

## 8. STUDY FINDINGS - EMERGENCY DETECTION AND RESPONSE SYSTEMS

The Group D ITI (Emergency Detection and Response Systems) include the following:

1. **Instrumented Truck Escape Ramps** are escape ramps that have an electronic monitoring system designed to automatically detect and notify authorities of intrusions. The system also features shoulder-mounted VMS upstream of the ramp to provide intrusion warnings and other information. Thus far, this system has been deployed only on a local basis.

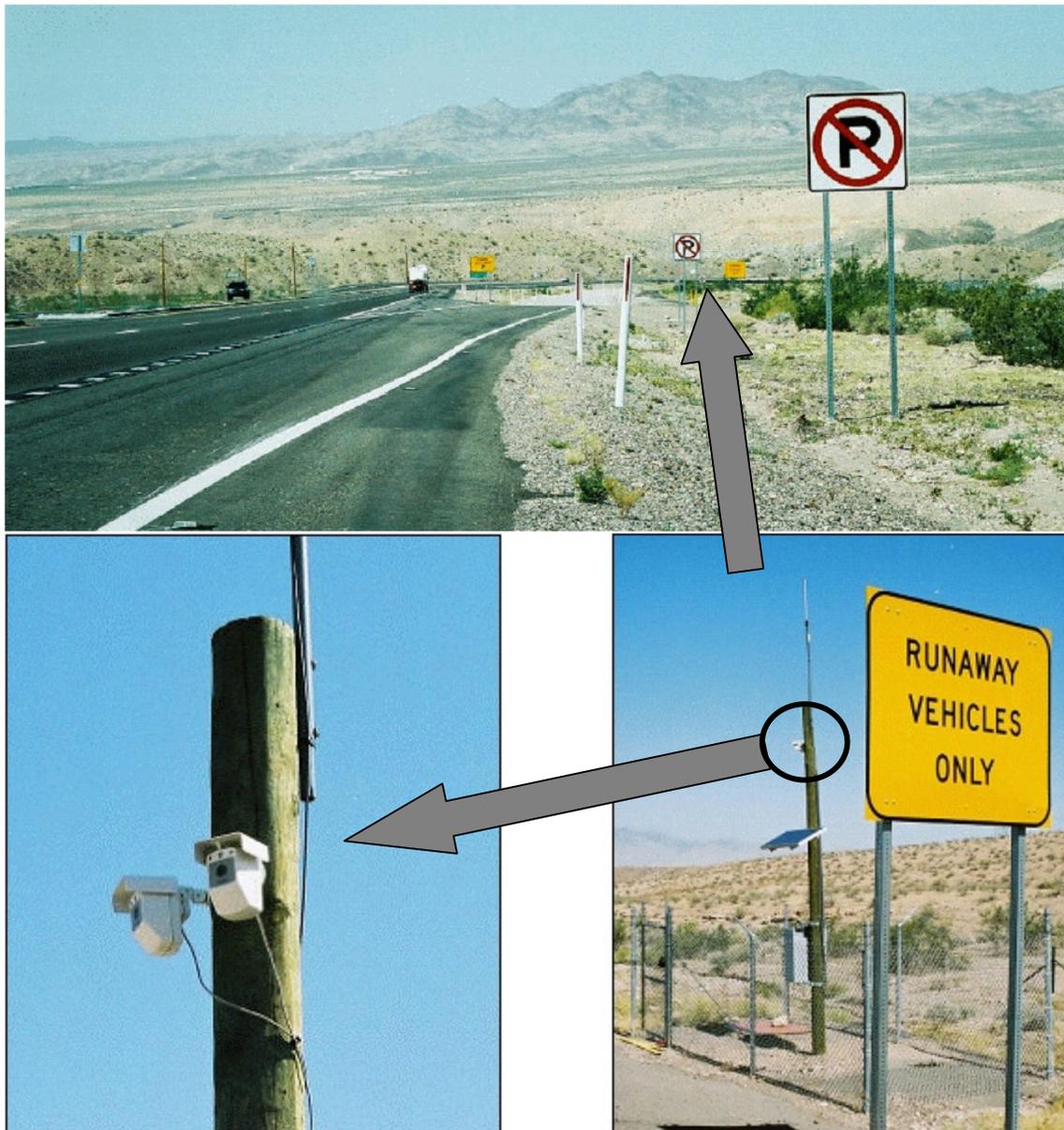


Figure 16: Truck Escape Ramp Instrumentation

2. **Emergency Roadside Callboxes** are cellular-based telephones for emergency use installed at intervals along roadways. Thus far, callboxes have been installed only on a local basis (I-19 south of Tucson and US 93)



