

NCHRP
SYNTHESIS 545

Electronic Ticketing
of Materials for
Construction Management



A Synthesis of Highway Practice

The National Academies of
SCIENCES • ENGINEERING • MEDICINE
OF THE NATIONAL ACADEMIES PRESS
WASHINGTON, DC 20005

NATIONAL
COOPERATIVE
HIGHWAY
RESEARCH
PROGRAM

100 YEARS

NCHRP Synthesis Report 545 Electronic Ticketing of Materials for Construction Management

Contributors:

Gabriel B. Dadi, University of Kentucky,

Roy E. Sturgill, Jr., Iowa State University

Dhaivat Patel, Stantec,

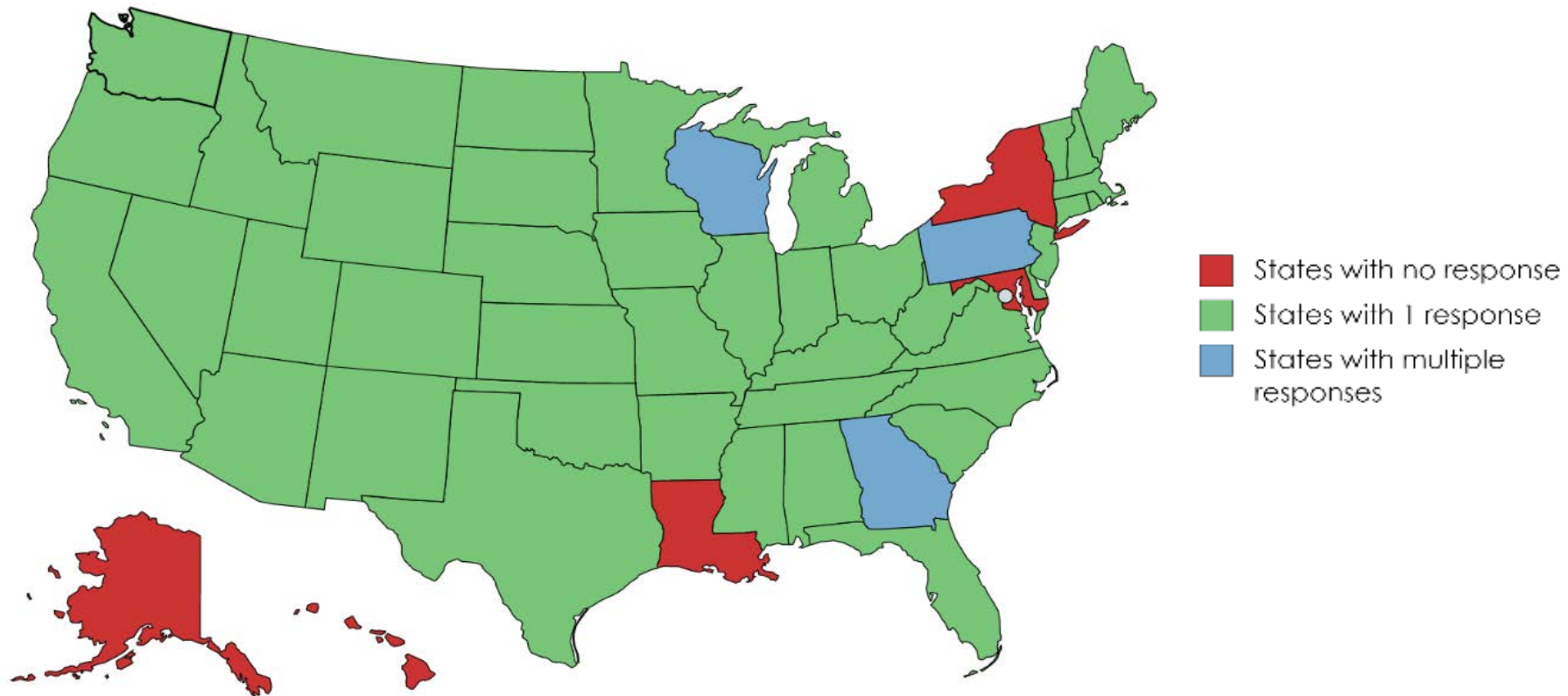
Chris Van Dyke, Kentucky Transportation Center, and

