

KeiBerg Inc.
LINE ALERT Field Trial
Installation & Excavation Record



February 2008

LINE ALERT Field Trial Installation & Excavation Record

Introduction

This document provides an overview of the use of Line Alert, a real-time measured guidance system for exposing line crossings, by a major oil & gas producer during the installation of a new pipeline. A total of 13 Line Alert panels were used on the right of way of a new 4" steel line being installed. This document provides a summary of the installation and excavation processes on crossings using Line Alert followed by specific details and photos for each crossing performed.

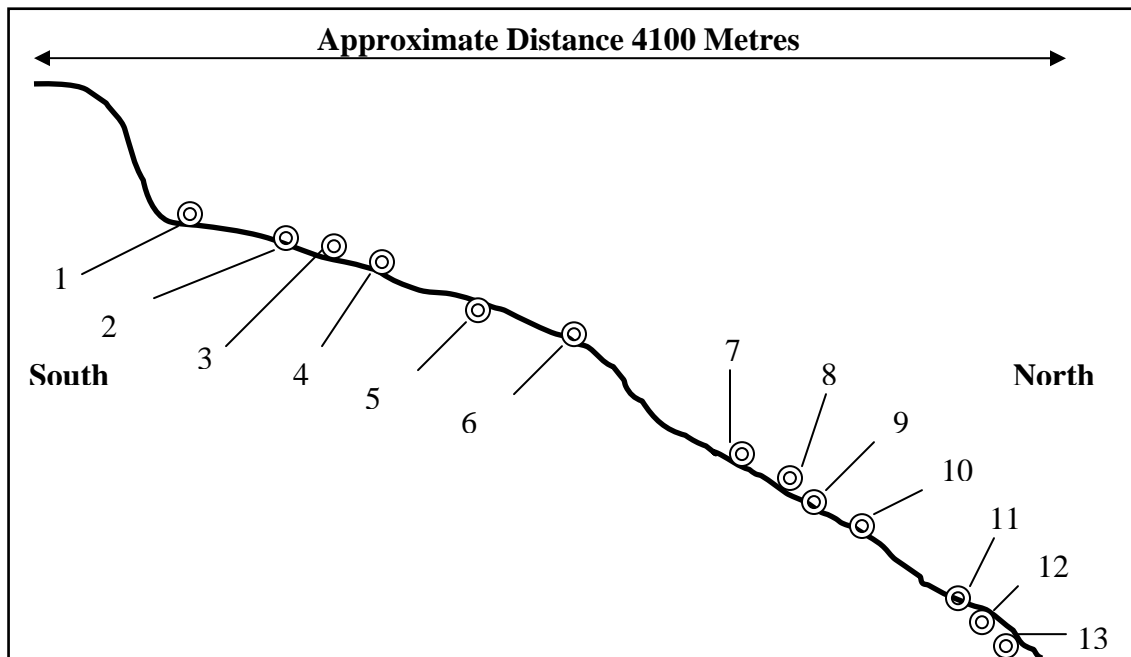
For more information, please contact:

KeiBerg Inc.
Phone: 1-204-319-8111
Web Site: www.line-alert-panel.com

Installation Overview

Thirteen (13) Line Alert panels were installed across a distance of approximately 4.1KM on various utility types, crossing angles and depths. Line Alert was not used on some crossings as per the notes provided below in the details section. Installation began on January 7, 2008 and was completed on January 10, 2008. The panels were in the ground for approximately two weeks (14 days) with excavation commencing on January 23, 2008.

The Line Alert panels were installed directly following Hydrovac exposure and backfilled with sand by hand/backhoe. Installation took about 3-5 minutes per crossing. Weather conditions varied during the installation process with temperatures ranging from -5 degree to -15 degree Celsius. The following diagram outlines the approximate location of each crossing.



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This photo shows the Line Alert panel held by the installation tool ready to be placed down the vachole on top of the line. Note the open saddle flap at the bottom of the panel that will wrap around the line and secure the panel once backfilled.



In this instance, the Line Alert panel is being placed down the vachole and on top of the line using the installation tool.

