



Review of Options

for Modification to

Berlin, NH

Public Emergency Alarm Reporting System

Berlin, New Hampshire

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I. Purpose and Scope

The purpose of this report is to provide the City of Berlin (through contract with HEB Engineers) with engineering options for their public emergency alarm reporting system (PEARS) as it relates to proposed roadway reconstruction in the City.

The City of Berlin is currently reconstructing a portion of Route 16 in the northern part of the city. Design and construction details for the proposed work are not included in this report for simplicity, but are available through HEB Engineers. As part of the planned roadwork, utility poles are being relocated. In addition to the utility poles being used for transmission of power, telephone, cable, etc., the poles also carry the cabling used for the PEARS circuits.

Initially, the scope of work developed by the City and HEB for the PEARS circuits was to simply relocate the existing cabling (replacing as needed) from the existing poles to the new poles. During the road design process there was a suggestion to use a radio box at one site due to difficulty installing a hard-wired connection with the revised utility pole layout. This discussion led to the question of converting the entire PEARS system from hard-wired to radio box. SFC has been asked to evaluate the two options as well as any other viable alternatives for the system, and provide the City with a report outlining the costs, benefits and risks of each option to allow the City to make an informed decision regarding the future of the system.

In addition to the two options noted above, SFC Engineering Partnership, Inc. (SFC) has identified a third option that is included in this report. That option is the use of independently owned fire alarm communicators that connect to third party monitoring companies. This is the common method of monitoring used in communities that do not maintain a PEARS.

II. Evaluation Approach

In an effort to achieve the goals of the project and meet the minimum level of safety set forth by the State of New Hampshire Fire Code, SFC has met with City officials and toured many of the properties affected by the work. In addition, SFC has reviewed applicable codes and standards and evaluated the different options. The recommendations reported are based on the engineer's opinion weighing all factors and concerns. Ultimately it is the responsibility of the City of Berlin to make the decision they feel best serves the City.

III. Codes and Standards

The National Fire Protection Association (NFPA) is a non-profit organization that focuses on fire and life safety around the world. NFPA develops and publishes codes and standards that are adopted by many companies, organizations, communities, states and countries worldwide. The state of NH has adopted numerous NFPA standards through the legislature that are compiled into the NH State Fire Code (Saf-C 6000). One of the standards, NFPA 72, the National Fire Alarm and Signaling Code (2013 edition), is the governing document for PEARS. SFC has reviewed the requirements outlined in NFPA 72 and they are cited in this report as appropriate.

IV. Existing System

The City of Berlin utilizes a PEARS that includes both publicly accessible alarm boxes and master alarm boxes connected to the receiving stations.

A receiving station is the head-end equipment that monitors and receives signals from the publicly accessible alarm and master alarm boxes. The primary receiving station is located at the Berlin Fire Station, with a secondary, redundant receiving station at the Berlin Police Department. If the members of the Berlin Fire Department are not in the

fire station due to fire department duties or operations, supervision of the PEARS is transferred to the police station.

Publicly accessible alarm boxes are manual alarm boxes connected to the receiving station in locations that are constantly available to the public and only activated by human interaction. Master alarm boxes are boxes that are used to connect protected premises fire alarm systems to the receiving station. They are automatically initiated by the fire alarm system and also have the capability to be manually activated by human interaction. Typically master boxes are located on the exterior of the protected facility and available to the public if needed.

The Berlin PEARS is a wired system that utilizes aboveground fire alarm cabling connecting the receiving station to the publicly accessible alarm boxes and the master boxes located out in the community. The fire alarm cable is distributed through multiple circuits that travel on utility poles.

The PEARS uses a Digitize brand receiving station at the firehouse to supervise and report the condition of the system. Each alarm box (publicly accessible and master) is independently supervised and monitored. In the event of activation of a box, the system reports the activation by identifying the box number and descriptor information that has been input into the system. The system reports only that the box has been activated; it does not have the ability to relay any additional information that may be available at the protected premise fire alarm control panel. Additional information that may be available at the protected premises includes sprinkler system water flow, zone in activation, individual device activation (in addressable fire alarm systems), trouble conditions or supervisory conditions.