**Figure 17: Callbox on US 93**

- 3. Motorist Assist Patrols (MAPs)** involve an operator equipped with a vehicle and emergency response equipment who monitors a section of roadway during nighttime hours, and responds to any motorists experiencing trouble or to hazardous conditions that could cause traffic problems. MAPs play a strong supportive role to the DPS highway patrol's duties. Thus far, rural MAPs have been utilized only on a project-by-project basis by ADOT, in the Kingman District.



**Figure 18: Motorist Service Patrol Vehicle**

Table 27 summarizes typical installation components and system functions/outputs associated with ADOT's emergency detection and response systems.

**Table 27: Group D ITI –Components and Functions**

ITI	Typical Installation Components	System Functions/ Outputs
D1. Instrumented Truck Escape Ramps	<p>An instrumented truck escape ramp as implemented in the Kingman District includes three subsystems:</p> <ol style="list-style-type: none"> <li>1. Truck escape ramp monitoring (magnetic in-pavement detector for triggering cameras, two pole-mounted cameras, remote processing unit, power supply) – senses ramp intrusion, captures camera image, transmits image via email to Phoenix Traffic Operations Center (TOC), Kingman District, Department of Public Safety (DPS), and local authorities.</li> <li>2. Ramp intrusion notification to authorities (software running on computers at the Phoenix TOC and the Kingman District) – receives ramp intrusion image. Authorities can then coordinate emergency response.</li> <li>3. Ramp intrusion notification to the public (using shoulder-mounted VMS, with components as previously discussed) – warns oncoming traffic upstream of ramps about ramp intrusion.</li> </ol>	
D2. Emergency Roadside Callboxes	<p>Callboxes include a telephone in a bright yellow enclosure mounted on a pole on a concrete pad. The sites in Arizona all have a keyboard for teletypewriter (TTY) usage of the phone, cellular communications and a solar powered light that is activated when the enclosure’s door is opened. The US 93 callboxes include booster antennas.</p>	<p>Calls from both systems are set up to ring directly into DPS Operational Communications (OpComm) Centers as 911 calls.</p>
D3. Motorist Assist Patrols (MAPs)	<p>A successful MAP depends on 1) a skilled operator; 2) a vehicle; 3) emergency equipment. Desirable operator skills include first aid training, Cardio-Pulmonary Resuscitation (CPR), radio communication skills, traffic control training, basic mechanical skills, people skills, basic computer literacy, and fluency in English and Spanish. Vehicle needs may vary from place to place; the Kingman District uses a two-wheel drive pickup truck. A few of the key emergency equipment items include front push bumper, spotlights, digital cell phone, camera, flashlights, jumper cables, fuel, tools, tow rope, flares, ABC- and D-class fire extinguishers, three-ton jack, first aid kit / accessories, citizens band radio, ADOT radio, multichannel mobile scanner, traffic cones, and drinking and coolant water.</p>	<p>A MAP operator performs a wide variety of tasks, including direct motorist assistance, removal of roadway debris, replacement of displaced/fallen barricades, and animal control.</p> <p>The Kingman MAP runs every weekday from 10:00 PM to 6:00 AM, covering a time period during which DPS patrols are rare. The official coverage area extends about 25 miles. Depending on events the operator becomes aware of, the patrol on any given night may extend to about 60 miles in length.</p>

Table 28 summarizes the quantity of deployed ITI, deployment plans and maintenance arrangements associated with ADOT’s emergency detection and response systems.

