The rules require that the state uses field observations, available work zone crash data, and operational information to manage work zone impacts. The state should use such data from multiple projects to analyze the effectiveness of the defined procedures and improve the procedures based upon lessons learned. Every two years, the state shall perform a process review and assess the effectiveness of its work zone management processes.

The rules require that the state train personnel in the development, design, implementation, operation, inspection, and enforcement of work zone related traffic management.

The rules require that specific plans be developed for significant projects. A significant project is a project that is expected to cause sustained work zone impacts that are greater than what is considered tolerable based on state policy or engineering judgment. For a significant project, you need to develop a Transportation Management Plan (TMP) that addresses Temporary Traffic Control (TTC), Transportation Operations (TO) and Public Information (PI) components. The TCC plan describes the temporary traffic control measures that will be used in the project. The Traffic Operations component identifies the strategies that will be used to mitigate the impact of the work zone on the transportation network. The Public Information component identifies the communication strategies that will be used to inform the public about the project and its affects upon the transportation network.

These rules apply to any project released after October 12, 2007.

Features of the system

Work Zone Monitoring systems are commercially available and can be customized by numerous systems integrators. Because so many different types of systems are available, transportation managers have a number of features from which to select. These features constitute the mechanism by which the project can be determined to be in compliance with the FHWA rules and regulations.

A number of features are available for Work Zone Monitoring Systems including:

- Web display of data and video
- Interfaces to third party systems
- Stand alone video
- Web display of video
- Integrated video into TMS
- Sensors for traffic and weather
- Changeable Message Signs
- Interfaces to existing infrastructure

Web Display of Data and Video

With advances in the World Wide Web and increased bandwidth, full motion and streaming video can be displayed on web sites—giving access to video from work zones to any authorized person with web access. Work Zone Monitoring Systems can take advantage of the Internet and display video images and data from work zones. This capability allows remote management of the work zone and easy dissemination of information to the traveling public. Figure 1 (shown on page 46) shows an example of data from a series of portable traffic monitoring systems being used for evacuation monitoring before a hurricane.

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for work zone monitoring, traffic sensors can provide traffic volume, occupancy, and speed on a per lane basis. Weather sensors can provide wind speed, wind direction, temperature, relative humidity, dew point, amount of precipitation, and type of precipitation. When aggregated over multiple stations, traffic sensors can be used to calculate travel times through the work zone and with enough coverage, weather sensors can be used for micro-casting.

**Changeable Message Signs**

Work Zone Monitoring systems work best when information concerning the work zone can be communicated to the public. While integration into 511 traveler information systems can be done, local integration with portable changeable message signs can provide work zone information to the public traveling around and through the work zone.

**Interfaces to Existing Infrastructure**

Information sharing concerning the state of traffic in and around work zones is a key to having a successful work zone. Sharing information via Portable Changeable Message Signs is an excellent method for disseminating information to the public traveling through the work zone. By integrating data from the work zone to existing infrastructure, information can be more widely disseminated. By integrating work zone information into a regional permanent variable message sign system, information can be shared regionally and travelers can avoid significant delays before hitting the work zone. Likewise, information can be integrated into a 511 system and distributed to a larger statewide audience.

**Procurement Options: Buy Versus Lease**

When determining what type of work zone monitoring system to procure, begin by identifying the features and capabilities that you want in the system. After determining the features, you have a choice – you can either buy the system or lease the system. When buying the system, you purchase the hardware and software, provide the communications system, and perform all operations and maintenance activities. If you lease the system, you pay a monthly fee, receive the data from the work zone monitoring system and have the vendor perform operations and maintenance fees.

If you choose to lease the system, you will need to determine the payment criteria. These criteria can include requirements regarding data quality and specific levels of service. For example, you could specify that the vendor receives 100% of their monthly fee if the system is operational 99% of the time for the period of payment; the vendor could receive 90% of their monthly fee if the system is operational 90-99% of the time for the period of payment. Likewise minimum levels of service can be specified. For example, the vendor could receive no monthly payment if the system is operational less than 50% of the time for the period of payment.

