaptations, and enabling factors and keys to adaptive street program successes.

5.2.1. Screening survey results

We gathered basic information about each of the 13 local adaptive streets programs during screening surveys. This information is summarized in Table 3 and detailed here. Of this group of 13, nine reallocated street space from cars to other uses, eight reallocated other transport-related space (e.g., sidewalks, alleys), and two implemented some form of shared streets. Street space reallocations were identified as the most impactful effort (referred to interchangeably in this report as 'key') by six respondents; an equal number identified other space reallocations as most impactful. Only one respondent (of two) identified their municipality's shared streets program as the most impactful element of their pandemic-related adaptive streets programs.

The key adaptive streets programs studied included conversion of on-street parking spots to outdoor commerce (dining, retail sales), conversion of on-street parking spots to pedestrian and/or cycling facilities, conversion of travel lanes to pedestrian and/or cycling facilities, and conversion of off-street spaces (sidewalks, alleys) to outdoor commerce.

All but two of the thirteen key adaptive streets programs took place on locally-owned streets. Three programs used local and state-owned streets, and two took place only on state-owned streets. The primary goal of the adaptive streets programs studied was to provide safe, physically-distanced space for outdoor commerce (nine programs). One program focused explicitly on providing space for walking, cycling, and outdoor recreation, while two programs added space for walking, cycling, and outdoor recreation as a secondary goal. Most programs focused on downtown areas and business districts; two of the programs that included supports for walking and cycling were implemented in residential areas.

Most (eight) were funded through internal programs; two of those also used some form of federal funding. One program relied solely on funding from an NGO, and four were implemented without any dedicated funding source.

Just over half of the programs have been dismantled or discontinued entirely. One of them—an outdoor dining permitting program—exists on paper only. Five remain physically in place. Of those, two have been made permanent; the other three remain in a semi-permanent state.

Table 3. Basic characteristics of key actions

	Total	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13
Key Action Type														
Street space reallocation	6		•	•	•	•				•	•			
Other space reallocation	6	•					•	•	•				•	•
Shared street	1											•		
All actions														
Street space reallocation	9	•	•	•	•	•	•			•	•	•		
Other space reallocation	8	•	•			•	•	•	•				•	•
Shared street	2					•						•		
Street Type														
Local	11	•		•	•	•	•	•	•	•	•	•		•
State	5	•	•				•					•	•	
Funding Source														
Internal	8	•	•	•	•	•			•			•		•
External (federal, NGO)	3			•						•		•		
None	4						•	•			•		•	
Current State														
Dismantled	7			•	•		•	•	•			•		•
Exists as program	2					•				•				
Exists in physical form	5	•	•							•	•		•	
Program goals														
Space for commerce	9	•	•	•		•		•	•	•	•		•	
Space for mobility	3		•			•						•		

5.2.2. Planning and implementation

This section and those that follow within the ‘action’ group are based on information gathered through follow-up interviews and questionnaires from eight municipalities, regarding nine key adaptive streets programs.

5.2.2.1. Agencies involved in adaptive streets planning

Adaptive streets initiatives were planned by a range of local agencies, including planning departments (five), public works and/or transportation departments (five), city/town managers’ offices (two), and downtown-focused organizations (two). Multi-departmental efforts were common, present in five municipalities. Two municipalities worked with NCDOT on their programs, one rather intensively. A third municipality consulted with NCDOT. The remaining municipalities purposefully avoided interacting with NCDOT on their adaptive streets plans.

5.2.2.2. Adaptive streets planning and implementation constraints

Municipalities reported a very wide range of constraints that they either had to overcome or adapt their plans to, listed in

in descending order of prevalence. These constraints affected the design, robustness, scale, and speed of implementation in a variety of ways. We summarize the most common of these constraints and whether and how municipalities worked around them below.

Table 4. Main constraints to adaptive streets planning and implementation

Constraint	Municipalities affected
Need for materials and equipment	5
Need to work around challenging roadway designs	3
Need to adopt local ordinances to allow the program	3
Public resistance (including fear of loss of parking)	3
Need for approval from NCDOT	2
Perceived need to adhere to Manual on Uniform Traffic Control Devices (MUTCD)	2
Need to safety for those using the reallocated space	2
Lack of funds	2
Need to ensure ADA compliance	1
Space constraints	1
Desire to minimize impacts on motor vehicle traffic	1
Desire to not involve law enforcement	1
Limits on the use of staff (concerns over virus transmission)	1

Materials

Specialized materials were needed in nearly all municipalities. Lack of materials, the need to acquire materials, or both were the number one limiting factor to planning, implementing, and maintaining adaptive streets programs. Materials were needed to delineate affected spaces, support program operations (e.g., tables, lighting), ensure compliance with ADA, meet NCDOT requirements, provide safety for users, and inform the public about the program. Difficulty obtaining materials delayed implementation in at least five municipalities. One municipality pointed to challenges in identifying and justifying the funds needed to meet NCDOT's equipment-related requirements (described below). The other four pointed to supply chain issues; these affected both timing (four municipalities) and scale (two municipalities). Lack of materials affected the timing in four municipalities; a respondent from one of those municipalities explained how this slowed their program's rollout:

We needed ramps to get people down onto the road surface and back up again at the end of the project area, and we had to buy these weird aftermarket ramps and drill them into the curb.... We had to scramble to find a product, you know, something ready-made that we could afford and install, and that took time.

Respondents from two municipalities reported that the need to acquire materials limited their programs' scale; one explained that the public's appetite for their municipality's adaptive streets program was larger than their supply of necessary safety equipment, a mismatch they strongly perceived to have restricted the program's scale:

The amount of equipment that we had to deploy definitely impacted how much and what areas we could provide support for... There was only so much equipment to go around... If we had had more stuff, we could have done it in other places.

The type of materials available for use affected the longevity of one program, as the barricades the municipality had on hand needed to be maintained by neighborhood champions, who eventually became tired of the effort, leading the municipality to cancel the program.

In all cases, however, respondents noted the benefit of now having these materials on hand. Some are still in place as originally deployed; others have been repurposed to support pilot initiatives elsewhere in the municipality.

Fear of lost parking

Many adaptive streets programs included reallocating on-street car parking to other uses. This necessarily meant a reduction in the availability of car parking for business customers. In most cases, this was offset by a reduction in traffic overall due to stay-home orders. In one municipality, however, business owners were strongly opposed to any reduction in on-street parking, arguing that the negative impacts of lost parking would outweigh the benefits of having expanded space in which to conduct business. This led staff to shift their plans for outdoor dining areas from the parking lane to off-street locations. While staff were pleased with the result, the shift in venue introduced new complexities that delayed implementation and likely increased costs to the municipality.

Two municipalities used data from regular downtown parking inventories to allay fears about lost parking. Both municipalities' respondents explained that fears about lost parking were insignificant, citing their parking inventory data as evidence that the conversions of a handful of spaces would have a negligible impact on customers' ability to access businesses via car.

Regulatory barriers

Three municipalities noted local regulations as a barrier to action, and each case resulted in the passage of special ordinances to allow the action. Two municipalities pointed to their small size and tolerance for experimentation as an enabling factor, allowing them to proceed without needing to concern themselves with the presence or lack thereof of supporting policies or regulations. One of these municipalities claimed that it was a general sense of 'this is an emergency, we need to do something' as the main enabling factor; the other endeavored to keep their actions simple, below the level of council approval, so that they could be deployed quickly and with minimum fuss.

We heard in a couple of municipalities that the Manual on Uniform Traffic Control Devices (MUTCD) standards were not compatible with the need to adapt street space to meet pandemic conditions. While some adaptive streets programs' designs were constrained by a perceived need to adhere to MUTCD, one municipality's planning staff was able to make a case for their proposed design by following standards developed for this purpose by a different organization.

Roadway ownership

Another prominent limitation—which also came through among the municipalities that did not implement adaptive streets programs—was NCDOT's control over local streets. In two cases in which actions were planned on NCDOT roadways, respondents felt NCDOT policies or staff delayed implementation. In one of these municipalities, NCDOT initially denied the action, then reversed course, but by then, the business community's fear of lost parking forced staff to

substantially adjust the location and design of the action. In the other municipality, NCDOT's requirements delayed implementation and limited the scale and attractiveness of the action, and substantially increased its cost.