**Table 28: Group D ITI – Quantity Deployed/Planned and Maintenance Arrangements**

<b>ITI</b>	<b>Quantity Deployed/Planned</b>	<b>Maintenance Arrangements</b>
D1. Instrumented Truck Escape Ramps	The Kingman District has instrumented two truck escape ramps. No known deployment plans.	ADOT has contracted with a consultant to provide maintenance of the field equipment located at the ramps. The Western Regional Traffic Engineering Office (RTEO) provides demand maintenance of the shoulder-mounted Variable Message Sign (VMS).
D2. Emergency Roadside Callboxes	Two callbox systems: 1) The US 93 system has four callboxes over 40 miles; and 2) the I-19 system has 12 callboxes over 14 miles. No known deployment plans.	The Kingman District has a maintenance agreement with the equipment vendor for the US 93 system. The Baja RTEO provides maintenance of the I-19 system, with vendor support as required.
D3. Motorist Assist Patrols (MAPs)	The Kingman District has operated one patrol via consecutive construction contracts more or less continuously for four and a half years. No known deployment plans.	The construction contractor is responsible for maintenance of the MAP vehicle. The MAP operator voluntarily contributes to minor MAP vehicle upkeep such as carwashes.

See Appendix L for maps of deployed ITI in Group D.

Table 29 summarizes planned system enhancements and integration and standardization attributes or issues associated with ADOT’s emergency detection and response systems.

**Table 29: Group D ITI – Enhancements, Integration and Standardization**

<b>ITI</b>	<b>Planned System Enhancements/Integration/Standardization</b>
D1. Instrumented Truck Escape Ramps	Communications allow remote monitoring of the instrumented truck escape ramp system by operators at the Phoenix Traffic Operations Center (TOC), where the main system server resides. This is because the TOC has 24-hour operations and ramp intrusions can happen at any time.
D2. Emergency Roadside Callboxes	Both emergency roadside callbox systems are integrated in the sense that calls from the boxes are answered as 911 calls at Department of Public Safety (DPS) Operational Communications (OpComm) centers. Another type of integration is that the I-19 system features a central computer server and software for system maintenance; the callboxes are programmed to call in and self-report on diagnostics and other system data.
D3. Motorist Assist Patrols (MAPs)	Because the US 93 MAP vehicle is not state-owned, it has not been possible to install a DPS radio in the vehicle. However, the MAP operator uses a scanner to listen to DPS communications and can easily contact DPS within coverage areas via a cellular telephone call to the Phoenix TOC. In general, the MAP operator has succeeded at dovetailing MAP duties and emphasis with DPS needs. Further, the operator’s familiarity with truck drivers that frequent the area and ready use of Citizen’s Band Radio to communicate with them is an invaluable asset and a boost to the patrol’s success.

Table 30 summarizes stakeholder awareness and usage of ADOT’s emergency detection and response systems.

**Table 30: Group D ITI – Stakeholder Awareness and Usage**

ITI	Awareness	Usage
D1. Instrumented Truck Escape Ramps	<p>Some ADOT staff are familiar with shoulder-mounted Variable Message Signs (VMS). The Kingman District’s use of the system is increasing ADOT’s level of familiarity.</p> <p>24% of DPS survey respondents reported being aware of ADOT’s instrumented truck escape ramps. The figure was 59% for Commercial Vehicle Operators (CVO).</p>	<ul style="list-style-type: none"> <li>- The instrumented truck escape ramps are operational 24-hours a day; the Phoenix Traffic Operations Center (TOC) provides 24-hour a day system monitoring.</li> <li>- Through September 2004, one ramp had been used 31 times and the other had been used 25 times.</li> <li>- 7% of CVO survey respondents reported having used ADOT’s instrumented truck escape ramps more than once or once.</li> </ul>
D2. Emergency Roadside Callboxes	<p>ADOT staff is generally familiar with emergency roadside callboxes.</p> <p>59% of DPS survey respondents reported being aware of ADOT’s emergency roadside callboxes. The figures were 59% for public from rural Arizona ZIP codes, and 58% for public from urban Arizona ZIP codes.</p>	<ul style="list-style-type: none"> <li>- Flagstaff Department of Public Safety (DPS) Operational Communications (OpComm) center received about 1130 calls from US 93 callboxes between July 2003 and June 2004, or 282 calls per box (four boxes). About 18% of received calls involved actual requests for emergency services.</li> <li>- The Tucson DPS OpComm center received 1314 calls from I-19 callboxes between July 2003 and June 2004, or 110 calls per box (12 boxes).</li> <li>- 9% of public survey respondents from rural Arizona ZIP codes reported having used ADOT’s emergency roadside callboxes more than once or once. The figure was 5% for public from urban Arizona ZIP codes.</li> </ul>
D3. Motorist Assist Patrols (MAPs)	<p>ADOT staff is generally familiar with motorist assist patrols.</p> <p>9% of DPS survey respondents reported being aware of ADOT’s motorist assist patrol. The figures were 23% for public from rural Arizona ZIP codes, and 22% for public from urban Arizona ZIP codes.</p>	<ul style="list-style-type: none"> <li>- The US 93 MAP operator has logged 522 “assists” over about four and a half years, or about 124 assists per year. Assists include direct aid to motorists in trouble as well as removal of roadway obstacles and other activities.</li> <li>- 5% of public survey respondents from rural Arizona ZIP codes reported having been aided by ADOT’s motorist assist patrol more than once or once. The figure was 3% for public from urban Arizona ZIP codes.</li> </ul>