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The Line Alert panel being held in place on the line by the installation tool as the hole is backfilled with sand.



The Line Alert panel has been backfilled to the top and the installation tool is being removed. Note the yellow "Line Alert Installed" caution tape between the feet of the worker. The caution tape is attached to the panel and runs to the surface providing an installation marker.

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General Excavation Results

KeiBerg representatives directly monitored the thirteen line crossings performed using Line Alert. Excavation occurred from January 23, 2008 to February 2, 2008. Weather conditions varied during the excavation with temperatures ranging from -10 to -25 degrees Celsius with periods of snow on some days. The digging conditions were extreme in some cases made very difficult due to the frost in the ground varying from 2 feet to 3 feet deep. Based on these line crossing excavations the following general conclusions are being presented.

- 1) Efficient and Accurate Excavation to No Mechanized Dig Zone – in all cases, the excavator dug to the two foot mark without intervention. No crew members were required to enter the ditch to estimate the distance from the line using tape measures and the marking stake depths. Depths shown by the panel were actual, not estimates. The only time crew members had to enter the ditch during this process was the odd time the large pieces of frost chunks fell on top of the panel sections obscuring the visual reading from the surface.
- 2) Line crossings going over an existing line were made significantly easier as the excavator simply dug to the depth over the line they wished to stop at. There was no manual labour required while maintaining a clear real-time distance measurement starting at three (3) feet from the line. In cases where existing lines were deep, the ability to go over the line without having to re-expose it took, on average, ten minutes. On this project four (4) lines were deep enough to have the new line installed over top. With the current slotting method of line crossing performed by many operators, these crossings would take significantly more effort and time. It should be noted, following our discussions with the crew, that extreme angle line crossings, if they had been performed with the normal slotting method, would have taken several hours of Hydrovac as well as forty-five (45) minutes to an hour of excavation time on each crossing. Using Line Alert, the crossing time took only minutes of excavation and forty-five (45) minutes of Hydrovac time to confirm the line and make the installation slot.
- 3) Visual Confirmation Made Easier – once the excavator stopped at the 24” no dig zone, the crew would use the panel as a guide to dig down to the line knowing their depth above the line as well as the location (angle) while shoveling. This is a major benefit in areas of frost where chipping/aggressive shoveling may be required. It is also of major benefit when manually exposing small lines such as electrical lines which can be very difficult to locate without such a guide. Finally, as they knew exactly where the line was, the amount of digging was kept to a minimum.
- 4) Probing was completely eliminated – the need to probe, either during the mechanized excavation or the hand exposure of the line, is not needed. Line Alert provides a clear guide to the line at all times.
- 5) Added Safety Zone with Frost Ground – for shallower lines, when significant pounding by the excavator is required to break the frost, the operator knows exactly how far they are from the line at all time (within three (3) feet of the line) providing them with guidance as to how aggressive they can continue their breaking activities.

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- 6) Existing Pipe Integrity Improved – When hand exposing a line using shoveling, more sensitive utilities, such as fiberglass or electrical lines are susceptible to damage both from probing and uncontrolled shoveling. Line Alert removed that potential for damage by providing a clear guide for the crew to shovel down each side of the panel while maintaining a visual depth gauge as to how far from the line they were. This virtually eliminates the risk of damaging the utilities with a shovel strike while trying to obtain visual confirmation. This is especially true in hard frost ground conditions where shallow lines may be in or near frost and chipping might have to be used to breakaway the soil. Additionally, when using Line Alert to go over a line, the line never has to be re-exposed removing any additional risk to the line.

Crew Observations

Throughout the trial, using Line Alert on thirteen (13) line crossings, the crew made a variety of comments and observations on the use of Line Alert.