Greg Mulder, Iowa Ready Mixed Concrete Association

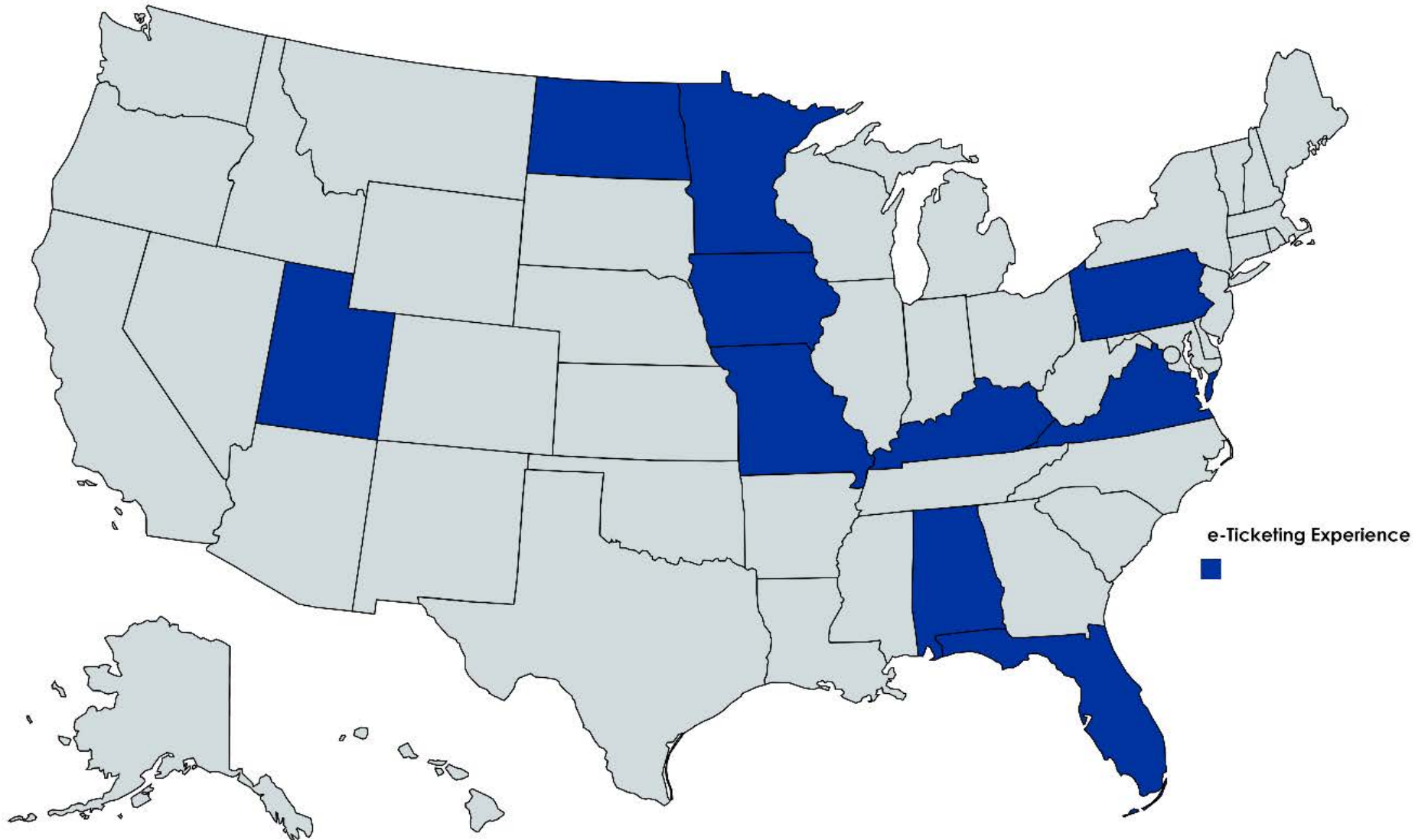
<http://www.trb.org/Publications/Blurbs/180798.aspx>

