# Current State of Mobile IT Device Use in Maintenance

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# Demand

- Reduced staffing & productivity demands
  - 4.1% more miles managed by 9.78% fewer employees (Taylor and Maloney, 2013)
- Increased documentation
- EDC-3 and EDC-4 Innovation (e-Construction)

# Mobile IT Devices

- Saves time and money
  - Field inspection and data collection
- Improves communication
  - On-demand email, text, Facetime/Skype
- Michigan DOT e-Construction
  - Saved $12M in added efficiencies
  - Saved 6M pieces of paper
  - Reduced average change order processing from 30 days to 3 days

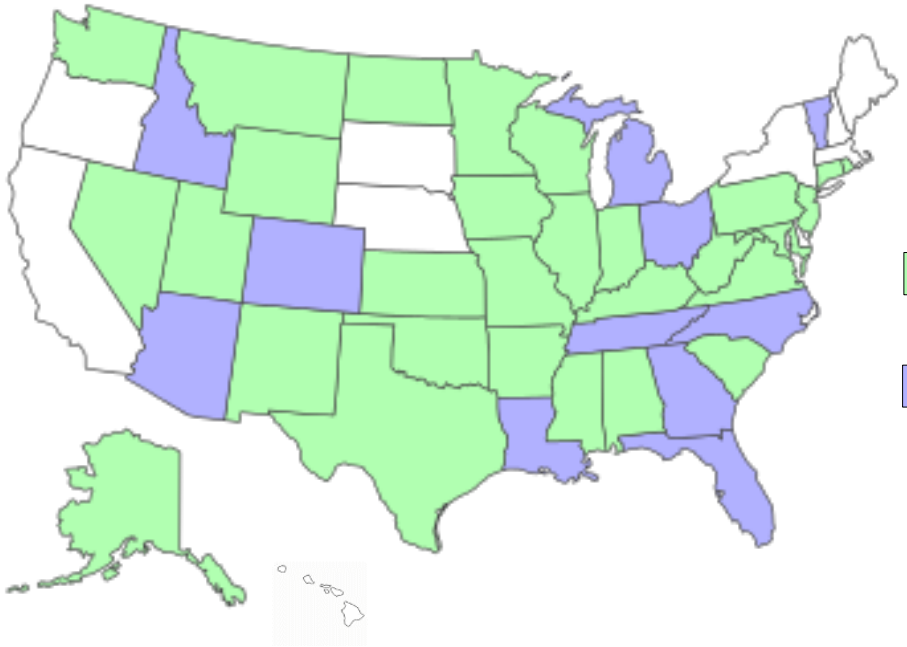
# Objective

- To identify the current state of practice in STAs for:
  1. Mobile IT devices and their applications
  2. Agency policies for mobile IT use
  3. Evaluation of mobile IT devices performance

# Procedure

- Electronic survey created in Survey Gizmo
- Sent to AASHTO Standing Committee on Finance and Administration Subcommittee on Information Systems
- Requested distribution to design, construction, IT, and maintenance

