

Miner to Reader Test Data

Equipment	Test Site	Comm Type	Number of Miners	Distance to Reader or Coverage Area	Rate of Travel	Describe Ride	Entry/Crosscut Conditions			
							Height	Width	Scenario	Notes
Breadcrumbs XL/ VoIP Phones (Zyxel #P200W) Laptop (Toshiba M400-S4032)	L-1A	2.4 GHz 802.11 Digital- 11 Mbps VoIP Phones	3	45 ft	Walking	NA	NA	NA	NA	Called made to communications system at top of slope using outside breadcrumb.
Breadcrumb WE-IS/ VoIP Phones (Zyxel #P200W) Laptop (Toshiba M400-S4032)	L-6	2.4 GHz 802.11 Digital- 11 Mbps VoIP Phones	2	700 ft	Walking	NA	8.5	16	3, 5	Breadcrumb located in intersection beneath belt. 54" belt in center of entry. Connectivity maintained through entire wireless mesh.
Breadcrumb WE-IS/ VoIP Phones (Zyxel #P200W) Laptop (Toshiba M400-S4032)	L-6	2.4 GHz 802.11 Digital- 11 Mbps VoIP Phones	2	750 ft	Walking	NA	8.5	16	1, 5, 7	One miner stayed near breadcrumb while other miner walked down entry until signal was lost. Connectivity maintained with BCAdmin Viewer and Miners.
Breadcrumb WE-IS/ VoIP Phones (Zyxel #P200W) Laptop (Toshiba M400-S4032)	L-6	2.4 GHz 802.11 Digital- 11 Mbps VoIP Phones	2	60 ft	Walking	NA	8.5	16	3, 5, 6, 7, 8	Breadcrumb located in x-cut 5. Miner traveled down belt entry on opposite side of stopping.
Breadcrumb WE-IS/ VoIP Phones (Zyxel #P200W) Laptop (Toshiba M400-S4032)	L-4	2.4 GHz 802.11 Digital- 11 Mbps VoIP Phones	1	400 ft	Walking	NA	8.5	16	2, 5, 7	Test conducted around corner on East/West Mains connection. Node disabled at L-3, L-5, and L-6. Voice Comm. was lost when L-3 was disconnected. Miner walked toward L-4 and comm. was received.