NCHRP Synthesis Report 545

- NCHRP Synthesis—Survey Findings
 - 51 responses from 45 states

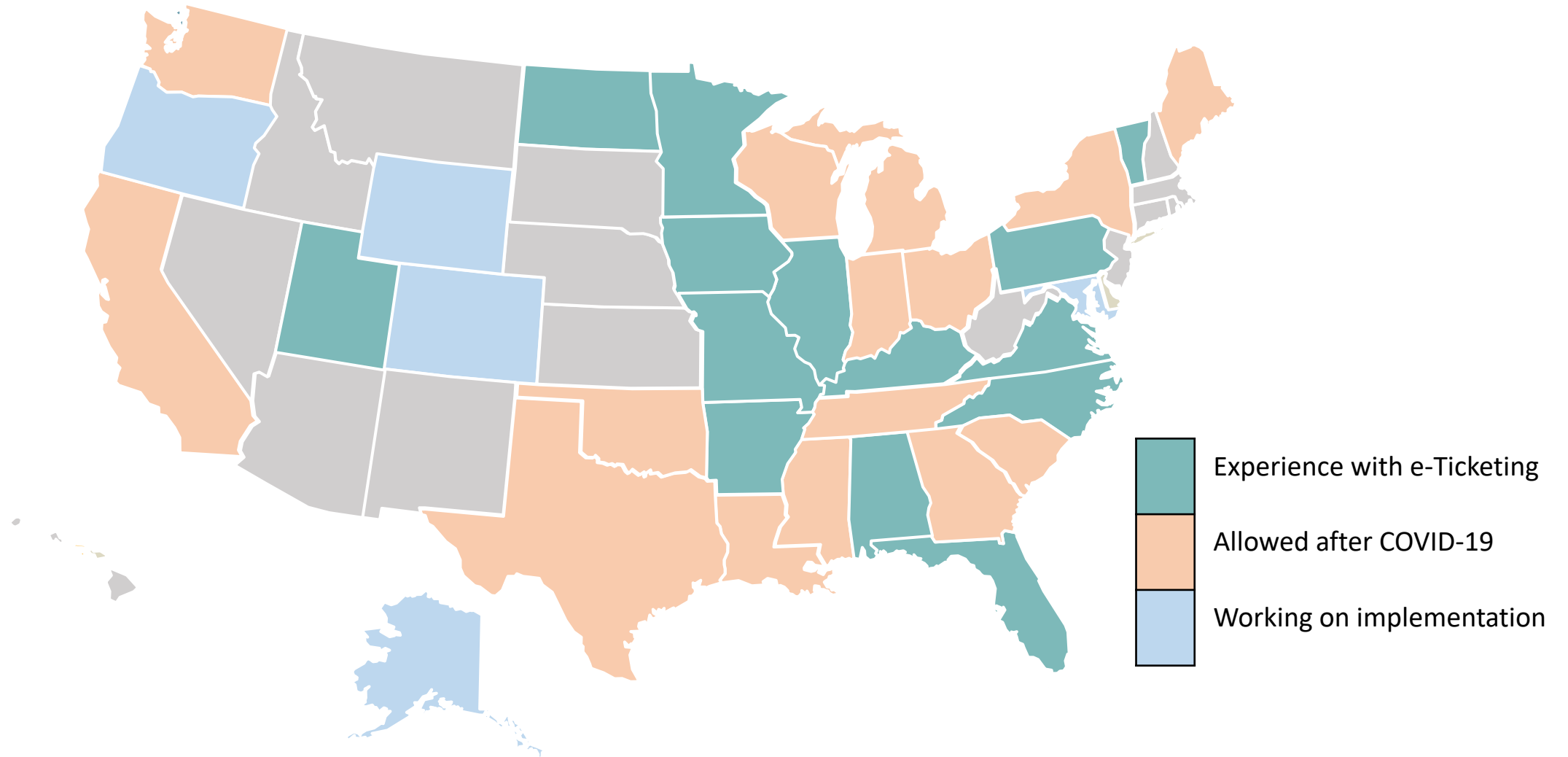


NCHRP Synthesis Report 545

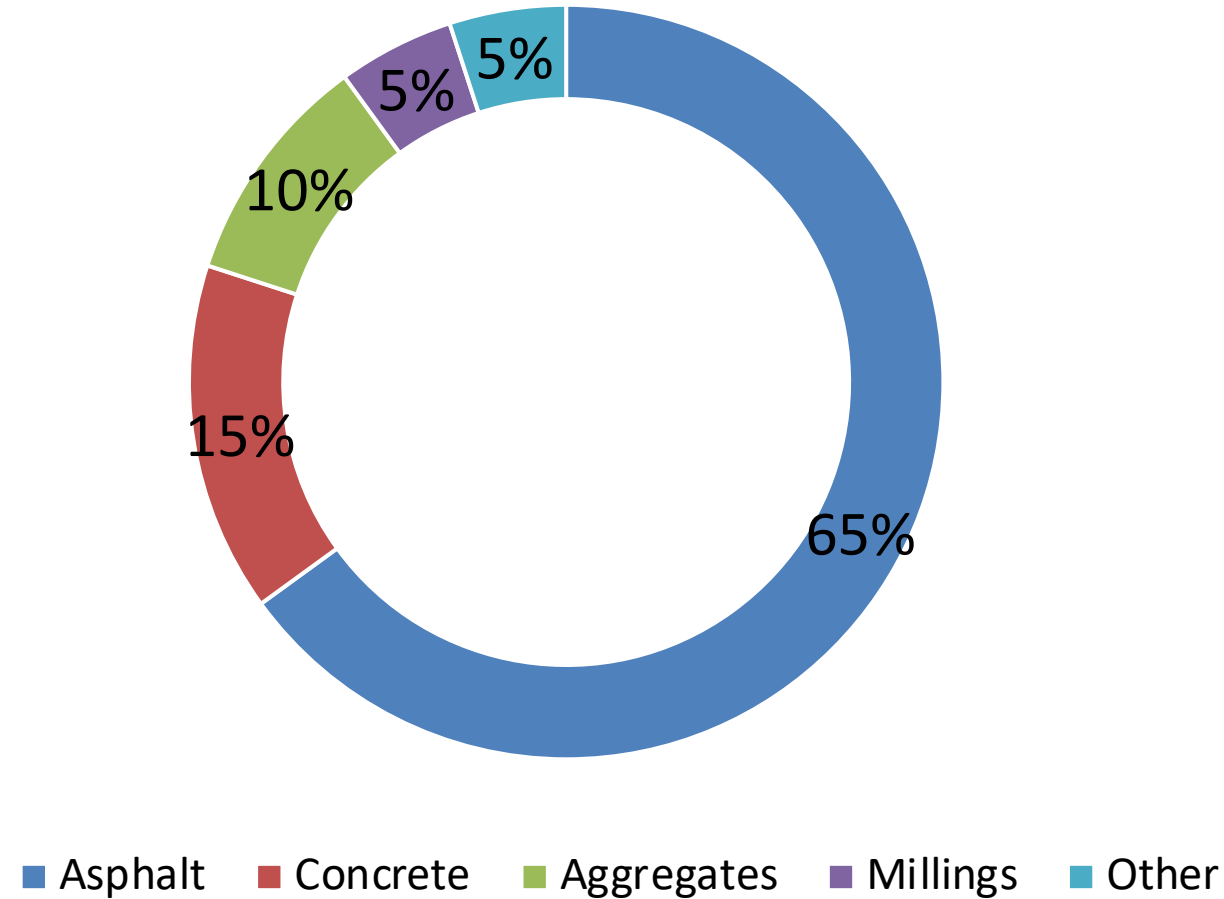


• Survey Findings 1st QTR 2019

Current Use

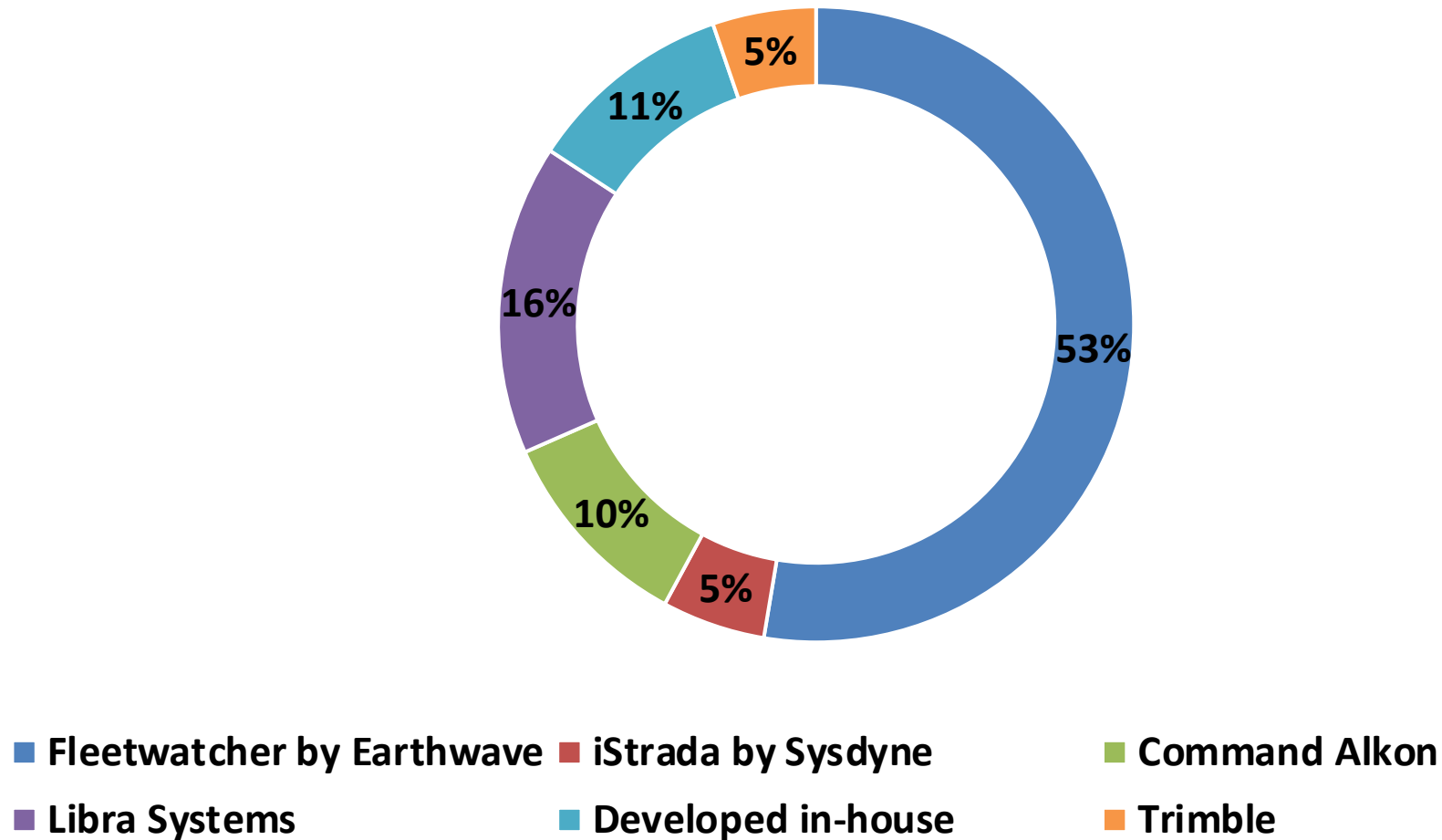


NCHRP Synthesis Report 545



• Survey Findings 1st QTR 2019

NCHRP Synthesis Report 545



• Survey Findings 1st QTR 2019

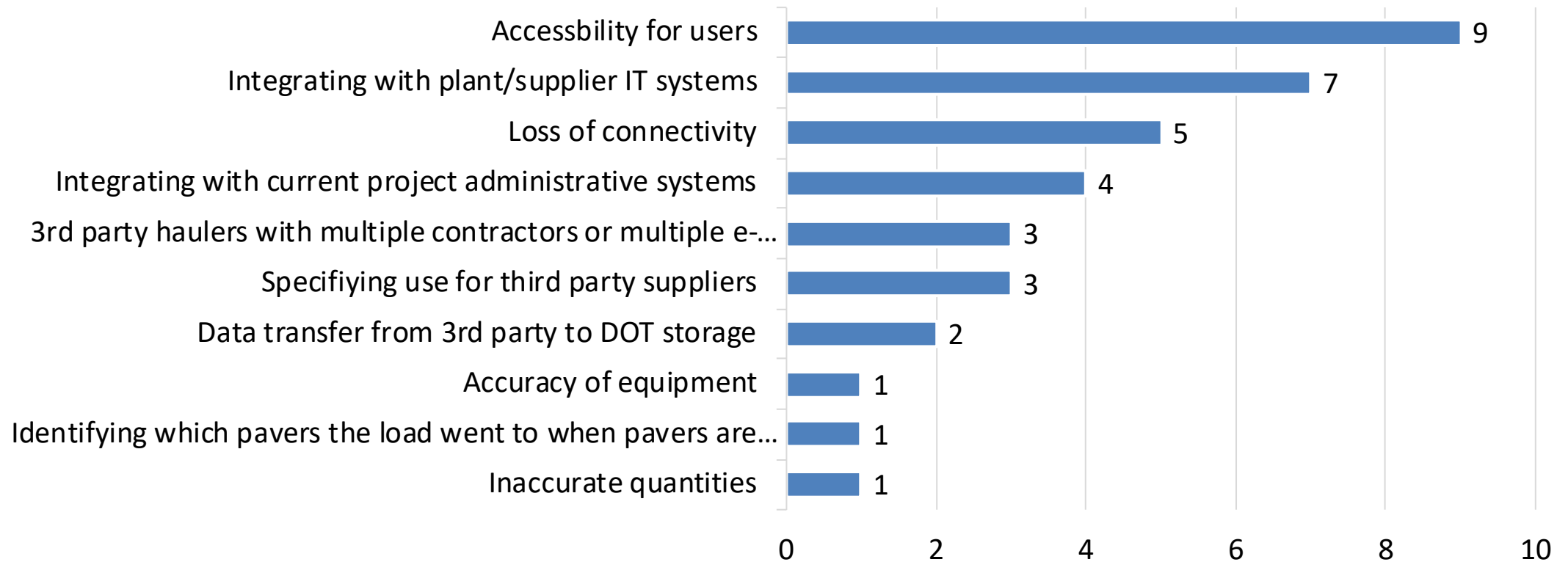
NCHRP Synthesis Report 545

What were the primary benefits of using e-ticketing technologies?		
Topic	Weighted Score (higher is better)	Rank
Reduced paper documentation	75	1
Safety benefits	71	2
Time savings in review and consolidation of material quantities	65	3
Readily available material quantity information	64	4
Real-time material tracking	58	5
Archived material placement location	40	6
Production tracking	27	7
Fleet management to assist with thermal uniformity	5	8

- Survey Findings 1st QTR 2019

NCHRP Synthesis Report 545

What are the greatest technical challenges?



• Survey Findings 1st QTR 2019

NCHRP Synthesis Report 545

Which of the following challenges do you believe is most significant to e-ticketing use?		
Topic	Weighted Score (higher is better)	Rank
Connectivity (cellular/Wi-Fi signals)	92	1
Haul company pushback	84	2
Plant/supplier pushback	76	3
Contractor pushback	64	4
Cost	58	5
Accessibility to DOT system/mobile devices to 3rd party e-Ticketing data	41	6
Technical Use	40	7
Data Security	39	8
Communication/collaboration challenges	34	9
DOT staff resistance to process change	32	10
DOT staff resistance to technology	22	11

