

**Selection and Use of
Underground Utility Locating
Ticket Management System (TMS)
White Paper
August, 2007**

Introduction

An automated Ticket Management System (TMS) can make or break your damage prevention goals when working with Call Center underground utility locate tickets.

Some of the problems addressed by a TMS

- Avoid the high cost of damaged utility facility lines;
- Growing costs of employees;
- Growing equipment costs;
- Pressure to do more with limited budgets;
- Errors in printed work tickets, transcribing data from handwritten notes;
- Growing demands for information from the field;
- Lost tickets – work not performed;
- Pressure to respond quickly to Emergency and other unplanned field situations;
- Opportunity costs – doing one task means that you are not doing something else;

These problems create additional pressure to choose a TMS that makes your utility locating effort fast, accurate and complete. The cost of a poor choice is quite high

The purpose of this document is to inform and prompt you to consider all of the questions that can impact decisions surrounding a move to a TMS. Most of the topics contained herein will apply to utility companies as well as contract locating operations. Regardless of which environment you work, damage prevention is at the core of what we do, and a TMS should assist you in that goal.

When you evaluate your current TMS, which you should do yearly, consider the latest technology available – not because you want to be on the bleeding edge, but because there are always improvements that can save time and money in the field. One of the main questions to ask is, “can your current (or one under consideration) TMS system adapt to your business, or must I shoehorn my business into the single mold created by the TMS?” No two utilities or contract locating operations are the same, so to meet your specific needs there must be some flexibility.

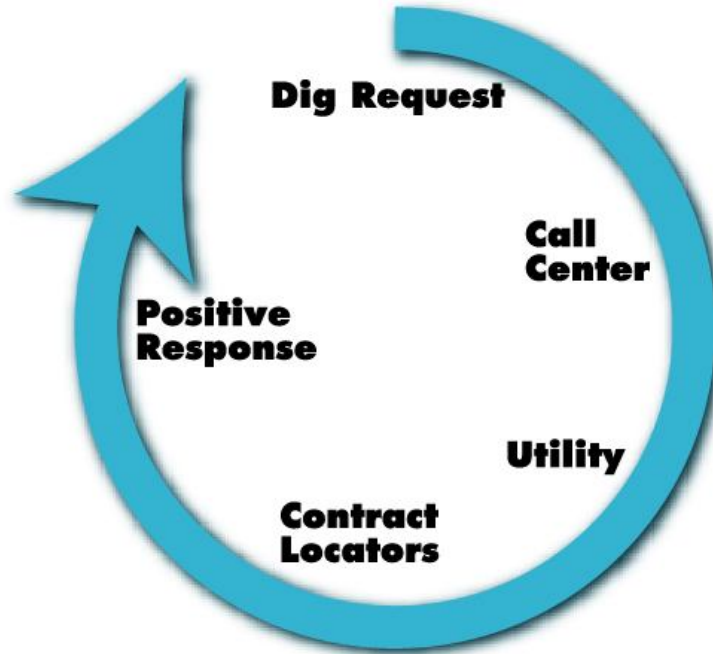
The Process

When working underground utility locate tickets from state One Call Centers (Call Before You Dig), there are several reception transfer options: fax, printer, email, modem, etc. Your initial choice here determines how quickly and reliably your system will run for years to come, so this single choice sets the tone for your future. Whether a utility or a contract locating company, your locate ticket management system is at the very core of your operation and thus should be carefully considered. The cost of a damage and the “hit” to your reputation if found at fault can be enormous.

Ticket Flow

Tickets originate with a call from a homeowner or excavator to the state One Call Center. The information is recorded by the Call Center and a “dig request” or “locate ticket” is created and sent to the utility and/or locating firm(s) using one of the transmission methods previously mentioned. This ticket is then available in the field to be worked and when completed, a positive response back to the caller can be sent (if required) informing them that the site is either marked or cleared (no facility line conflicts).

Dig Ticket Request



In most cases, the tickets are sent via email. Email is the most current and reliable system for handling tickets, replacing the often unreliable 1970s technology of modems and faxes and the constant doubt about whether or not "it went through". Sending tickets to printers can be more reliable than modems and faxes, but again there are troubling limitations including the cost of paper, ribbons and physical problems including paper jams and the ecological cost of using trees.

At the most basic level, a Ticket Management System must be:

- Fast
- Accurate
- Complete
- Expandable/Extensible
- Provide Support

TMS Users Control

It is imperative that any TMS address the needs of different types of users who require access locate tickets: Locators, Dispatchers, Supervisors, Crew Leaders, System Administrative users and perhaps upper management. All have needs that are quite different and the TMS should accommodate them all.