The remaining municipalities purposefully avoided implementing their actions on NCDOT roadways, working under the assumption that NCDOT would either not allow the actions or would pose so many obstacles as to not be worth the effort. One respondent explicitly noted that there were NCDOT roadways that would have been good candidates for their action, but based on previous experience, they did not even seek permission from NCDOT to implement the action on those roadways. The respondent explained,

It was a town street so, and we would not have even considered trying to do it on an NCDOT street. That would have been a thankless battle.... We would have never done that. I don't think they'd be open to something like that.

It is worth noting—and this will be discussed more extensively below—that several municipalities in the study had previously taken over ownership of some or all of their downtown streets specifically because they felt NCDOT's control over them had limited their ability to pursue long-term goals around economic development, safety, sustainability, and resilience. This ownership change, respondents explained, was instrumental in allowing these municipalities to pursue their chosen actions during the pandemic. Another municipality had always controlled most of its downtown streets, which the respondent acknowledged likely simplified their COVID-19 response planning, including adaptive streets.

Not every municipality viewed NCDOT as a barrier, however. One outdoor dining program was implemented primarily on local streets, but staff did consult with NCDOT about a portion of the program that would be adjacent to two state-owned roadways. The respondent attributed the ease of implementation and success of the program in part to the strength of their relationship with their local NCDOT office.

Staff perceptions

While it may have been an unconscious factor in all municipalities, respondents from two municipalities made clear references to self-imposed constraints (aside from reluctance to engage with NCDOT), stating that presumed public resistance, physical constraints, or both imposed boundaries on their creativity and willingness to pursue more robust actions.

Two respondents did explicitly report that the stated constraints did not noticeably affect their implementation speed; they were simply considerations needed to be worked around.

Other limitations

One respondent cited lack of experience and knowledge on legal and effective ways to reallocate street space (including on state owned roads) for delaying implementation of an outdoor dining program. Finally, a municipality that deployed a robust adaptive streets program had to develop new processes and chains of command for implementation; this did not appear to limit the program's rollout but was nonetheless a complication that had to be addressed.

5.2.2.3. *Factors leading to the decision to continue the program beyond the pandemic*

Four municipalities shared information about the factors that led to the decision to continue their adaptive streets programs beyond the pandemic. The most prominent of these factors were alignment with pre-pandemic efforts, changes in state laws, and public enthusiasm.

One adaptive street program was aligned with a pre-pandemic plan, allowing the municipality to treat it as a pilot project. The project was positively received, which encouraged staff to convert it to permanent. Another municipality's effort was an expansion of a pre-pandemic program; this was also perceived to be positively received and thus was made permanent.

Respondents from two municipalities specifically noted that the change in state alcohol laws to be more permissive of outdoor alcohol consumption in 'social districts' was a main factor in their decision to keep their programs alive post-pandemic. Three municipalities cited overall public enthusiasm and support for their adaptive streets programs as the main reason for continuing them.

5.2.2.4. *Factors leading to the decision to discontinue the program*

Among the municipalities that discontinued their adaptive streets programs, two cited maintenance or enforcement fatigue. In one case, sidewalk dining equipment had to be put away at the end of business hours every day, which created an enforcement challenge. In the other case, neighborhood champions who were charged with maintaining the installation grew weary of doing so. Another two municipalities' representatives pointed to the end of pandemic restrictions, explaining that once businesses were allowed to operate at full capacity again, there was no longer a need to use outdoor space for commerce.

5.2.3. *Potential impacts of the adaptive streets program on planning practices*

Respondents reported several ways in which their experiences planning and implementing adaptive streets programs are changing their approach to planning and practice. These include institutionalizing their adaptive streets programs beyond the pandemic, expanding their use of pilot programs to inform planning efforts, and shifts in thought processes, philosophies, and attitudes toward flexible use of public roadway space.

5.2.3.1. *Increased flexibility and willingness to experiment*

Two respondents noted an *increased willingness to be flexible* with their own regulations and policies, for their own benefit and with respect to the needs of businesses. Relatedly, we also saw an *increased appetite for creative, experimental uses of street space*. One respondent noted that the pandemic produced a spirit of forgiveness, as business owners and the public recognized the lengths to which staff were going to keep businesses open. This forgiveness culture led to staff viewing their adaptive streets experience as a catalyst for thinking more strategically about use of public space, including finding better ways to encourage people outdoors and supporting local businesses. Another respondent noted that their municipality is now pursuing a wider range of street uses, beyond what they implemented during the pandemic, including parklets and sidewalk dining. A third described a greater tolerance for experimentation based on their success with their adaptive streets program and the knowledge they gained in implementing it. This tolerance

has manifested in the form of increased support by elected officials to implement pilot projects, go after federal funding, and more effectively advocate for their interests to NCDOT.

Relatedly, respondents from two municipalities discussed a newfound comfort with using *pilot projects to inform future planning efforts*, a change that was enabled both by their adaptive streets experiences and the fact that they now had materials on hand necessary to implement those pilots.

5.2.3.2. *New ways to gain public support*

The respondent in one municipality shared how they had developed a new *appreciation for small, uncomplicated changes*. That municipality had been struggling to implement a major street change since before the pandemic, and staff realized during the pandemic that small, simple improvements could help them work toward that goal more effectively than trying to push a major change through all at once. Another municipality's respondent said they felt more empowered to pursue a streetscape plan that had been met initially (pre-pandemic) with resistance by businesses and the public. Based on the excitement generated by their pandemic-related parklet program and on decreased sense of fear on the part of business owners about the impacts of reduced on-street parking spots, they felt a new sense of *optimism* that they could move forward with the plan.

5.2.3.3. *Institutionalized changes*

Two municipalities made *permanent* the ability to continue and expand their adaptive streets programs beyond the pandemic through ordinance changes; one of those municipalities also updated their roadway design standards to include sections on permanent and temporary street space reallocations. A third municipality is exploring ways to replicate their adaptive street changes in a more permanent way.

Finally, one municipality has created a *communications position*, recognizing the need to be better equipped to inform the public about planned changes than they had been during the pandemic.

5.2.3.4. *Changing relationship with NCDOT*

Two municipalities' respondents described changes in how they communicate with NCDOT. One noted they and their colleagues felt more willing to push NCDOT harder to approve their proposed streetscape changes after this experience, while another explained that they were better prepared to be proactive in their communication with NCDOT.

5.2.4. *Adaptive streets experience helping municipalities prepare for future disruptions*

The new practices and approaches reported above have helped with preparedness in several ways, including prompting regulatory changes, developing institutional knowledge, building new skills, and acquiring necessary materials.

One respondent explained how an ordinance update to permit flexible use of street space will help guide future emergency responses:

The ordinance change gives us a foundation, if something like this were to happen again, to be able to more quickly move without having to answer big policy questions about, ‘Is this a good idea?’ ‘Who’s in charge?’ ‘Should we be doing this?’ All of those things have now been settled. So, if something were to happen at that scale again, we’d be able to mobilize a lot more quickly than we did before. We have an idea of who does what, and how we prioritize and consider locations.

Even without formally adopting new policies or practices, respondents in some municipalities felt the experience helped them develop institutional knowledge, confidence, and agility to react to and adapt to future disruptions. As one respondent explained,

...just kind of going through something like that in general gives you a little bit of practice that you couldn’t have had without an actual event like that to work through. But we didn’t make any procedural or policy changes to implement reactions to states of emergency any differently.

Some respondents discussed how the experience helped them learn how to conduct more effective public engagement during disruptive situations, and provided an opportunity to develop the skills and confidence to use flexible materials for temporary traffic calming installations. And just having such materials on-hand, ready to deploy for disasters or day-to-day events, has contributed to a greater sense of preparedness in some municipalities.