- Project Consultant (new to Line Alert) - It eliminates probing, shows you the direction and angle of the facility you are crossing, you know how far you are away from the line at all times, saves time while being safer.
- Lead Hand (has used Line Alert on other pipeline projects) – liked Line Alert and how it helped him do his job much more efficiently and safer. A comment was made that he is not sure how he will adapt to future projects if Line Alert is not used.
- Excavator Operator #1 (has used Line Alert on other pipeline projects) – likes the comfort level of knowing where he is during the excavation of the crossing.
- Excavator Operator #2 (new to Line Alert) – liked knowing exactly how close he was to the line and how he could see the angle of the line. He also felt that when having to use extreme pounding of the bucket to break through the frost, knowing the distance he was from the line provided a better comfort level.
- Excavator Operator #3 (new to Line Alert) – felt Line Alert would be of benefit to new and less experienced operators. He liked being able to know the exact depth above the line. The primary area of benefit that was commented on was the simplicity and ease provided by Line Alert when going over lines instead of under them.

Line Crossing Details

The following section contains details for each line crossing in this trial. For information on the visual location of these crossings, see the installation diagram in the installation section above.

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#1 Crossing

Installation Date: January 8, 2008
Excavation Date: January 23, 2008
Location: 49°33.924N, 103°08.695W
Soil Type: Type B (Frost)
Line Alert Installed: NO
Crossing Type: Electrical
Crossing Depth: 23"
Crossing Angle:



Comments: This was a very shallow line so it was decided not to install a Line Alert panel and to expose the line manually.

#2 Crossing

Installation Date: January 8, 2008
Excavation Date: January 23, 2008 - Left in Ground
Location: 49°33.929N, 103°08.695W
Soil Type: Type B (Frost)
Line Alert Installed: YES
Crossing Type: 3" Steel
Crossing Depth: 66"
Crossing Angle:



Comments: **EXCAVATION:** This panel was not excavated. It was decided post installation that the crossing was very close to the roadway which was being bored under. The crew simply extended the bore slightly past the roadway going under the line. This removed the requirement to excavate this line crossing.

#3 Crossing

Installation Date: January 8, 2008
Excavation Date: January 23, 2008
Location: 49°34.067N, 103°08.650W
Soil Type: Type B (Frost)
Line Alert Installed: YES
Crossing Type: 3" Steel
Crossing Depth: 53"
Crossing Angle:



Comments: **EXCAVATION:** The panel was excavated to the 24" marker where hand exposure began. The ground was very hard with 2.5 feet of frost. Time to expose 24" marker was 8 minutes. Total crossing time was approximately 35 minutes with Line Alert performing normally.

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This photo provides a clear view of the exposed green sections of the Line Alert panel following a pass of the bucket.

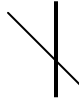


Workers hand exposing the line digging down the sides of the Line Alert panel providing guidance to the worker. Note the yellow sections (13"-24") and red sections (1"-12") providing clear depth indication from the buried line.

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#4 Crossing

Installation Date: January 9, 2008
Excavation Date: January 24, 2008
Location: 49°34.108N, 103°08.644W
Soil Type: Type B (Frost)
Line Alert Installed: YES
Crossing Type: 3" Steel
Crossing Depth: 61"
Crossing Angle:



Comments:

EXCAVATION: This panel was excavated to the 24" marker where hand exposure began. The ground in this summer fallow area was very hard/frozen with frost down to 3 feet. Total crossing time was approximately 48 minutes. Line Alert performed well providing depth measurements as well as clearly showing the angle of the crossing.

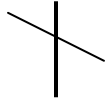


Worker showing the operator the depth indicator of 33" following the first encounter of the bucket with the panel. Note how even in the frost conditions with large chunks of soil, the panel indicators are still highly visible.

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#5 Crossing

Installation Date: January 9, 2008
Excavation Date: January 25, 2008
Location: 49°34.231N, 103°08.581W
Soil Type: Type B (Frost)
Line Alert Installed: YES
Crossing Type: Electrical Line
Crossing Depth: 26"
Crossing Angle:



Comments: **INSTALLATION:** This crossing was shallow and as such 10" of the Line Alert Panel was above ground. The section above ground was covered by a mound of dirt.

EXCAVATION: Due to the shallow location of this line, only one pass with the excavator was required to break the top soil and get to the 24" mark. The line was hand exposed with the panel providing guidance to the labourers showing them where the line was allowing them to stay away from the line with their shovels.

