NO BOUNDARIES
Transportation Maintenance Innovations

No Boundaries Synthesis

Equipment Acquisition and Management: Challenges and Solutions

Prepared by CTC & Associates
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Executive Summary

Over the last several years, members of the No Boundaries Transportation Maintenance Innovations pooled fund study have discussed the impacts of the maintenance equipment cost and supply chain challenges that arose during the COVID-19 pandemic. Today, even as many pandemic-related impacts have receded, members report that equipment-related challenges persist. This synthesis report looks beyond pandemic-related impacts to examine systemic, sustained challenges related to equipment acquisition and management.

Using a national survey of state departments of transportation (DOTs), this synthesis sought to:

- Assess the current state of equipment cost and supply chain challenges
- Identify the impact of these challenges
- Discover innovative solutions that can be adapted by other agencies
- Examine barriers to addressing supply chain issues and potential solutions
- Identify the incremental steps that can improve an agency's response to these challenges

Survey responses were received from 26 states, including 13 No Boundaries member states. All but one of the 26 state DOTs participating in the survey reported struggling with acquiring or managing equipment. While not a statistical sampling of all state transportation departments, these findings provide useful insight for agencies seeking to mitigate ongoing equipment acquisition and management challenges.

The full report that follows this executive summary details specific states' challenges and solutions presented in this overview. Included among these are several points of practice—strategies that have proved particularly effective among survey participants.

Equipment Acquisition Challenges

Respondents described the principal challenges their agencies face when acquiring equipment and noted if any particular pieces of equipment present outsized acquisition challenges:

- *Principal challenges*. All responding states except one reported delivery or order delays. Other most frequently reported challenges include suppliers lacking needed stock and cancelled orders. Slightly more than half of respondents reported rising equipment costs after placing their order and before delivery. Selected respondents provided details of their more significant acquisition challenges: lack of available stock; delivery or order delays; and pricing, funding and contractual impacts.
- *Acquiring specific equipment*. Most respondents have had difficulty acquiring certain pieces of equipment, with only seven respondents reporting no such challenges. Challenges were reported across the spectrum of equipment, from light-duty and pickup trucks to medium- and heavy-duty trucks and heavy equipment. Lack of availability, delayed delivery and across-the-board delays were among respondents' concerns.

Equipment Maintenance and Management Challenges

The survey sought perspective on the timeline of equipment maintenance and management challenges, as well as the principal challenges in keeping on-road, off-road and ancillary equipment operating safely and effectively. The following summarizes key findings in these topic areas.

- *Timeline*. Nearly twice as many respondents reported long-term challenges with equipment maintenance and management than those indicating that challenges started with the COVID-19 pandemic.
- *Principal challenges*. More than 80% of the responding agencies reported that the principal challenge they face when maintaining equipment is parts delivery or order delays, followed by suppliers not having the needed stock and insufficient staff to maintain equipment. Rising parts cost was also a common concern. Respondents also reported extended service times and noted that decentralized maintenance shops present management challenges.
- *Acquiring specific items or parts*. Respondents were almost evenly split when asked if their agencies have experienced challenges obtaining specific items or parts. Those reporting such challenges described issues with maintaining aging equipment and delays in obtaining specialty and standard parts such as off-road replacement tires, dump truck parts, and electrical and electronic parts.

Impacts of Equipment Challenges

Respondents described the service or operational impacts of ongoing challenges related to acquiring and managing equipment:

- *Extent of the impacts*. Only four states have not experienced impacts to services or operations as a result of equipment challenges. Services for a fifth state have remained constant but not at the level the agency would like to offer. For other agencies, equipment maintenance has generally suffered. Maintenance activities are delayed, agencies are required to maintain equipment past its anticipated life cycle, and the level of service provided in winter maintenance operations suffers.
- *Responding to the impacts*. Seventy percent of the 20 agencies reporting impacts to services and operations reported that services are delayed or deferred as a result of equipment challenges. Other impacts include some type of reduction—in level of service, efficiency or productivity—and delayed equipment replacement.

Possible Solutions to Equipment Challenges

The responding agencies have adopted a range of practices and workarounds to address the challenges they face in acquiring and managing equipment. The following highlights practices that may offer possible solutions for other agencies experiencing similar challenges.

- *Fleet acquisition and management*. Responding agencies are reevaluating equipment needs; reducing fleets; using or considering the use of multipurpose vehicles and attachments on standard equipment to limit special equipment purchases; and using equipment longer than originally planned, in some cases beyond its anticipated useful life. Other solutions include borrowing or sharing equipment, renting or leasing equipment, and purchasing used vehicles and vehicles off the lot rather than ordering them.
- *Maintenance*. Agencies are refurbishing older equipment or salvaging parts in-house, increasing preventive maintenance, and contracting with other entities to refurbish equipment. Other practices include salvaging parts from external sources and taking a proactive approach to obtaining parts.
- *Procurement.* One of the more common approaches to overcoming acquisition challenges is to diversify lists of suppliers and vendors to increase the chances of obtaining equipment when it is needed. Agencies also participate in purchasing agreements and are proactive in how they order

equipment, ordering as much as a year in advance. Respondents also reported prioritizing orders for equipment with long lead times, purchasing available equipment before a need for it has been identified and making emergency purchases.

- *Staffing*. Contracting out for services and repairs is the most common practice agencies use to address staffing challenges. The 12 respondents reporting this practice appear to outsource in varying degrees. Agencies reporting special employment practices use higher pay, in-house training and bonuses to fill staffing gaps, with one agency launching an in-house apprenticeship program to "grow its own" mechanics. Another agency limits the maintenance required by focusing on preventive maintenance and inspection.

Overcoming Barriers and Continuing Needs

The survey's final questions addressed possible barriers to meeting equipment challenges and agency needs as these challenges continue.

Relatively few respondents described barriers they have encountered when attempting to address equipment acquisition and management challenges. For those who did encounter them, barriers fell into two categories: budgetary and procurement issues. One agency's biennial budget restriction risks the loss of allocated funds if the agency cannot identify needs, build specifications, complete the procurement process, and purchase and accept delivery within the two-year window. Procurement regulations are challenging for some agencies, with issues such as replacement criteria set by oversight agencies limiting how the DOT proceeds with equipment purchases and delays in purchase approvals.

Other than funding, respondents most often cited improvements related to fleet management, procurement and staffing when asked what is needed to better manage their fleets. Among the fleet management needs are fleet management tools, standardized fleet management practices, identification of vendors and resources in rural areas, and better tracking of equipment use to allow for more even distribution of useful life throughout the fleet. Recommended changes to procurement practices include allowing for use of private price agreements, eliminating equipment contracts and accelerating purchase approvals. Ongoing staffing-related needs include additional staff, more training and improved pay and benefits to allow the DOT to compete with private sector employers.