Note that Locators need to only see those options that are directly required to work tickets, while someone from upper management will most likely never mark a ticket. The TMS will display the options that are required for each job type, showing only the relevant data and controls for that specific user.

Field Users of TMS

First and foremost, your ticket management system must be quick and easy to use by your field personnel. If working tickets is a cumbersome process, burdened with computer screen after screen which forces the Locator to sift through options that are not appropriate for the specific ticket being worked, the entire process can be slow, error-prone and disastrous. The TMS should be easy and straightforward enough so that a user without any computer experience can work tickets quickly and accurately. If the TMS is too complicated or provides options for the selection of invalid data, then management will have a difficult, if not impossible, task of making sense of the field collected "data".

Contract-specific work screens mean that when a Locator works a ticket, the work screen only provides the specific markings and other data collection options that the specific utility on the ticket requires, based on the member codes on the ticket. For example a ticket with both gas and cable TV will most likely have completely different completion options for marking each utility – often gas requires the entry of pipe diameter while the CATV contract may only specify Marked or Cleared. Of course, there's no reason to force the Locator to dig through screens of gas ticket options to work the CATV utility and vice versa. It's easier for the software vendor to simply list every possible option for every member code, forcing the Locator to search for the correct options required to complete the ticket – a very slow and often inaccurate method of data collection. The goal of a TMS should be to provide just enough options to be fast and accurate while minimizing the opportunity for errors.

Field users are often online throughout the day using wireless aircards in their laptops. This technology provides internet access where coverage is available and makes the entire TMS operate in real time. Real time operation means that tickets are sent to the field within seconds of being received from the Call Center. It also means that managers can view the current status of the field operation and make decisions with complete and accurate data. However some Locators are out in remote areas where aircard service might be unreliable or even nonexistent. The TMS should provide a means of working tickets offline in these cases, maintaining the detailed audit trail using date/time stamping of all work performed – online or offline. Field users should be able to not only work tickets offline, but also record photos and other file attachments to tickets.

When the ticket is completed (marked or cleared), many states require a "positive response" – a notification that the ticket has been either marked or cleared (there are other possible responses dictated by the state Call Center). Responses are sent to either the Call Center or the excavator. Regardless of the destination, the TMS should handle this automatically. You don't want to pay Locators to take the time making phone calls to excavators, leaving messages and ultimately distracting them from working tickets. Locator time spent outside of working tickets is not only lost time and revenue, but also time that could be better spent making sure all tickets are worked in a timely manner. It is this "opportunity cost" that can undermine any planned/potential benefits of installing a TMS.

The TMS should also have the ability to "highlight" or otherwise draw attention to tickets you choose are important. Often this means Emergency tickets, but it might just as well be a high pressure gas line or a high profile fiber communications line. Locators should be able to glance at a laptop screen and readily determine which tickets you have marked as needing additional attention. The same kind of visual aids are also helpful to focus Locator efforts when determining how close tickets are to the Due Date or Work Start Date.

Dispatchers/Supervisors/Crew Leaders using TMS

While Dispatchers are usually in an office environment with a wired network connection, Supervisors and Crew Leaders can be in and out throughout the day, often on aircards like Locators. Again, flexibility in configuring and using the system should allow these users to not

only supervise, manage and move tickets for load balancing, but also complete locate tickets if needed.

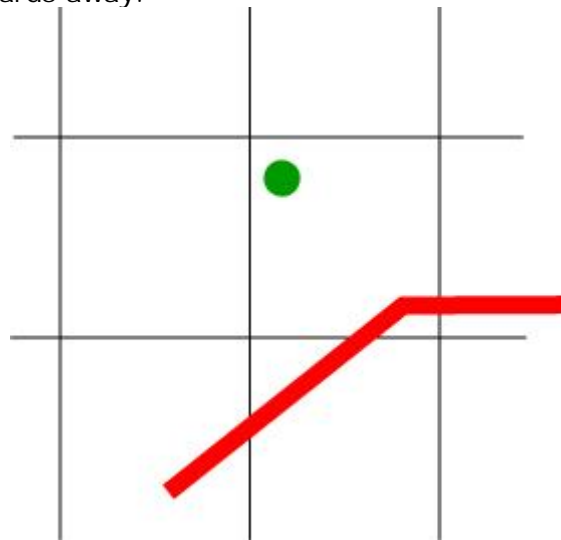
TMS tools to oversee a specific group of Locators or to Dispatch to a select group of all Locators are required. Again the idea is to narrow the choices to only those that are specific to the user. An alert method for specific ticket types and for tickets nearing and past the ticket Due Date/Work Start Date is also a required when dealing with hundreds, if not thousands of Call Center dig requests.