# Survey Response

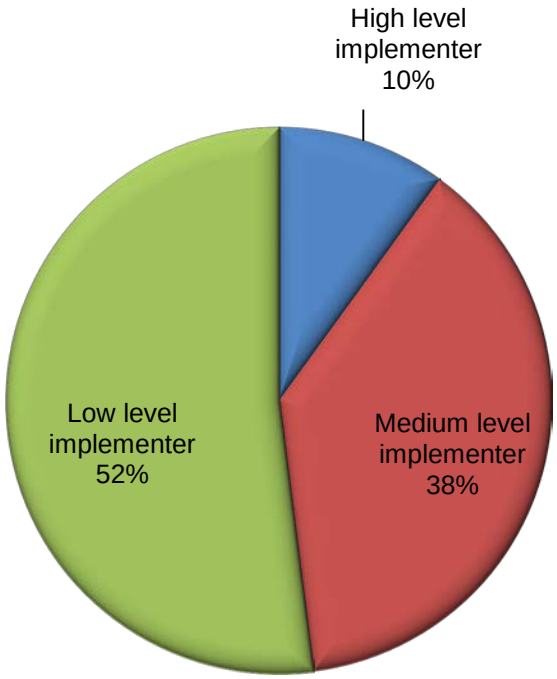


- states with 1 response

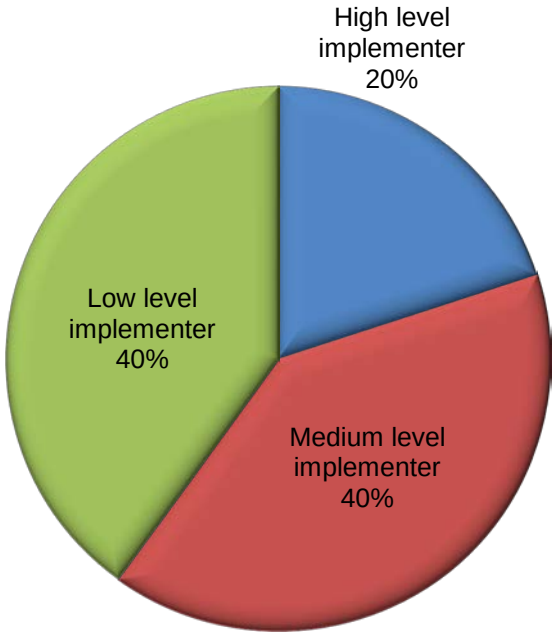
- states with multiple responses

100 total responses

# To what degree has your agency adopted/implemented mobile IT



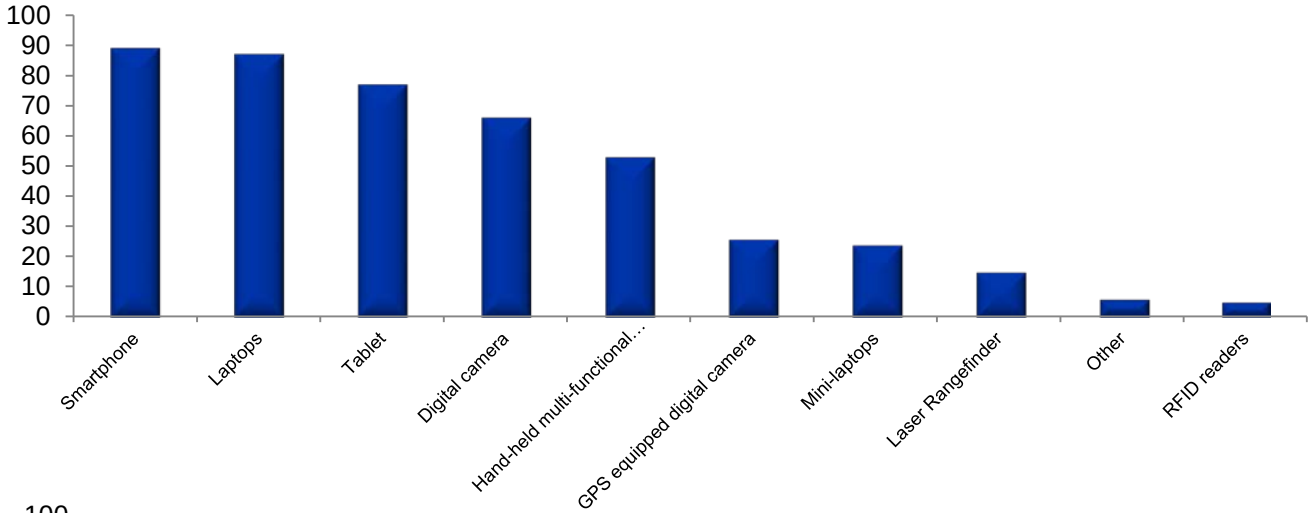

All respondents



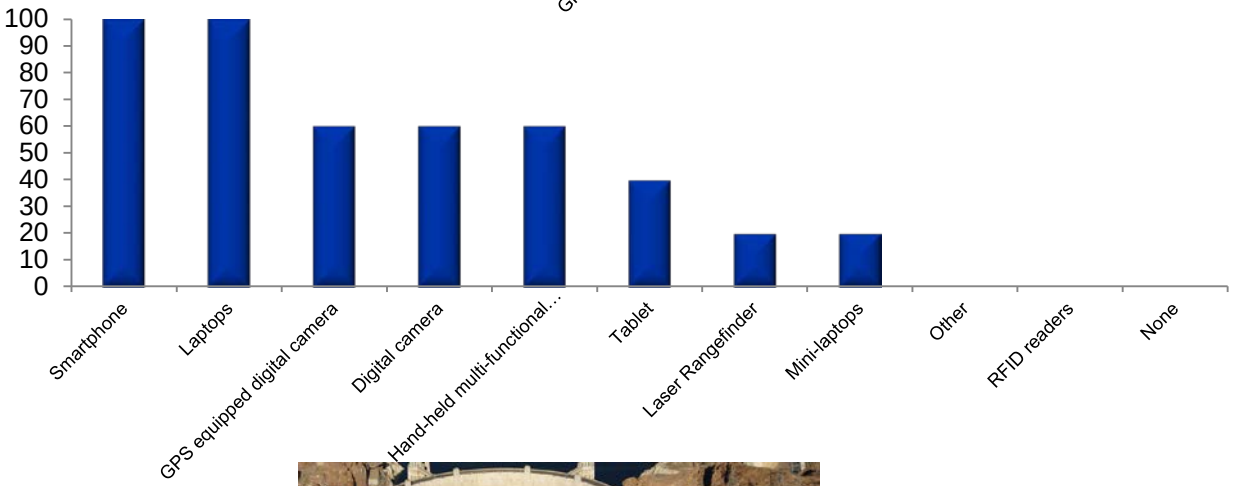

Maintenance respondents

## What mobile IT device (s) does your agency issue (not including personally-owned devices) for use in the field?