1 Introduction

1.1 Background

The fall 2022 peer exchange of the No Boundaries Transportation Maintenance Innovations pooled fund study in Indianapolis included a roundtable discussion on maintenance equipment cost and supply chain challenges. Nine members provided examples of their agencies' challenges and described the solutions employed to address them, including many related to fleet management:

- Identify equipment needs early and be ready when the window to order opens.
- Access a national register of purchasing agreements and diversify the vendors used.
- Borrow or share equipment within the agency and with other agencies, rent rather than own and relocate equipment to high-use areas.
- Refurbish older equipment to delay replacement, scavenge parts from old equipment that can't be sold and focus on preventive maintenance.
- Swap equipment types when possible (pickup trucks rather than SUVs).
- Retain a contract employee on-site to locate the parts needed for equipment repairs.

This synthesis gathered information to address No Boundaries members' interest in expanding on the roundtable findings that were focused on supply chain challenges related to the COVID-19 pandemic to examine systemic, sustained challenges related to equipment acquisition and management.

1.2 Project Description

CTC & Associates employed a two-part strategy to gather information for this project:

- *Survey of No Boundaries members and selected AASHTO Committee on Maintenance members*. The survey was distributed to all 50 states and the District of Columbia. It gathered anecdotal evidence to assess the current state of practice regarding the impacts of and responses to equipment acquisition and management challenges.
- *Literature search*. While this synthesis included an examination of publicly available domestic resources and in-progress research to supplement survey findings, no relevant documents were found. Agencies must respond quickly to ever-changing circumstances, and we found no publicly available documented guidance that addressed the equipment acquisition and management challenges that No Boundaries members described.

While the survey received responses from slightly more than half of the state transportation agencies in the United States, the conclusions cannot be generalized to all state DOTs. However, the information presented can inform agency practices in meeting ongoing equipment acquisition and maintenance challenges.

2 Survey Findings

2.1 Background

CTC & Associates gathered information from state DOTs through an online survey of No Boundaries member state transportation agencies and selected members of the AASHTO Committee on Maintenance. The survey received 26 complete or mostly complete responses, including 13 responses from No Boundaries members:

- California (Caltrans) (partial response)
- Colorado
- Connecticut
- Idaho
- Indiana (partial response)
- Louisiana
- Maryland
- Mississippi
- North Dakota
- Ohio
- South Carolina
- Texas
- Utah

Thirteen AASHTO Committee on Maintenance members from the following states also responded:

- Arizona
- Florida
- Montana
- Nebraska
- New Hampshire
- New Mexico
- North Carolina
- Oklahoma
- Oregon
- Pennsylvania
- South Dakota (partial response)
- Tennessee
- West Virginia

Survey questions are provided in Appendix A. The full text of survey responses, including respondent contact information, has been provided to No Boundaries separately as a supplement to this report.

Among the topics examined in this chapter are:

- Challenges acquiring equipment
- Challenges maintaining and managing equipment
- Impacts to services and operations
- Solutions to equipment challenges
- Identifying barriers and continuing needs

2.2 Challenges Acquiring Equipment

State DOT maintenance programs rely on a variety of equipment to keep the transportation network operating safely, effectively and efficiently. Procuring trucks, snowplows and other on-road vehicles, as well as off-road vehicles and ancillary equipment such as trailers and plows, generally requires substantial capital outlay and careful planning.

Survey responses on challenges acquiring equipment are summarized below in the following categories:

- Timeline of equipment acquisition challenges
- Principal challenges acquiring equipment
- Challenges acquiring specific vehicles or equipment

Timeline of Equipment Acquisition Challenges

Supply chain, labor and materials issues can come and go in any manufacturing market. These issues have been particularly challenging since the COVID-19 pandemic began and do not appear to have been fully resolved.

Respondents from all agencies except North Carolina DOT indicated that their agencies are struggling with acquiring or managing equipment. Eighty percent of these respondents (20 of 25 responding agencies) reported that the challenges began in the past three years with the onset of the COVID-19 pandemic. Respondents from Caltrans and Florida, Indiana and North Dakota DOTs reported long-term issues, and Maryland DOT reported facing challenges for five years. For North Dakota DOT, these long-term challenges are due to insufficient funding.

Principal Challenges Acquiring Equipment

Agencies reported numerous challenges acquiring equipment, summarized in Table 1. The most frequently cited challenge, reported by all responding states except one (*Maryland*), is delivery or order delays. Close behind are suppliers lacking needed stock and cancelled orders. Slightly more than half of respondents reported rising equipment costs after placing their order and before delivery as a principal challenge. Competition from municipal or county agencies or from other state agencies and trouble accessing different vendors were least likely to be seen as a principal challenge when acquiring equipment.

Table 1. Principal Challenges Acquiring Equipment

State	Competition from Municipal or County Agencies	Competition from Other State Agencies	Competition from the Private Sector	Contracting Difficulties	Delivery or Order Delays
Arizona					X
California				X	X
Colorado					X
Connecticut					X
Florida					X
Idaho					X
Indiana			X		X
Louisiana	X	X	X		X
Maryland					

State	Competition from Municipal or County Agencies	Competition from Other State Agencies	Competition from the Private Sector	Contracting Difficulties	Delivery or Order Delays
Mississippi					X
Montana					X
Nebraska				X	X
New Hampshire					X
New Mexico			X	X	X
North Dakota					X
Ohio				X	X
Oklahoma					X
Oregon			X		X
Pennsylvania			X	X	X
South Carolina			X		X
South Dakota					X
Tennessee		X	X	X	X
Texas					X
Utah			X		X
West Virginia					X
Total	**1**	**2**	**8**	**6**	**24**

Table 1. Principal Challenges Acquiring Equipment (continued)

State	Insufficient Budget	Losing Funds (No Carryover) Because of Delays	Orders Cancelled	Other Costs, Including Surcharges	Rising Equipment Costs After Order and Before Delivery
Arizona			X		
California	X		X		X
Colorado	X		X	X	X
Connecticut				X	
Florida	X	X	X		
Idaho				X	X
Indiana		X	X		X
Louisiana	X	X	X		X
Maryland	X				
Mississippi		X	X		
Montana	X		X	X	X
Nebraska	X		X		X
New Hampshire			X		
New Mexico			X	X	X
North Dakota	X				
Ohio			X	X	
Oklahoma					
Oregon	X	X	X	X	X

State	Insufficient Budget	Losing Funds (No Carryover) Because of Delays	Orders Cancelled	Other Costs, Including Surcharges	Rising Equipment Costs After Order and Before Delivery
Pennsylvania	X		X	X	X
South Carolina	X			X	
South Dakota	X	X	X		X
Tennessee					X
Texas			X		
Utah			X	X	X
West Virginia			X		
Total	**12**	**6**	**18**	**10**	**13**

Table 1. Principal Challenges Acquiring Equipment (continued)

State	Rising Shipping Costs	Rising Costs (Other)	Suppliers Don't Have Needed Stock	Suppliers Selling Out	Trouble Accessing Different Vendors
Arizona					
California	X	X	X	X	
Colorado	X	X	X		
Connecticut			X		
Florida			X		
Idaho			X		
Indiana			X	X	X
Louisiana			X		
Maryland					
Mississippi		X	X		
Montana	X	X	X		
Nebraska		X			
New Hampshire					
New Mexico	X		X		
North Dakota		X			
Ohio	X	X	X	X	
Oklahoma			X	X	
Oregon		X	X	X	
Pennsylvania	X	X	X	X	
South Carolina		X	X		
South Dakota		X			
Tennessee			X		
Texas			X		
Utah	X		X	X	
West Virginia		X	X		
Total	**7**	**12**	**19**	**7**	**1**

Many respondents provided more detail on the most significant challenges regarding lack of available stock; delivery or order delays; and pricing, funding and contractual impacts, as summarized below.

