I-90 Gold Creek Traction Control

Organized Chain-Up

Save the Space – Bringing Order to Chaos

James Todd Daley
SCR Assistant Traffic Engineer

2014 Western States Rural Transportation Technology Implementers Forum

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Washington State Department of Transportation

I-90 Organize Chain-up (OCU) Abstract

The Problem:

70 times a year snow and ice covered roads require chains. Large volumes of trucks and cars in a disorganized fashion overwhelm the space creating hazardous conditions that has been described as utter chaos.

Source: WSDOT

Organized Chain-Up Goals

If we can get the chain-up area organized, we will accomplish:

- ***Improve safety by providing increased buffers area between moving traffic and those chaining up***
- ***Increase safety by providing defined paths for vehicle movement***
- ***Reduce freight delays***
- ***Increase thru-put***
- ***Keep traffic moving***
- ***Allow for plowing***
- ***Keep vehicles from being locked in by double or triple parking***

Source: WSDOT

I-90 Conditions "as is" was not working

7000 trucks cross daily

300+ trucks peak hour trying to chain-up causes congestion, chaos

Average yearly snow: 457 in

Something needs to change!

Washington State Department of Transportation

Source: WSDOT

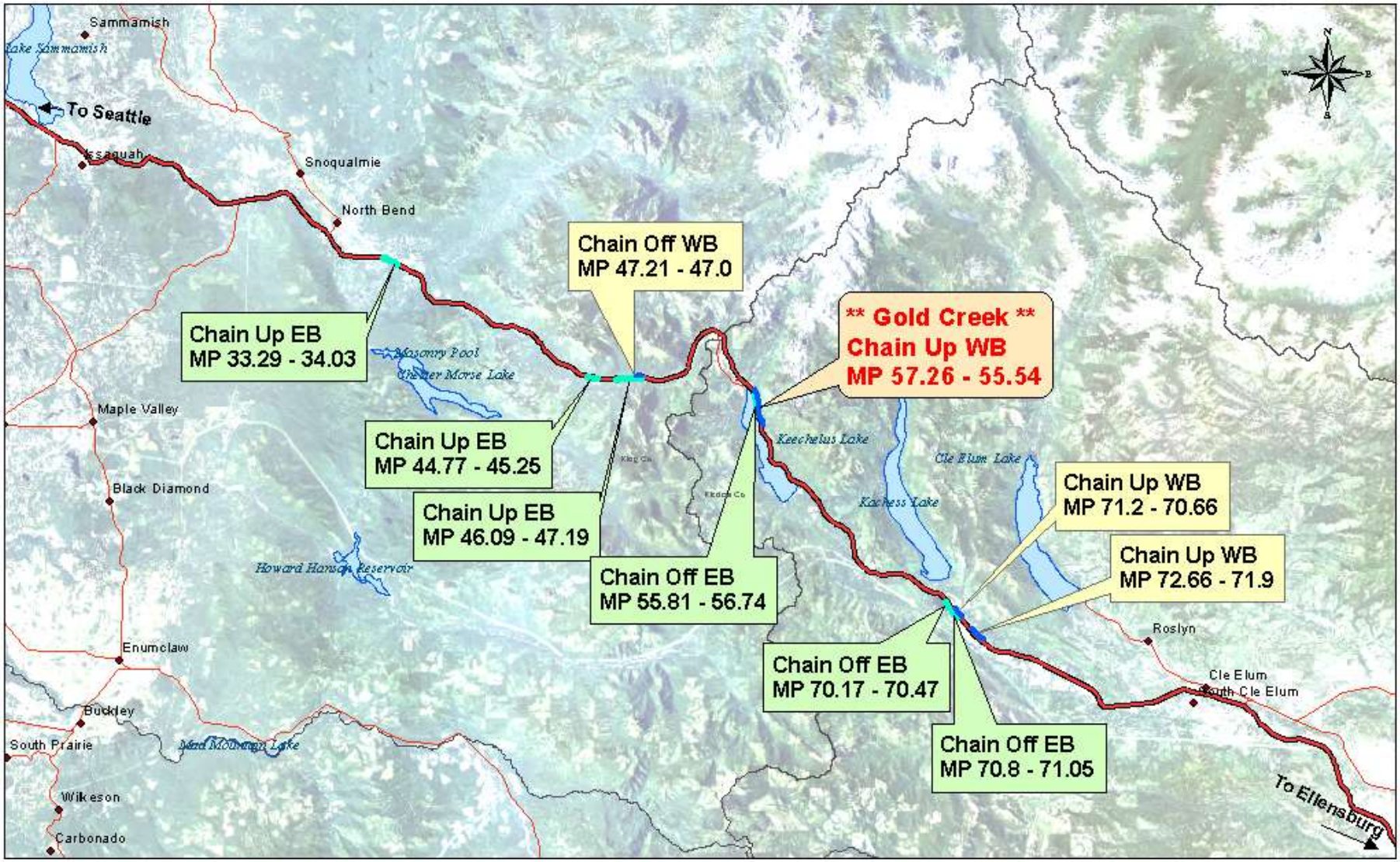
I-90 Organized Chain-up "The beginning"

In October 2007 a cross sectional group of Washington State DOT (WSDOT) staff and consultants discussed the problems and objectives for chain-up facility operations.

A world wide search found that no one was attempting to facilitate a technological solution for chain-up operations.

I-90 Snoqualmie Pass

Chain Up Facilities



Source: WSDOT

I-90 Chain-up
The Problems

Chain-up areas are limited in both directions of I-90 and heavy traffic congestion often results when chains are required.

Several problems converge to create the congestion and backups:

- Chain-up areas are too small to accommodate all the traffic that need to chain up.
- Some trucks park waiting for the conditions to improve (rest), thereby reducing the space available for those wanting to chain up and move on.
- Lane stripes are effectively eliminated by snow and ice on the roadway.
- The right-hand “lane(s)” becomes part of the chain-up area.

Play

“as it was”

Aka not so good.

Source: WSDOT

I-90 Chain-up Proposed Designs

To help the Chain-up areas several ideas were purposed.

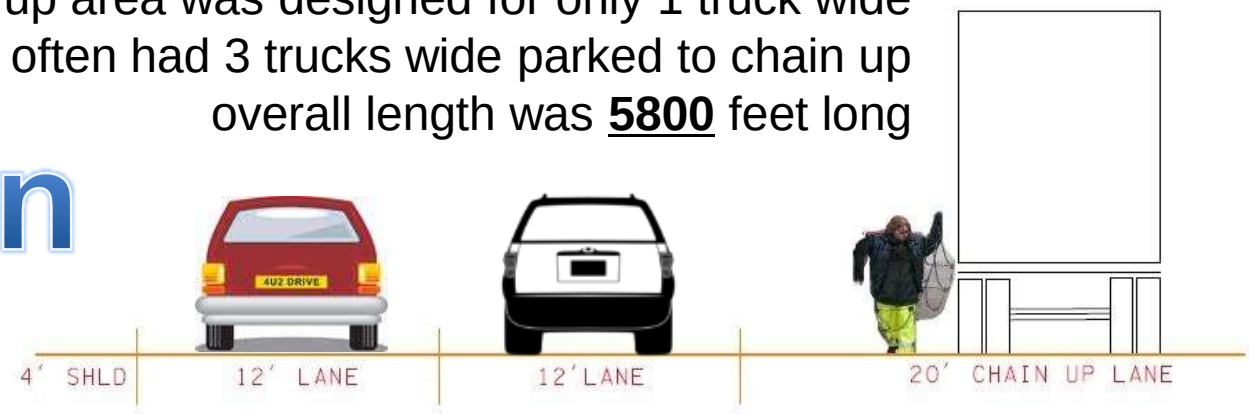
- Increase the width Chain-up areas
- Increase the length of the chain up areas
- Use different colored lights or zones to direct trucks to current open areas
- Increase enforcement for those who linger longer than they need to
- Use variable message signs (VMS) to direct chain up operations
- Use cameras to keep track of what is happening in the area