**All respondents**

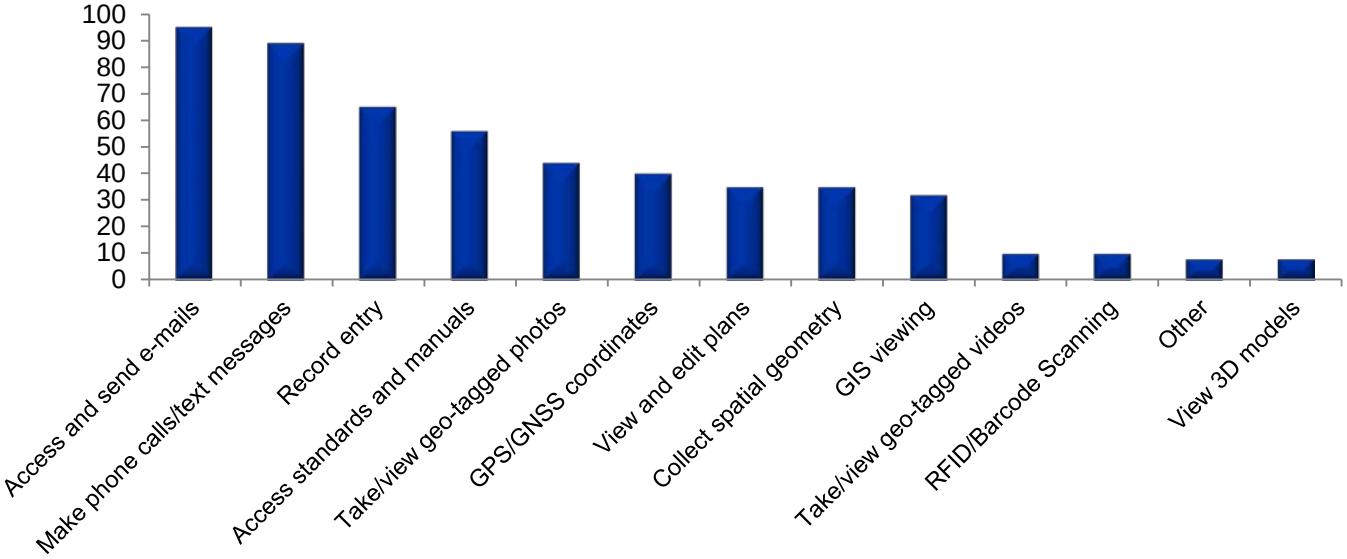



**Maintenance respondents**

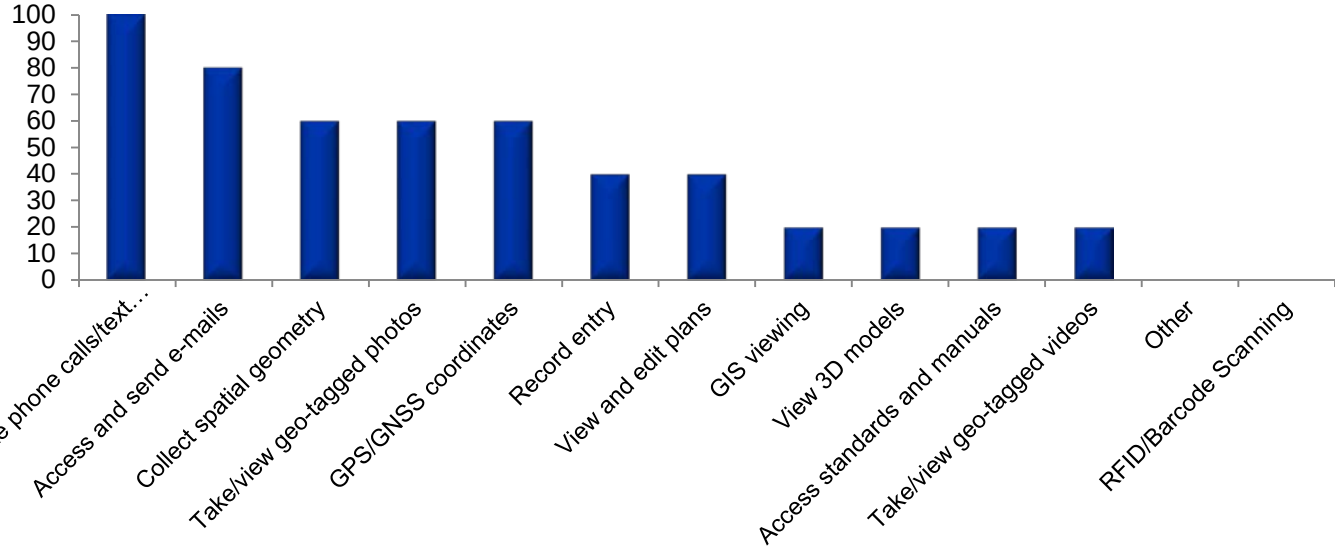


# What is (are) the main purpose(s) for your current use of mobile IT?

## All respondents

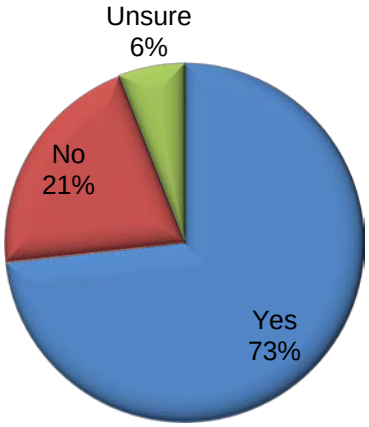



## Maintenance respondents

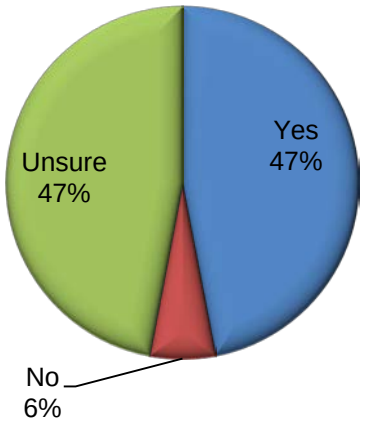


# Device Standardization

**Does your agency standardize mobile IT devices to be used across multiple business areas?