Lack of Available Stock

The Caltrans respondent noted that all equipment is difficult to purchase; the Idaho Transportation Department respondent commented that vehicle availability is limited. For Mississippi DOT, vehicles arriving with different options than those ordered and having to adjust the purchase order accordingly presented challenges.

Several agencies specified supply chain issues (*Pennsylvania, South Carolina* and *Texas*). New Hampshire and Oregon DOTs identified limited manufacturer allocations driving the vehicle scarcity. Other respondents noted issues regarding vehicle choices and availability:

- *Arizona.* Lack of E85-capable vehicle choices. (The U.S. Department of Energy defines E85 as "an alternative fuel that is a blend of ethanol and hydrocarbon, of which the ethanol portion is 75-85% denatured fuel ethanol by volume….")
- *Pennsylvania.* Original equipment manufacturers (OEMs) are not supporting government contracts.

> *Supply chain difficulties are the primary problems. Additionally, the industry has a lot of uncertainties about the future of combustible engines.*
>
> — No Boundaries South Carolina member

Delivery or Order Delays

Some agencies reported that orders that used to take four to nine months now take a year (*Colorado, Idaho* and *South Dakota*). It takes 24 months for Colorado DOT just to obtain a chassis. Similarly, South Dakota DOT was accustomed to ordering a snowplow chassis in July and receiving it in October. Now the agency can expect to wait a year before maintenance crews can start getting the trucks built on the chassis. In Oklahoma, equipment generally has long lead times, and delivery times have significantly increased in Utah.

The Oregon DOT respondent suggested that very long manufacturing and shipping timelines are a result of major equipment manufacturers operating worldwide. In Mississippi, the DOT has seen AROs of 400 days and longer. (ARO refers to *after receipt of order*. Definitions of this term may vary. It can refer to the number of days a customer waits before receiving goods and services, or the number of days before payment is due after the seller has received the order.) This delay pushes purchases beyond the current fiscal year, requiring the agency to cancel or rewrite purchase orders, adjust budgets, and consider making emergency purchases or seek other sources of funding. Similarly, Ohio DOT reported orders are cancelled months after being placed, which unnecessarily ties up the funds committed on these purchase orders.

Pricing, Funding and Contractual Impacts

Respondents reported price increases, with the Oregon DOT respondent citing a 30% overall hike in equipment purchasing costs. Raw material costs are a concern in Idaho, with the respondent noting that

these increases create "excessive inflation." Limited available funding was cited by the Maryland and North Dakota DOT respondents as a particular challenge.

Tennessee DOT is unable to use its contracts to pay to hold a manufacturer's build slots, while private sector buyers who are not similarly constrained can purchase build slots to guarantee their orders. The limitations—and sometimes the benefits—associated with public agencies also come into play for Utah DOT. Vendors are opting to sell snowplow trucks to other buyers at the full retail price rather than to Utah DOT, which pays the discounted contract price associated with a governmental agency.

Challenges Acquiring Specific Vehicles or Equipment

Only seven respondents indicated their states had no challenges acquiring specific vehicles or equipment (*Arizona*, *Florida*, *Maryland*, *New Mexico*, *Ohio, South Dakota* and *Texas*). North Dakota DOT has employed concessions and trade-offs to allocate funds to the highest priority needs, which means lower priority equipment continues to age and deteriorate.

Among those reporting acquisition challenges, the Mississippi DOT respondent noted across-the-board delays when acquiring heavy equipment, though more pronounced delays are associated with heavy equipment acquired through the bidding process. Respondents reported other challenges acquiring specific vehicles or equipment that are described in Table 2.

Table 2. Vehicles and Equipment That are Challenging to Acquire

Vehicle or Equipment	State and Description of Vehicle, Equipment or Impact
Light-Duty and Pickup Trucks	*Idaho, New Hampshire* *Connecticut*. Smaller/light-duty vehicles. *Indiana.* Work vehicles, including pickups, flatbeds, etc. *Montana.* Pickups and tandem axle dump trucks. *Nebraska.* Pickups with V8 engines and Flex Fuel E85 compatibility. *Oklahoma*. Half-ton and three-quarter-ton pickups. *Pennsylvania*. Light-duty vehicles.
Medium- and Heavy-Duty Trucks	*Pennsylvania* *Colorado.* Delivery times for chassis in medium- to heavy-duty trucks severely limit upfitters; impacted by rising steel prices. *South Carolina*. Class 8 cabs and chassis have not been available for the past three years. *Tennessee.* Dump trucks. *Utah*. Plow trucks. *West Virginia*. Mack and International trucks.
Other Equipment	*Idaho*. Delayed delivery of manufactured equipment such as trailers. *Tennessee*. Road tractors. *Utah*. Snowblowers.

Point of Practice Vehicle Allocations are Spread Thin

Several respondents noted that when auto manufacturers face shortages in production due to material availability, economic factors or other reasons, they allocate the limited supply of vehicles to specific dealers within each state.

The Louisiana Department of Transportation and Development (DOTD) respondent highlighted the difficulty in obtaining passenger vehicles because of competition from other state agencies for a portion of manufacturers' limited allocations.

2.3 Challenges Maintaining and Managing Equipment

To keep on-road, off-road and ancillary equipment operating safely, effectively and efficiently, state transportation agencies need sufficient resources to cover ongoing costs and acquire parts to maintain the equipment. Survey responses on challenges maintaining and managing equipment are summarized below in the following categories:

- Timeline of equipment maintenance challenges
- Principal challenges maintaining equipment
- Challenges acquiring specific items or parts

Timeline of Equipment Maintenance Challenges

Nearly twice as many respondents reported long-term challenges with equipment management than those indicating that challenges started with the COVID-19 pandemic:

- Decades or longer (*Florida, Indiana, Louisiana, Maryland, North Dakota, Oregon* and *South Carolina)*
- Five to 10 years (*Connecticut, Nebraska, New Hampshire, Tennessee, Texas* and *Utah)*
- Less than five years (*Arizona, California, Colorado, Idaho, New Mexico, Ohio, Oklahoma* and *Pennsylvania*)

Three agencies said it has always been a struggle (*Indiana, North Dakota* and *Oregon*). North Dakota DOT is constantly looking at ways to address the various challenges that come up; for Indiana DOT, the COVID-19 pandemic and supply chain issues have amplified the struggle.