5.2.5. Existing NCDOT programs or policies to support local street space adaptations

Overall, respondents were uncertain about whether there were any existing policies, programs, or other opportunities within NCDOT that could be leveraged to support local street space adaptations. Three municipalities’ respondents had no knowledge of any such supports at all. Another three respondents had a sense that some supports probably did exist within NCDOT, but could not identify any specifically. In one of those municipalities, the respondent mentioned a perceived inconsistency in supportiveness across NCDOT districts:

No formal policies I’m aware of, but it seems like some district offices are more supportive of these types of projects than others.

Similarly, the respondent from another municipality felt like some divisions of NCDOT had favorable attitudes toward this sort of work, but was unclear whether that favorable attitude had actually translated into tangible benefits for communities. Another respondent explained how their municipality had passed ordinances that temporarily repurposed travel lanes on state highways for special events in the past, and wondered whether that practice could be pushed to allow for extended lane closures:

Council could pass an ordinance like that and repurpose a street for a day.... In theory, I would like to know exactly what they would accept. How far can we push that? Is that really for, like, commercial things, or can we use it for a more kind of governmental purpose, for disaster recovery or mitigation or whatever? That would be interesting to kind of run by them.

The respondent in one municipality was able to point to some specifics, including the state's complete streets policy, which they felt should be amended to include a section on how NCDOT would respond to requests to do local street activations or disruption-related changes. This would include clarification on the sorts of streets on which these changes would be allowed. This respondent also felt NCDOT could leverage existing funds to enable localities to purchase equipment necessary for adapting streets in emergency situations, particularly when other sources of funds are not available:

One thing that we kind of struggled with was a lack of equipment. We attempted to use FEMA money to purchase equipment to close down streets, and that all got rejected. So, if NCDOT had an established policy that, in the event of a significant impact like a pandemic, would allow for reasonable purchases of equipment that could then be repurposed to other uses when that event ends... Having some breathing room to be able to make those purchases using either state dollars through the Powell Bill, or something else, would be really helpful, because then we would be able to redirect some funds in order to have enough equipment to meet everybody's needs.

5.2.6. *Enabling factors and keys to adaptive streets success*

Respondents described a number of factors that they believe were instrumental in their municipalities' successful adaptive streets programs, including pandemic-related emergency orders, having local control of the relevant roadways, consistency of their adaptive streets programs with existing, pre-pandemic initiatives, and supportive attitudes among the public, business owners, and municipal staff.

5.2.6.1. *Emergency orders*

Many of the adaptive streets programs we studied focused on using public space for outdoor dining. This means they also, if implicitly, focused on using public space for alcohol consumption. The emergency orders issued by Governor Cooper increased flexibility around liquor licensing, which one respondent said was a key enabler in their municipality's adaptive streets program:

...emergency orders the Governor issued gave us flexibility around things like liquor licensing and being able to serve alcohol in spaces that would not be considered part of [businesses'] permitted areas prior to that.

Another municipality's decision to continue their outdoor dining program beyond the pandemic was strongly influenced by the permanent change in state alcohol laws to be more permissive of outdoor alcohol consumption. Absent that, the program would have been terminated:

I think the biggest factor for us, especially with the downtown dining program, was continued interest in having those expanded areas, flexibility from the State law that was changed, and flexibility from ALE [Alcohol Law Enforcement] to allow for the expansion of ongoing alcohol sales and

consumption in the public right away in those places. Had those things not changed, we probably would have terminated the program.

5.2.6.2. *Local control of roads*

Just as state control of local streets was a barrier to adaptive streets efforts in many municipalities, local roadway ownership, where present, was a critical enabling factor, with several respondents emphasizing the importance of having local control of their downtown streets. Unlike the municipalities that explicitly had to plan around state-owned roadways, two municipalities in the action group had taken ownership of their downtown streets prior to the pandemic; a third had always had control of most of its streets. In each case, respondents pointed to the lack of having to coordinate with NCDOT as a key enabler of their adaptive streets programs. As one respondent pointed out,

It probably only worked because we didn't have to involve NCDOT

5.2.6.3. *Consistency with pre-pandemic initiatives*

Two municipalities noted that their adaptive streets initiatives aligned with pre-pandemic planning efforts. One of those expanded an existing outdoor dining program, with the respondent explaining that having a version of the program previously permitted was one of the main factors behind the decision to expand and continue the program beyond the pandemic. In the other municipality, a roadway reconfiguration had been planned before the pandemic. Implementation of that reconfiguration was delayed by the pandemic itself, but the idea of such a change had already been introduced, vetted, and approved by local officials and by NCDOT, removing a critical hurdle many other towns had to overcome. The municipality was able to pivot its original designs into a temporary installation that was consistent with the planned reconfiguration, but adapted to pandemic needs.

5.2.6.4. *Supportive attitudes*

Four of the respondents talked about how their planning and implementation efforts were buoyed by supportive attitudes among staff, residents, and business owners. These supports seemed to arise from a recognition in two of the municipalities that something needed to be done to protect local businesses. In one instance, council members had not shown much interest in the idea of adaptive streets until it became about supporting businesses:

...it was probably mostly Economic Development — when they started to get interested in it, mostly for sidewalk dining and giving restaurants and businesses more space to do things, that was, I would say, probably what moved the needle to get us able to go and start working on it.

The respondent in another municipality noted that they felt a greater sense of forgiveness or tolerance during the pandemic, which emboldened them to experiment with ways to support businesses. They explained that they were operating somewhat in panic mode, and any efforts

they made to save local businesses were appreciated by the public and the business community.² Staff in that municipality also showcased a ‘can-do’ attitude, using their own online accounts to buy equipment the town needed to roll out its off-street outdoor dining program.

One municipality’s main key to success was a ‘keep it simple’ approach. Staff reported being able to act quickly because they focused on small, simple interventions that minimized the need for council approval or red tape. Similarly, another municipality’s respondent pointed to flexibility as important enabling factor for their adaptive streets program, as implementing the program required answering questions they’d never faced before:

There were just all kinds of things that would come up, questions that have never been asked before. Policy challenges that we just never encountered before. It required a lot of flexibility on everybody’s part.

Another respondent suggested that a culture of flexibility could be critical in fostering resiliency going forward, particularly for collaborations with NCDOT:

I think approaching this with a philosophy of flexibility and maximizing any flexibility that NCDOT already has under their existing policies would be something. I mean, that’s something we were definitely challenged to do in our own community, and I could see how having a flexible mindset would really come in handy and be impactful in other communities where NCDOT controls the main street.

5.3. Non-action municipalities

This section provides an overview of data from screening surveys in the 15 municipalities that did not implement adaptive streets during the pandemic, followed by an analysis of ten follow-up interviews and questionnaires on municipalities’ reasons for not taking action, other COVID-19 response measures (included to gauge the seriousness with which the pandemic was perceived in those municipalities), and interest in potential future NCDOT supports for street space adaptation.

5.3.1. Screening survey results

Once respondents indicated their municipalities had not implemented adaptive streets during the pandemic, they were directed to a much shorter screening survey. This short version was aimed at capturing basic information about whether or not discussions had taken place among staff regarding potential adaptive streets interventions, and whether the municipality had received pressure from the public to implement adaptive streets.

² Other studies have found similarly, that many adaptive streets actions were made possible by a spirit of camaraderie brought on by the stress of the pandemic, e.g., Combs, Morin, et al., 2024; Combs, Nordback, et al., 2024; Oluyede et al., 2024

Across all 15 non-action municipalities, only one respondent reported that discussions had taken place regarding adaptive streets changes. Respondents in four municipalities were not sure whether discussions had taken place, while the remaining respondents said no discussions had taken place. Public pressure did not seem to influence decisions not to act: all but two respondents said their municipalities had received no public pressure at all; the remaining two were unsure whether public pressure had been a factor.

5.3.2. *Reasons for inaction*

Reasons for not pursuing adaptive streets largely focused on businesses, and specifically on lack of perceived need to make street changes in order to support businesses. This perception was explicitly present in nearly every municipality. Respondents in four municipalities explained that state and federal COVID-19 guidance suppressed activity enough to curtail any need for adaptive street programs. In a fifth, the temporary closure of a major downtown attractor was enough to keep foot traffic away from the downtown. Three municipalities' respondents noted that businesses already had access to sufficient private outdoor space in the form of private parking lots; one of those also noted that where downtown businesses existed, there was not enough street space to accommodate adaptations.