**

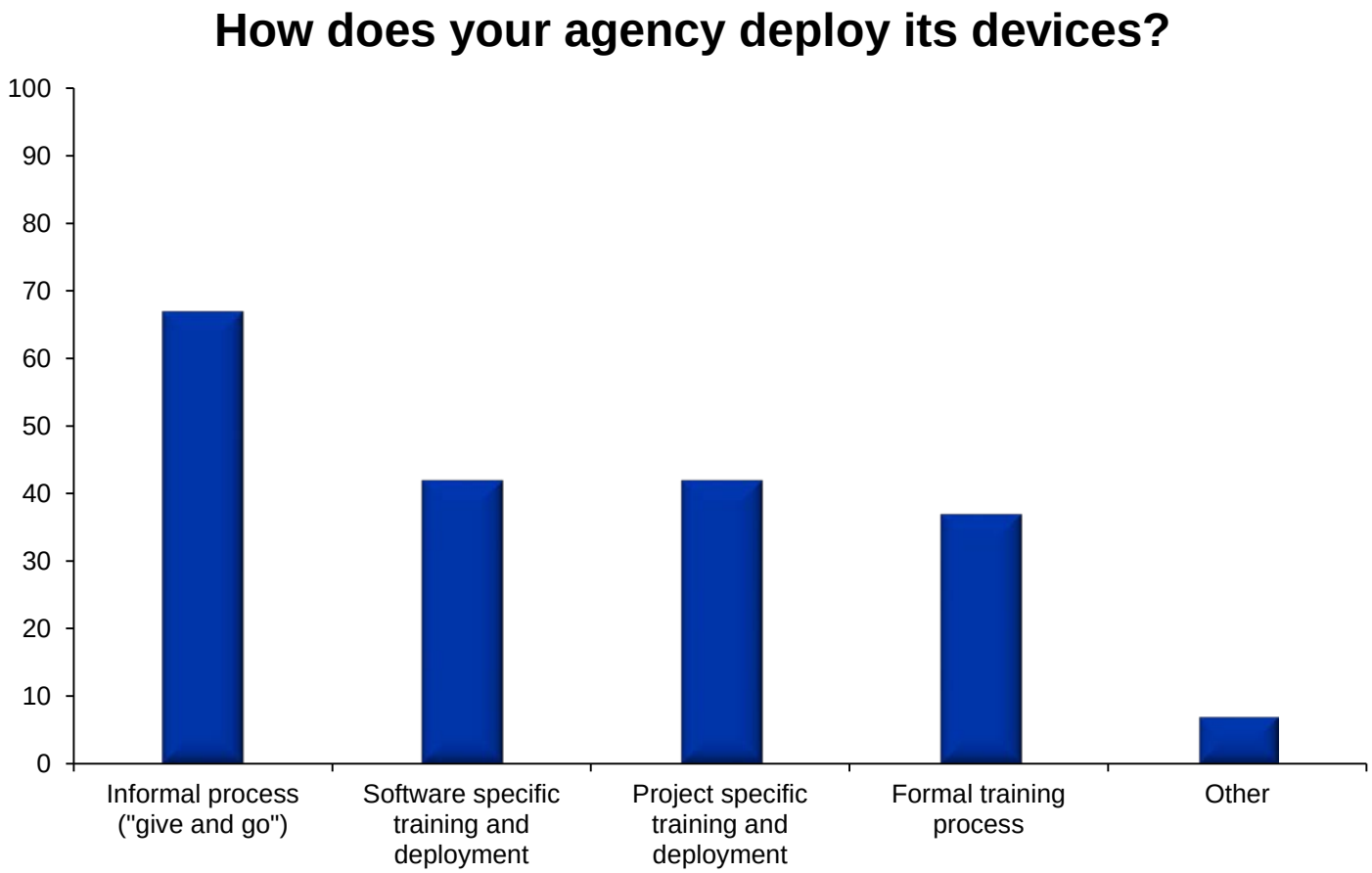



**According to IT respondents**



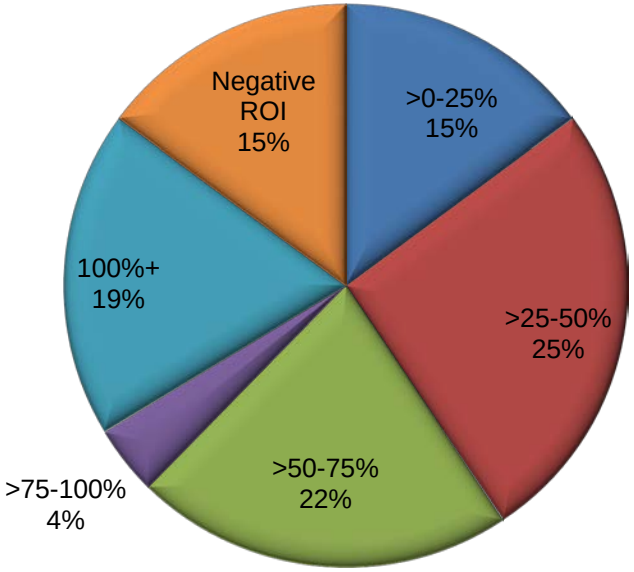

**According to End User Respondents**

# Device Deployment

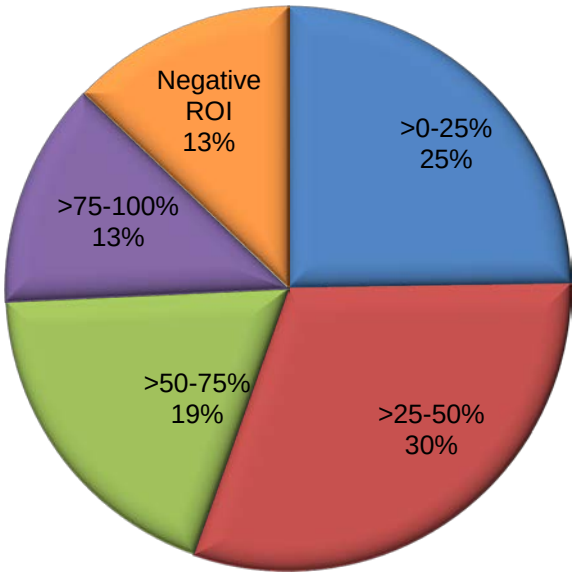


# Perceived Return on Investment

**IT Division: What do you believe is the overall return on investment (ROI) from your agency's mobile IT use?