Source: WSDOT

I-90 Gold Creek Accepted Geometrics

Former chain up area was designed for only 1 truck wide but often had 3 trucks wide parked to chain up overall length was **5800** feet long

Then

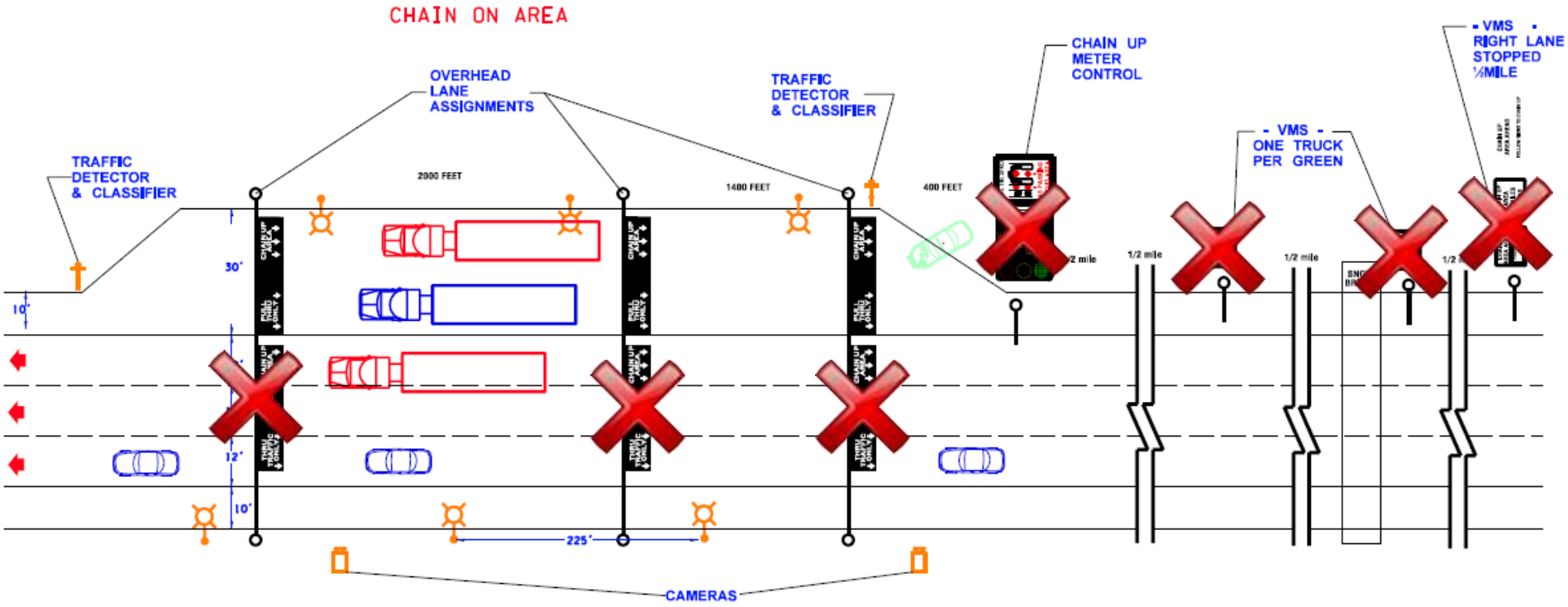


New chain up area offers 3 lanes and 30' wide chain area and over all length of **9300** feet long

Now

Chain-up System Winter 2012-2013

Parts of the Gold Creek OCU system not available winter 12-13



Increased Geometrics & no ITS, Same old problems

I-90 Chain-up Proposed Designs

Modified geometrics increased capacity by 60%

This would still fall short of peak hour volumes

Prior to the project the chain up area had

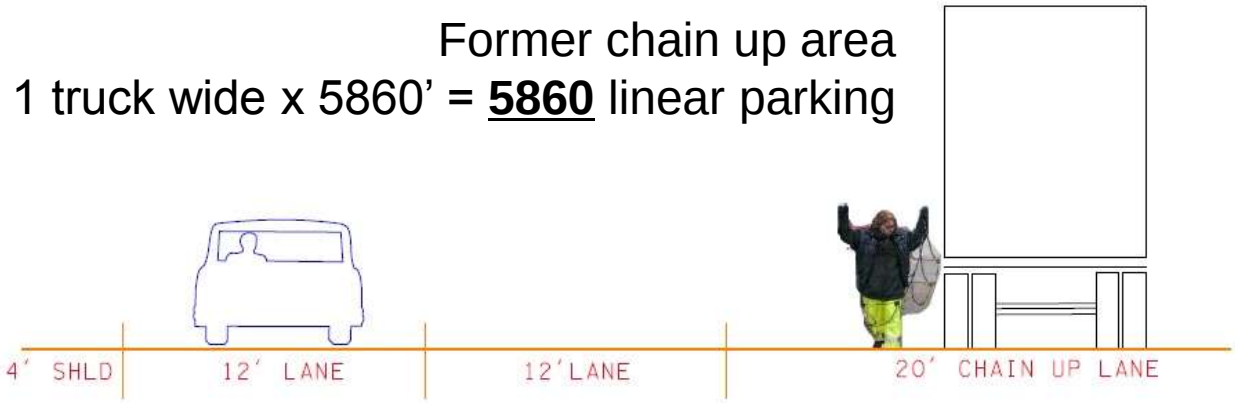
- 1 VMS to post current chain requirements.
- 1 Pan tilt zoom (PTZ) Camera

Most proposed operational solutions we tossed out including the color zones.