Working with Utility Facility Maps

If your operation is a utility, or if the utility has allowed your contract locating operation access to facility maps, providing this information in the field is a real time saver for Locators when at the dig site. They'll know if the service is in the front yard or back, underground or aerial, for instance.

However, beyond using these maps at the dig site, utility mapping might also be used to evaluate ticket addresses before tickets are sent to the field. By comparing the ticket address and/or dig site coordinates with the utility facility maps, the decision to clear it or release to the field as a conflict ticket can be made. This ticket "screening" saves the time and energy of driving to a site where there are no facilities. This screening can be either automatic or manual.

Why would anyone choose manual screening when there's an automatic option? Utilities with high profile, high cost or high consequence facility lines want to visually check each ticket to ensure that there is nothing on the ticket source that might indicate that the actual dig site could be several yards or streets away from the (perhaps non-existent) ticket address. Natural gas and petroleum utilities are often interested in manually screening each ticket visually because avoiding a single hit saves lives *and* tens of thousands of dollars. Another reason is that some Call Centers use a very large grid system that generates a locate ticket when the closest utility line might be several hundred yards away.



The grid lines are the coordinates that the Call Center puts on the ticket.
The green area is the dig site on the locate ticket.
The red line is the utility facility line.

Since the facility line is in the same grid block as the dig site,
a locate ticket is generated – even though we can see that
the dig site isn't anywhere near the facility line in this ¼ mile grid.

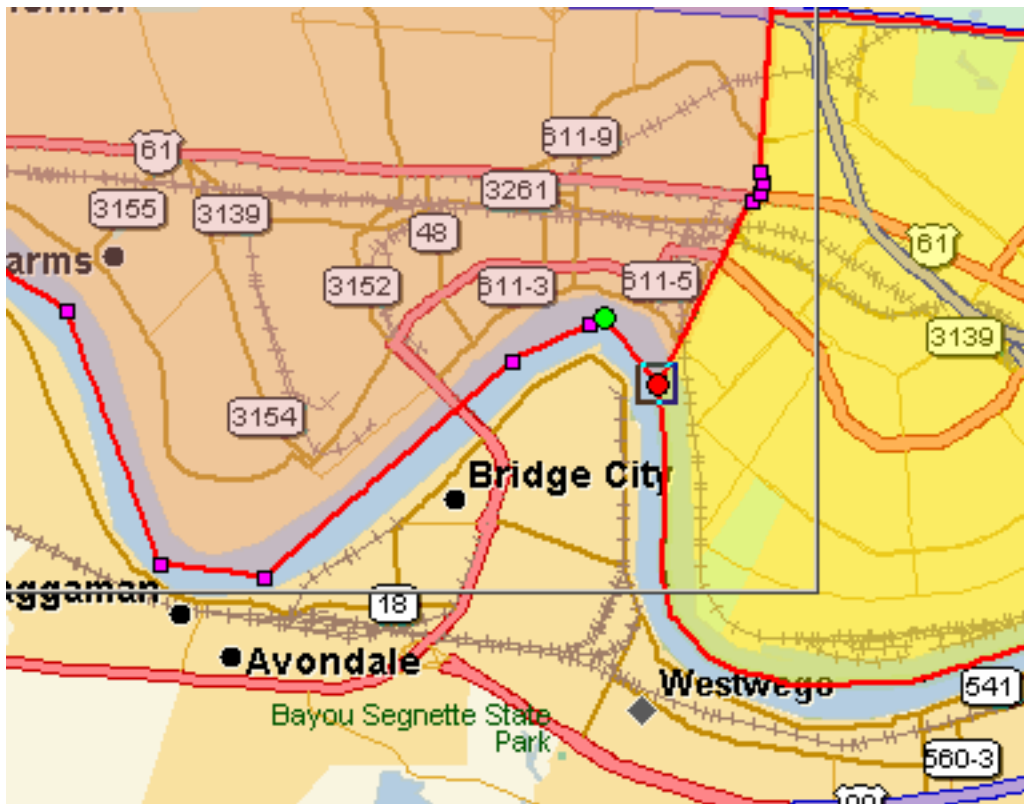
That being said, there are many applications for automatically screening utility locate tickets. In cases where you can set buffers around facility lines to a degree that will not rule out tickets with a nearby facility but still provide savings over rolling a truck to each and every ticket, then automated screening is the answer. Grid systems with large grid areas (as mentioned earlier) are good candidates for automatic screening where the grid can be as much as a quarter mile or larger. Often TMS screening tests with sample facility data and real tickets can help you make this decision. Ask potential vendors about testing facility data against locate tickets.