**




**End Users: What do you believe is the overall return on investment (ROI) from your agency's mobile IT use?**



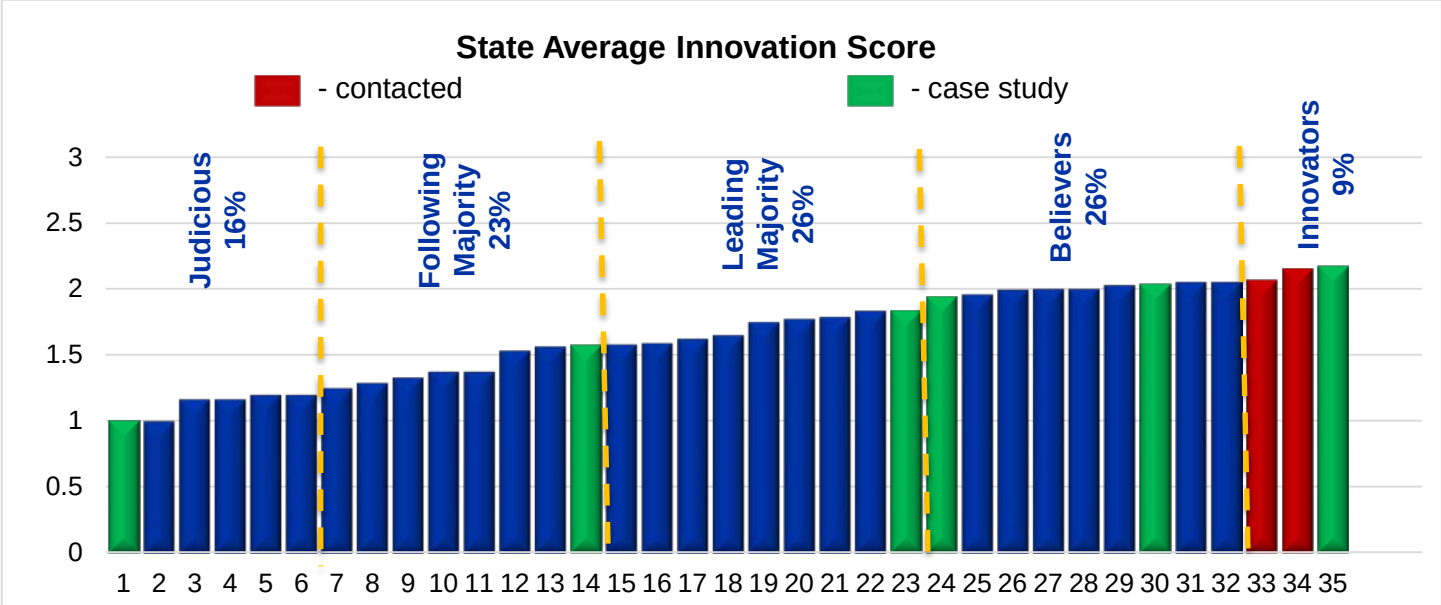
# Most Significant Challenges

| | IT Overall Rank | End User Overall Rank | Maintenance Overall Rank |
|---|---|---|---|
| Connectivity Issues (loss of cell signal) | 1 | 2 | 8 |
| Device maintenance and user support | 2 | 3 | 2 |
| Application maintenance and support | 3 | 6 | 5 |
| Cost effectiveness | 4 | 1 | 9 |
| Poor/ineffective applications | 5 | 4 | 4 |
| Interoperability Issues (software incompatibility) | 6 | 7 | 3 |
| Lack of security of collected data | 7 | 14 | 12 |
| Poor Durability/Lack of Ruggedness | 8 | 8 | 7 |
| Electronic signatures/approval | 9 | 13 | 15 |
| Quality of collected data | 10 | 11 | 14 |
| End-user resistance | 11 | 10 | 6 |
| Training requirements | 12 | 9 | 11 |
| Battery life | 13 | 12 | 10 |
| Deploying devices to employees | 14 | 5 | 1 |
| Other | 15 | 15 | 13 |