Ultimately the use of VMS, metering and increased camera coverage was selected

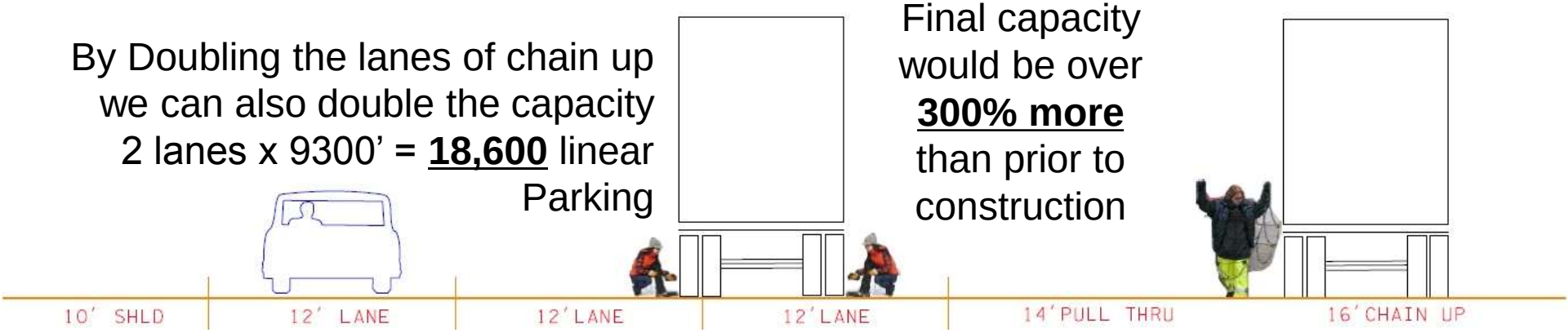
I-90 Gold Creek Chain Up – We Need More

Former chain up area
1 truck wide x 5860' = **5860** linear parking



By Doubling the lanes of chain up we can also double the capacity
2 lanes x 9300' = **18,600** linear Parking

Final capacity would be over **300% more** than prior to construction



Pull Thru Lane is Crucial

- Filling the spaces while ensuring space is available is key to the operation
- Trucks may queue up in right lane to enter the area waiting for an available space
- Trucks enter on green once space is available for them
- Keeping a pull through lane open is key to avoid trapping vehicles and allow new vehicles to enter the chain-up area

How to Build a Chain Up System

Placement of VMSs key. Overhead VMS every 800' would be ideal but also too expensive for an unproven system.

Place VMS at the end of tangents to optimize viewing distance and effect. Best design had 3 overhead sign bridges. However with budgets being tight initial bid documents had two sign bridges. However, the third was added during the advertisement period.

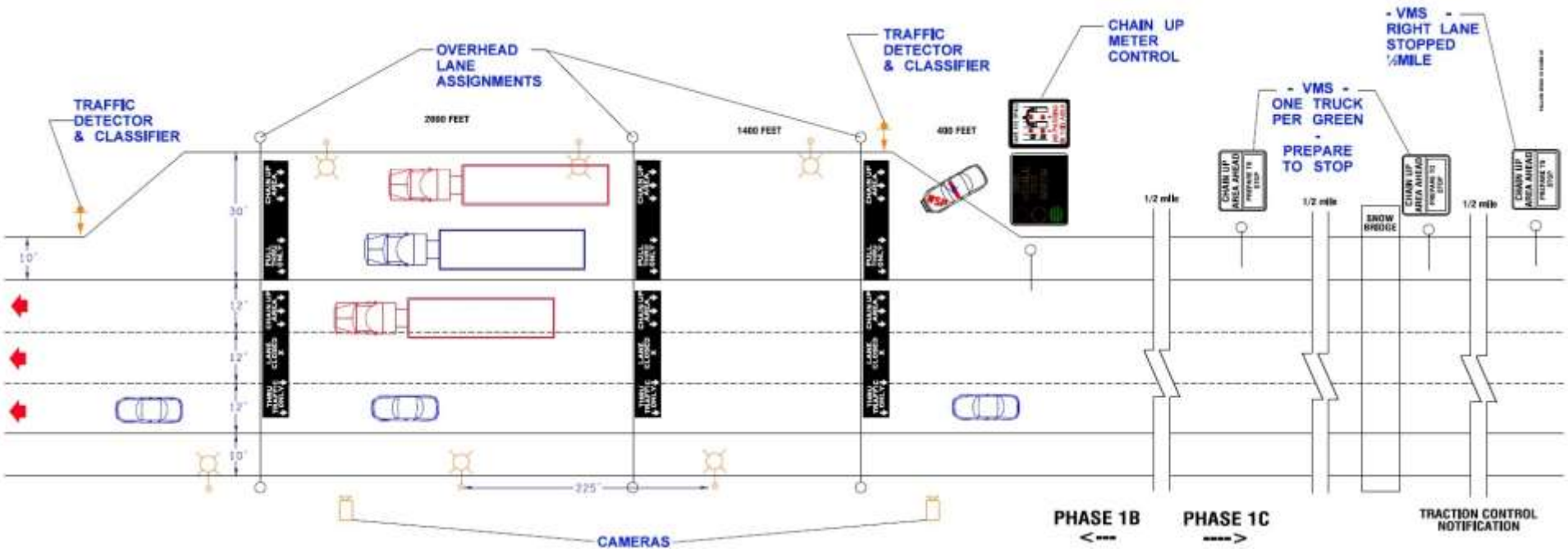
A small 6x5' VMS would be used to "meter" trucks in to avoid failure by clogged up area.

Data stations at the beginning and end of the area would "count" vehicles in and out of the area.

Cameras should be able to see 900' in each direction. Therefore camera placement every 1800'

Organized Chain-Up: Final Design

An overview of the Gold Creek organized chain-up System



Source: WSDOT

Organized Chain-Up: Acquisition of System

An overview of the Gold Creek organized chain-up System

All sign bridges, cantilevers and camera poles will be Contractor provided.

With technology advancing as quickly as it does, electronics will be provided by the State including:

- 9 VMS total
  - 6 Full color overhead in the area
  - 3 Amber advanced notification
- 1 Meter control (small dense pixel VMS)
- 6 Cameras
- 2 Data stations

Organized Chain-Up: Acquisition of VMS

An overview of the Gold Creek organized chain-up System

When the time came to provide the $550,000 in VMS the state did have a procurement contract for VMS. However, the contract was with a vendor who's track record was quickly going down hill and did not provide color VMS.

Decision to go for a Request for Qualifications and Quotes (RFQQ) contract was selected.

- RFQQ was about 25 pages with an addition 34 pages of specs for sign and controller.
- RFQQ was not based on price alone, successful winner had to:
  - RFQQ contract compliance
  - Vendor Qualifications
  - Experience
  - Technical Requirements
  - Cost

Proposal #: _____

Review 455700-12-01-DMS Section 5: Mandatory Technical Requirements before beginning the evaluation process.
Instructions:

1. Complete one Technical Score sheet for each Vendor who has submitted a proposal in response to 455700-11-01-RFQQ.
2. Only score information provided in the Vendor's proposal. Score is based solely on the information provided a Vendor's proposal.
3. To maintain an open and fair competitive process, all evaluators must remain unbiased through out the evaluation process.
4. Do not contact any Vendor nor discuss any Vendor's proposal with other evaluators.
5. Do NOT evaluate as a comparison between Vendors' proposals.
6. Points listed are the maximum available per section.
7. Points may be awarded anywhere from "0" to the maximum amount available per criterion.