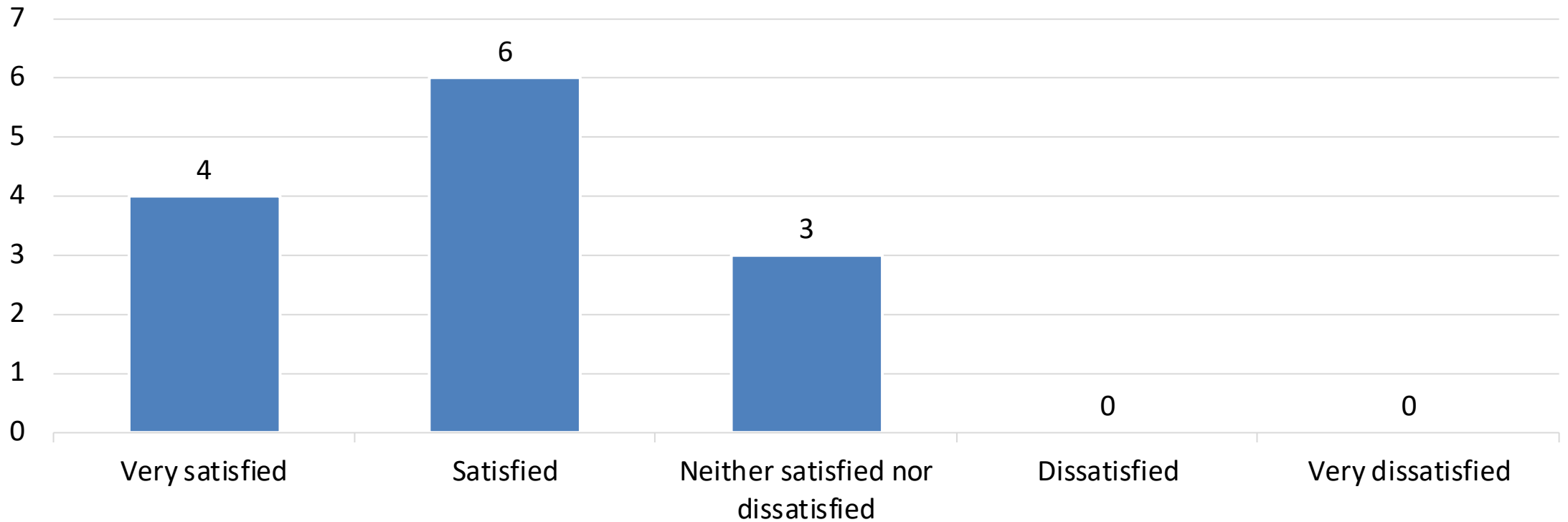
- Survey Findings 1st QTR 2019

NCHRP Synthesis Report 545

- Other Benefits
 - Assisted staff...automatic “ticket-taker”
- Challenges were noted as...
 - Technical Challenges
 - Plant integration
 - Connectivity
 - Process Barriers
 - Data ownership
 - Costs

NCHRP Synthesis Report 545

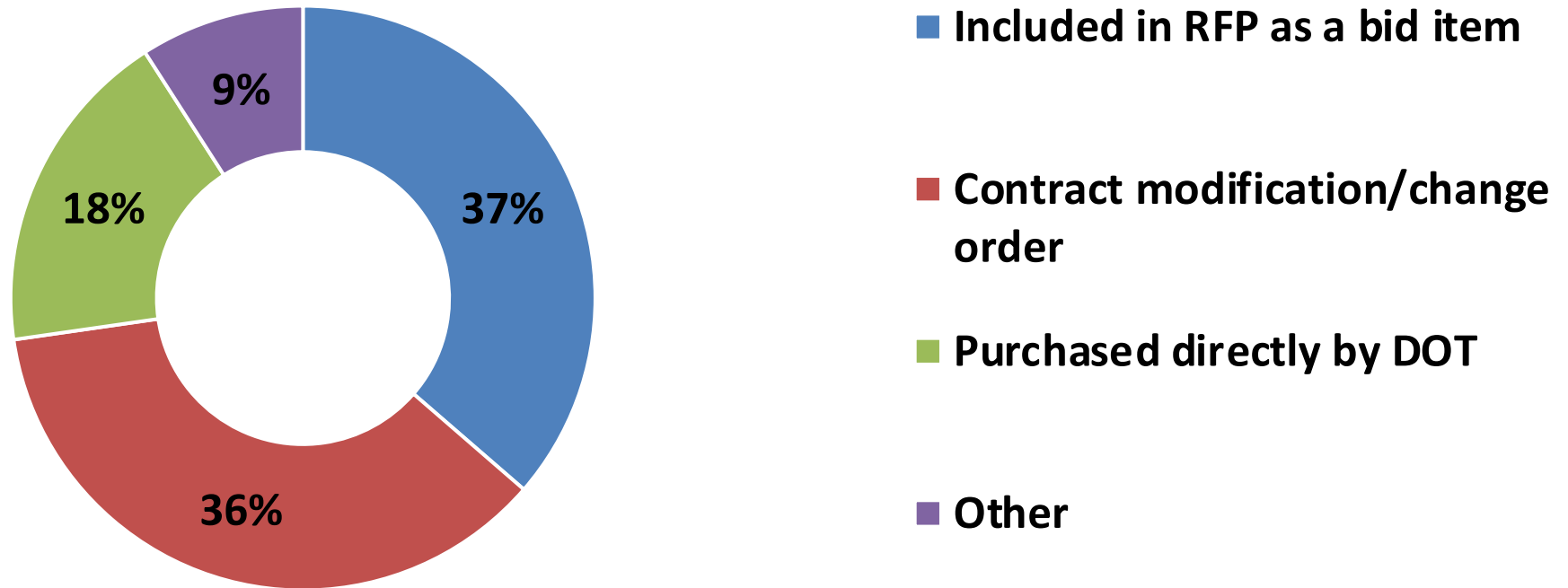
Considering costs and benefits, what was your level of satisfaction with using e-ticketing?



• Survey Findings 1st QTR 2019

NCHRP Synthesis Report 545

How did you procure e-ticketing?