We all know that facility maps change: as new lines are added; old lines are abandoned; and from field observations. Getting these updates into the hands of screeners and Locators is key to providing cost savings, safely. Since the update process is a regular function, the facility map update process should be painless, quick and without undue costs.

Assigning Tickets

The TMS should allow you several ways to assign tickets from one locating area to another. Often these options include Call Centers, grids, map shapes, city/county/state, TRSQ and many others. Depending upon the geographic coordinates found on the locate ticket from the Call Center, the most useful options should be apparent once you have a sample ticket.

Often, if the locate ticket has latitude and longitude points, drawing a shape file is an easy-to-understand means of assigning tickets. You can basically replicate the wall map most locating operations have, in digital format. When the map needs to be changed, the update applies to all map areas (below: pink area in the upper left and yellow area in the right half) that share boundary lines (red) and points (purple squares). See the example below. Whether this feature is built into the TMS or not isn't as important as the ability to use custom maps to assign tickets with lat/long coordinates.



It's also necessary to be able to match, maintain and update Locators with geographic assignments easily and without outside assistance or additional expense and/or delays. A single Locator might be matched to one or more geographic areas and changes can be required as people take vacation or are out for sickness or other reasons.

Beyond mapping and ticket assignment to a specific area, you will want to ensure that Locators are not sending tickets to one another. Ticket assignment is a management function and should rarely, if ever, be delegated to the field. "Loading up the new guy" with tickets so that a tee time or other recreational event can be accomplished during normal work hours, is not a temptation Locators need. This is not to suggest that Locators cannot be trusted, it's an issue of maintaining not delegating control.

Billing for Contract Locating

While most TMS systems will record how tickets are marked, they should also have a means of assigning contract costs to various marking options, for those contract locating operations that bill utility customers. While you may decide to export the ticket work data and actually invoice from a separate accounting system, the original billing data from the TMS should give you all the detail necessary to create accurate billing.

Billing Rates

	<i>single</i>	<i>double</i>	<i>triple</i>
Regular Locate	\$18.00	\$16.50	\$15.25
Site Visit	\$15.00	\$14.75	\$13.80
Call Out	\$12.50	\$12.00	\$11.75
Cleared	\$ 9.25	\$9.00	\$9.00

As a contract locator, you should have options to update and date price changes for various types of utility locate work (assuming that you need/want to bill for your work). Multiple 'tier' pricing takes into account the number of utilities at the dig site and generates billing for them automatically.

Often locating contracts are complex and there can be dependencies that affect how certain tickets and utilities are priced. The TMS should be able to assist you in extracting accurate billing from the worked ticket data, by incorporating your billing rules for various contracts. A word of caution, delegating billing selections to Locators is not prudent. When there are choices to be made about billing, keeping that out of the field almost always results in faster work and fewer inaccuracies.

You should also be able to update the pricing in the system to reflect changes in locating contract pricing, entering price changes in the system in advance, and when the change date is reached, the new pricing is used. Of course, these price changes should not require the vendor's participation (although they will assist you).

It also likely that contract locators will have a single ticket with different types of billing. For instance, you might have a city utility customer that bills one price if the ticket has electric and another set of prices if the ticket has both water and electric. A communications customer might specify that one price is charged for coax line only and another price level is charged for coax and fiber. These are all billing challenges that your TMS should help you with.

Maintaining Users

Adding new users, temporarily disabling vacationing users and deleting users who are no longer employed are essential elements of a TMS. You should also be able to mix and match at will

Locators with Supervisors and Dispatchers as well as matching Locators with geographic ticket assignment areas.

Archive Data

One of the most important parts of any TMS is the ability to generate reports and ultimately to archive your data. Exporting accumulated data is desirable after a number of years as well as a requirement by law. Rather than a jumble of exported data in human unreadable form, ticket archive data should be readable and preferably outside the TMS – say in a database or spreadsheet format. The point is that years from now, you don't want to be dependent upon the TMS to view and search ticket archive data. You must be able to perform searches on the archived data quickly and easily.