A lack of a commercial core led respondents in three municipalities to feel that adapting street spaces would not serve an identifiable purpose. Two of those respondents explained that their municipalities lacked downtowns altogether, and the third reported that their municipality's downtown did not have any businesses that could have taken advantage of an adaptive streets program.

Three municipalities had existing supports respondents felt were sufficient to address changes in demand for street space. Two of them already had flexible outdoor dining policies in place, and respondents felt they could handle new requests for space informally. The third had taken significant steps to pedestrianize their downtown prior to the pandemic, and thus felt they had sufficient space already for both commercial activity and walking and biking. That municipality's respondent also reported a lack of political appetite for additional changes.

Finally, respondents in three municipalities pointed to the fact that NCDOT owns most of their roads as an explicit reason for not even considering making changes. In one small town the only local businesses were on major state roads, which the respondent felt would not have been good candidates for adaptation:

*We have NCDOT roads in town, and they are our major thoroughfares...
They're essential arterial roads. So, there wasn't anything that could be done
during the pandemic to change people's travel patterns.*

The respondent in another municipality felt similarly:

*Most of our main roads are owned by NCDOT and we knew NCDOT would
not allow it, or if they did allow it, it would be too complicated to work through
it with them.*

5.3.3. Other COVID-19 response measures

We attempted to gain a sense of how seriously the municipalities perceived the public health risks of the pandemic itself, as a way to gauge whether their thoughts about street space adaptation were influenced by their level of concern about virus transmission. In most cases, however, the staff members we spoke with were not in a position to represent their municipalities' views on the virus, and were only able to provide information about basic workplace precautions consistent with whatever state or federal guidance was in place at the time. Thus, we are not able to draw conclusions about workplace COVID-19 reduction measures and attitudes toward street space accommodations.

We also attempted to understand whether municipalities perceived a need to support local businesses in other ways (not street space adaptations) during the pandemic. Respondents in four municipalities reported they did not make explicit efforts to support local businesses during the pandemic. Three municipalities offered either informal support as needed or tacit support through the relaxation of regulations on businesses. The respondent in one municipality explained that they temporarily rescinded enforcement of a regulation that would have prohibited using private parking lot space for outdoor commerce. Another municipality took a permissive attitude toward businesses spilling out into sidewalk space, and a third chose to ignore restaurants that appropriated on-street parking spots into takeaway zones.

5.3.4. Interest in NCDOT supports in future

Respondents in most of the non-action municipalities we studied responded affirmatively when asked if they would be interested in receiving support from NCDOT during future disruptive events. Not all were able to articulate specific sorts of supports that could be beneficial, but some did. One respondent expressed interest in guidance about policies regarding flexible use of space on state-owned roads. Another respondent felt their municipality would benefit from examples of successful model ordinances from other states, specifically addressing the creation of parklets and on-street dining areas on both state and locally owned roadways. A third municipality's respondent focused on the need to keep roads operating normally and supply lines open. Yet a fourth respondent shared a desire to have the concept of 'disruption' or 'disaster' supports be expanded to include special events as well.

Two respondents expressed frustration with a lack of flexibility in NCDOT operations during disruptive events. In one municipality, the respondent shared a general need for more flexibility and less red tape regarding the use of state funds during emergency situations. Another respondent was more frank:

Changes in policy that would just allow some discretion and the use of common sense occasionally would be very helpful from the DOT.

Only in one municipality did we detect a lack of interest in NCDOT supports during disruptive events; here, the respondent explained that they would be open to listening to guidance from NCDOT but were not sure they would follow it.

5.4. Critiques of NCDOT

Though not specifically asked for in the surveys or interviews, strong critiques of NCDOT emerged across both groups of municipalities in our study. We have organized these critiques into general themes, which paint a picture of a state transportation department that local professionals often find frustrating to work with, particularly in urban contexts. The study respondents expressed a strong desire for more flexibility, greater consistency across districts, a better understanding of urban needs, and a willingness to prioritize factors beyond just traffic flow in NCDOT's decision-making processes.

5.4.1. Inflexibility and rigid adherence to rules

A perception that NCDOT is inflexible and unwilling to bend rules, even when those rules don't fit specific situations, was a major source of frustration. Multiple interviewees described NCDOT as unwilling to think outside the box or adapt to specific situations. They often stick strictly to guidelines, even when common sense might suggest a different approach. This inflexibility is seen as particularly problematic in urban areas, where NCDOT's rural-focused policies are often ill-suited:

My experience with NCDOT is they are very rural, regimented, and unable to think outside the box and problem solve. They have a set of guidelines, and a lot of times the guys following those guidelines do not either have the ability or the willingness to exercise common sense.

5.4.2. Prioritization of traffic flow over other needs

NCDOT's practice of prioritizing traffic flow and speed over other needs is another recurring theme. Several respondents noted that NCDOT is reluctant to implement changes that might reduce vehicle speeds or increase congestion, even when such changes could improve safety, support local businesses, or enhance the urban environment:

NCDOT is, in general, unwilling to sacrifice speed or traffic flow. Our NCDOT District Office has not been supportive of these types of projects due to concerns it would 1) change the character of the roadway (which is the whole point of the project) and 2) it would increase travel times and/or congestion.

5.4.3. Lack of accountability

Respondents in some municipalities felt that there was a lack of accountability to the public at NCDOT. District engineers were perceived as having too much discretion, and are neither obligated to nor interested in understanding and respecting local needs and priorities, particularly in urban contexts.

5.4.4. Lack of interest in urban issues

The lack of understanding or respect for urban needs was frequently mentioned as a barrier to good planning. Interviewees felt that NCDOT applies rural standards to urban areas, failing to recognize the unique requirements of city streets. This approach is seen as detrimental to local placemaking efforts, economic development, and sustainable transportation options:

NCDOT imposes its rural focus in urban areas. They don't understand or respect urban needs... NCDOT's unyielding focus on their mission of expanding traffic flow is counterproductive for safety and sustainability and detrimental to local placemaking and economic development efforts.

5.4.5. Slow and complicated

The complicated and time-consuming nature of working with NCDOT was highlighted by several respondents. Some municipalities avoided making changes to NCDOT-owned roads during the COVID-19 pandemic due to the perceived difficulty of getting approval. Others have taken ownership of roads from NCDOT to gain more control over their streetscapes.

5.4.6. Inconsistency across divisions

Inconsistency across different NCDOT divisions was noted, with some division and district engineers perceived as being more supportive of local projects than others. This lack of uniformity creates uncertainty for local planners and engineers.

5.4.7. Lack of clear interest in local resilience efforts

Respondents also noted a lack of clear policies or programs for emergency situations, and some even expressed surprise that NCDOT was actually interested in supporting municipalities' efforts to adapt street space as part of their emergency or disaster responses. Finally, there is a desire for NCDOT to be more supportive of alternative transportation modes. Some interviewees felt that NCDOT's policies continue to prioritize driving over other forms of transportation, which is seen as problematic in the face of rising gas prices and sustainability concerns. As one respondent explained:

Their policies continue to force people to drive.

6. Discussion and recommendations

6.1. Summary of findings from North Carolina

North Carolina municipalities' adaptive streets efforts were generally fairly localized, implemented temporarily, and focused on immediate business supports. Respondents expressed a high degree of concern over local businesses during the COVID-19 pandemic, and were keen to find creative ways to support their local economies and sustain their tax bases. Accordingly, the primary motivation behind adaptive streets programs in North Carolina was to provide safe, physically-distanced space for outdoor commerce, particularly in downtown areas.

Among municipalities that did not implement adaptive streets, a perception that local business supports were either not needed or that street space changes would not provide relevant support was a leading factor in the decision not to implement. Respondents frequently pointed to a lack of a vibrant, walkable downtown as a reason such street space adaptations would not serve a purpose in their municipalities.

Local control of roadways, particularly in downtown areas, was a critical factor in municipalities' willingness to consider and ability to implement adaptive streets programs quickly and robustly. Uncertainty over NCDOT's willingness to permit or support adaptive streets on state-controlled roadways was a deterrent to action in many cases. Across the sample, there was a strong desire for more flexibility, consistency, and context-sensitivity from NCDOT.