Table 31 summarizes the costs and perceived and reported benefits associated with ADOT’s emergency detection and response systems.

**Table 31: Group D ITI – Costs and Benefits**

ITI	Costs	Perceived and Reported Benefits
D1. Instrumented Truck Escape Ramps	The total system cost, including the site survey, installation, and equipment and materials, was \$227,350.	<ul style="list-style-type: none"> <li>-ADOT and the Department of Public Safety (DPS) can remotely assess and more effectively respond to ramp intrusions. ADOT/DPS personnel involved in incident management and ramp repair are safer due to public notification of intrusion.</li> <li>- Faster ramp repairs and lower incidence of truck brake failures due to speed warnings benefits everyone.</li> <li>- Commercial Vehicle Operators (CVO) involved in ramp intrusions benefit from faster and more effective responses by ADOT and DPS.</li> </ul>
D2. Emergency Roadside Callboxes	<ul style="list-style-type: none"> <li>- The original design and installation costs for the four-callbox system on US 93 totaled \$27,380, or \$6,845 per callbox. A concurrent project absorbed some of the true costs of the installation. Average annual cellular communications costs for the whole system are about \$4,070. The Kingman District’s maintenance agreement with the equipment vendor costs \$2,800/year for the whole system.</li> <li>- Recent upgrades to the I-19 system, including a cement slab around the base of the pole and a teletype (TTY) keyboard, cost about \$60,000 per site. Annual cellular communications costs for the whole system range from about \$3,000 to about \$7,000.</li> </ul>	<ul style="list-style-type: none"> <li>- ADOT’s sponsorship of the callboxes is a good way of building public confidence and appreciation. Some calls alert ADOT and DPS to incidents that require their attention. It is believed that with factors like the recently improved callbox signing on US 93 and growing public familiarity, the number of non-emergency calls will diminish over time, which will reduce DPS’s workload.</li> <li>- Among the public, it is recognized that callboxes have a role to play despite the popularity and ubiquity of cell phones. Some people don’t have cell phones at all, or forget to bring it with them, or have one that runs out of battery power or whose coverage area does not extend to certain areas.</li> </ul>
D3. Motorist Assist Patrols (MAPs)	The current rural MAP represents less than 1% of the total US 93 project construction cost. The MAP bid item totaled \$150,000 for a patrol to run full time (eight hours) during weekday nights during a 30-month time frame.	<ul style="list-style-type: none"> <li>- ADOT benefits from the positive public perception of the program. DPS benefits by having a knowledgeable person (the MAP operator) assess the situation, identify needed resources, and apply first aid if needed. Some incidents require no DPS response at all.</li> <li>- The MAP operator at times provides direct mechanical and first aid assistance to the public.</li> </ul>

Table 32 summarizes the key issues and operational status/element-specific system performance measures associated with ADOT’s emergency detection and response systems.