#6 Crossing

Installation Date: January 9, 2008
Excavation Date: January 26, 2008
Location: 49°34.357N, 103°08.409W
Soil Type: Type B (Frost)
Line Alert Installed: YES
Crossing Type: 3" Fiberglass / Electrical Line (12" away)
Crossing Depth: 64"
Crossing Angle:



Comments: **INSTALLATION:** Both the fiberglass line and the electrical line were 64" deep and one foot apart. The Line Alert panel was installed on top of the Fiberglass line.

EXCAVATION: This panel was excavated to the 24" marker where hand exposure began. The ground in this area was very hard with frost down to 3 feet. Additionally several rocks were encountered slowing the excavation process. Line Alert performed well providing depth measurements as well as clearly showing the angle of the crossing.

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This photo shows the extreme soil conditions caused by frost during this excavation work.



A clear image of the green section of the Line Alert panel showing in the ditch following a bucket pass. Note how even in the frost conditions with large chunks of soil, the panel indicators are still highly visible.

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#7 Crossing

Installation Date: January 10, 2008
Excavation Date: February 1, 2008
Location: 49°34.929N, 103°07.401W
Soil Type: Type B (Frost)
Line Alert Installed: YES
Crossing Type: 4" Flexpipe
Crossing Depth: 68"
Crossing Angle:



Comments:

EXCAVATION: Due to the depth of this line, it was decided by the consultants and inspectors that it would be best to go over the line. Due to heavy frost at the surface the crossing was slowed somewhat. However, the trench was completed over top of the line at a depth of 19" in 16 minutes. The remaining section of Line Alert was left in the ground and the line was never exposed.

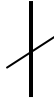


A clean trench over top of the line with the remaining section of Line Alert showing.

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#8 Crossing

Installation Date: January 10, 2008
Excavation Date: February 1, 2008
Location: 49°34.939N, 103°07.382W
Soil Type: Type B (Frost)
Line Alert Installed: YES
Crossing Type: Electrical Line
Crossing Depth: 44"
Crossing Angle:



Comments:

EXCAVATION: The majority of the panel was in frost. Excavation through the frost stopped at 24" mark. Even though fully in frost, Line Alert provided depth guidance once encountered. The line was hand exposed with the panel providing guidance to the labourers showing them where the line was allowing them to stay away from the line with their shovels. It should be noted that on such a small electrical line, the panel provides a very clear guide to locating and exposing the line without touching it in hard ground conditions. The saddles also wrapped around the line protecting it.



This photo shows how the Line Alert depth markers still shear and are visible even in full frost conditions. Note the red paint mark showing the angle of the line. Note how Line Alert provides the actual and angle of the line in the trench, not at surface.

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Using the panel as a guide to stay away from the line while working through hard ground to hand expose the line.

#9 Crossing

Installation Date: January 10, 2008
Excavation Date: February 1, 2008
Location: 49°35.010N, 103°07.299W
Soil Type: Type B (Frost)
Line Alert Installed: YES
Crossing Type: 3" Fiberglass / 3" Fiberglass
Crossing Depth: 75" / 77"
Crossing Angle:



Comments:

INSTALLATION: Due to the different depths of these two lines that were about a foot apart, a Line Alert panel was installed on each line.

EXCAVATION: Due to the depth of these lines, it was decided that it would be best to go over them. The trench was completed over top of the line at a depth of 21" above these lines in 7 minutes. The remaining sections of both of the Line Alert panels were left in the ground and the two fiberglass lines were never exposed.

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Both lines and depth above them clearly shown in the trench stopping mechanized excavation. No requirement for hand digging or re-exposing the lines.

#10 Crossing

Installation Date: January 10, 2008
Excavation Date: February 1, 2008
Location: 49°35.131N, 103°07.081W
Soil Type: Type B (Frost)
Line Alert Installed: YES
Crossing Type: 6" Poly
Crossing Depth: 52"
Crossing Angle:



Comments:

EXCAVATION: This panel was excavated to the 24" marker where hand exposure began. The ground in this area was very hard with frost down to 3 feet. Total crossing time was approximately 15 minutes. Line Alert performed well providing depth measurements as well as clearly showing the angle of the crossing.