Aside from roadway control issues, challenges associated with obtaining suitable materials were the biggest limiting factor in implementing and maintaining adaptive streets programs, and were a main reason for restricting their scale and longevity.

Municipalities that implemented adaptive streets programs reported that the experience would likely lead to specific practice changes, as well as broader shifts in perspectives on street space allocation. These changes include increased willingness to experiment with street space usage, particularly through the use of pilot projects.

Finally, there is a clear appetite, even among more rural communities, for the capacity to be more responsive to changing transportation conditions. Respondents provided a wide range of suggestions on ways to build this capacity, even within the unique North Carolina context.

6.2. Comparison of NC findings with other states

Communities in Colorado and Massachusetts benefited from state DOT supports in implementing their adaptive streets programs in several ways. CDOT's Revitalizing Main Streets program provided critical financial support for rapid implementation of adaptive streets programs. Communities used this funding to pay for materials for outdoor dining programs and to improve pedestrian and bicycle connections to commercial areas. CDOT also provided material support in some communities, such as traffic barriers. CDOT's support came with few restrictions, making it easier and quicker for communities to use the supports to help implement emergency responses. Multiple respondents mentioned the importance of CDOT's hands-off

approach in allowing communities to exercise their own judgment in how best to respond to the crisis of the pandemic.

MassDOT's Shared Streets and Spaces program also provided essential funding and technical support. The program offered rapid-deployment grants for enhancing various municipal infrastructure elements. Technical support included assistance with grant writing, matching consultants with communities' specific design needs, and help navigating bureaucratic hurdles. The Shared Streets and Spaces program enabled communities to move quickly on pre-existing plans and, in some cases, helped with the design and implementation of new, pandemic-specific interventions. There were mixed reviews on the program's flexibility, but most respondents were pleased with the latitude MassDOT granted them regarding the use of funds and technical support.

The ownership context of roads in North Carolina is obviously quite different from Massachusetts and Colorado. Nevertheless, communities' needs regarding the use of those roads during the pandemic were quite similar: to provide space to support local businesses and, to a lesser extent, ensure safety for the growing numbers of pedestrians and bicyclists using streets for mobility, exercise, and social interaction.

Where we see differences across the states is in scale and ambition of the responses. As previously mentioned, adaptive streets efforts in North Carolina were quite localized and short-term, focused on immediate supports for local businesses. With few exceptions, NC communities' adaptive streets programs were *ad hoc*, conceived of, designed, and implemented entirely in reaction to the pandemic. These were *coping* responses—municipalities were focused on low-resource efforts they could undertake quickly to help businesses cope with the immediate impacts of the pandemic.

In contrast, Massachusetts and Colorado communities' efforts struck a balance between *coping* and *catalyzing*—leveraging their responses to the disruptive effects of the pandemic to address broader, more long-standing challenges and improve resilience to future disruptions. Massachusetts communities in particular placed an emphasis on using the pandemic's impacts on mobility demands to kick-start implementation of pre-existing plans, and respondents in both MA and CO frequently discussed how their adaptive streets experiences have led to large-scale reimagining of what urban streetscapes can be.

In North Carolina, many respondents pointed to a lack of flexibility, funding, and regulatory guidance as limiting factors in their efforts to respond to the changing mobility demands brought on by the COVID-19 pandemic. Many NC respondents specifically expressed a need for standardized guidance and expectations as to what changes might be allowed on state-owned roads and a relaxation of regulations on the use of state roads during emergency situations. Respondents also explained how they were often hamstrung by a lack of budget lines they could draw on to pay for adaptive streets programs, a lack of knowledge about how to safely reallocate street space, and a lack of clarity as to what sorts of changes NCDOT would permit.

While we obviously cannot state with certainty that CDOT's or MassDOT's support programs would have eliminated the obstacles North Carolina communities faced, it's likely they would have at least help alleviate some of the limiting factors reported here.

6.3. Recommendations to support timely, effective responses to future disruptive events

This research has shown that the implementation of adaptive streets programs is most successful when several key components are present:

- The ability to respond quickly, requiring prior planning and a clear chain of command;
- Jurisdictional authority over the change;
- Access to resources, materials, and equipment;
- Support for the change across multiple levels (including agency, business community, public); and
- Clear communication

For North Carolina municipalities there are several organizational and structural barriers that can impede the success of adaptive street strategies. This section attempts to highlight those challenges and to offer recommendations that could help to overcome those barriers and increase flexibility and adaptability to future disruptive events. This discussion is framed under three main topic areas: mobilization, resources, and communications and training.

6.3.1. Mobilization

One of the key challenges for North Carolina municipalities is that NCDOT owns the majority of the roadways in North Carolina. This poses a challenge on several levels, the first being that the lack of jurisdictional authority over the change directly impacts the ability of municipalities to respond quickly to disruptive events. This further complicates mobilization because the chain of command is not always clear and progress towards implementation can be impeded by not knowing who to coordinate with, or even which department or division should take the lead on initiating and implementing the adaptation.

NCDOT's authority also presents a challenge with respect to the types of interventions that NCDOT will allow on NCDOT roadways, regardless of whether or not that roadway serves primarily to provide access or to provide mobility. Given the number of roadway miles that NCDOT is responsible for maintaining, it stands to reason that standardization is a critical component of efficiency. As such, it may be challenging to develop policies and guidelines that result in different treatments and allowances for different categories of roadways. And yet, this is one of the factors that allowed many other states and municipalities greater success in adapting streets during the COVID-19 pandemic. The perception seems to be that NCDOT treats the roadway system with a "one size fits all" approach when it comes to prioritizing mobility. This is counter to the widely accepted hierarchy of roads that recognizes that roadways serve different functions along a continuum from mobility to access.

Another challenge within this space that is also related to the communication theme discussed later is the need for standardization and predictability across all of NCDOT, including the

Division and District offices. The development of standards for roadway types is an important first step, but in order to be successful, it should be administered and communicated consistently across Divisions. This research documented frustration with the inconsistent application of policies and procedures. Division Engineers are perceived as having enormous latitude in how they communicate with and make decisions about jurisdictions within their purview. This could be addressed through standardization, but must also be addressed through improved communication and community accountability at the Division level.

6.3.1.1. Recommendations regarding mobilization

To facilitate the mobilization of street space adaptations during disruptions for North Carolina municipalities, NCDOT could adopt a formal hierarchy of streets that would allow for various tiers of adaptive streets approaches for different classifications of streets. While informed by data and analysis, the development of this hierarchy should consider input from NCDOT and local staff. This input could be generated through interactive hands-on workshops coordinated through the Metropolitan and Rural Planning Organizations (POs).

The street classification hierarchy could form the outline of a guidebook that recommends possible adaptive street interventions for certain types of streets. Consideration should be given to allowing certain interventions to get an automatic approval for streets focused on access, while certain mobility-oriented street classifications may be excluded from adaptive interventions. For streets in-between mobility and access, the guidebook could provide data-informed guidelines for what sorts of adaptations and interventions could be considered under certain situations and a process that communities in search of approval could easily follow.

Critically, any documentation regarding pre-approved street space interventions by street type should not be restrictive but should allow for creativity and innovation to emerge during an event. This reflects the power of growth in our experiences and learning, and is consistent with the newfound appetite among local leaders and community members for experimentation and with the perspectives of municipal staff that disruptive events often call for novel responses.

Interactive GIS maps could be developed as a supplement to the guidebook. These maps would allow users to easily review street classifications and approved or suggested interventions. For streets requiring additional data, popup information could reference the user to a location in the guidebook where more detailed information is found. If the guidebook were maintained in a wiki, the map could link the user directly to the required section. In cases such as these, the guidebook should clearly address the data required to support decision making and the appropriate chain of command for submitting a request and monitoring results. If approval requires several layers of authority, this should be outlined as well. Clear channels of communication for NCDOT District and Division offices should be provided, including position titles and contact information where appropriate. Given the perceived inconsistency in support across NCDOT Districts and Division, the guidebook should contain clear guidance that can be consistently applied, coming from the top but administered locally.