> *[Challenges maintaining equipment have] always been part of our agency, and I expect always will be. We have a large and diverse fleet that is scattered across our state. There are a lot of challenges with service and utilization.*
>
> — Oregon DOT respondent

Principal Challenges Maintaining Equipment

The principal challenge respondents face when maintaining equipment is parts delivery or order delays, followed by suppliers not having the needed stock and insufficient staff to maintain equipment. Rising parts cost was also a common concern. Retaining mechanics is New Hampshire DOT's most significant issue other than supply constraints, and two respondents (*Florida* and *Nebraska*) noted their agencies can't offer competitive wages. Agency responses regarding the principal challenges with equipment maintenance are presented in Table 3.

Table 3. Principal Challenges Maintaining and Managing Equipment

State	Competition from Municipal or County Agencies	Competition from Other State Agencies	Competition from the Private Sector	Contracting Difficulties	Insufficient Budget	Insufficient Staff to Maintain Equipment
Arizona						X
California				X	X	X
Colorado				X	X	X
Connecticut						X
Florida						X
Idaho						
Indiana			X			X
Louisiana			X		X	X
Maryland					X	X
Mississippi					X	X
Montana						X
Nebraska						X
New Hampshire						X
New Mexico			X	X		
North Dakota						
Ohio						
Oklahoma						
Oregon					X	X
Pennsylvania				X	X	X
South Carolina						
Tennessee						
Texas						
Utah						X
West Virginia						
Total	**0**	**0**	**3**	**4**	**7**	**15**

Table 3. Principal Challenges Maintaining and Managing Equipment (continued)

State	Losing Funds (No Carryover) Because of Delays	Other Costs, Including Surcharges	Parts Delivery or Order Delays	Parts Orders Cancelled	Rising Equipment Costs after Order and Before Delivery	Rising Parts Costs
Arizona		X	X		X	
California	X	X	X		X	X
Colorado			X			
Connecticut			X			X
Florida			X			
Idaho		X	X	X	X	X
Indiana			X	X	X	X
Louisiana			X			X
Maryland	X					
Mississippi			X			
Montana		X	X		X	X
Nebraska			X			
New Hampshire						
New Mexico			X	X	X	X
North Dakota			X			
Ohio		X	X			X
Oklahoma			X	X		
Oregon	X	X	X	X	X	X
Pennsylvania		X	X	X	X	X
South Carolina			X			X
Tennessee			X	X	X	X
Texas			X		X	
Utah			X	X		X
West Virginia						
Total	**3**	**7**	**21**	**8**	**10**	**13**

Table 3. Principal Challenges Maintaining and Managing Equipment (continued)

State	Rising Shipping Costs	Rising Costs (Other)	Suppliers Don't Have Needed Stock	Suppliers Selling Out	Trouble Accessing Vendors
Arizona					
California		X	X	X	
Colorado			X		X
Connecticut			X		
Florida			X		
Idaho	X		X	X	
Indiana	X	X	X		
Louisiana	X		X		
Maryland		X			

State	Rising Shipping Costs	Rising Costs (Other)	Suppliers Don't Have Needed Stock	Suppliers Selling Out	Trouble Accessing Vendors
Mississippi		X			
Montana	X	X	X		
Nebraska					
New Hampshire					
New Mexico	X		X		
North Dakota			X		
Ohio	X	X	X	X	
Oklahoma			X		
Oregon	X		X	X	X
Pennsylvania	X		X	X	
South Carolina		X	X		
Tennessee			X		
Texas			X		
Utah	X		X	X	
West Virginia					
Total	**9**	**7**	**18**	**6**	**2**

Respondents from Colorado and North Dakota DOTs also reported challenging delays in service times. North Dakota DOT has experienced dealer service times of four weeks or more that would typically require only a week.

> *We have a shortage of mechanics and personnel to handle maintenance and repair activities. We are probably [also] lacking in operator training specific to routine maintenance requirements.*
>
> — No Boundaries Louisiana member

Respondents also reiterated the lack of availability of new equipment (*California* and *South Carolina*) and parts (*California, Pennsylvania, Tennessee* and *Utah*). The Utah DOT respondent noted that wiring or electronic parts are a struggle to obtain. For Ohio DOT, OEM parts can be harder to find than aftermarket parts.

Other challenges reported by respondents include:

- Agency stresses extend to the preventive maintenance of existing equipment that has, in many cases, reached the end of its service life but the agency is trying to "stretch" it (*Indiana*).
- Decentralized maintenance shops present management challenges (*Colorado*).
- Fleet issues are not a high priority for upper management (*Maryland*).
- If new equipment can't be obtained, aging fleets need more repair and parts may be discontinued (*Florida, Indiana* and *Montana*).

- Life cycle costs are driven up by the unavailability of new equipment and prolonged use of existing equipment (*South Carolina*).
- Maintaining a large amount of equipment in multiple places across the state requires additional staff and funding to have all equipment serviced to manufacturer-specified levels (*Oregon*).
- Parts costs have doubled (*Utah*).

Challenges Acquiring Specific Items or Parts

Twelve respondents indicated that their agencies have not experienced challenges obtaining specific items or parts (*Arizona*, *Colorado*, *Idaho*, *Maryland*, *Mississippi*, *Nebraska*, *New Hampshire*, *New Mexico*, *Ohio*, *Oklahoma*, *South Carolina* and *Texas).* Other agencies described issues with aging equipment. Respondents from Caltrans and Florida and Montana DOTs noted that their agencies have older equipment. In Florida, older heavy equipment hasn't been replaced due to funding shortages for replacement. For Indiana DOT, it isn't the age of the equipment but the availability of pickup and flatbed trucks has proved to be challenging.

Specialty and standard parts delays have impacted other states. In Louisiana, a forklift sat on blocks for over eight months waiting for specialty off-road replacement tires. Dump truck parts are difficult for Tennessee DOT to obtain, and Utah DOT has found it difficult to procure electrical and electronic parts. For Pennsylvania DOT, parts delays are always changing and impossible to predict. Service availability is an issue for Oregon DOT, with some vendors maintaining only one or two service locations in the state.

Point of Practice Working Around Just-in-Time Delivery

Some OEMs have adopted a just-in-time (JIT) delivery practice to limit the volume of inventory on hand. A JIT practice means that the vendor manufactures parts as they are requested, which can create an unacceptable delay when requesting parts for equipment that is used only seasonally. Sometimes delivery delays can take equipment out of service for an entire season.

North Dakota DOT has identified and moved business away from OEMs that use JIT delivery and shifted it to manufacturers that are more responsive and provide parts more timely—as they are needed.

2.4 Impacts to Services and Operations

Respondents were asked to describe the service or operational impacts of ongoing challenges related to acquiring and managing equipment.