Miner to Surface Test Data

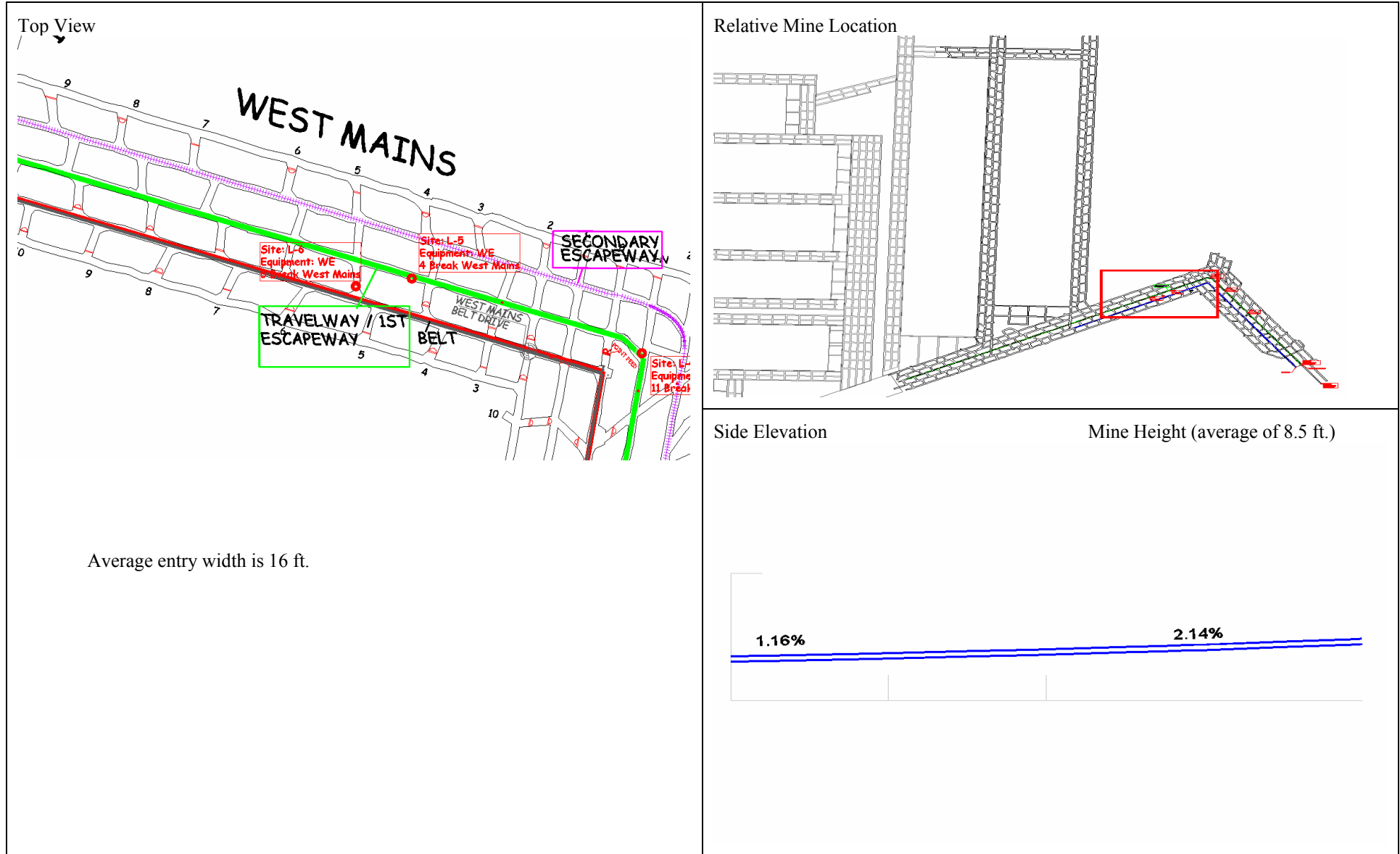
Equipment System/Miner	Test Site	Comm Type	Distance from Backbone or Node	Entry/Crosscut Conditions				SIO Score	Distance from Surface Comm-Center	Number Amps/Nodes to Surface Comm-Center
				Height inches	Width feet	Scenario	Notes			
Breadcrumbs XL/ VoIP Phones (Zyxel #P200W) Laptop (Toshiba M400-S4032)	L-5	2.4 GHz 802.11 Digital- 11 Mbps VoIP Phones	20 ft	8.5 ft	16 ft	1, 5, 7	Called outside communications center from Break 5 using VoIP phone.	5,5,5	~2200 ft	*5
Breadcrumbs WE-IS/ VoIP Phones (Zyxel #P200W) Laptop (Toshiba M400-S4032)	L-6	2.4 GHz 802.11 Digital- 11 Mbps VoIP Phones	100 ft	8.5 ft	16 ft	1, 5, 7	Entry was partially blocked.	4,4,4	~2700 ft	*6
Breadcrumbs WE-IS/ VoIP Phones (Zyxel #P200W) Laptop (Toshiba M400-S4032)	L-6	2.4 GHz 802.11 Digital- 11 Mbps VoIP Phones	160 ft	8.5 ft	16 ft	2, 5, 7, 8	Call was made to surface from x-cut prior to crossing stopping. Call was clearly around coal pillar.	4,3,3	~3200 ft	*6
Breadcrumbs WE-IS/ VoIP Phones (Zyxel #P200W) Laptop (Toshiba M400-S4032)	L-7	2.4 GHz 802.11 Digital- 11 Mbps VoIP Phones	60 ft	8.5 ft	16 ft	3, 5, 6, 7	WE Node set up 30 ft from stopping. Complete mesh connectivity noticed after node was placed.	3,3,3	~3200	*7
Breadcrumbs WE-IS/ VoIP Phones (Zyxel #P200W) Laptop (Toshiba M400-S4032)	L-3	2.4 GHz 802.11 Digital- 11 Mbps VoIP Phones	160 ft	8.5 ft	16 ft	2, 5, 7, 8	Called from around coal pillar one break in by last node.	4,4,4	~1600	*3

*-Number of nodes can vary depending on mesh network.