Some respondents pointed out that a framework for such a guidebook may already exist, as it could logically fall within the scope of the state's Complete Streets policy.

6.3.2. Resources

In addition to the ability to mobilize quickly, the successful implementation of adaptive streets requires access to resources, materials and equipment. Many municipalities across North Carolina, especially the smaller ones, lack this necessary equipment. This prevented some municipalities from moving forward with adaptive streets programs, even in cases where no other barriers to implementation existed.

6.3.2.1. Recommendations regarding resources

NCDOT has a clear role to play in overcoming the barrier of resource limitations. One recommendation would be for NCDOT to offer grant opportunities to cover the cost of materials. The other would be the creation of a “lending library” of sorts, a program that allows municipalities to borrow materials during certain events or periods of need. Still another would be for NCDOT to provide a funding mechanism for making purchases using either state dollars through the Powell Bill or other sources.

6.3.3. Communication and Training

One of the foundational findings from this research that extends beyond adaptive streets is the perceived barrier to communication between municipalities and NCDOT. Effective communication is critical not only for disruptive events, but for everything NCDOT and North Carolina municipalities do in the transportation space. In fact, NCDOT lists great customer service as one of their goals, but the experience of many municipalities around adaptive street programs highlighted a need for better mechanisms for coordination and communication. Many municipalities that may have otherwise implemented plans did not do as they assumed NCDOT would not be cooperative based on prior experiences.

The POs serve as a conduit for regional coordination and communication in the planning space, but in a structure that focuses on regional coordination and planning, the voice of municipalities may not be heard. The process for communicating needs and requests regarding roadways that form the backbone of many municipalities is unclear. North Carolina municipalities want to have a voice on these streets, even if these streets are owned by NCDOT. This research has identified the need for more formal ways to communicate these needs and requests to NCDOT in a consistent and effective manner.

Related to communication is a need for proactive training and information sharing aimed at educating agency staff, the business community, and the public. In recent years both NCDOT and its municipal partners have worked hard to elevate the role that community engagement plays in transportation projects. However, during certain events there is little time for traditional community engagement. In these situations, NCDOT and municipalities need to operate from a position of prior knowledge and information. This can help overcome the barrier to street space adaptation that comes from resistance from inside the agency, from the business community, and from the public. A proactive campaign focused on training agency staff and educating the business and local community on adaptive streets and their benefits would help overcome this resistance.

6.3.3.1. Recommendations regarding communication and training

Improved channels of communication

As noted, the POs are in place to facilitate coordination on the planning side and with a regional focus, but there seems to be a need for better municipal coordination. Rather than implementing a new structure for communication, one possible approach could be the development of a subcommittee of the PO focused on municipal issues with membership including a broad cross-section of municipal transportation staff (not just planners), and representation from the Division and District offices of NCDOT. A first directive of this subcommittee could be the development of a communication protocol that sets expectations and standards around communication and coordination expectations. Measures could be developed and monitored by the committee to track progress towards improved communication and accountability. NCDOT could also sponsor annual meetings for municipalities to discuss local preparedness needs with NCDOT.

Training and knowledge sharing

If guidelines are developed and adopted by NCDOT as a result of this research, then technology sharing will be key. This suggests getting the information into the hands of the locals and the District and Division staff will be key. The regular administration of training and webinars is the recommended approach for this transfer of information. A webinar series should be developed for these purposes. As a starting point, the first webinar could highlight North Carolina municipalities that were successful in their adaptive street efforts during COVID, allowing these municipalities to showcase what they did. That would serve to educate and attract interest in learning about what was possible across the state prior to the adoption of the guidelines. The series would then include information from municipalities outside of North Carolina where the barriers to adaption were lower. The final webinars in the series would focus on a concerted effort to educate everyone on the newly developed hierarchy of streets and various types of adaptive strategies, the process for implementation and communication, and the benefits of these strategies. The goal should be to institutionalize these concepts and processes in order to reduce the barriers to future implementation.

Fact sheets, e-blasts and short videos can be an effective way to communicate the purpose and benefits of adaptive street strategies during certain events to the public and business municipalities. These materials could be developed from the webinar materials but with a change in target audience.

7. Conclusions

The COVID-19 pandemic significantly disrupted travel patterns in cities around the world, prompting local transportation agencies worldwide to reconfigure streets and roadways to ensure safe spaces for walking, cycling, and socializing, while supporting business continuity. These responses demonstrated a newfound willingness among transportation professionals to rapidly deploy flexible, low-cost, temporary facilities in response to changing demands. Prior research has uncovered a range of benefits of policies and programs to support adaptation of street space in response to disruptive events, including improved transportation outcomes, positive public perception and well-being, and economic benefits. While some North Carolina municipalities implemented adaptive streets programs, they were generally smaller in scale and later to appear compared to peer states. As we move beyond the pandemic, North Carolina municipalities are seeking guidance from local and global experiences to inform their responses to future disruptive events.

This research identified state-level factors that support municipalities in responding quickly and effectively to changes in mobility demand, and assesses the transferability of successful state DOT supports from other states to North Carolina. The report provides a comprehensive overview of the rise of adaptive streets programs and their beneficial impacts, and examines case studies from Massachusetts and Colorado, two states recognized for their early state-level support of local adaptive streets efforts. Through surveys, interviews, and questionnaires with local officials in 26 North Carolina municipalities, we offer insights and recommendations to enhance our state's preparedness for future disruptions to its transportation networks.

7.1. Summary findings

Among eleven North Carolina municipalities that implemented some form of adaptive streets program, most were localized, reactionary interventions that were focused on reallocating street space for outdoor commerce. The main motivations for action were supporting local businesses and safeguarding public health. Key enabling factors included local control of roadways, alignment of the program with pre-existing initiatives, and supportive attitudes among staff and the public.

Major constraints to adaptive streets programs among these eleven municipalities included difficulty obtaining materials, fear of lost parking, regulatory barriers, and NCDOT's control over many local streets. Many municipalities purposefully avoided implementing changes on NCDOT-controlled roads due to perceived difficulties in obtaining approval. The pandemic experience led to increased willingness to experiment with street space usage, greater use of pilot projects, and some permanent changes in policies and infrastructure.

Among the fifteen municipalities that did not implement adaptive streets programs, the main reasons for not doing so were a lack of perceived need, sufficient existing supports, or lack of a commercial core. NCDOT's ownership of roads was also cited as a deterrent. Most non-action municipalities expressed interest in receiving support from NCDOT for future disruptive events, particularly in the form of flexible policies and guidance for state-owned roads.

Key challenges for North Carolina municipalities included NCDOT's ownership of most roadways, lack of clear guidelines for interventions on state-owned roads, inconsistent application of policies across NCDOT divisions, and limited access to resources and materials.

7.2. Summary recommendations

To address these issues, we have developed a set of recommendations that includes establishing a formal hierarchy of streets with associated guidelines for adaptive interventions, creating interactive GIS maps to supplement these guidelines, and establishing clear communication channels between municipalities and NCDOT. We also suggest a program to offer grants to support equipment purchases, creation of a lending library for such equipment, or both.

Finally, our recommendations emphasize the importance of proactive training and information sharing as a way to institutionalize adaptive streets concepts and processes, reducing barriers to future implementation during disruptive events.

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10. Appendices

10.1. Screening survey



THE UNIVERSITY
of NORTH CAROLINA
at CHAPEL HILL

Welcome, and thank you for assisting with the *Transportation Disruption and Street Space Adaptation Study*

This study examines how North Carolina communities responded to changing demands for public street space during the COVID-19 pandemic. We are particularly interested in the learning from municipal staff and leadership about how state policies, guidance, and funds shape local government responses to transportation disruptions.

This survey will ask for information about whether and how your municipality adapted public street space in response to the COVID19 pandemic. Even if your municipality did not take such actions, we still want to learn from you. This survey should take approximately ten minutes to complete. After you complete the survey we may—with your consent—contact you for a more in-depth conversation about your municipality's response to the pandemic.