**Table 32: Group D ITI – Key Issues and Operational Status**

ITI	Key Issues	Operational Status/ Element-Specific Performance Measures
D1. Instrumented Truck Escape Ramps	<ul style="list-style-type: none"> <li>- ADOT’s policy for truck escape ramp construction is designed to minimize legal liability.</li> <li>- Double occupations have occurred on one of the SR 68 escape ramps on two different occasions. Such events highlight the need for efficiency and effectiveness in responding to ramp intrusion events.</li> </ul>	<ul style="list-style-type: none"> <li>- 49% of Department of Public Safety (DPS) survey respondents reported strongly or moderately agreeing that instrumented truck escape ramps contribute to travel safety. The figure was 63% for Commercial Vehicle Operators (CVO).</li> <li>- 51% of CVO survey respondents reported strongly or moderately agreeing that instrumented truck escape ramps contribute to cost savings.</li> </ul>
D2. Emergency Roadside Callboxes	<ul style="list-style-type: none"> <li>- Districts with callboxes reported no significant vandalism problems.</li> <li>- Remote areas outside regular DPS patrol areas need callboxes the most, but cellular coverage is often poor in such areas. Booster antennas help but may not be enough.</li> <li>- DPS policy is to make three attempts to reach members of a stranded motorists’ family when tow service is requested.</li> <li>- Some hang-up calls are believed to be intentional; others are people who are caught by surprise when they are greeted with a 911 operator.</li> <li>- Closer callbox spacing is desirable. Suggestions for additional areas of coverage included non-interstate highways, locations with poor cellular coverage and locations where breakdowns frequently occur.</li> </ul>	<ul style="list-style-type: none"> <li>- 64% of DPS survey respondents reported strongly or moderately agreeing that emergency roadside callboxes contribute to travel safety. The figures were 65% for public from rural Arizona ZIP codes and 59% for public from urban Arizona ZIP codes.</li> <li>- 69% of DPS survey respondents reported strongly or moderately agreeing that emergency roadside callboxes result in emergency help arriving quicker. The figures were 58% for public from rural Arizona ZIP codes and 46% for public from urban Arizona ZIP codes.</li> </ul>

**Table 32: Group D ITI – Key Issues and Operational Status/Element-Specific Performance Measures (cont’d)**

ITI	Key Issues	Operational Status/ Element-Specific Performance Measures
D3. Motorist Assist Patrols (MAPs)	<ul style="list-style-type: none"> <li>- The MAP program reduces the workload of DPS officers, who can then proceed with enforcement activities</li> <li>- Motorists think very positively of MAPs.</li> <li>- In addition to patrolling the area, MAP effectiveness depends heavily on word of mouth.</li> <li>- Communications dead spots exist.</li> <li>- There may be some advantages to making the MAP operator a state employee (which is not now the case).</li> <li>- MAPs currently operate at night, but similar benefits would be derived from running a daytime patrol.</li> <li>- The MAP operator is unarmed but at times encounters illegal activities (such as human/drug smuggling). Spotlights are an invaluable aid for assessment of this and other situations.</li> <li>- Suggestions for additional rural MAP locations included areas where breakdowns frequently occur: I-10 between Tucson and Phoenix, I-17 between Phoenix and Flagstaff, and desert highways such as SR 85 and SR 86.</li> </ul>	<ul style="list-style-type: none"> <li>- 61% of DPS survey respondents reported strongly or moderately agreeing that MAPs contribute to travel safety. The figures were 62%/56% for public from rural/urban Arizona ZIP codes.</li> <li>- 58% of DPS survey respondents reported strongly or moderately agreeing that MAPs result in emergency help arriving quicker. The figures were 51% for public from rural Arizona ZIP codes and 48% for public from urban Arizona ZIP codes.</li> </ul>

Table 33 summarizes the performance evaluation of ADOT’s emergency detection and response systems, based on universal performance measure composite scores.

**Table 33: Group D ITI – Evaluation Based on Universal Performance Measures**

ITI	Composite Goal Area Scores				Composite Overall Score (Overall / Group Rankings)
	Safety	Mobility	Costs	Reliability/ Usefulness	
D1. Instrumented Truck Escape Ramps	80	40	72	58	250 (10 of 18 / 1 of 3)
D2. Emergency Roadside Callboxes	53	60	48	63	224 (14 of 18 / 3 of 3)
D3. Motorist Assist Patrols (MAPs)	60	60	72	58	250 (10 of 18 / 1 of 3)