Reader to Surface Test Data

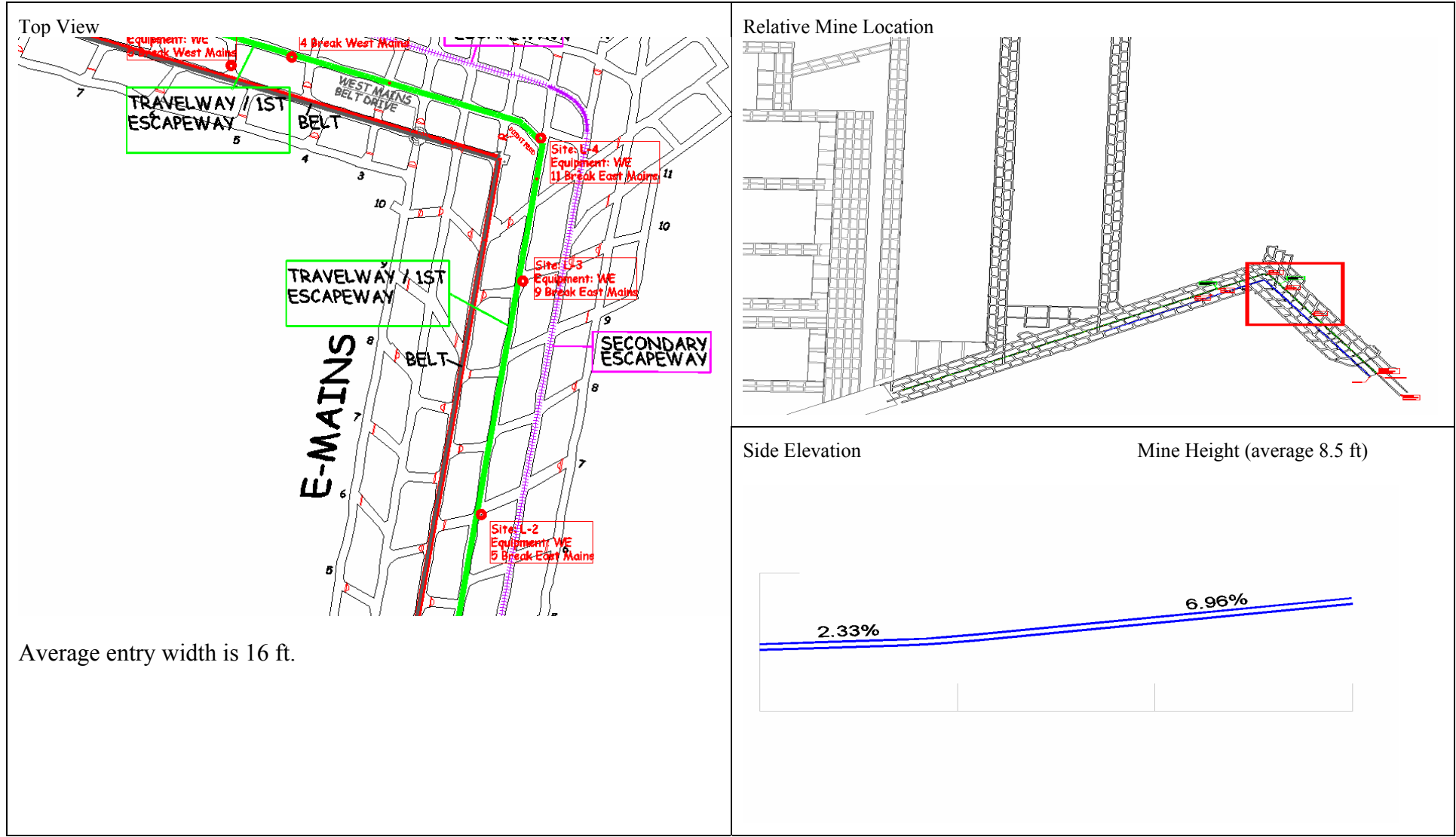
Equipment System/Miner	Test Site	Comm Type	Distance Reader to Surface Comm-Center	Entry/Crosscut Conditions				Number Amps/Nodes to Surface Comm- Center
				Height inches	Width feet	Scenario	Notes	
Breadcrumb XL/ VoIP Phones (Zyxel #P200W) Laptop (Toshiba M400-S4032)	L-1A	2.4 GHz 802.11 Digital-11 Mbps	45 ft	NA	NA	NA	BCAdmin screen tested on Laptop and VoIP calls made to communications center in hoist house.	1
Breadcrumb WE-IS/ VoIP Phones (Zyxel #P200W) Laptop (Toshiba M400-S4032)	L-5	2.4 GHz 802.11 Digital-11 Mbps	~2200 ft	8.5 ft	16 ft	1, 2, 5, 7	Called made to outside comm center from VoIP phone. All wireless nodes maintained connectivity through vertical curve of slope to outside. BCAdmin screen on laptop tracked all phones and wireless nodes in place.	5
Breadcrumb WE-IS/ VoIP Phones (Zyxel #P200W) Laptop (Toshiba M400-S4032)	L-6	2.4 GHz 802.11 Digital-11 Mbps	~3040	8.5 ft	16 ft	2, 5, 7, 8	Node was placed in xcut 5, around coal pillar from primary escapeway. Connectivity was maintained through entire mesh. BCAdmin screen indicated full wireless mesh was intact including all VoIP phones.	6
Breadcrumb WE-IS/ VoIP Phones (Zyxel #P200W) Laptop (Toshiba M400-S4032)	L-6	2.4 GHz 802.11 Digital-11 Mbps	~3250	8.5 ft	16 ft	3, 5, 6, 7	Breadcrumb located on belt in xcut 5, separated by stopping to primary escapeway and previous breadcrumb. BCAdmin screen indicated full connectivity through stopping and in entry containing belt. Verified by call to outside comm center.	7
Breadcrumb WE-IS/ VoIP Phones (Zyxel #P200W) Laptop (Toshiba M400-S4032)	L-3	2.4 GHz 802.11 Digital-11 Mbps	~1600	8.5 ft	16 ft	2, 5, 7, 8	Nodes were placed around curve in mains, precluding line of site. Wireless mesh was intact including all VoIP.	3