Section Title	Max Pts	Instructions	Points Awarded
2.1 – RFQQ Compliance (M)	0	Pass Fail – Did Vendor follow all instructions? Failure to do so may be ground for disqualification.	Pass/ Fail
3.x – Vendor Qualifications (M)	0	Pass Fail – Did Vendor submit all mandatory information? Failure to do so may be ground for disqualification.	Pass/ Fail
3.1 – DMS Manufacturer Qualifications & Relevant Experience (MS)	25	The following is based on experience. • Grant 10 points for having specified DMS in field for 2 years. • Grant 10 points for having 20 specified DMS in field. • Grant 3 additional points for having 30 or more specified DMS in field. • Grant extra points for having specified DMS in field for each year beyond 2 years (2 max).	_____
4.x – Technical Requirements (MS)	25	The following is based on meeting the specifications. Base score is 25 and points are deducted for sections not meet not to be less than 0 points. • Subtract 1 point for each section or major item in the specification that is not meet. • Subtract .5 point for NTCIP items not meet. • Subtract 15 points if not NTCIP v02.39 or later • Subtract 10 points if not tested compatible with Vanguard SDK. Extra emphasis put on NTCIP v02.39 for its graphic capability, and Vanguard as it will be the control software used.	_____

Section Title	Max Pts	Instructions	Points Awarded
5.x – Cost Proposal (MS)	50	Cost proposal is based on % of engineers estimate with a default of 25 points ($550,000 - Total price _____) / $550,000 = _____ % *200 = _____ Add the either positive or negative result to 25 for a total between 0 to 50 points max. Note total price includes freight but not tax. A bid of $481,250 or lower will produce a score of 50 A bid of $618,750 or higher will produce a score of 0	_____
	100	**TECHNICAL EVALUATION SCORE**	_____

Evaluator Name _____ Date _____

Evaluator Signature _____

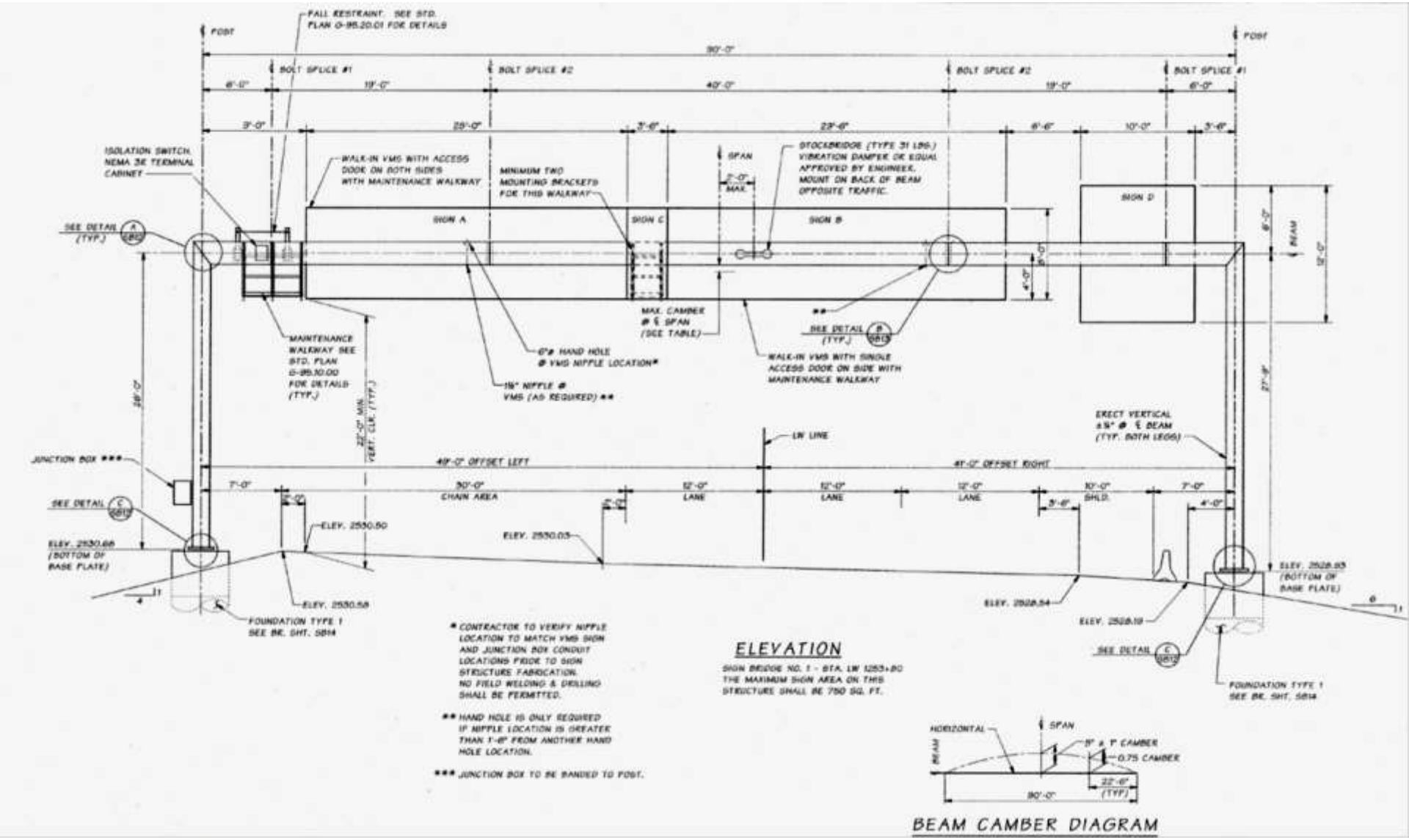
Ultimately two qualified VMS manufactures submitted bid. Skyline and Daktronics

When scoring was complete Daktronics scored significantly higher and received the contract.

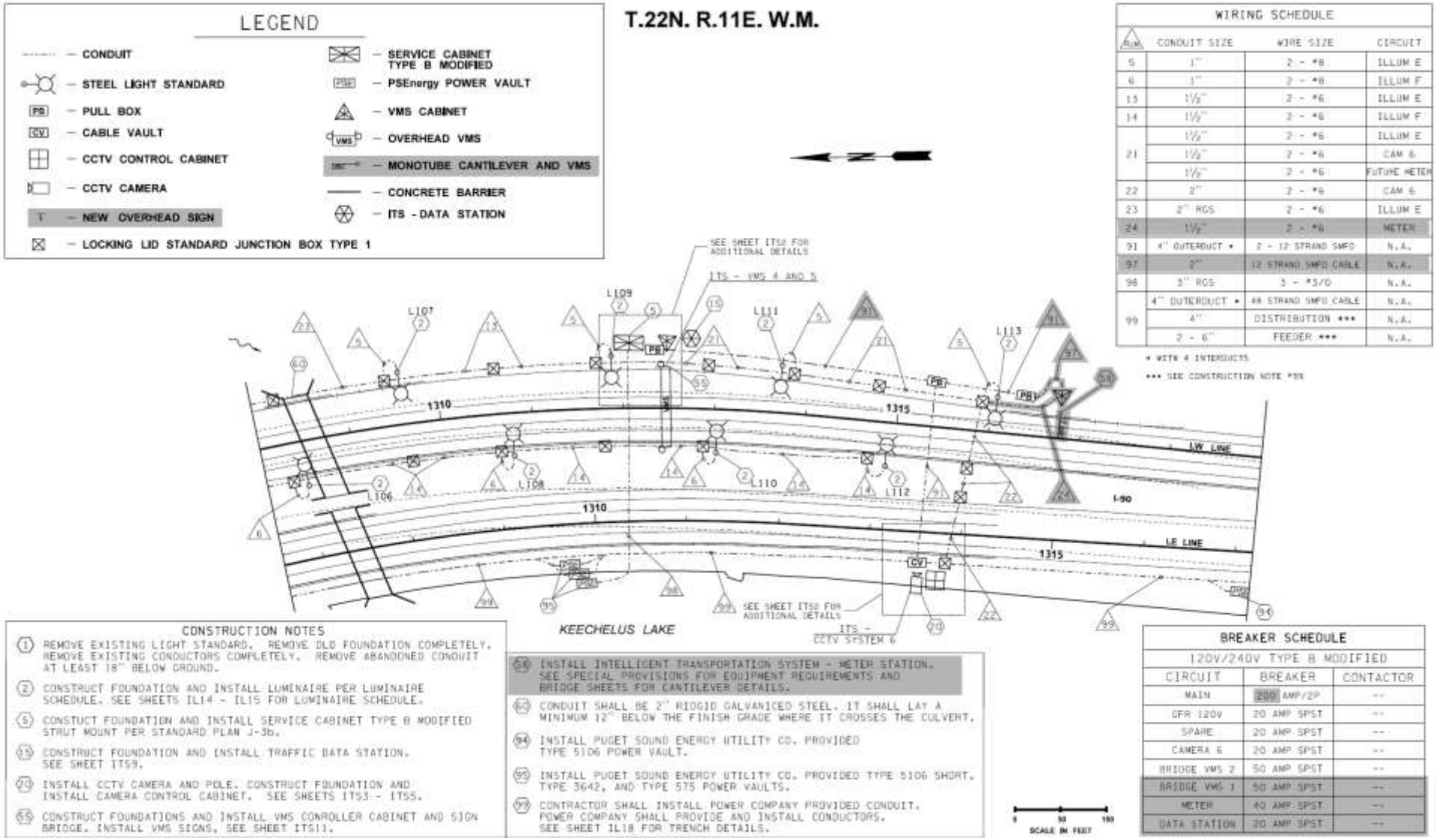
Both request via public information to see each other's submittal (let the redacting begin!)