• Survey Findings 1st QTR 2019

NCHRP Synthesis Report 545

- NCHRP Synthesis—Case Studies
 - Alabama Department of Transportation
 - Growing project demands...fewer people
 - Deployed iPads to staff
 - Focused on asphalt
 - E-ticket duplicated by paper in pilots
 - Weighmaster sealed/stamped tickets
 - Worry about staff using multiple platforms

NCHRP Synthesis Report 545

- NCHRP Synthesis—Case Studies
 - Alabama Department of Transportation

Year	Road Function Classification	Road Location	Work Type	Material	Procurement	Vendor	Cost (Unit or Total), Quantity
2018	Collector	Rural	Road Resurfacing	Asphalt	Change Order/Supplemental Agreement	Fleetwatcher	\$9,969, 12,000 tons
2018	Interstate	Rural	Road Resurfacing	Asphalt	Change Order/Supplemental Agreement	Fleetwatcher	\$9,969, 16,094 tons
2018	Collector	Rural	Road Resurfacing	Asphalt	Change Order/Supplemental Agreement	Fleetwatcher	\$2,000,* 18,000 tons
2018	Collector	Rural	Road Resurfacing	Asphalt	Change Order/Supplemental Agreement	Fleetwatcher	\$0.00,** 20,000 tons
* - Change order for devices, but no charge for pilot because contractor is already using the system. ** - No charge to ALDOT because contractor is already using the system.							

- Case Studies 2nd QTR 2019

NCHRP Synthesis Report 545

- NCHRP Synthesis—Case Studies
 - Florida Department of Transportation
 - A desire to go paperless
 - Industry pushback...tracking not a priority
 - Pilot not awarded...supplemental agreement
 - FleetWatcher, Spot-on Performance, MOBILEticket, Ticketless Asphalt
 - Hesitant to get rid of paper
 - Data transfer by CSV
- Case Studies 2nd QTR 2019

NCHRP Synthesis Report 545

- NCHRP Synthesis—Case Studies
 - Florida Department of Transportation

Year	Road Function Classification	Road Location	Work Type	Material	Procurement	Vendor	Cost (Unit or Total), Quantity
2019	Interstate	Rural	Bridge Replace/New	Concrete	Change Order/Supplemental Agreement	Command Alkon	\$33,650, 50 CY
2019	Interstate	Rural	Road Resurfacing	Asphalt	Change Order/Supplemental Agreement	Fleetwatcher	\$19,965, 48,808 tons

- Case Studies 2nd QTR 2019

NCHRP Synthesis Report 545

- NCHRP Synthesis—Case Studies
 - Iowa Department of Transportation
 - Goal: safety and verify material location and chain of custody...
 - Concrete industry interest
 - Data ownership concerns
 - Now, looking for a program and consistency
 - e-ticketing without tracking

NCHRP Synthesis Report 545

- NCHRP Synthesis—Case Studies
 - Iowa Department of Transportation

Year	Road Function Classification	Road Location	Work Type	Material	Procurement	Vendor	Cost (Unit or Total), Quantity
2015	Interstate/Other Arterials	Rural	Road Rehab	Asphalt	Change Order/Supplemental Agreement	Fleetwatcher	60,000 tons
2016	Interstate/Other Arterials	Rural	Major/ Expansion	Asphalt	Change Order/Supplemental Agreement	Fleetwatcher	120,000 tons
2018	Interstate/Other Arterials	Rural	Bridge Replace/New	Concrete	Change Order/Supplemental Agreement	iSTRADA	\$385/CY 933 CY
2018–2019	Interstate/Other Arterials	Urban	Bridge Replace/New	Concrete	Change Order/Supplemental Agreement	iSTRADA	820 CY
2018–2019	Interstate/Other Arterials	Urban	Major/ Expansion	Concrete	Concept	Command Alkon	\$450/CY 36,000 CY

- Case Studies 2nd QTR 2019

NCHRP Synthesis Report 545

- NCHRP Synthesis—Case Studies
 - Kentucky Transportation Cabinet
 - *Doing more with less...*
 - Combining technologies to supplement inspection
 - e-ticketing, Pave-IR, IC...GPR
 - Plant technology...cost effective upgrades
 - Rural plants
 - Industry interest
 - How do you scale up?

NCHRP Synthesis Report 545

- NCHRP Synthesis—Case Studies
 - Kentucky Transportation Cabinet

Year	Road Function Classification	Road Location	Work Type	Material	Procurement	Vendor	Cost (Unit or Total), Quantity
2018	Collector	Urban	Road Resurfacing	Asphalt	Bid Item	Fleetwatcher	\$2,500, 7,600 tons
2018	Local	Rural	Road Resurfacing	Asphalt	Bid Item	Fleetwatcher	\$5,000, 2,735 tons

- Case Studies 2nd QTR 2019

NCHRP Synthesis Report 545

- NCHRP Synthesis—Case Studies
 - Pennsylvania Department of Transportation
 - Desired remote data collection for safety
 - Compared vendors
 - 3rd party concerns and data security
 - Visual verification (magnetic signs)
 - Typically develop systems in-house
 - iPad based system coming