Services, Functions and Practices Impacted

Agencies reported that equipment maintenance has suffered in general, producing longer downtime due to shortages of both parts and mechanics and impacted by long delivery times and challenges sharing or renting equipment. For other agencies, operational impacts are reflected in delayed maintenance activities such as tree trimming, ditch cleaning and mowing. Still other agencies have seen impacts to winter maintenance operations with fewer plow trucks in service.

Only four states have not experienced impacts to services or operations as a result of equipment challenges: Montana, New Hampshire, Ohio and Pennsylvania. Services for a fifth state—Idaho—have

remained constant but not at the level the agency would like to offer. Table 4 summarizes agency experiences.

Table 4. Services, Functions and Practices Impacted by Equipment Challenges

Service, Function or Practice	State and Description of Impact
Equipment Maintenance in General	*Connecticut*. Equipment repair and installations. *Mississippi*. Sharing and replacing equipment; hiring and retaining qualified operators. *Nebraska*. Increased equipment downtime due to parts and mechanic shortages. *Oklahoma*. Time delays on projects while waiting for parts or locating rental equipment. *Oregon*. Rising costs, long delivery timelines and canceled orders at factory. *West Virginia*. Equipment maintenance and parts supply issues.
Maintaining Equipment Past its Anticipated Service Life	*Arizona*. Equipment that should not still be in service has extended repair times. *Utah*. Inability to obtain parts for new trucks forces the agency to fix old, worn-out trucks.
Winter Operations	*Tennessee* *Colorado*. Fewer plow trucks are available to support winter operations. *North Dakota*. Equipment repair delays, such as for certain snowblowers or snowplows, extend the time needed to clear roadways.
Other Service, Function or Practice	*Florida.* Shoulder work and ditch cleaning. *Louisiana.* Tree trimming, roadside grass mowing and ditch cleaning. *Maryland*. Mowing and other roadway maintenance; inspections. *South Carolina.* All maintenance activities are impacted when assets are out of commission or too worn out to be efficient. *Tennessee*. Service level decreases with fewer and older dump trucks. *Texas*. Projects and crews are delayed.

Point of Practice Anticipate Emergencies and Plan Ahead (If You Can)

Preparing to respond to the emergencies a state DOT may encounter—and considering the types of equipment that could be needed—may seem unnecessary during periods of regular operations. But forecasting emergency needs can pay off when time is of the essence.

A significant wildfire in New Mexico led the state DOT to investigate an emergency equipment purchase to help respond to the fire's impacts. The agency was required to create a new price agreement because emergency purchases are not permitted for drivable equipment. This additional step delayed by three months even ordering the large excavator that could be used to respond to the fire's impacts.

Agency Responses to Equipment Challenges

Seventy percent of the 20 agencies reporting impacts to services and operations reported that services are delayed or deferred as a result of equipment challenges. The Oregon DOT respondent noted that "everything just takes longer and costs more." Other respondents also reported that services are not

provided at the same level as before. For example, Tennessee DOT has fewer and older dump trucks, which has decreased the level of service during winter operations.
Other agencies are contracting work out or considering the costs and benefits of doing so (*Mississippi*), outsourcing a significant amount of repair work in certain areas and costs have risen significantly (*Utah*), and bringing in rental equipment, though scheduling and availability can be a problem (*Texas*). Agency responses to service impacts are presented in Table 5.

Table 5. Service Impacts as a Result of Equipment Challenges

State	Services are Not Provided at the Same Level as Before	Services are Delayed or Deferred	Services are Not Provided	Work is Contracted Out
Arizona		X		X
Colorado	X	X		
Connecticut	X	X		X
Florida		X		X
Idaho[1]	X	X		
Louisiana	X	X		
Maryland		X	X	X
Nebraska	X	X		X
New Mexico	X			
Oklahoma	X	X		X
Oregon	X	X		
South Carolina	X	X		X
Tennessee	X	X		
Texas		X		
Utah				X
West Virginia		X		
Total	**10**	**14**	**1**	**8**

1 These impacts are specific to winter operations. Parts shortages have prevented the agency from ensuring the typical number of plow trucks remains operational throughout the winter season.

Delays in getting new equipment and parts to repair old equipment have made us less efficient and late to addressing the needs of our highway system.

— No Boundaries Louisiana member

Other Operational Impacts

Respondents also described operational impacts other than changes in how services are provided. Eight of the 20 responding agencies reported such impacts, which are summarized in Table 6. Three respondents reported some type of reduction—in level of service, efficiency or productivity—while other agencies delayed equipment replacement or employed less efficient methods to provide services.

Table 6. Other Operational Impacts Resulting from Equipment Challenges

Operational Impact	State and Description of Impact
Delayed Equipment Replacement	*Colorado*. Replaces equipment much later than planned, which results in increased equipment maintenance costs and downtimes. *Oregon*. Experiences long delivery times that make it difficult to obtain seasonal equipment when needed. The health of the fleet suffers as a result of delayed deliveries, which require the agency to expend funds repairing equipment that is slated to be turned in rather than replacing it with new equipment.
Delays	*Texas.* Unspecified delays.
Increased Cost	*Arizona* (maintenance), *Nebraska*
Reduced Efficiency	*Louisiana*. Employs less efficient methods to provide services.
Reduced Level of Service	*Connecticut*. Reduces the level of service to the public for clearing snow and ice and vegetation control.
Reduced Productivity	*Oklahoma*. Decreases productivity as equipment remains idle while looking for parts and optional vendors.

2.5 Solutions to Equipment Challenges

State DOTs have adopted a variety of practices and workarounds to address the challenges they face in acquiring and managing equipment. Respondents identified effective practices in these categories:

- Fleet acquisition and management
- Maintenance
- Procurement
- Staffing

Fleet Acquisition and Management

Most respondents reported engaging in fleet acquisition and management practices to address ongoing equipment-related challenges. Some are reevaluating equipment needs and reducing fleets. Other agencies are using or considering the use of multipurpose vehicles and attachments on standard equipment to limit special equipment purchases:

- *Colorado.* The agency looks for opportunities to use multipurpose vehicles with different attachments. Such adaptations include hook lift trucks that are capable of weed spraying in the summer and plowing in the winter and a slide-in patching unit that replaces a dedicated patching truck.
- *Louisiana.* Multiuse pieces of equipment such as trucks with interchangeable beds and a single prime mover with multiple attachments are being explored.
- *Ohio.* The use of attachments to decrease the need for special equipment has reduced the impact to services.
- *Oklahoma.* The agency purchases special attachments to make standard equipment multifunctional.

Many agencies are also using equipment longer than originally planned, which may mean that equipment still in use has exceeded its anticipated service life. Idaho's fleet managers are retaining vehicles longer to use as backups when other units fail. Borrowing or sharing internally or with other agencies, renting or leasing, purchasing used or different equipment than originally planned, and using different contracting mechanisms are among other common practices summarized in Table 7.