One of the intriguing issues in work zone monitoring is communications. Many recent systems use the cell phone network to send video images back to a server for video distribution. Public sector agencies can qualify for better pricing than most private sector entities when dealing with communications companies. In order to achieve the lowest price, the transportation agency should consider providing the communications network to the vendor from which you lease the work zone monitoring system. In some cases, a private sector company would spend $5,000 per month per platform to provide full motion video over the cellular network. For the same situation, a public sector agency would spend $250 per month per platform.

**Technical Choices and Issues**

Once you have identified the features of the work zone monitoring system that you want and determined a procurement approach, there are additional technical choices and issues that you will need to address.
Requirements, Choices, and Issues in Work Zone Monitoring . . . Continued from page 46

If you choose to lease the system, you can get lower pricing if you allow used equipment as a part of the service. If you specify that all equipment used in the system must be new equipment, you will pay the full capital cost of the equipment as a part of your lease payment. [SPECIFY AS LEASE TO OWN] If you instead specify performance requirements for the system, you can allow the vendor to use previously owned equipment and achieve a lower cost. You are protected by requiring minimum levels of performance for the system. If you have a lease to own option as a part of your agreement, you should specify that new equipment is used in the system so that you get the maximum benefit from owning the equipment at the end of the lease.

Another issue is the question of who owns the data provided by the system. Some vendors may attempt to limit the uses of data generated from a leased work zone monitoring system. Some examples may include a vendor who wants to resell real-time traffic data to various information service providers. As a part of your procurement, please make sure that you own the data and that there are no data restrictions being imposed by the vendor.

In portable, solar powered work zone monitoring systems, power is the key to everything. Power requirements for sensors, cameras, and communications determine the size of the solar power plant. If you specify a longer duration for autonomous operations of the equipment in the field, the larger the power plant required. Likewise, the more different types of sensors that you specify, the larger the power plant. As the power requirements increase, the solar power requirements likewise increase. The net result is a larger price for the system or a larger monthly lease cost.

Multiple vendors sell and lease portable work zone monitoring systems. In order to maximize your ability to get the system that best fits your need, you can provide a functional specification rather than specifying a specific vendor. Functional specifications identify the functions and features of the system. By providing a functional specification as a part of your procurement, you can get the system that best fits your needs at the best price. By specifying an individual vendor, you are locked in to a proprietary system and subject to future increased pricing once you are committed to a specific product line.

When deciding whether to buy or lease the system, pay attention to the maintenance requirements of the system and what level of labor support the system requires. If your staff members have a full load of responsibilities, adding maintenance of work zone monitoring systems to their workload can reduce the effectiveness of the system. If your staff do not have the time to operate and maintain the system, you may be better served by leasing the system and have the vendor provide the operations and maintenance staff.

Liability is often an overlooked issue when leasing a system. When you buy a work zone monitoring system, the vendor’s liability is often limited to correct manufacture of the equipment. If you lease a system and have the vendor operate and maintain the system, the vendor faces liability associated with correct operation. However, many vendors do not have deep pockets or appropriate liability insurance for operations. If the vendor is sued, the state will also often be included because the state has deep pockets. Be sure to specify that the vendor has appropriate insurance to cover any liability issues related to field operations.

Another choice to be made for work zone monitoring is how many portable units are needed to adequately cover the area of the work zone. At a minimum, have at least one portable sensor unit up-

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Here in Tucson Arizona, we not only have to deal with the heat, but the wildlife as well. Pictures were taken by my son Cory Valdez.

Submitted by Norm Valdez

Happy St. Patrick’s Day!

The signal and sign are in an Irish neighborhood, Tipperary Hill, in Syracuse, New York.

Submitted by Bruce Friedman

Requirements, Choices, and Issues in Work Zone Monitoring

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stream from the work zone. Use at least one additional unit for every mile of work zone to be covered. Portable Changeable Message Signs should be placed in locations that allow the traveling public to divert to alternate routes if necessary.

Potential sources

A number of vendors have technical systems dedicated to work zone monitoring. The following companies have supplied work zone monitoring systems to Departments of Transportation and can be contacted regarding the details of their systems and associated cost.

- ADDCO Inc. 570-523-7072
- ASTI Transportation Systems 302-328-3220
- Highway Tech Inc. 207-375-8248
- NES Traffic Safety Inc. 508-580-6700
- Trichord, Inc 703-737-0162
- Work Safe Inc. 802-223-6154