Organized Chain-Up: Construction Topics

90’ Wide Sign Bridges - $155,000 each

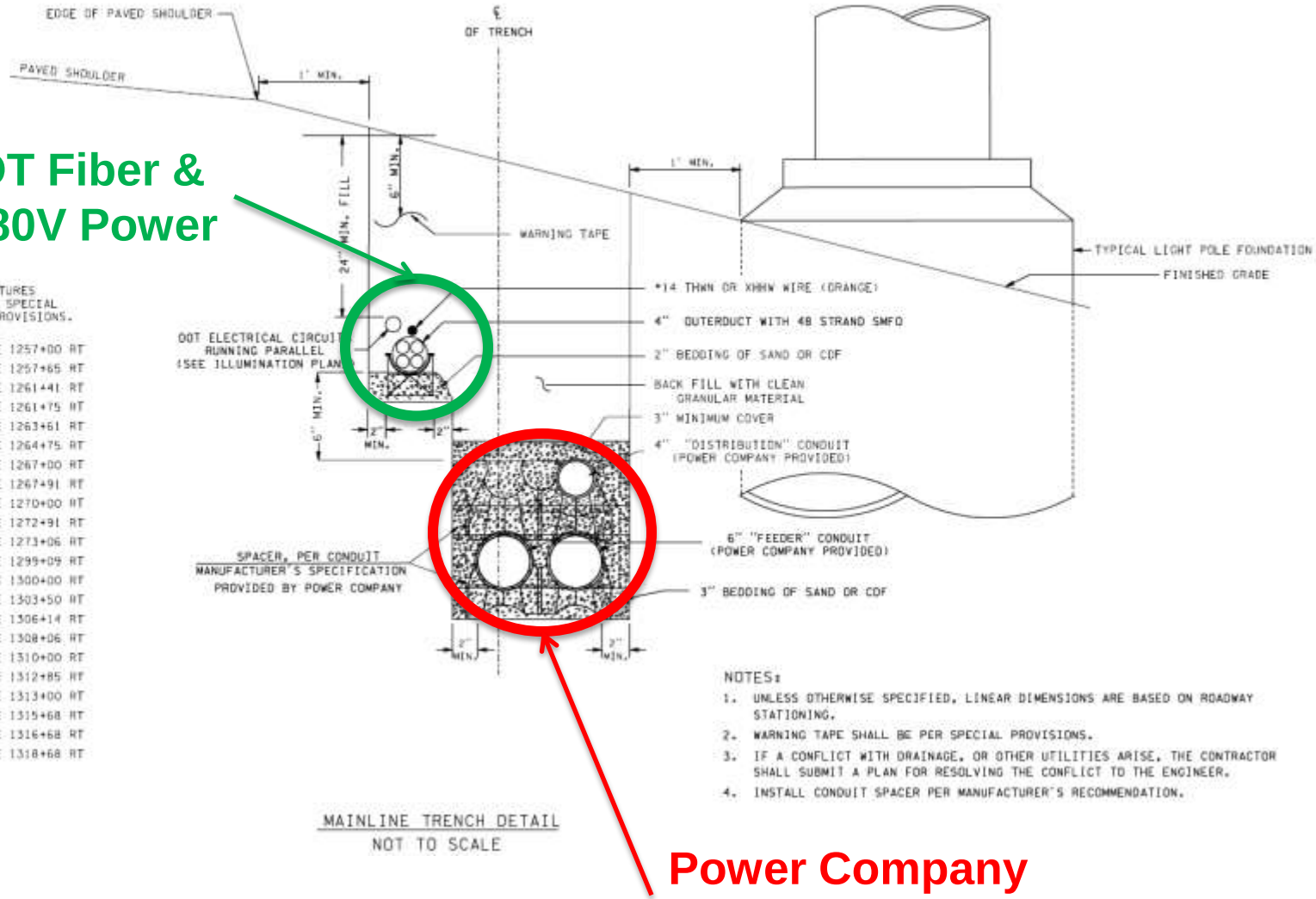


Typical plan sheet (Gray is addendums)



Joint Utility Company / DOT Fiber Trench

WSDOT Fiber &
120V – 480V Power



POWER CONDUIT AND DRAINAGE FEATURES MAY BE CLOSER THAN 6" MINIMUM. SEE SPECIAL PROVISIONS FOR CONFLICT RESOLUTION PROVISIONS.