# Case Studies

# Case Studies

| Score | Mobile Devices | Mobile IT Uses |
|---|---|---|
| 1 (Low) | Laptops, mini-laptops, smartphones | Access standards and manuals, email, phone calls, text messages, etc. |
| 2 (Medium) | Tablets, digital cameras | View/edit plans, take photos, view 3D models, and record entry |
| 3 (High) | Handheld multi-functional data collectors, GPS cameras, RFID readers, and laser range finders | Take/view geotag photos & videos, RFID scanning, GPS/GNSS coordinates, GIS viewing, and collecting spatial geometry |



# North Carolina

**Innovator**

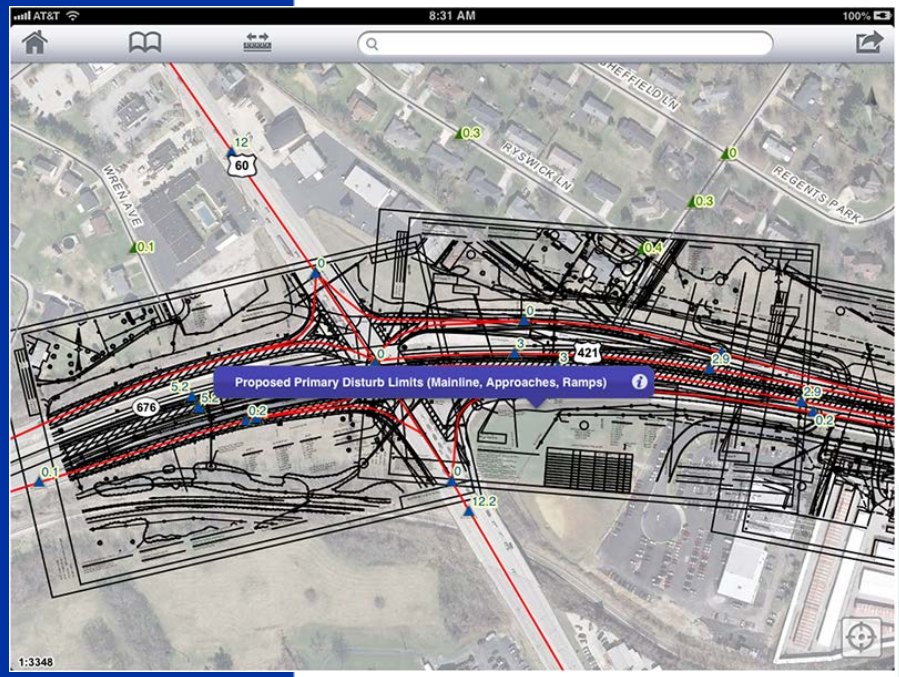
| | |
|---|---|
| **Device Selection** | Standard spec used for bid; have BYOD with reimbursement |
| **Maintenance Mobile IT Uses** | Automated maintenance management system, tracking operations, equipment, and personnel. Use GPS tablets for geolocating assets with automatic syncing to databases |
| **Application Development** | Develops or adapts apps with either consultant or in-house expertise |
| **Data Sharing and Storage** | Using data management group for consistency |
| **Challenges** | Supporting multiple devices on multiple OSs |
| **Benefits** | Time savings |
| **Unique Product(s)** | • Highway Construction Materials System (HiCAMS)<br>• Xamarin and AgileAssets for app development |

# Ohio and Kentucky

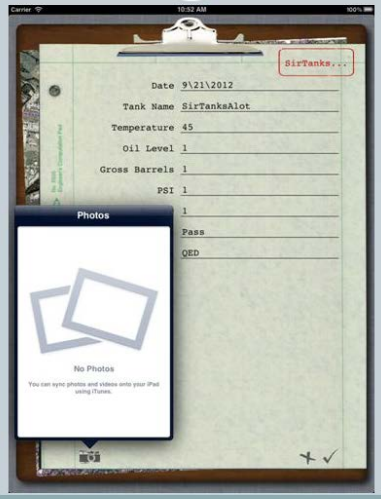
**Believer**

| | |
|---|---|
| **Device Selection** | Business units request purchase to IT for final decision |
| **Maintenance Mobile IT Uses** | Uses videotelephony and talk-to-text features. Sign inventory, pavement condition evaluations, and maintenance rating program. |
| **Application Development** | Mostly in-house customization of commercially available apps |
| **Data Sharing and Storage** | Enterprise Data Branch monitors systems and has security but no documented standards |
| **Challenges** | Rural connectivity, resistance to technology |
| **Benefits** | Time savings, connectedness, reducing erroneous and redundant data |
| **Unique Product(s)** | • AASHTOWare/Trns.port<br>• Carrymap/Esri |