It is important to note that PEARS is used to connect the protected premise fire alarm system to the Berlin Fire Department. The fire alarm system at each of the protected premises is defined as an auxiliary fire alarm system and does not rely on the PEARS for any of its functionality. Regardless of what system is used to notify the fire

department of an activation, the auxiliary fire alarm will notify building occupants of an activation without using any components of the PEARS. The auxiliary fire alarm system functions independently of the municipal system.

V. Route 16 Reconstruction

The work currently underway to reconstruct a portion of NH Route 16 will have a direct impact on the Berlin PEARS. The roadway reconstruction requires multiple utility poles to be relocated. The poles that need to be relocated are currently used to support the PEARS circuit protecting that area of the City.

Based on SFC's knowledge of codes, standards and engineering practices, SFC believes there are three viable options for alterations to the PEARS to accommodate the needed roadway work. SFC has evaluated each of the options and believes that while all are viable and in conformance with applicable standards, each option has a unique set of characteristics that need to be reviewed prior to determining the best option for the City of Berlin. The three options are;

Option #1 – Relocate the existing PEARS circuit to the new utility poles.

Option #2 – Eliminate the wired circuit in its entirety and install radio transmitters at the protected premises to communicate with the receiving station. This will require modifications to the receiving station to accept the radio signals.

Option #3 – Eliminate the wired circuit in its entirety and require the owners of protected premises to install private communication methods to private supervising stations.

With the prevalence of cell phones the need for publicly addressable alarm boxes has diminished in recent years country-wide. In discussions with the Berlin Fire Department, SFC understands that no new publicly accessible boxes are being installed in the City and when boxes become problematic (due to age, vandalism or damage) the boxes are eliminated and not replaced. SFC agrees with this approach city-wide and

recommends removal and discontinuation of all publicly accessible alarm boxes in the work area regardless of the chosen path forward.

VI. Option #1

The relocation of the existing circuits to the new utility poles is a simple solution that does not have any impact on the current system technologies or operation. If the circuit is relocated the information currently received by the Digitize receiving station will remain the same and aside from a temporary service outage during transfer from the existing circuit to the new circuit, there will be little disruption of service.

SFC's concern with relocation of the circuits in kind is that the technology will remain the same. As noted above, the current system only monitors the masterboxes and can only receive general alarm signals from the protected premise. The technology is the same as the original telegraph fire alarm systems installed circa 1890s. As outlined in the options to follow, there are current technologies that allow significantly more information to be transmitted to the responding agency prior to their arrival at the incident.

Providing that information to responding agencies is valuable in that it allows the responding fire officers and incident commanders to assess the possible scenarios, formulate an operational plan, determine apparatus placement or request additional resources.

The cost to relocate the circuit is estimated at \$100,000.00 - \$125,000.00. This cost was provided by Berlin Fire Department to HEB at the start of the reconstruction project and has been included in the Route 16 roadway reconstruction budget.

VII. Option #2

The second option for modification to the system is the introduction of a wireless network into the PEARS. The wireless network can be designed and installed and run

in parallel to the existing hard wired system. This wireless network would eliminate the need for the wired circuit.

The most common type of wireless system is a system that utilizes radio frequency to transmit the signal. In an RF signal system, each of the protected premises installs a RF transmitting radio box to send the signals and the receiving station installs an RF receiver to receive the signal. As the radio boxes are installed out in the field, the boxes are all installed on the same wireless network and the boxes communicate with each other to create a “mesh” network. This “mesh” network allows the signal to be transmitted further distances using each box to “boost” the signal. This system of communication is very reliable and is used throughout New England and the United States with great success. Each of the radio boxes are powered by onsite power from the protected premise and also contains a backup battery in the event of power failure. If there was a prolonged power outage, it is possible for the radio boxes to lose power and come off-line.