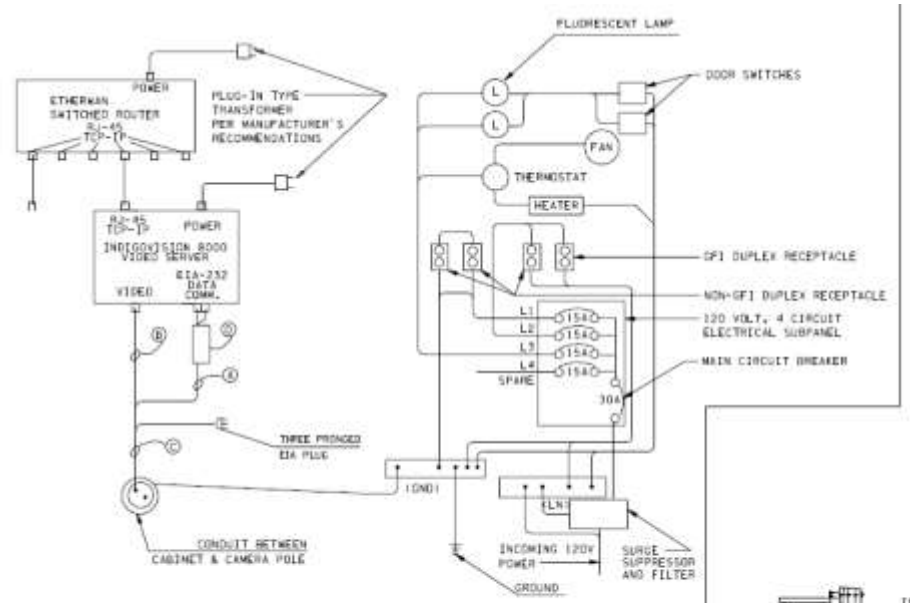
STA = LE 1206+40 RT	STA = LE 1257+00 RT
STA = LE 1206+46 RT	STA = LE 1257+65 RT
STA = LE 1206+54 RT	STA = LE 1261+41 RT
STA = LE 1210+34 RT	STA = LE 1261+75 RT
STA = LE 1210+49 RT	STA = LE 1263+61 RT
STA = LE 1224+31 RT	STA = LE 1264+75 RT
STA = LE 1226+00 RT	STA = LE 1267+00 RT
STA = LE 1229+50 RT	STA = LE 1267+91 RT
STA = LE 1232+30 RT	STA = LE 1270+00 RT
STA = LE 1233+00 RT	STA = LE 1272+91 RT
STA = LE 1234+00 RT	STA = LE 1273+06 RT
STA = LE 1235+00 RT	STA = LE 1299+09 RT
STA = LE 1236+17 RT	STA = LE 1300+00 RT
STA = LE 1239+48 RT	STA = LE 1303+50 RT
STA = LE 1242+00 RT	STA = LE 1306+14 RT
STA = LE 1243+87 RT	STA = LE 1308+06 RT
STA = LE 1244+68 RT	STA = LE 1310+00 RT
STA = LE 1246+65 RT	STA = LE 1312+85 RT
STA = LE 1247+50 RT	STA = LE 1313+00 RT
STA = LE 1250+00 RT	STA = LE 1315+68 RT
STA = LE 1251+37 RT	STA = LE 1316+68 RT
STA = LE 1252+50 RT	STA = LE 1318+68 RT
STA = LE 1255+91 RT	

MAINLINE TRENCH DETAIL
NOT TO SCALE

NOTES:
1. UNLESS OTHERWISE SPECIFIED, LINEAR DIMENSIONS ARE BASED ON ROADWAY STATIONING.
2. WARNING TAPE SHALL BE PER SPECIAL PROVISIONS.
3. IF A CONFLICT WITH DRAINAGE, OR OTHER UTILITIES ARISE, THE CONTRACTOR SHALL SUBMIT A PLAN FOR RESOLVING THE CONFLICT TO THE ENGINEER.
4. INSTALL CONDUIT SPACER PER MANUFACTURER'S RECOMMENDATION.

Power Company Conduits

Do not connect cabinets to poles in high snow area. Snow plows beat them up!

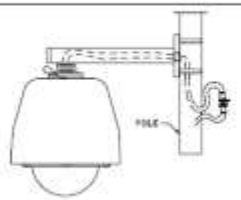


CAMERA & COMMUNICATION CONTROL CABINET WIRING DIAGRAM

NOTES:

ALL CONDUCTORS SHALL BE #14 AWG UNLESS DESIGNATED OTHERWISE. GROUNDING CONDUCTORS SHALL BE GREEN IN COLOR.

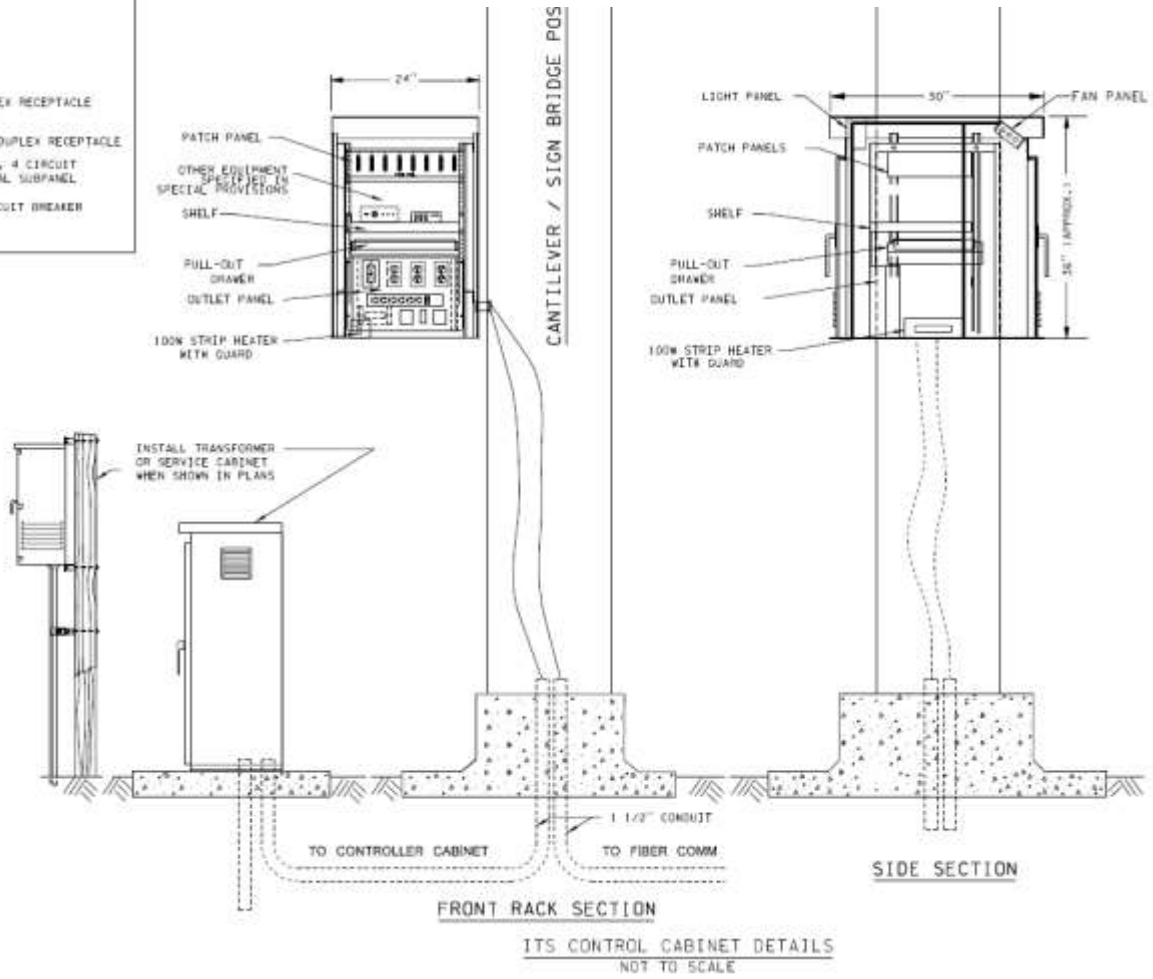
- (A) RS422 DATA LINE
- (B) CAMERA NTSC COAX CABLE
- (C) CAMERA CABLE TO CAMERA POLE
- (D) EIA-422 TO EIA-232 CONVERTER
- (E) IN LINE LIGHTING SURGE SUPPRESSOR