Both this survey and any follow-on conversations are optional and you may decline to participate in them at any time. Your responses will be used to inform ongoing research that will be shared with the public through written reports, webinars, and academic journal articles. For more information about this study or to request copies of our outputs, please email Dr. Tabitha Combs at tab@unc.edu.

When you are ready to proceed, click the button at the bottom right of your screen.

Q1 For what municipality do you currently work?

Q2 Please provide your name and work email address:

This information will not be shared outside the research team

Name (1) _____

Email address (2) _____

Q34 What is your current role in $\{Q1/ChoiceTextEntryValue /1\}$?

Q20 This survey focuses on actions cities and towns took in response to the COVID19 pandemic during 2020 and 2021.

Did you work for $\{Q1/ChoiceTextEntryValue /1\}$ during this time period?

- ☐ Yes, in my current role (20)
- ☐ Yes, in a different role (please explain) (19) _____
- ☐ No (21)

Display This Question:

- *If This survey focuses on actions cities and towns took in response to the COVID19 pandemic during 2... != No*

Q23 To your knowledge, did $\{Q1/ChoiceTextEntryValue /1\}$ make any changes to the allocation or use of public streets in response to the COVID19 pandemic?

- ☐ Yes (1)
- ☐ No (2)
- ☐ I do not know or cannot recall (3)

Display This Question:

- *If To your knowledge, did $\{q://QID20/ChoiceTextEntryValue/1\}$ make any changes to the allocation or... = No*
- *Or To your knowledge, did $\{q://QID20/ChoiceTextEntryValue/1\}$ make any changes to the allocation or... = I do not know or cannot recall*

Q24 To your knowledge, were changes to street space as part of $\{Q1/ChoiceTextEntryValue /1\}$'s pandemic response discussed by staff or leadership?

- ☐ Yes, discussions took place regarding changes to street space in response to the pandemic (1)
- ☐ No, discussions did not take place regarding changes to street space in response to the pandemic (2)
- ☐ I do not know or cannot recall such discussions (3)

Display This Question:

- *If This survey focuses on actions cities and towns took in response to the COVID19 pandemic during 2... = No*
- *Or To your knowledge, did $\{q://QID20/ChoiceTextEntryValue/1\}$ make any changes to the allocation or... = I do not know or cannot recall*
- *And To your knowledge, were changes to street space as part of $\{q://QID20/ ChoiceTextEntryValue/1\}$'s... = I do not know or cannot recall such discussions*

Q33 Is there someone else in your department we should speak to about actions $\{Q1/ChoiceTextEntryValue /1\}$ took in response to the COVID19 pandemic during 2020 and 2021?

Name (1) _____

Email address (2) _____

Department or division (3) _____

Skip To: End of Survey If Condition: Name Is Displayed. Skip To: End of Survey.

Display This Question:

- If To your knowledge, were changes to street space as part of $\{q://QID20/ChoiceTextEntryValue/1\}$'s... = Yes, discussions took place regarding changes to street space in response to the pandemic

Q25 Were you involved in discussions about changes to street space as part of $\{Q1/ChoiceTextEntryValue /1\}$'s pandemic response?

- ☐ Yes, I was involved in such discussions (1)
- ☐ No, I was not involved in such discussions (2)
- ☐ I cannot recall whether I was involved in such discussions (3)

Display This Question:

- If To your knowledge, did $\{q://QID20/ChoiceTextEntryValue/1\}$ make any changes to the allocation or... != Yes

Q27 To your knowledge, did $\{Q1/ChoiceTextEntryValue /1\}$ receive public pressure to modify the allocation or use of public street space in response to the pandemic?

- ☐ Yes (1)
- ☐ No (2)
- ☐ I do not know or cannot recall (3)

Display This Question:

- If To your knowledge, did $\{q://QID20/ChoiceTextEntryValue/1\}$ make any changes to the allocation or... = No

Q29 We would be grateful if you could briefly explain why $\{Q1/ChoiceTextEntryValue /1\}$ did not make changes to street space in response to the pandemic. (If you do not know, please simply type "I do not know").

Skip To: Q30 If Condition: Would you please briefly ex... Is Displayed. Skip To: We are particularly interested in way...

Display This Question:

- If To your knowledge, did $\{q://QID20/ChoiceTextEntryValue/1\}$ make any changes to the allocation or... = Yes

Q3 In what ways did $\{Q1/ChoiceTextEntryValue /1\}$ change the allocation or use of public streets during the COVID19 pandemic?

Please choose all that apply

- ☐ Closed entire roadways to motor vehicles (emergency vehicles may be allowed) (1)
- ☐ Implemented shared streets (pedestrians and cyclists given priority but motor vehicles are allowed) (2)
- ☐ Reallocated travel lanes, parking lanes, and/or on -street curb space to walking, cycling, and/or outdoor commerce (4)
- ☐ Reallocated non -street space to walking, cycling, and/or outdoor commerce (e.g., sidewalks, alleys, off-street parking spaces) (8)
- ☐ Something else (please explain) (7) _____

Display This Question:

- If In what ways did $\{q://QID20/ChoiceTextEntryValue/1\}$ change the allocation or use of public streets during the COVID19 pandemic? Please choose all that apply $q://QID18/SelectedChoicesCount$ Is Greater Than 1

Q4 Which of the actions or programs $\{Q1/ChoiceTextEntryValue /1\}$ implemented do you feel was the most influential or important?

- ☐ Closed entire roadways to motor vehicles (emergency vehicles may be allowed) (1)
- ☐ Implemented shared streets (pedestrians and cyclists given priority but motor vehicles are allowed) (2)
- ☐ Reallocated travel lanes, parking lanes, and/or on -street curb space to walking, cycling, and/or outdoor commerce (3)
- ☐ Reallocated non -street space to walking, cycling, and/or outdoor commerce (e.g., sidewalks, alleys, off-street parking spaces) (4)
- ☐ $\{Q3/ChoiceTextEntryValue /7\}$ (5)

Display This Question:

- If In what ways did $\{q://QID20/ChoiceTextEntryValue/1\}$ change the allocation or use of public stree... , Closed entire roadways to motor vehicles (emergency vehicles may be allowed) Is Displayed

Q5 If this action or program has (or had) a name, please enter it below:

Display This Question:

- If In what ways did $\{q://QID20/ChoiceTextEntryValue/1\}$ change the allocation or use of public stree... , Closed entire roadways to motor vehicles (emergency vehicles may be allowed) Is Displayed

Q16 Were you involved in planning, implementing, and/or evaluating this program?

- ☐ Yes, I led or was substantially involved in planning, implementing, and/or evaluating this action or program (1)
- ☐ I was involved in planning, implementing, and/or evaluating this action or program, but did not play a substantial role (2)
- ☐ I was not involved in planning, implementing, and/or evaluating this action or program (3)

Display This Question:

- If In what ways did $\{q://QID20/ChoiceTextEntryValue/1\}$ change the allocation or use of public stree... , Closed entire roadways to motor vehicles (emergency vehicles may be allowed) Is Displayed

Q9 Briefly, please explain the goals or motivations for this program:

Display This Question:

- If In what ways did $\{q://QID20/ChoiceTextEntryValue/1\}$ change the allocation or use of public stree... , Closed entire roadways to motor vehicles (emergency vehicles may be allowed) Is Displayed

Q10 Are any elements of this program still in effect, either in the original or a revised form?

- ☐ yes (1)
- ☐ no (2)
- ☐ it's complicated (please explain) (3) _____

Display This Question:

- If In what ways did $\{q://QID20/ChoiceTextEntryValue/1\}$ change the allocation or use of public stree... , Closed entire roadways to motor vehicles (emergency vehicles may be allowed) Is Displayed

Q11 How was this program funded?

Please choose all that apply

- ☐ internal funds (1)
- ☐ state funds (2)
- ☐ federal funds (3)
- ☐ funds from a non -profit or non -governmental organization (4)
- ☐ funds from private or corporate donors (5)
- ☐ other funding sources (6)
- ☐ no funds (7)

Display This Question:

- If How was this program funded? Please choose all that apply != no funds
- And In what ways did $\{q://QID20/ChoiceTextEntryValue/1\}$ change the allocation or use of public stree... , Closed entire roadways to motor vehicles (emergency vehicles may be allowed)

Q12 Were any of these funds specific to the COVID19 pandemic?