There are several advantages to using wireless signals in a PEARS. First, the elimination of the wires eliminates the possibility of a wire failure creating a situation where an alarm signal is not received by the receiving station. In discussions with Berlin Fire, SFC has learned that the current cabling is susceptible to weather issues and during heavy wind/rain events, it is not uncommon for circuits to experience enough troubles for the fire department to disregard the trouble signals or shut off the circuit monitoring until the weather improves.

Secondly, the use of radio boxes allows the responding agencies to obtain more information about the incident. Radio boxes can be ordered with multi-channel inputs, allowing the system to provide more precise data to the receiving station. Radio boxes with up to eight channels can be installed allowing 8 distinct signals to be transmitted from the protected premise to receiving station.

The current Digitize receiving station at the fire station has the ability to be expanded to include a radio receiver. If a radio signal receiver is installed at the fire station to accommodate the current roadwork, that receiver can serve as the back bone for the future. As new end users are brought on line in the PEARS, they can install the radio boxes at the protected premise and the receiver can just be programmed for the new box. No additional hardware will be needed. Once in place, the radio receiver will provide an opportunity to phase out the hard-wired circuits over time and bring the system up to the newer technology and give the Berlin Fire Department an advantage that they do not currently possess.

The cost of materials and installation of the equipment needed to receive the radio signals at the receiving station is estimated at \$35,000.00 - \$45,000.00 and the cost of materials and installation of the equipment needed at the protected premise is \$3,000.00 - \$5,000.00 each with each of the 16 premises on circuit #14. Each installation would carry a one-year warrantee. The cost estimate includes the radio box, installation testing and training. In addition, the existing wiring will need to be removed. The estimated cost to remove the existing wiring is \$10,000.00 - \$15,000.00.

If option #2 is chosen by the city, it is important to note, that unless there is a local city ordinance requiring the owners of the protected premises to connect to the new RF system, there is no state code that requires it. Where facilities contain fire alarm systems that require automatic emergency forces notification, the codes permit the owner to select the transmission method. Owner's may opt for option #3 detailed below. If owners elect to not connect to the PEARS using the new technology, the recurring revenue currently received may be affected. Currently, the City receives \$450.00 per year for each master box as a monitoring fee.

VIII. Option #3

The third, and final, option for the City of Berlin is to eliminate the Pears circuit affected by the roadway reconstruction and not provide a connection for the protected premise to connect to the PEARS. There is no requirement for a municipality to maintain a PEARS, and in fact several communities have discontinued their PEARS in recent years or are in the process of eliminating their PEARS.

If the PEARS was eliminated, it would be the responsibility of the protected premise to provide whatever notification was required by applicable codes. One of the more likely solutions would be for each protected premise to install a cellular transmitter. The cellular transmitter will monitor the building fire alarm system and in the event of a system activation, send a signal to a third party supervising station. The supervising station will then, in turn notify the fire department via telephone. Not all fire alarm systems require automatic emergency forces notification. A review of each protected premise will need to be conducted to determine if the end user needs to install a communication device once the PEARS is decommissioned.

The main advantage of option 3 is the reduction in project costs. The cost would only be the removal of the existing wiring from the utility poles and the removal of the boxes from the community. If option 3 is chosen, the City would need to put together a plan to phase out the remainder of the system to maintain equality between users.

A second advantage of option 3 is the ability for the supervising station to notify the building owner (or their representative) in addition to the Berlin Fire Department. With the Berlin Fire Department operating the PEARS as it currently does, the owner notification of an event is delayed until City resources can be available to make contact. With the use of a remote supervising station, once contact is made with the emergency services, the supplier then contacts the building owner/representative to advise them of the alarm activation. Also, with option 3, trouble and supervisory signals can be transmitted from the protected premise to the supervising station. These signals

represent a condition at the protected premise that needs to be addressed and corrected, but may not require emergency forces notification and/or response. The supervising station can contact the building representative and advise them of the situation. This is especially useful where the building contact is not on site at the protected premise.