Table 7. Fleet Acquisition and Management Practices to Address Equipment Challenges

Practice	State and Description of Practice
Borrow or Share Equipment	*Arizona, Louisiana, Mississippi, New Hampshire, New Mexico*, *Tennessee* *Montana.* Shares equipment, purchasing only what is essential. *Ohio.* Shares equipment statewide through a new equipment-sharing software that includes the entire state's inventory. *Oklahoma.* Shares among other state agencies. *South Carolina*. Borrows rather than purchases equipment. *Texas.* Borrows underutilized equipment.
Modify Contract Instruments	*Montana.* Uses multiyear purchasing contracts to make purchasing easier.
Purchase Directly or Purchase Used or Alternative Equipment	*Arizona.* Purchases vehicles off the lot when available. *Florida.* Purchases used equipment. *Montana.* Searches government surplus sites for used equipment. *Ohio.* Purchases "in-stock" vehicles. *Oregon.* Purchases vehicles on lots instead of through manufacturers, though at higher cost. *Pennsylvania.* Accepts new equipment that would not have been accepted in the past. *Utah.* Changed from one to three brands of trucks to fulfill orders.
Rent or Lease Equipment	*Colorado.* Created more equipment rental price agreements and contracts. *Florida.* Leases equipment. *Louisiana.* Encourages end users to rent equipment that is underutilized. *Mississippi*. Rents tractors in some districts. *New Hampshire.* Rents only a few pieces of equipment. *North Dakota*. Balances purchases versus rentals (for example, seasonal equipment such as tractors for mowing can be rented and returned before winter). *Oklahoma.* Rents specialty equipment by the day and leases rather than purchases other equipment and vehicles. *Oregon.* Was leasing but leasing costs have risen, so will not renew leases. *South Carolina.* Rents rather than purchases to reduce its fleet to only necessary assets. *Texas.* Rents equipment. *West Virginia.* Rents equipment when available.

Practice	State and Description of Practice
Other Practices	*Connecticut:* • Changes service, construction, maintenance or other operational schedules. • Shortens equipment life cycle to get higher trade-in value. *Florida:* • Requests additional funds from legislature. • Purchases equipment during emergency declaration. • Increases equipment purchases as part of a fleet management plan. *Idaho.* Works more closely with preferred vendors, which enables the agency to be "first in line." *Mississippi.* Maximizes the use of existing equipment. *Ohio.* Purchases from off-contract vendors. *Oklahoma:* • Groups similar equipment by usage to shorten the life cycle of high-use equipment. • Standardizes the classification of passenger vehicles to rotate high-use vehicles to low-use locations. *Oregon:* • Rotates low-use equipment to high-use areas. • Standardizes equipment to bulk order items and speed up build time. • Trades in equipment for a reduced purchase price. *Tennessee:* • Considers purchasing through nontraditional sources. • Reviews equipment specifications to better match the agency's budget with purchasing requirements. *Texas.* Utilizes strategic reserve equipment. *West Virginia.* Makes emergency purchases.

Maintenance

Agencies employ a wide range of approaches when establishing new practices or workarounds to deal with maintenance challenges. Thirteen agencies refurbish older equipment (or plan to) or salvage parts in-house; six are increasing preventive maintenance. Less common practices are contracting with other entities to refurbish equipment, maintaining a parts inventory and taking a proactive approach to obtaining parts. Table 8 summarizes survey responses.

Table 8. Maintenance Practices to Address Equipment Challenges

Practice	State and Description of Practice
Contract with Other Entities to Refurbish Equipment	*Connecticut, Maryland, Tennessee* *Colorado*. Maintains a price agreement/contract to replace cracked and rusted truck frames for plow trucks, which extends the life of the trucks. Also refurbishes the rusted beds and replaces sanders with stainless steel instead of mild steel. *Oklahoma*. Outsources the refurbishment of assets.

Practice	State and Description of Practice
Increase Preventive Maintenance	*Connecticut, Maryland, Tennessee* *Mississippi.* Analyzing replace versus repair. *Montana*. Repairs instead of sells older equipment because the agency can't find—or can't afford—replacements; stocks more parts. *Oklahoma:* • Increasing and documenting preventive maintenance in-house. • Documenting external maintenance by asset in the agency's database.
Maintain Parts Inventories	*Mississippi*. Maintains a parts inventory in each of six districts; vendor parts are mostly purchased on blanket purchase orders. *Oklahoma*: • Developed long-term relationship with contract parts vendors to supply and locate parts as needed. • Decreased on-site parts inventory to rely on vendor JIT deliveries.
Refurbish Older Equipment In-House	*Arizona, Florida, Maryland, New Mexico, Ohio, Pennsylvania, West Virginia* *Colorado*. Conducting a pilot to repower a CAT C13 engine with a Cummins engine. *Oregon*. Considering establishing a refurbishing program to extend the life of older equipment.
Salvage Parts from External Sources	*Maryland, Tennessee*
Salvage Parts In-House	*Florida, Maryland, Oregon, Pennsylvania, South Carolina, Tennessee, Texas, West Virginia* *Montana.* Salvages parts from equipment being phased out. *Ohio.* Salvages electronics from dump trucks.
Proactive Approach to Obtaining Parts	*Idaho, Tennessee*
Other Practices	*Nebraska*. Outsourcing of repairs is more common. *Texas*. Uses Strategic Reserve equipment. *Utah:* • Uses external labor sources in certain locations due to staffing shortages. • Uses mechanics as fill-in plow drivers to help during storms.

Procurement

There is no one-size-fits-all approach to managing—and overcoming—procurement-related challenges. Respondents are most likely to expand and diversify lists of suppliers and vendors to increase the chances of obtaining equipment when it is needed. Participation in purchasing agreements is also one of the more common approaches to meeting equipment challenges, though two agencies noted they are precluded from entering into such agreements. Agencies are proactive in how they order equipment, ordering as much as a year in advance, and prioritize orders for equipment with long lead times. Some agencies purchase equipment when it is available, not necessarily when it is needed. Table 9 summarizes survey responses.