Test Sites L-5 and L-6



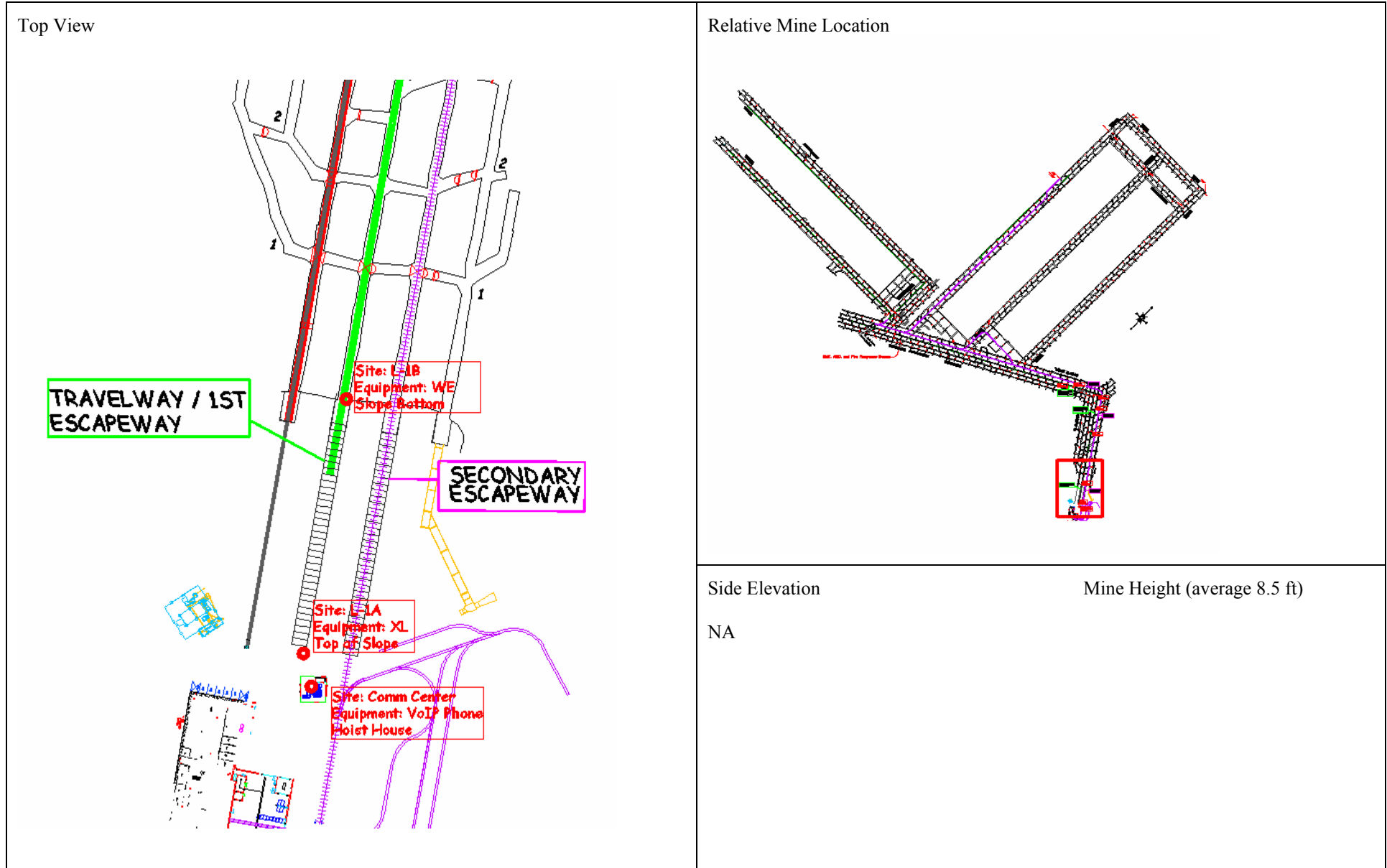
<p>Name of Mine Mountain View Mine</p>	<p>Date of Testing 06/19/07</p>	<p>Certifying Engineer Todd R Beavan</p>
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Test Sites L-2, L-3, and L-4



