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

100 total responses

- states with 1 response
- states with multiple responses
To what degree has your agency adopted/implemented mobile IT

- **All respondents**
  - Low level implementer: 52%
  - Medium level implementer: 38%
  - High level implementer: 10%

- **Maintenance respondents**
  - Low level implementer: 40%
  - Medium level implementer: 40%
  - High level implementer: 20%
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

- Access and send e-mails
- Access standards and manuals
- Make phone calls/text...
- Take/view geo-tagged photos
- Collect spatial geometry
- GPS/GNSS coordinates
- View and edit plans
- View 3D models
- View/3D Scanning
- Other

Maintenance respondents

- Access and send e-mails
- Collect spatial geometry
- Make phone calls/text...
- Take/view geo-tagged photos
- View and edit plans
- GIS viewing
- View 3D models
- Other
- RFID/Barcode Scanning
Device Standardization

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

According to IT respondents:
- Yes: 73%
- No: 21%
- Unsure: 6%

According to End User Respondents:
- Yes: 47%
- No: 6%
- Unsure: 47%
Device Deployment

How does your agency deploy its devices?

- Informal process ("give and go")
- Software specific training and deployment
- Project specific training and deployment
- Formal training process
- Other
Perceived Return on Investment

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

- Negative ROI: 15%
- 0-25%: 15%
- 25-50%: 25%
- 50-75%: 22%
- 75-100%: 4%
- 100%+: 19%
- >75-100%: 25%
- >25-50%: 25%
- >50-75%: 13%
- >100%: 13%

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

- Negative ROI: 13%
- 0-25%: 25%
- 25-50%: 13%
- 50-75%: 30%
- 75-100%: 19%
- 100%+: 30%
- >50-75%: 19%
- >25-50%: 25%
- >100%: 13%
- >75-100%: 25%
# Most Significant Challenges

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

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

**State Average Innovation Score**

- **Judicious** 16%
- **Following Majority** 23%
- **Leading Majority** 26%
- **Believers** 26%
- **Innovators** 9%
## North Carolina Innovator

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

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

Pavement Evaluation iOS Application
## Vermont

### Leading Majority

<table>
<thead>
<tr>
<th>Device Selection</th>
<th>Used some Apple, moving to MS with IT support.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance Mobile IT Uses</td>
<td>iPhones as hotspots for laptops. Use ArcGIS for snow/ice condition reports</td>
</tr>
<tr>
<td>Application Development</td>
<td>Primarily off the shelf</td>
</tr>
<tr>
<td>Data Sharing and Storage</td>
<td>Storage managed through VPN, moving to cloud-based solution</td>
</tr>
<tr>
<td>Challenges</td>
<td>Rural connectivity, relying on users to update devices and apps</td>
</tr>
<tr>
<td>Benefits</td>
<td>No longer using landlines, communication in emergencies</td>
</tr>
<tr>
<td>Unique Product(s)</td>
<td>• XenServer by Citrix for file sharing</td>
</tr>
<tr>
<td>Device Selection</td>
<td>No process in place</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>Maintenance</td>
<td>Conference calls for reacting to emergencies, 511 mobility index</td>
</tr>
<tr>
<td>Mobile IT Uses</td>
<td>Using commercially available applications</td>
</tr>
<tr>
<td>Application Development</td>
<td>Use remote wiping for lost or stolen devices, Androids require antimalware</td>
</tr>
<tr>
<td>Data Sharing and Storage</td>
<td>Standardization is difficult with various devices and OSs. A lot of BYOD with legal issues with personal data</td>
</tr>
<tr>
<td>Challenges</td>
<td>Real-time information transfer, quicker responses to emergencies</td>
</tr>
</tbody>
</table>
| Unique Product(s)                | • ProjectWise/Trns.port  
<pre><code>                             | • Esri |
</code></pre>
<table>
<thead>
<tr>
<th>Device Selection</th>
<th>DOT does not supply smartphones but does use laptops.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance Mobile IT Uses</td>
<td>None reported. Just a construction management system.</td>
</tr>
<tr>
<td>Application Development</td>
<td>Only use one developed for a different DOT with small modifications</td>
</tr>
<tr>
<td>Data Sharing and Storage</td>
<td>Some issues with synching data. Store data on web-based applications.</td>
</tr>
<tr>
<td>Challenges</td>
<td>Rural connectivity, devices getting rotated out</td>
</tr>
<tr>
<td>Benefits</td>
<td>Time savings, project information available to all</td>
</tr>
<tr>
<td>Unique Product(s)</td>
<td>• Exevision for daily records, change orders, and construction management</td>
</tr>
</tbody>
</table>
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?

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