Table 9. Procurement Practices to Address Equipment Challenges

Practice	State and Description of Practice
Change Timing of Procurement Processes	*Connecticut, Pennsylvania*
Change Other Procurement Processes	*Mississippi*. Increased the threshold for bid solicitations from $50,000 to $75,000. *Tennessee*. Considering unspecified alternatives to fleet equipment purchases.
Diversify Suppliers and Vendors	*Pennsylvania* *Louisiana*. Seeks to diversify suppliers and vendors; awards passenger vehicle contracts to multiple vendors and brands to have more order banks open throughout the year. *Ohio*. Diversified vendors, which has reduced impacts on the agency's equipment replacement program. *Oklahoma*. Utilizes multiple vendors when filing larger orders of vehicles. *Oregon*. Awards contracts to multiple vendors to allow for options when considering purchase price and delivery timeline. *South Carolina*. Tries to diversify suppliers and vendors. *Tennessee*. Rewriting agency equipment specifications to open up to more brands and increase availability.
Diversify the Fleet	*Utah*. Required to diversify its fleet due to vehicle manufacturer shortages.
Overpurchase Equipment When Available	*Connecticut, Pennsylvania* *Oregon.* Purchases available equipment when the need has yet to be identified. *West Virginia*. Tries to purchase when the equipment is available.
Participate in Purchasing Agreements	*Montana* *Colorado*. Uses Sourcewell[1] contracts rather than a bid process. *Florida*. Uses Sourcewell when state contract vendors can't provide goods or aren't available. *Maryland*. Attempts to obtain as many Intergovernmental Cooperative Purchasing Agreements (ICPAs) as possible. *New Mexico*. Unable to use a private price agreement. *Pennsylvania*. Unable to use centralized agreements. *South Carolina*. Uses National Association of State Procurement Officials (NASPO) contracts.
Proactive Ordering	*Idaho*. Seeks to be more proactive in submitting orders. *Montana:* • Orders a year in advance to receive purchases within budgetary time frames. • Develops multiyear contracts to purchase equipment. *Oregon*. Prioritizes the ordering of equipment with longer lead times. *West Virginia.* Makes emergency purchases of equipment when readily available.
Other Practices	*Nebraska.* Considering leasing or renting specialty equipment. *Oregon.* Assists smaller agencies in obtaining their equipment needs.

1 Sourcewell, a centralized register of purchasing agreements, is self-described as a "service cooperative created by the Minnesota Legislature as a local unit of government."

Staffing

Contracting out for services and repairs is the most common practice agencies use to address staffing challenges. The 12 respondents reporting this practice appear to outsource in varying degrees. Three agencies are using higher pay, in-house training or bonuses to fill staffing gaps. In Montana, the agency hires mechanics who will travel to work in other locations that are unable to make local hires. Oregon DOT's approach to staffing challenges is to focus on preventive maintenance and inspection to limit required maintenance. Table 10 summarizes survey responses.

Table 10. Staffing Practices to Address Equipment Challenges

Practice	State and Description of Practice
Contract Out for Services and Repairs	*Arizona*, *Connecticut*, *Pennsylvania.* Contracts out for services. *Oregon, Texas*. Contracts out for repairs. *Florida*. Employs a mix of in-house employees and contracted services. *Louisiana*. Contracts out vehicle and equipment repairs more than ever before. *Mississippi*. Contracts out some repairs and preventive maintenance to vendors participating in the Fuelman Maintenance program, a commercial fleet maintenance solution. *Montana.* Contracts out more repairs and preventive maintenance activities. *New Hampshire.* Anticipates contracting out work if employee retention issues continue. *North Dakota.* Uses private contractors for snow removal when lacking in equipment or personnel. *Tennessee.* Outsources more repair work than ever before.
Focus on Preventive Maintenance	*Oregon*. Reevaluating staff work priorities to focus on preventive maintenance and inspections.
Modify Employment Practices	*Colorado.* Hired a few inexperienced technicians at a lower pay grade and provided in-house training. The agency used a similar practice to provide in-house commercial driver license training and testing for highway maintenance workers. *Montana.* Hires mechanics in one area to travel and work in other areas unable to hire locally. *New Hampshire:* • Pays overtime to existing employees. • Has paid bonuses to attract other state employees to assist in winter maintenance operations. *Utah.* Starting an in-house apprenticeship program to "grow its own" mechanics; see also the respondent quotation below.

> *We have had to use contract vendors for repairs because we can't keep up due to the mechanic staff shortages. We have also had to significantly increase the wage of our mechanics to retain them. Both of these solutions have upped our costs.*
>
> — No Boundaries Utah member

2.6 Identifying Barriers and Continuing Needs

Barriers

Relatively few respondents identified barriers they have encountered when attempting to address equipment acquisition and management challenges. For those who did encounter them, barriers fell into two categories—budgetary and procurement issues:

- **Budgetary issues** are a key barrier for Florida, Montana and South Carolina DOTs. In Florida, this barrier takes the form of funding restrictions. Colorado DOT is limited by an agency requirement that equipment replacement funding is truly limited to replacement and will not cover refurbishing existing equipment.

  Oregon DOT's biennial budget restrictions require the agency to complete its purchasing cycle within that two-year window or lose the allocated funding. The respondent noted that it is becoming increasingly difficult to identify needs, build specifications, complete the procurement process, and purchase and accept delivery of equipment within a two-year period.

- **Procurement issues** present challenges for Montana and Pennsylvania DOTs. Procurement regulations are a barrier in Louisiana, and in Mississippi, legislative restrictions and limitations regarding such issues as replacement criteria set by oversight agencies have proved to be challenging. Purchasing restrictions require Ohio DOT to obtain approval from its controlling board. If board meetings are held too infrequently, equipment or vehicles may no longer be available when board approval for a purchase is obtained.

Continuing Needs

Respondents offered lessons learned from their own experiences navigating equipment-related challenges and identified what is still needed to improve equipment acquisition and management within their agencies.

Point of Practice Tools and Practices to Better Manage Challenging Times

Agencies are finding ways to better manage equipment acquisition, maintenance and management in challenging times.

- *Request assistance from an oversight agency*. Mississippi DOT can request waivers and alternative funding for items with long AROs.
- *Leverage relationships*. Oregon DOT's attention to relationship building over the years has paid off when obtaining equipment that is in high demand.
- *Seek out supportive programs*. AASHTO's Equipment Management Technical Service Program serves as a comprehensive national resource for South Carolina DOT in managing its fleet.
- *Use management tools*. Mississippi DOT is using its equipment management system to help maintain and extend the life of its equipment. Using this tool is becoming even more necessary as the agency continues to experience limited funding allocations and supply chain challenges. Nebraska DOT also sees the value in such a tool and is issuing a request for proposal for a new fleet asset management system.

When asked what would be needed to better manage their fleets (other than more funding), respondents most often cited improvements related to fleet management, procurement and staffing. Table 11 summarizes responses.

Table 11. Agency Needs for Improved Equipment Management

Tool or Practice	State and Description of Practice or Need
Fleet Management Tool	*Connecticut*. The agency has increased use of AssetWorks, the agency's fleet management software. *Florida*. A fleet-sharing dashboard is needed. *Louisiana*. Better fleet management tools and a well-defined management plan are needed. The agency's outdated version of SAP (a commercial enterprise business solution) that is used for fleet management is not user-friendly.
General Fleet Management	*Maryland*. The respondent recommends that agencies "listen to the people who've been doing fleet management. You can't outsmart or buy time." *Mississippi*. Once supply chain challenges abate, the agency hopes to replace vehicles sooner so they bring more at auction. *Oklahoma*. The agency has identified a gap in identifying vendors and service resources in rural areas. *Oregon*. Better tracking of utilization and equipment rotations is needed to distribute useful life throughout the agency's fleet. *South Carolina*. A smaller fleet is needed that will "turn" faster. The agency is also seeking more efficient equipment that does more than one job.
Procurement Changes	*Montana*. Changes to purchasing rules are needed. *New Mexico*. The agency would like to utilize private price agreements. *Ohio.* Changes to the agency's procurement process are needed to allow fleet managers to acquire items in a more reasonable time frame, before items are sold. *West Virginia*. The respondent recommends eliminating equipment contracts.
Staffing	*Connecticut*. Additional staffing and training are needed. *Montana*. Additional mechanics are needed. *Oregon*. Additional staff is needed. *Tennessee*. Additional fleet management staff is needed.
Standardized Fleet Management Practices	*Colorado*. The agency's biggest challenge is the lack of standardization among maintenance sections (districts). An effort now underway to revise policies and manuals seeks to address this. *Idaho*. Districts are collaborating to evaluate and manage the fleet from a statewide perspective, replacing the previous individualized, district-level approach. *Louisiana*. For many years, districts have determined when equipment is replaced and what replaces it. A planned replacement schedule, especially for passenger vehicles, is needed.