<p>Name of Mine Mountain View</p>	<p>Date of Testing 06/19/07</p>	<p>Certifying Engineer Todd R Beavan</p>
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Test Sites L-1A, L-1B, and Communications Center



<p>Name of Mine Mountain View</p>	<p>Date of Testing 06/19/07</p>	<p>Certifying Engineer Todd R Beavan</p>
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Survivability/Re-Establish

Element(s)	Dynamic Impact	Fire	Static Pressure	Power Interruption
<Name/Description>	<Likely failure>	<Likely failure>	<Likely failure>	<Likely failure>
	<Re-establish options>	<Re-establish options>	<Re-establish options>	<Re-establish options>
Breadcrumb WE-IS	The device will likely be destroyed	The device will likely be destroyed	The device will likely be destroyed	Because the unit is battery powered, the unit would be removed from the wireless mesh.
	Connectivity to the wireless network would be maintained so long as the nearest breadcrumb is within range of the communication and data devices. A new breadcrumb could be deployed at or near the location of the breadcrumb that is offline, and the wireless network would recognize the new point immediately. The handheld devices would show connectivity to the new point immediately assuming they are in range. Screen shots have been provided that show the BCAdmin screen on the wireless laptop used in testing. The screen shots clearly indicate the wireless mesh established by the breadcrumbs and handheld devices as well as redundant data paths between breadcrumbs and handheld devices.			

Pre-Recovery Test Condition

The screenshot displays the BCAdmin v9.64 (pre-release build 1924M) interface. The main window shows a network topology with several nodes and their connections. The nodes are:

- SE 2E10-896 (2)**: Cross Break under Belt, 1 peer, 2 clients. (Highlighted with a red dashed box)
- WE 1E10-532 (6)**: Cross Cut, 2 peers, 1 client. (Highlighted with a red dashed box)
- WE 1E10-750 (0)**: Turn, 4 peers, 0 clients.
- WE-15 1 (1)**: 3 peers, 0 clients.
- WE-15 2 (5)**: 10 Break, 4 peers, 0 clients.
- WE-15 3 (7)**: Bottom of Slope, 3 peers, 0 clients.
- WE-15 4 (4)**: #5 Break, 4 peers, 0 clients.
- XLE 2E10-525 (3)**: Portal, 2 peers, 1 client.

Client devices are also shown:

- Todd's Phone**: Connected to SE 2E10-896 (2).
- Peter's Laptop**: Connected to WE 1E10-532 (6).
- Peter's Phone**: Connected to WE 1E10-532 (6).
- Dave's Phone #17**: Connected to WE-15 3 (7).

The right-hand pane shows detailed information for the selected device, **WE 1E10-532 (00:60:B3:8D:2D:77)**:

Name:	SE 2E10-896
ID:	00:60:B3:2E:D0:3A
Version:	9.65 (Build 2081)
Mode:	Bridge
DHCP:	Enabled
Uptime:	0:08:12
Platform:	elf3 (armv5tel)
eth0:	00:50:c2:39:84:7b Ethernet
wlan0:	00:60:b3:2e:d0:3a 802.11b (Ch 1) (Mesh) (AP) 10.208.58.1
wlan1:	00:60:b3:2e:d0:01 802.11b (Ch 11) (Mesh) (AP) 10.208.1.1

The breadcrumb trail indicates the selected device is in the **Clients \ Nonreporting Peers** category. The bottom status bar shows the system time as 11:44 AM.

Recovery test – client devices migrated to another BreadCrumb following the loss of SE-896 and WE-532

The screenshot displays the BCAdmin v9.64 (pre-release build 1924M) interface. The main window shows a network topology with several BreadCrumb nodes and their associated clients. The nodes are:

- XLE 2E10-525 (9)**: Portal, 2 peers, 1 client
- WE-15 3 (5)**: Bottom of Slope, 3 peers, 0 clients
- WE-15 2 (3)**: 10 Break, 4 peers, 0 clients
- WE-15 4 (2)**: #5 Break, 4 peers, 0 clients
- WE 1E10-750 (6)**: Turn, 3 peers, 0 clients
- WE-15 1 (7)**: 1 peer, 3 clients
- WE 1E10-532 (108)**: Cross Cut, 1 peer, 3 clients

Client devices shown include Dave's Phone #17, Peter's Phone, Todd's Phone, and Peter's Laptop. A notification at the bottom right states: "Wireless Network Connection is now connected. Connected to: breadcrumb(unsecured). Signal Strength: Very Low".