When meeting with Berlin Fire, a concern was raised regarding option 3. SFC has learned that several years ago there as was single event on Route 16 (motor vehicle accident) and all communication lines serving the City were unavailable. SFC has learned from city officials that following the previous outage, modification were made to the communications pathways serving the City and a single incident will no long eliminate communications into and out of the City. The probability of an event disrupting phone service is small, but the effect is significant. SFC recognizes the limitations of the telephone system and believes the information is key to determining the best path forward for the City. As noted previously, the ability for the supervising station to contact the Berlin Fire Department has no relation to the operation of the fire alarm system to monitor the protected premise and notify building occupants of an emergency condition. One option to overcome the loss of the telephone distribution system, is to ensure that Berlin Fire Department maintains a cellular telephone that is used as a backup phone number in the event that that supervising station cannot reach Berlin Fire Department on the standard telephone lines.

SFC estimates the cost of removing the existing fire alarm cable to be \$10-15,000.00. In addition, if option 3 is chosen, each of the protected premises will need to install communication devices to allow the current fire alarm system to communicate with the supervising station. Each protected premise will have different costs based on existing equipment, but SFC estimated each protected premise would cost between \$3,000.00 and \$5,000.00.

IX. Emergency Siren

While not directly related to the PEARS, the section of Route 16 being altered also includes cabling that connects the Berlin fire station with an exterior wide area siren used to alert residents of an emergency under certain circumstances. Similar to the PEARS, it is possible to simply relocate the cabling from the existing poles to the new poles; however SFC feels that it may be a better option to modify the siren to receive a tone-alert for activation. By converting to a wireless signal, the cables will no longer be needed. The cost to convert the emergency siren to a wireless signal is estimated at \$25,000.00.

X. Moving Forward

After completing visits to a representative sample of protected premises, meeting with HEB Engineers, City of Berlin officials, and the Berlin Fire Department, and while this report outlines three viable options for modification to the PEARS, SFC believes that options 1 is not in the best interest of the City of Berlin and its residents. Because of the outdated technology, high cost of installation and maintenance and the lack of detailed information available to responding agencies during alarm activation responses, relocation of the existing system does not provide a good cost to benefit ratio.

Regarding options 2 and 3, both options provide benefits and both have limitations. While option 3 provides the best cost option to the City, the lack of a reliable telephone transmission lines into the City has the possibility to severely limit the abilities of the Berlin Fire Department to quickly respond to a fire emergency. The conversion to radio boxes allows for immediate fire department notification and gives the City the ability to expand the network and convert the other hard wired circuits in the future. Each of the options provides the emergency responders with the ability to gain valuable information regarding the fire event, but option 3 also provides the owner with that valuable information and additional information for non-fire events at the protected premises.

While this report identifies the expected tasks and costs for each of the options, it does not identify which costs will be borne by the City and which costs will be borne by the end user. That is a discussion that should take place prior to making a final decision. SFC understands that the recurring revenue received for the current system is a component in the overall City financial planning and loss of that revenue may have a significant impact.

SFC recommends that the City of Berlin key stakeholders review this report and meet to discuss the findings. Depending on the priorities of the City, either of the two options can be implemented in a code compliant and appropriate manner. Based upon all information, SFC feels that option 3 would provide the best services to the City of Berlin. The use of a remote supervising station and its ability to notify the fire department and the owner of both emergency and non-emergency events is substantial.

XI. SUMMARY OF COSTS

Item	Option #1 Cost	Option #2 Cost	Option #3 Cost
Removal of Existing Wiring	\$10,000-\$15,000	\$10,000-\$15,000	\$10,000-\$15,000
Installation of New Wiring	\$95,000-\$115,000	N/A	N/A
Modification to Receiving Station to Accept Radio Signal	N/A	\$35,000-\$45,000	N/A
Installation of Radio Boxes	N/A	\$40,000-\$50,000	N/A
Installation of Supervising Station Comm Devices	N/A	N/A	\$40,000-\$50,000
Total	\$100,000-\$125,000	\$75,000-\$95,000	\$50,000-65,000

Note: these costs are for the fire alarm circuit affected by the current scope of work. As other circuits are evaluated, additional costs will be incurred at that time.