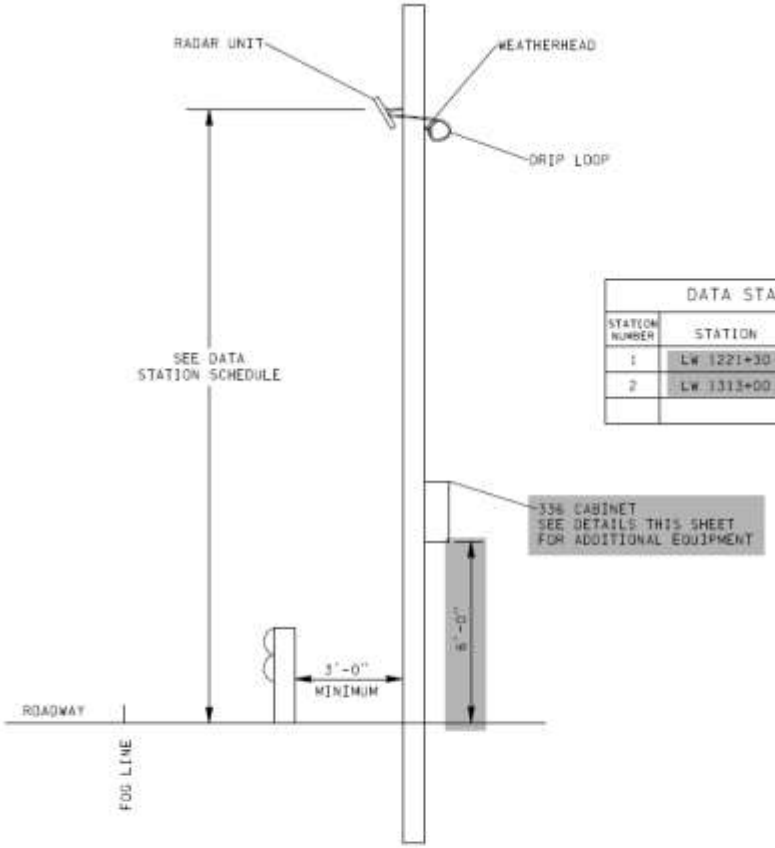
GENERAL NOTES:

1. CABLES SHALL BE SUSPENDED SUCH THAT NONE OF THE CABLE WEIGHT IS TRANSFERRED TO THE CABLE CONNECTIONS OR TERMINATIONS.
2. ALL HARDWARE SHALL BE STAINLESS STEEL OR GALVANIZED.

TYPICAL CAMERA MOUNTING DETAIL

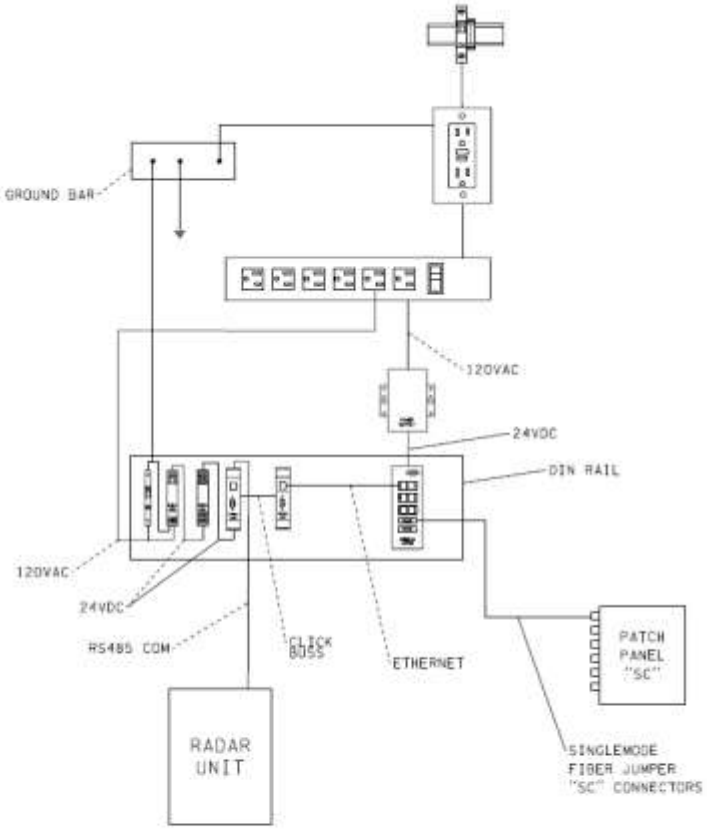


ITS CONTROL CABINET DETAILS
NOT TO SCALE



DATA STATION SCHEDULE			
STATION NUMBER	STATION	OFFSET	MOUNTING HEIGHT
1	LW 1221+30	35' LT	33'
2	LW 1313+00	50' LT	35'