Reporting

The TMS should have a variety of reports that fall into a few general categories: tickets, work/productivity and billing, among others. The reports should provide management tools to track tickets through the system, track Locator activity as well as general management reporting. Flexibility in terms of who may run reports is essential to get the information into the hands of those who need it.

The ability to create simple database queries should be accessible to a group of users you specify. You may also want to the option to enlist the TMS provider to create custom (often more elaborate) reports for you in the future.

Damage Investigations

While we all work towards damage prevention, facility line damages occur and having a process in place for dealing with them is paramount. The ever-climbing cost of damages quickly provides strong incentives for those who perform utility locating to prove that the site was marked correctly - often using photos. The downside risk of incomplete locating data is the increased cost of doing business (through fines and remediation) and jeopardizing the reputation of the company (not to mention driving insurance rates through the roof).

You should be able to click a single button in the TMS and get *all* relevant data you need to prepare a detailed damage report, and feel confident about presenting your case. While it's not likely that the TMS will have the exact form you use, it *is* likely that the TMS will be able to supply you with most all of the information required to complete your specific form.

Training/Transition

Few things produce more tension (outside of damage investigations) than changing processes and procedures – especially in a core function such as utility locating. The transition from what you're doing now to a new TMS is obviously a change, but must be made as painless as possible.

If you need to complete tickets while making the transition (and almost everyone does) then the training schedule must be flexible and may include multiple off-peak training sessions in the evenings and possibly weekends. You may need extra training time with certain employees to ensure that they are comfortable with the entire system: computer, aircard and TMS software. It will also best best if most of the procedures for working with tickets and the new TMS are also thought out in advance, so that they can be expanded on during training.

	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5	WEEK 6	WEEK 7
TMS provider							
Final requirements	Gather final details						
Call Center		Coordination and system set up					
Servers set up	Data Center						
Internet set up	Data Center						
Test Call Center Tickets			Testing				
Positive Response			Testing				
System Testing				Functional Accuracy			
Locator Training					3-4 hour sessions		
Admin & Dispatch Training					2 hour sessions		
Go Live date						Support	
Follow up							First week eval
Locating operation							
Ticket Assignments		Setup and test					
System Testing				Functional Accuracy			

You should have a timeline with milestones to measure the progress of the installation, training and other key points in the transition from one TMS to another. There are commitments to be made by your company as well as the TMS provider.

Is there a dedicated TMS provider contact for your account during and after the installation? Is that person available from 9AM to 4PM or are the contact hours flexible? Is there on-site training at your office and in the field? Can training be held in multiple field office locations, if necessary? Can the trainer shift gears for the new computer users as well as the experienced users in the training session? Ensure the training is delivered in non-jargon, plain ol' English and that there is ample time for questions for each training session. Ensure that there is a TMS trainer on-site when you go live, to make the first day as trouble-free as possible and to answer any last-minute questions and situations.

Support

Probably one of the most important components in any TMS is support. When you need help, does a native English language speaker answer the phone and can that person do more than read from a prepared support script? Are your questions answered in a timely manner? Does the TMS provider have a desire to solve your problem, or is it just another phone call that they'll get to when they get around to it?

Ensure you get TMS updates (assuming that the technology is updated, which it should be) easily, and that the update process is easy. Can you get changes and/or modifications made to meet your needs specifically?

Call Centers will change the ticket format and sending options over time. Your TMS provider must be able to adapt to these changes as well to ensure you receive and can work all tickets sent.

In addition to receiving tickets, your TMS provider should have a number of monitoring processes in place to ensure that the complex systems running 24/7 are performing as expected. When system parameters are out of spec, alerts are often used to notify system administrators at the TMS vendor so that the system can be checked.

If third party applications are part of the operation of the TMS, who supports those "outside" applications when there are updates and questions about how they work? The issue here is not the use of programs outside of the TMS, it's an issue when they are integrated into the TMS and when a problem occurs, finger pointing prevents timely problem resolution. For instance, if reporting or mapping inside the TMS is provided by an outside vendor, when those applications are updated and/or changed, the TMS must adapt to those changes immediately without putting

the users at risk or creating dangerous downtime when reporting, mapping or even worse, if tickets cannot be worked.

Offsite server

A mandatory disaster planning measure is to have your TMS server(s) offsite, to preserve data during a local catastrophic event. Why? Having servers out of your immediate area allows your Locators to receive and work tickets in the field with laptops and wireless cards, when the server remains up and running. Whether the server(s) are moved from the local office prior to a disaster or are hosted offsite all the time, keeping them and the data safe is paramount to uninterrupted utility locating workflow.