# CarryMap/Esri




## Pavement Evaluation iOS Application



# Vermont

## Leading Majority

| | |
|---|---|
| **Device Selection** | Used some Apple, moving to MS with IT support. |
| **Maintenance Mobile IT Uses** | iPhones as hotspots for laptops. Use ArcGIS for snow/ice condition reports |
| **Application Development** | Primarily off the shelf |
| **Data Sharing and Storage** | Storage managed through VPN, moving to cloud-based solution |
| **Challenges** | Rural connectivity, relying on users to update devices and apps |
| **Benefits** | No longer using landlines, communication in emergencies |
| **Unique Product(s)** | • XenServer by Citrix for file sharing |

# Idaho

## Following Majority

| | |
|---|---|
| **Device Selection** | No process in place |
| **Maintenance Mobile IT Uses** | Conference calls for reacting to emergencies, 511 mobility index |
| **Application Development** | Using commercially available applications |
| **Data Sharing and Storage** | Use remote wiping for lost or stolen devices, Androids require antimalware |
| **Challenges** | Standardization is difficult with various devices and OSs. A lot of BYOD with legal issues with personal data |
| **Benefits** | Real-time information transfer, quicker responses to emergencies |
| **Unique Product(s)** | • ProjectWise/Trns.port<br>• Esri |

# Wyoming

Judicious

| | |
|---|---|
| **Device Selection** | DOT does not supply smartphones but does use laptops. |
| **Maintenance Mobile IT Uses** | None reported. Just a construction management system. |
| **Application Development** | Only use one developed for a different DOT with small modifications |
| **Data Sharing and Storage** | Some issues with synching data. Store data on web-based applications. |
| **Challenges** | Rural connectivity, devices getting rotated out |
| **Benefits** | Time savings, project information available to all |
| **Unique Product(s)** | • Exevision for daily records, change orders, and construction management |

# Field Maintenance Uses

- Geospatially identified inventory
- Geospatially collected and reported asset conditions

# Conclusions

- Many STAs are using mobile IT devices but there's a large gap between high level and low level adopters
- Few transportation specific applications exist
- STAs need more guidance
- Solutions require collaboration across the STA

# Future Needs

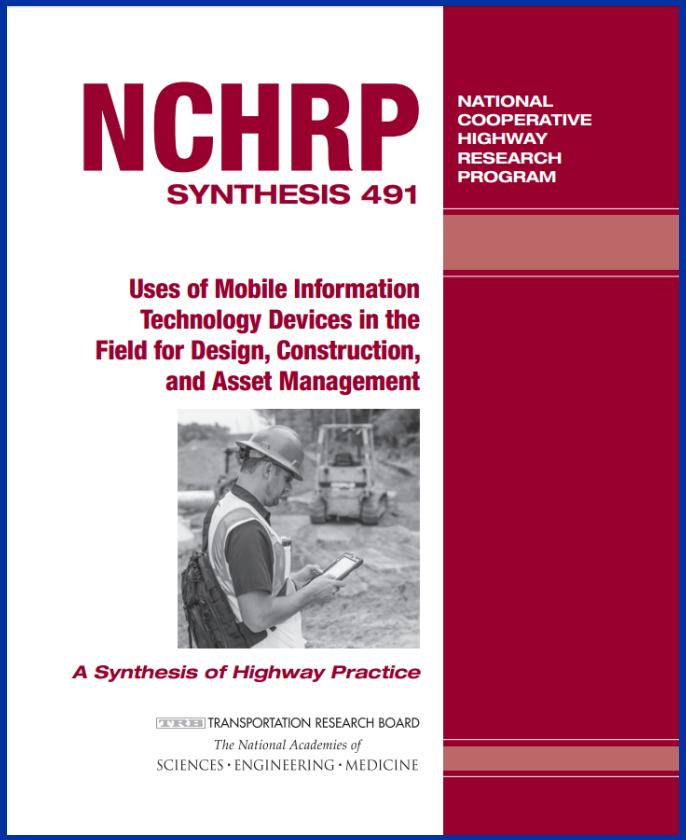
- Formal cost/benefit methodology
- Guidebook that includes implementation of mobile IT devices in current practices

# Questions?

The authors wish to thank NCHRP and the panel members of Synthesis Report 491 for supporting this research effort.

Any products/services mentioned are for information purposes only and are not intended to be recommendations or endorsements by the authors or the University of Kentucky.

# For more info…




http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_syn_491.pdf

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