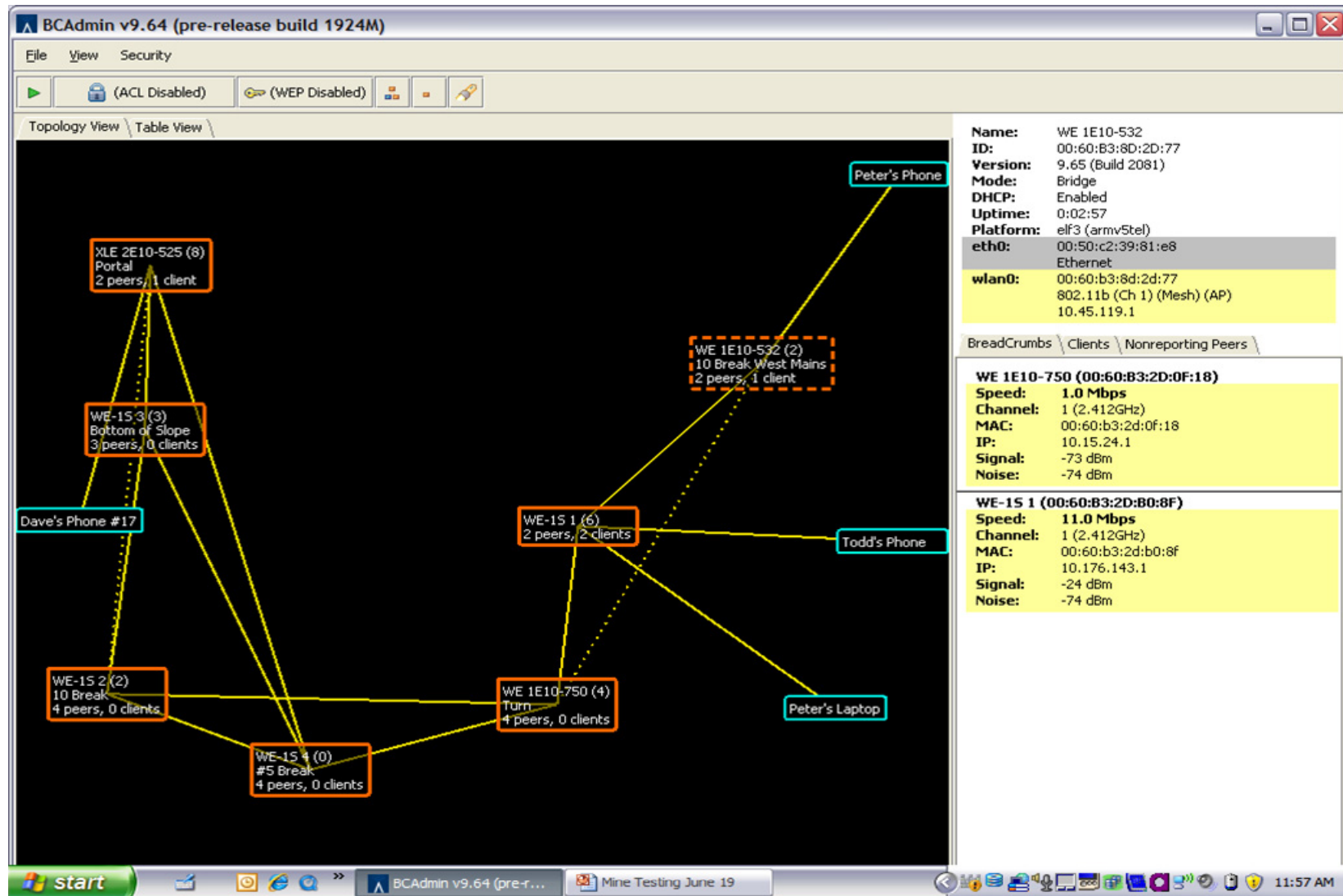
The right-hand pane displays details for the selected device, **WE 1E10-532**:

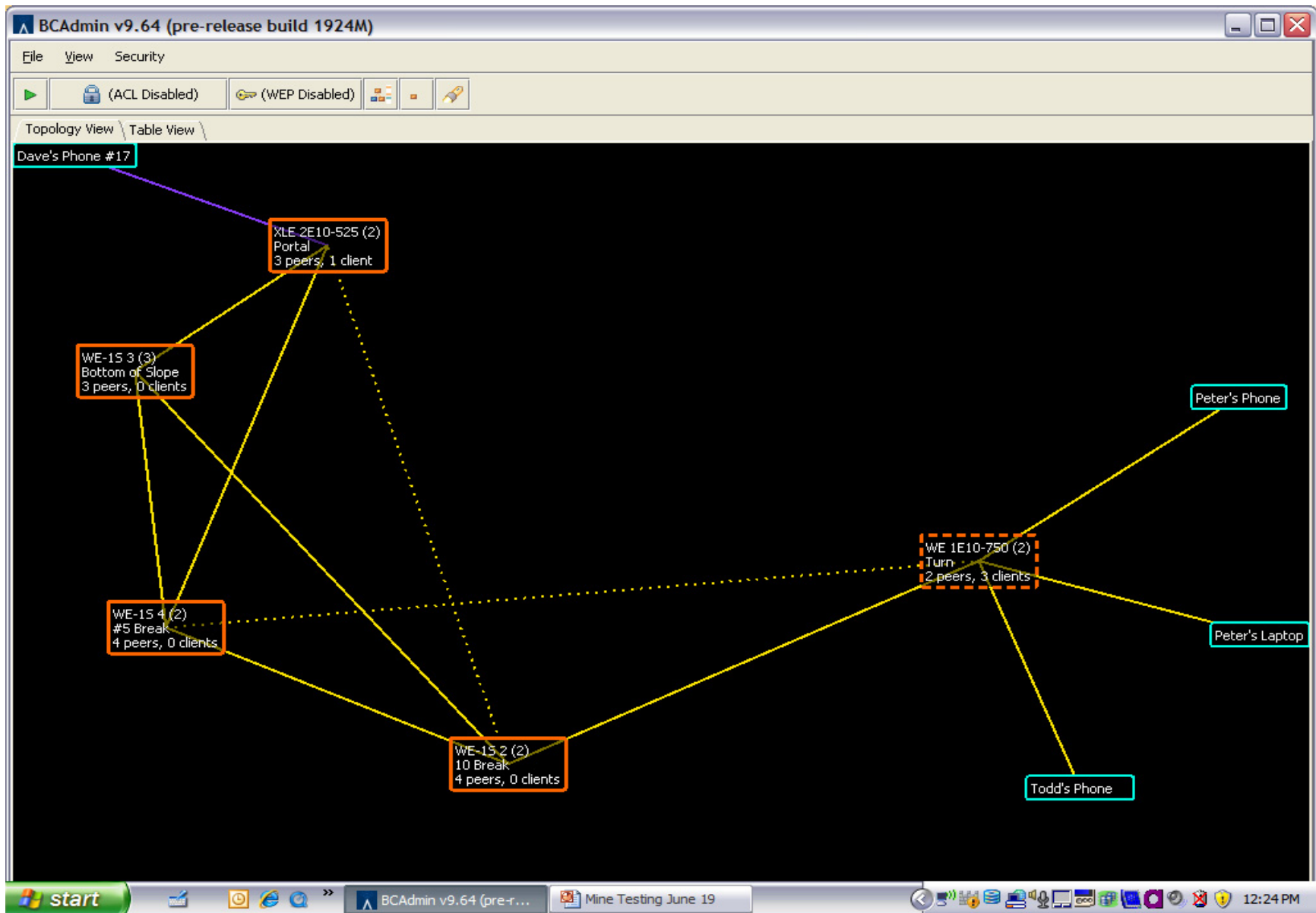
- Name:** WE 1E10-532
- ID:** 00:60:B3:8D:2D:77
- Version:** 9.65 (Build 2081)
- Mode:** Bridge
- DHCP:** Enabled
- Uptime:** 0:17:55
- Platform:** elf3 (armv5tel)
- eth0:** 00:50:c2:39:81:e8 (Ethernet)
- wlan0:** 00:60:b3:8d:2d:77 (802.11b (Ch 1) (Mesh) (AP), 10.45.119.1)

The bottom pane shows the breadcrumb path: **BreadCrumbs \ Clients \ Nonreporting Peers \ WE-15 1 (00:60:B3:2D:80:8F)**. Details for this breadcrumb include:

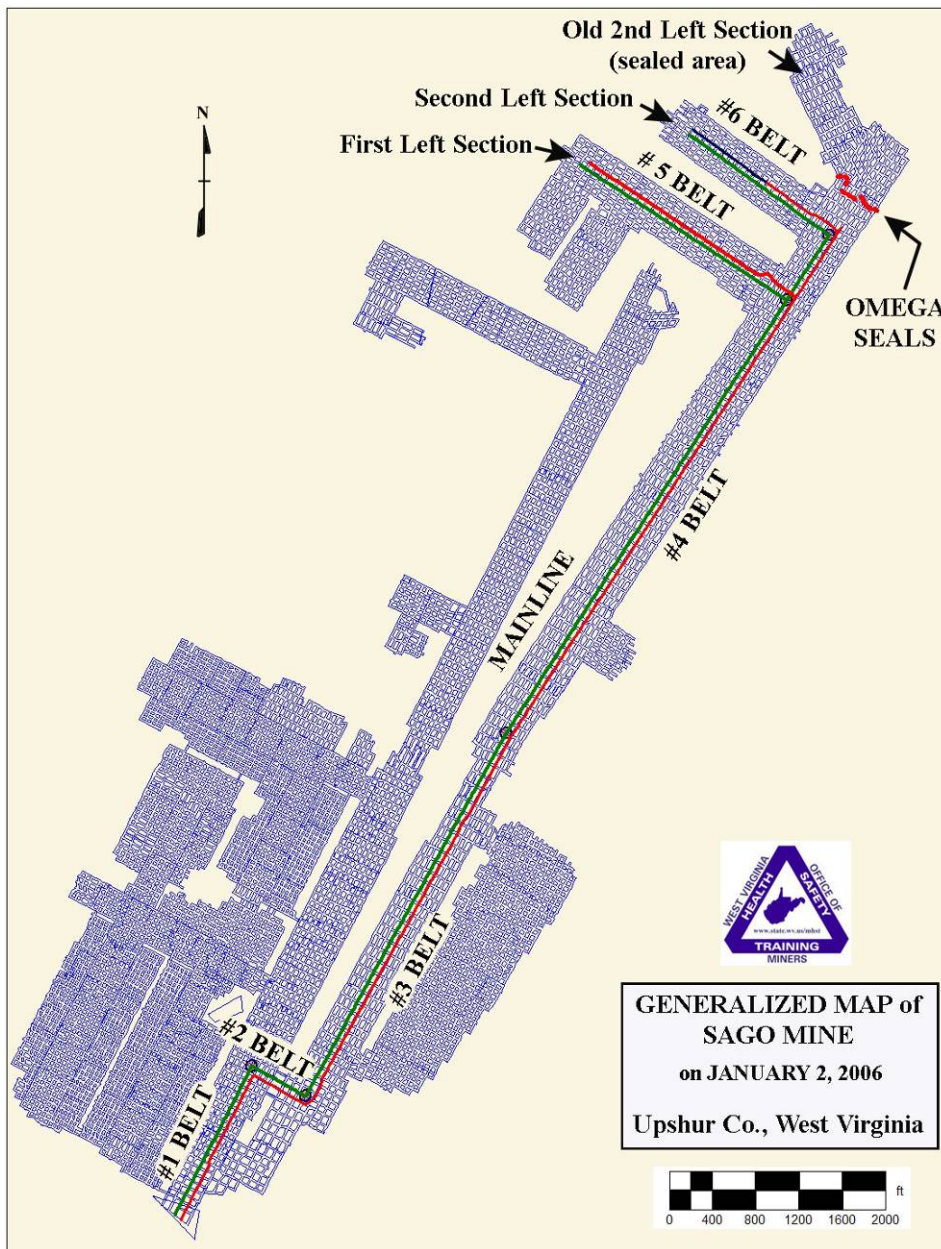
- Speed:** 11.0 Mbps
- Channel:** 1 (2.412GHz)
- MAC:** 00:60:b3:2d:b0:8f
- IP:** 10.176.143.1
- Signal:** -29 dBm
- Noise:** -74 dBm

Miner to Miner testing – Distance. Todd at 4 Break WM, Jim at 12 Break WM





**Representative Mine Layout
(Noting Proposed Element Locations)**



**Survivability Options Provided
Assuming Explosion in Old 2nd Left**

Individual System Element(s)	Breadcrumb WE wireless nodes
Damage by Dynamic Impact	Per the reference scenario described, if there was a large explosion, the breadcrumb would likely survive if it was installed in an XP (explosion proof). If a breadcrumb was damaged, it could easily be redeployed as there are no physical connections to other breadcrumbs. No testing was done to simulate the dynamic impact conditions described. Because of the wireless mesh connectivity, the mesh would remain intact except for the destroyed node.
Damage by Fire/Heat	Per the reference scenario described, if there was a large fire, the breadcrumb would likely survive if it was installed in an XP (explosion proof). If a breadcrumb was damaged, it could easily be redeployed as there are no physical connections to other breadcrumbs. No testing was done to simulate the fire conditions described. Because of the wireless mesh connectivity, the mesh would remain intact except for the destroyed node.
Damage by Static Pressure	Per the reference scenario described, if there was static pressure in excess of 150 psi, the breadcrumb would likely survive if it was installed in an XP (explosion proof). If a breadcrumb was damaged, it could easily be redeployed as there are no physical connections to other breadcrumbs. No testing was done to simulate the static conditions described. Because of the wireless mesh connectivity, the mesh would remain intact except for the destroyed node.
Function in Power Interruption	If there was a power interruption, the breadcrumb would remain functional. The current breadcrumb configuration is a battery operated unit, requiring no input power. If power input is included, then the unit would continue to function assuming a battery backup is in place.