Appendix A: Survey Questions

The survey below was provided in an online format to members of the No Boundaries Transportation Maintenance Innovations pooled fund study and selected members of the AASHTO Committee on Maintenance.

"Equipment" in this survey refers to all transportation maintenance on-road and off-road vehicles and ancillary equipment such as trailers and plows.

Note: The question below determined how respondents were directed through the survey.

(Required) Is your agency struggling with acquiring or managing equipment?

- Yes (Skipped the respondent to **Challenges Acquiring Equipment**.)
- No (Skipped the respondent to **Equipment and Fleet Management**.)

Challenges Acquiring Equipment

1. How long has your agency experienced challenges in acquiring equipment?
2. What are the primary challenges in acquiring equipment? Select all that apply.
    - Competition from municipal or county agencies
    - Competition from other state agencies
    - Competition from the private sector
    - Contracting difficulties
    - Delivery or order delays
    - Insufficient budget
    - Losing funds (no carryover) because of delays
    - Orders cancelled
    - Other costs, including surcharges
    - Rising equipment costs after order and before delivery
    - Rising shipping costs
    - Rising costs (other)
    - Suppliers don't have needed stock
    - Suppliers selling out
    - Trouble accessing different vendors
    - I don't know.
    - Other (Please describe.)
3. Please provide any comments you wish to share about the challenges you selected in the previous question.
4. Are challenges greater with any specific vehicles or equipment?
    - No
    - Yes (Please describe these challenges.)

Challenges Maintaining and Managing Equipment

1. How long has your agency experienced challenges with maintaining and managing equipment?
2. What are the primary challenges in maintaining and managing equipment? Select all that apply.
    - Competition from municipal or county agencies
    - Competition from other state agencies

- Competition from the private sector
- Contracting difficulties
- Insufficient budget
- Insufficient staff to maintain equipment
- Losing funds (no carryover) because of delays
- Other costs, including surcharges
- Parts delivery or order delays
- Parts orders cancelled
- Rising equipment costs after order and before delivery
- Rising parts costs
- Rising shipping costs
- Rising costs (other)
- Suppliers don't have needed stock
- Suppliers selling out
- Trouble accessing vendors
- I don't know.
- Other (Please describe.)

3. Please provide any comments you wish to share about the challenges you selected in the previous question.
4. Are challenges greater with any specific items or parts?
    - No
    - Yes (Please describe these challenges.)
5. (Required) Have there been impacts to services or operations resulting from your agency's equipment challenges?
    - Yes (Skipped the respondent to **Impacts of Challenges Acquiring or Managing Equipment**.)
    - No (Skipped the respondent to **Solutions to Equipment Acquisition and Management Challenges**.)

Impacts of Challenges Acquiring or Managing Equipment

1. What types of services have been impacted by challenges in acquiring or managing equipment?
2. How has your agency responded to the service impacts? Select all that apply.
    - Services are not provided at the same level as before.
    - Services are delayed or deferred.
    - Services are not provided.
    - Work is contracted out.
    - Other. (Please describe these other responses to service impacts.)
3. Please provide any comments you wish to share about the service impacts you reported in the previous question.
4. Has your agency experienced operational impacts, other than changes in how services are provided, that are associated with challenges acquiring and managing equipment?
    - No
    - Yes (Please describe these operational impacts.)

Solutions to Equipment Acquisition and Management Challenges

1. Please provide a brief description of any agency efforts to address equipment acquisition and management challenges in the following six categories:
    - Acquisition alternatives
    - Fleet management practices
    - Maintenance practices
    - Procurement practices
    - Staffing practices
    - Other practices

    We have provided examples of possible practices in each category to illustrate the types of agency efforts you might describe below.

    Acquisition Alternatives

    - Borrowing equipment from or sharing with other agencies
    - Renting rather than purchasing equipment or vehicles
    - Purchasing used equipment from nontraditional sources, such as government surplus auctions

    Please enter your response below:

    Fleet Management Practices

    - Changing service, construction, maintenance or other operational schedules
    - Reassigning high-mileage equipment to low-mileage uses and vice versa
    - Reevaluating equipment needs
    - Shortening equipment life cycle to get higher trade-in value
    - Using attachments on standard vehicles instead of purchasing specialized vehicles
    - Using different equipment for certain tasks (swapping) or buying alternatives, e.g., single-axle truck instead of tandem
    - Using equipment longer than originally planned

    Please enter your response below:

    Maintenance Practices

    - Contracting with other entities to refurbish equipment
    - Increasing preventive maintenance
    - Refurbishing older equipment in-house
    - Salvaging parts from external sources
    - Salvaging parts in-house from old equipment that can't be sold

    Please enter your response below:

    Procurement Practices

    - Changing timing of procurement processes
    - Diversifying suppliers and vendors
    - Overpurchasing equipment when available
    - Participating in national, statewide or other centralized register of purchasing agreements such as Sourcewell, self-described as a "service cooperative created by the Minnesota [L]egislature as a local unit of government"

    Please enter your response below:

Staffing Practices

- Retaining an on-site contract employee to locate parts for equipment repairs
- Contracting out for services

Please enter your response below:

Other Practices

Please enter your response below:

2. Has your agency considered or expressed interest in other strategies that have yet to be implemented to address equipment acquisition and management challenges?
    - No
    - Yes (Please describe these other strategies.)
3. Has your agency identified any unintended impacts of strategies to address equipment acquisition and management challenges?
    - No
    - Yes (Please describe these unintended impacts.)
4. Has your agency identified any barriers to implementing strategies to address equipment acquisition and management challenges?
    - No
    - Yes (Please describe these barriers.)

Equipment and Fleet Management

1. Supply chain issues and rising costs have made implementing fleet management plans difficult. Other than a fleet management plan, does your agency have tools or other decision processes supporting equipment management?
    - I don't know
    - No
    - Yes (Please describe these tools or processes.)
2. In addition to any plans or tools, what does your agency need to better manage its fleet (other than more funding)?

Wrap-Up

1. If available, please provide links to documentation that describes your agency's equipment supply chain challenges and responses. Send any files not available online to susan.johnson@ctcandassociates.com.
2. Please use this space to provide any comments or additional information about your previous responses.