Please choose all that apply

- ☐ yes (1)
- ☐ no (2)
- ☐ it's complicated (3)
- ☐ unsure (4)

Display This Question:

- If In what ways did $\{q://QID20/ChoiceTextEntryValue/1\}$ change the allocation or use of public stree... , Closed entire roadways to motor vehicles (emergency vehicles

Q13 What agencies or entities owned the streets or roads on which this program was implemented?

Please choose all that apply

- ☐ streets/roads owned by $\{Q1/ChoiceTextEntryValue /1\}$ (1)
- ☐ streets/roads owned by the state DOT (2)
- ☐ streets/roads owned by another public entity (please list entity) (4) _____
- ☐ streets/roads owned by private entities (3)

Display This Question:

- If What agencies or entities owned the streets or roads on which this program was implemented? Pleas... != streets/roads owned by the state DOT

Q14 Why was this program not implemented on any state -owned streets or roads?

Please choose all that apply

- ☐ The state does not own roads in $\{Q1/ChoiceTextEntryValue /1\}$ (1)
- ☐ None of the state -owned roads were good candidates for implementation of this program (2)
- ☐ Implementation of this program on state -owned roads would not have helped meet the objectives of this program (3)
- ☐ Implementation of this program on state -owned roads was not worth the effort (4)
- ☐ The state does not allow implementation of programs like this on its street (5)
- ☐ Another reason (feel free to share) (6) _____

Display This Question:

- If In what ways did $\{q://QID20/ChoiceTextEntryValue/1\}$ change the allocation or use of public streets during the COVID19 pandemic? Please choose all that apply $q://QID18/SelectedChoicesCount$ Is Greater Than 1

Q15 Were any of these other actions or programs implemented on state -owned streets or roads?

Please choose all that apply

- ☐ $\{Q4/ChoiceDescription /1\}$ (1)
- ☐ $\{Q4/ChoiceDescription /2\}$ (2)
- ☐ $\{Q4/ChoiceDescription /3\}$ (3)
- ☐ $\{Q4/ChoiceDescription /4\}$ (4)

Display This Question:

- If In what ways did $\{q://QID20/ChoiceTextEntryValue/1\}$ change the allocation or use of public stree... , Closed entire roadways to motor vehicles (emergency vehicles may be allowed) Is Displayed

Q31 To your knowledge, were there other changes to the allocation or use of public street space in $\{Q1/ChoiceTextEntryValue /1\}$ that were discussed, but not implemented?

- ☐ No, we did everything we set out to do (1)
- ☐ I do not know/do not recall if anything else was dicussed but not implemented (2)
- ☐ Yes, we discussed additional changes, but did not implement them(3)

Display This Question:

- If In what ways did $\{q://QID20/ChoiceTextEntryValue/1\}$ change the allocation or use of public stree... , Closed entire roadways to motor vehicles (emergency vehicles may be allowed) Is Displayed
- And To your knowledge, were there other changes to the allocation or use of public street space in. = Yes, we discussed additional

Q32 We would be grateful if you could briefly explain why these changes were not implemented (if you do not know, please simply type "I do not know").

Q30 May we contact you to discuss ways state DOTs could better support local efforts to adapt public street space in response to future disruptive events?

- ☐ Yes, please contact me to set up a time to talk (1)
- ☐ Yes, please send me a list of questions I can respond to via email (2)
- ☐ No (3)

Q19 Is there someone else we can contact to about this topic instead?

- ☐ No (1)
- ☐ Yes (please provide their name) (2) _____

End of Survey

10.2. Interview guide for action municipalities

In your initial survey response, you described [municipality's] program to [key response] as part of the city's COVID response. The questions in this interview will ask for more detail about the process of planning and implementing this program, followed by more general questions about ways in which NCDOT could better support towns' efforts to prepare for and respond to future disruptive events.

We will make every effort to maintain your anonymity when disseminating the findings of this study, although readers with deep familiarity with your work may be able to deduce your identity anyway. Please feel free to skip questions you do not feel comfortable responding to. If you have questions about this study, including about how your information will be used, please reach out to the study PI, Tab Combs, at tab@unc.edu.

[ask for permission to record the interview, then begin the recording]

The first set of questions focuses on planning and implementation of [municipality's key response]:

1. Did this program have a name?

[if so, refer to it by name as much as possible]

2. Can you share a bit more detail about how the program worked?

[E.g., what kinds of spaces were involved? Who could use them?]

3. What agency or agencies were responsible for planning this program?

4. What sorts of constraints did the city have to work around when planning and implementing this program?

[These could be, for example, physical constraints, processes, regulations, materials, public sentiment, MUTCD or other roadway standards, funds, etc.]

5. Did these constraints affect the design or robustness of the program, the scale of the program, or the speed with which the program was implemented? If yes to any of the above, please explain.

[this is a 3-part question; you may need to break it up and/or prompt for responses on all 3 parts]

6. In what ways did NCDOT influence the planning or implementation of this program?

7. When was this program discontinued?

8. What factors led to the decision to discontinue the program?

9. If there were any negative consequences that arose from this program, please describe them.

The next few questions focus on potential impacts of the program on planning practices in [municipality]:

10. Did implementation of this program alter the city's approach to collaborating with NCDOT on roadway design or usage matters? If so, please describe.
11. How have transportation practices, plans, or programs changed because of the city's experience with this program?
12. How has [municipality's] experience with this program helped the city prepare for future challenges or disruptions?

Finally, these last questions address ways in which NCDOT could support communities' efforts to prepare for future disruptive events—things like pandemics, natural disasters, fuel shortages, etc.:

13. Are you aware of any existing NCDOT programs or policies that could support municipal efforts to adapt street space in the future? If so, please describe them.
14. Would [municipality]—or at least your department—be interested in an NCDOT program to support changes to street space as part of its response to future disruptive events? If so, what kinds of supports would be most useful?
15. In what other ways could NCDOT support cities' efforts to prepare for and respond to future disruptive events?
16. Is there anything else you would like to share about [municipality's] experience with this program?

[Thank the interviewee, tell them we will send them a copy of the final report, and reiterate the request to send us publicly available information about the program's impacts, if that exists.]

10.3. Interview guide for non-action municipalities

In your initial survey response, you mentioned that [municipality] did not make changes to the allocation or use of street space as part of the city's response to the COVID19 pandemic. The questions in this interview will ask about various factors shaping [municipality's] decisions about the pandemic response, including ways in which NCDOT could better support local efforts to prepare for and respond to disruptive events in the future.

We will make every effort to maintain your anonymity when disseminating the findings of this study, although readers with deep familiarity with your work may be able to deduce your identity anyway. Please feel free to skip questions you do not feel comfortable responding to. If you have questions about this study, including about how your information will be used, please reach out to the study PI, Tab Combs, at tab@unc.edu.

[ask for permission to record the interview, then begin the recording]

1. In your survey response, you indicated that [municipality] did not make changes to the allocation or use of street space as part of the town's COVID response. Did NCDOT policies or regulations influence the decision not to make such changes?

[if yes, prompt for explanation of NCDOT's role in this decision]

2. Were there other considerations that influenced [municipality's] decision not to make street space changes during the pandemic?

[e.g., lack of demand, budgetary limitations, compliance with MUTCD or other roadway standards, etc. If yes, prompt for more information]

3. Aside from state and federal mandates, were there other special measures [municipality] took to reduce the spread of COVID?

[if yes, prompt for explanation of these measures, including dates they were in effect, if known]

4. Were there any special measures [municipality] took to support local businesses during the pandemic?

[if yes, prompt for explanation of these measures, including dates they were in effect, if known]

5. Would your department be interested in an NCDOT program to support changes to street space as part of its response to future disruptive events? If so, what kinds of supports would be most useful?

6. In what other ways could NCDOT support cities and towns' efforts to prepare for and respond to future disruptive events?

7. Is there anything else you would like to share about [municipality's] response to the COVID19 pandemic, or about the city's preparations for future disruptive events?

[Thank the interviewee, tell them we will send them a copy of the final report.]