Having the server(s) located inside an extreme weather-hardened facility is also an excellent means of protecting data. Part of that solution is to have backup power, should normal electrical power become unavailable – and more than just a simple battery backup (a good short term bandaid, for an hour or two). Often diesel generators are employed to power your server facility for days, if needed. Part of the solution too might also include climate control to ensure that heat-producing computer hardware runs cool. As you may know, a server typically generates far more heat than a common laptop or desktop computer. Larger hard disks, bigger more powerful power supplies and other hardware often require additional cooling for 24/7 reliability. They are often very noisy and if you have multiple servers, the roar can be mind numbing.

You'll also prefer to have more than one internet access point for your server(s). If one communications line is damaged/cut, a separate line can be used to ensure consistent internet access - for incoming tickets and to record tickets worked in the field and sending the resulting positive responses.

Security of your offsite server facility is also critical. This facility should have several means of allowing only authorized personnel into the building. Often authorization is controlled using access cards, call-ahead appointments (if off site), biometrics and other means of restricting access.

Data backup

It is important to have a rigorous data backup plan for TMS (and most other computer functions). You'll probably need to retain ticket data for several years and then archive it off of the servers to other removable media for long term storage – often this long term storage is kept off site as well.

Database

A TMS system should be based on an enterprise-class database. What does that mean? You want to use the most heavy-duty, widely supported and flexible solution possible. For most businesses with database needs (inside and outside of the utility locating industry) that means Oracle. Oracle is most often used in Fortune 500 class businesses and the reasons are:

- It's robust;
- Very well supported;
- Ongoing development and improvement;
- Requires a level of training to maintain that requires a commitment

It is no desktop application you can purchase at Best Buy or Circuit City. The license alone is \$5,000 for a single processor, and often it takes more than one processor to get the job done for high ticket volumes. This is not a database that is maintained by someone's teenage relative after school.

A major Oracle database benefit is that when you grow, the server can accommodate your growth – in ticket volume and in scope of operation (across multiple states and/or regions). The same TMS database should allow you to scale from as few as a handful of Locators to more than 1,000 without having to retool, reinvent and start over from the beginning.

Management

The TMS should provide a quick and easy means of seeing an overview of your entire operation across all areas (including multiple states) as well as the ability to drill down to the individual Locator to see which tickets have been received in the field. You should be able to quickly move tickets from one area to another to load balance.

Making decisions based on complete information is a big part of management and the TMS should give you reporting tools to be able to manage your locating effort. However, each utility and contract locating company has special reporting needs and often creating a specific report is necessary.

Being able to use real time data from the field, makes the TMS vital to damage prevention as well as tracking locating efforts. You will need to know, “where is this Locator right now?” The TMS will provide some indication of what the Locator is doing currently, perhaps with a “in process” ticket number indicated.

Future Growth and Extensibility

Most locating operations find that over time, reporting and data gathering needs increase, from internal or external demands. And as technology is made available in the field, ticket management systems will have more built-in capabilities to capture data in the field – either more data or faster or both. Certainly as industry “best practices” are refined and grow, the TMS should be updated to accommodate industry requirements.

Conclusion

It should be obvious that there are several considerations when selecting a TMS for any locating operation. The questions raised here hopefully will make you a more informed buyer of such a system and will provide you with questions to ask vendors and others who work in the industry. You can use this summary checklist to evaluate your current and future TMS options.

See the following checklist to assist in the evaluation and selection of a Call Center ticket management system.

Underground Utility Locating Ticket Management System Evaluation and Selection Checklist

- History of TMS vendor in industry – customer references, longevity, accomplishments;
- Support options and processes;
- Reporting – built in and custom report development options;
- Expandability – how does the system grow with your business;
- Training options – flexible transition planning;
- System speed and accuracy – can you see your locating staff using this tool effectively;
- System maintenance – can you update/change the system yourself;
- Use of utility facility maps – for locating and ticket screening;
- Archiving your ticket data - process and frequency;
- Offsite data storage and security – planning, process and procedures for data storage;
- Billing for contract locating operations – contract pricing options, tiered pricing;
- Work online or offline in the field – work tickets wireless, wired to a network or offline;
- Contract specific ticket work options – limit choices in the field to only those that are specific to the ticket being worked;
- Tight management controls – limit users to the parts of the TMS that they need;
- Easy to master by the field technician – training should be accessible by users of all levels of technology backgrounds;
- Third party application integration and support – who supports outside applications when there are questions and problems;