NCHRP Synthesis Report 545

- NCHRP Synthesis—
Case Studies
 - Pennsylvania
Department of
Transportation

- Case Studies 2nd QTR 2019

Year	Road Function Classification	Road Location	Work Type	Material	Procurement	Vendor	Cost (Unit or Total), Quantity
2017	Collector	Urban	Road Resurfacing	Asphalt Millings	Bid Item	Libra Zonar	\$2,725 Asphalt \$22,725 Millings
2017	Collector	Urban	Road Resurfacing	Asphalt Millings	Bid Item	Fleetwatcher	\$4,745 Asphalt \$4,745 Millings
2017	Collector	Urban	Road Resurfacing	Asphalt	Bid Item	Fleetwatcher	\$7,500
2017	Collector	Urban	Road Resurfacing	Asphalt	Bid Item	In-house	\$1,000
2018	Collector	Urban	Road Resurfacing	Asphalt	Bid Item	Libra Zonar	\$4,909
2018	Collector	Urban	Road Resurfacing	Asphalt	Bid Item	In-house Digital Forces	\$10,800
2018	Collector	Urban	Road Resurfacing	Asphalt	Bid Item	Fleetwatcher	\$2,655
2018	Collector	Urban	Road Resurfacing	Asphalt	Bid Item	In-house	\$2,000
2018	Collector	Urban	Road Resurfacing	Asphalt	Bid Item	Fleetwatcher	\$7,500
2019	Collector	Urban	Road Resurfacing	Asphalt	Bid Item	In-house Digital Forces	\$16,500
2019	Collector	Urban	Road Resurfacing	Asphalt	Bid Item	Fleetwatcher	\$2,800
2019	Interstate	Urban	Road Resurfacing	Asphalt	Bid Item	Fleetwatcher	\$2,601
2019	Collector	Urban	Road Resurfacing	Asphalt	Bid Item	Fleetwatcher	\$8,750

NCHRP Synthesis Report 545

- NCHRP Synthesis—Case Studies
 - Utah Department of Transportation
 - Difficulty procuring vendor supplied solutions
 - Who purchases the GPS units?
 - In-house GIS based system
 - iPad logs a latitude & longitude
 - Focused on the fundamentals without tracking

NCHRP Synthesis Report 545

- NCHRP Synthesis—Case Studies
 - Utah Department of Transportation

Year	Road Function Classification	Road Location	Work Type	Material	Procurement	Vendor	Cost (Unit or Total), Quantity
2019	Collector	Urban	Road Resurfacing	Asphalt	DOT purchased	UDOT Developed	No cost reported, 8,291 tons
2019	Collector	Urban	Road Resurfacing	Asphalt	DOT purchased	UDOT Developed	No cost reported, 4,887 tons
2019	Collector	Urban	Road Resurfacing	Asphalt	DOT purchased	UDOT Developed	No cost reported, 6,400 tons

- Case Studies 2nd QTR 2019

NCHRP Synthesis Report 545

Material Type	Procurement	States with Experience	Vendors Used	Cost Reported	Effective Practices
Asphalt	<ul style="list-style-type: none"> Bid Item Change Order Developed own system Purchased by STA 	AL, FL, IA, KY, MN, MO, ND, PA, UT, VA	<ul style="list-style-type: none"> Fleetwatcher In-House Trimble Libra Systems 	\$1.04/ton (KYTC) \$10,000 per project (PennDOT)	<ul style="list-style-type: none"> Early stakeholder communication Hands-on training Data storage and transfer plan
Concrete	<ul style="list-style-type: none"> Change Order 	FL, IA	<ul style="list-style-type: none"> iStrada Command Alkon 	None reported	<ul style="list-style-type: none"> Contractor-producer early buy-in Contractor-producer communication Thorough stakeholder training
Aggregate	<ul style="list-style-type: none"> Change Order 	VA	<ul style="list-style-type: none"> Fleetwatcher 	None reported	<ul style="list-style-type: none"> None reported
Millings	<ul style="list-style-type: none"> Bid Item 	PA	<ul style="list-style-type: none"> Fleetwatcher Libra Systems 	None reported	<ul style="list-style-type: none"> Early stakeholder communication Hands-on training Data storage and transfer plan
Earthwork	N/A	None	N/A	N/A	N/A

NCHRP Synthesis Report 545

- National Trends
 - A lot of DOT interest...
 - Many states piloting
 - States trying new materials and...
 - Looking for an enterprise solution
 - A lot of vendor competition
- Moving to systems without hauler tracking
 - Pros & Cons

Considerations for Instituting e-Ticketing

- You need buy-in
- Can you have partnership without knowing who your stakeholders are?
- Is your agency (& field staff) ready?
- Is you industry ready?
- What material(s) will you focus on?
- Will the solution provide material tracking?
 - Does this entail 3rd party haulers?
 - Is there liability in tracking (speed histories, etc.)?

Considerations for Instituting e-Ticketing

- How will data be transferred and who owns it?
- Is there a vendor that fits your needs?
 - Will staff need training for multiple technologies?
 - Will you consider an in-house developed solution?
- Will the data integrate into your contract admin system?
- Is there a bill of lading (electronic)?

Considerations for Instituting e-Ticketing

- How will you procure the solution?
- Is there a good place to start a pilot?
 - Willing industry, good connectivity, technology savvy staff
- Will contractors want to know how data is going to be used?
- Is this a single pilot or is there a scale up plan?

e-Ticketing and the Impacts of COVID-19

- Rapid implementation of many electronic aspects
 - Moves to contactless & paperless
 - e-Signatures rapidly adopted
 - Pilot e-Ticketing to statewide use
- Pressure on e-Ticketing (and other electronic tool) vendors
 - Rapid increase in number of vendors
- Some barriers seems to fade