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Using the panel as a guide to stay away from the line while working through hard ground to hand expose the line.

#11 Crossing

Installation Date: January 10, 2008
Excavation Date: February 2, 2008
Location: 49°35.284N, 103°06.948W
Soil Type: Type B (Frost)
Line Alert Installed: YES
Crossing Type: 3" Fiberglass
Crossing Depth: 71"
Crossing Angle:



Comments:

EXCAVATION: Due to the depth, it was decided to go over this line. The Peerless inspector agreed to allow the new line to be placed 14" above the existing line. The excavator operator, consultant and crew were impressed with the ease and timing of this procedure. According to the foreman, using Line Alert on this crossing with an extreme angle saved significant effort over the regular slotting process. Normally the Hydrovac crew would have to slot out approximately 3 metres on each side of line and approximately 2.5 feet under the line requiring about 3.5 to 4 hours of Hydrovac time. To finish the crossing would have taken another few hours of excavator work to dig out dirt and go underneath the fiberglass line. Using Line Alert only took approximately one (1) hour of Hydrovac time and seven (7) minutes of excavation work to reach the required depth above the line.

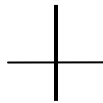
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The Line Alert section clearly shown in the trench stopping mechanized excavation above the line. No requirement for hand digging or re-exposing the existing line.

#12 Crossing

Installation Date: January 9, 2008
Excavation Date: February 2, 2008
Location: 49°35.307N, 103°06.932W
Soil Type: Type B (Frost)
Line Alert Installed: YES
Crossing Type: Electrical
Crossing Depth: 43"
Crossing Angle:



Comments:

EXCAVATION: This panel was excavated to the 24" marker where hand exposure began. The top of the panel was in frost. Total crossing time was approximately 15 minutes. Line Alert performed well providing depth measurements as well as clearly showing the angle of the crossing. Hand exposure of the small electrical line was also facilitated by using Line Alert as a guide to hand dig to the line without hitting it.

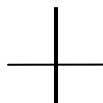
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Worker clearing frost chunks to confirm the depth on the Line Alert sections after the bucket first encountered the panel.

#13 Crossing

Installation Date: January 9, 2008
Excavation Date: February 2, 2008
Location: 49°35.311N, 103°06.930W
Soil Type: Type B (Frost)
Line Alert Installed: YES
Crossing Type: Electrical
Crossing Depth: 45"
Crossing Angle:



Comments:

EXCAVATION: This panel was excavated to the 24" marker where hand exposure began. The top of the panel was in frost. Total crossing time was approximately 20 minutes. Line Alert performed well providing depth measurements as well as clearly showing the angle of the crossing. Hand exposure of the small electrical line was also facilitated by using Line Alert as a guide to hand dig to the line without hitting it.

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Using the Line Alert panel as a guide to stay away from the line while hand exposing the line.

Summary

Based on the excavations that KeiBerg attended as well as obtaining feedback from the crew on the project using Line Alert, the following general conclusions are being presented.

- Less Labour Intensive – when labourers did hand expose, they were fresh as they did not have to exert themselves manually reconfirming the lines
- The level of stress attributed to performing hot digs may have been reduced by knowing the exact depth over the line
- High degree crossings were aided by a clear visual of not only the depth but the angle of the line.
- Line crossings going over an existing line were extremely simplified with no manual labour required at all while maintaining a clear real-time distance measurement starting at 3' from the line.
- Existing Pipe Integrity Improved – with more sensitive lines such as fiberglass or telecommunication lines in that multiple manual reconfirmation or probing did not occur reducing the stress and potential damage to these more sensitive types of lines.
- Worker safety improves on several fronts as less manual digging is required reducing potential physical injury through exertion or fall as well as reducing the risk of overburden related injuries such as cave-in (less time in ditch=less risk). Additionally, practices such as probing are no longer required removing any potential safety risks caused by these depth re-confirmation methods.

In general, we are confident in drawing the conclusion that the use of Line Alert was beneficial and created a safer and more efficient line crossing excavation process for this project.

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