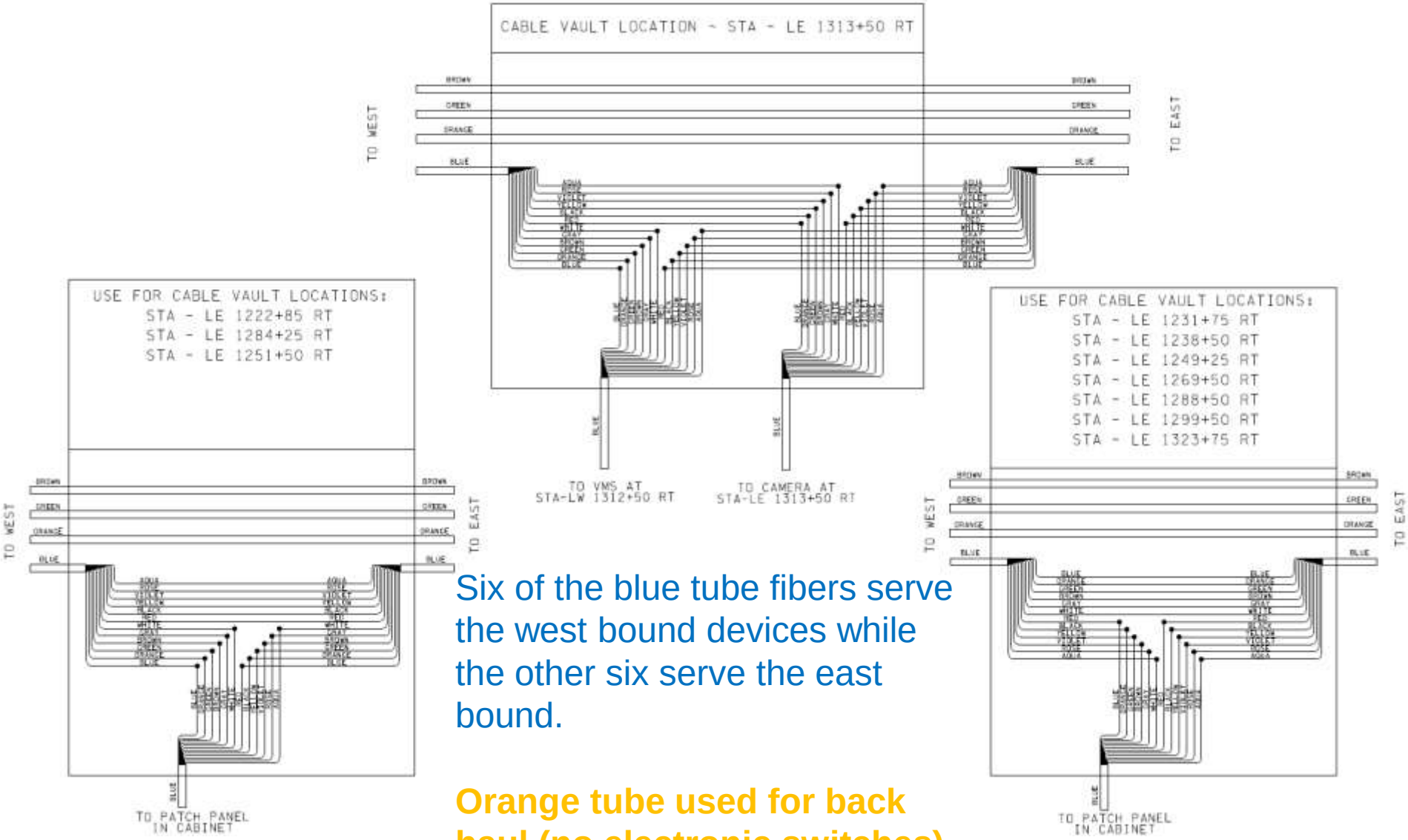
PROFILE



CABINET ADDITIONAL EQUIPMENT DETAILS

INTELLIGENT TRANSPORTATION SYSTEM - DATA STATION

SEE SPECIAL PROVISION "INTELLIGENT TRANSPORTATION SYSTEM - DATA STATION"



Six of the blue tube fibers serve the west bound devices while the other six serve the east bound.

Orange tube used for back haul (no electronic switches)

Green & **Brown** to barter later.


Tight Squeeze!


Anticipated but
unseen construction
obstructions


Approved construction methods?

Farpotshket

Origin - Yiddish

Definition - Something that is all fouled up, especially as the result of repeated attempts to fix a minor imperfection.

Do you have anything Farpotshket'ed?


How did that happen?
It wasn't like that yesterday!


Let me just throw this in my pickup


Nice try,
but did not work
“as advertised”


EXIT 54
906
WEST
Hyak
RIGHT 1 MILE
090vc05651 - Gold Creek #3 SCR_ITS
26 Feb 2014 02:00:22 Pacific Standard Time


Meter Station


Just have to line up those bolts…

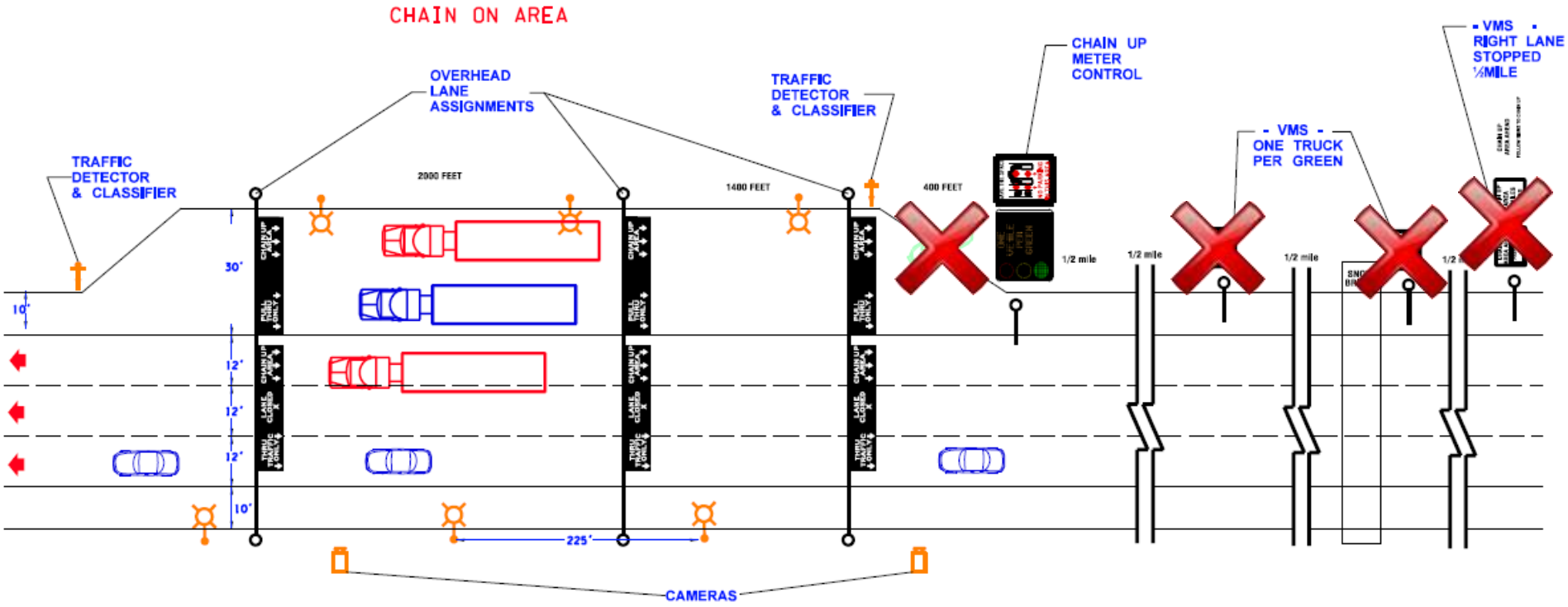

NATIONAL
09/29/2012 09:13


Where’s the other half?


TRACTION TESTS
TESTING - WASTDOT
WJSSWU TESTED
DAKTRONICS
090vc05688 - Gold Creek #4 SCR_ITS
3 Jan 2014 07:59:03 Pacific Standard Time

Chain-up System Winter 2013-2014

Parts of the Gold Creek OCU system not available winter 13-14



Chain-Up Signing Winter 13-14

We were ready to go, but needed to coordinate Washington State Patrol assistance. This did not go as expected.

State Patrol Concerns with implementation

- Pull through lane
- Liability
- Closing active travel lane for chain up parking
- Safety
- Enforcement
- Not having full system in place
- Did I mention liability for closing a lane?

State Patrol still has discomfort with future plans.

Change of Plans for Winter 13-14

- No taking the right lane
- No metering trucks
- Limited enforcement
- Limited advanced VMS notification

Source: WSDOT

How did it work?

Play

“The Good”

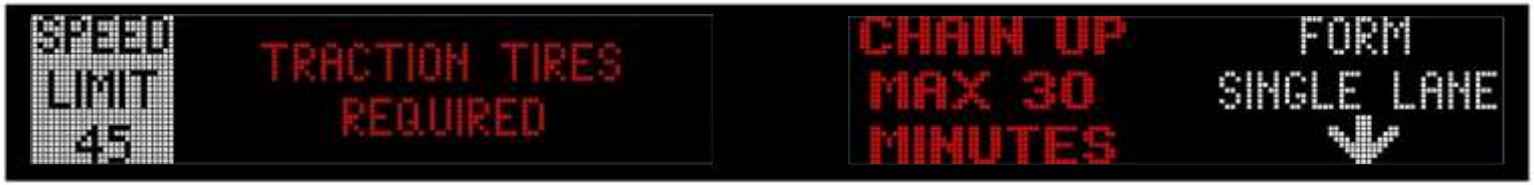
How did it work?

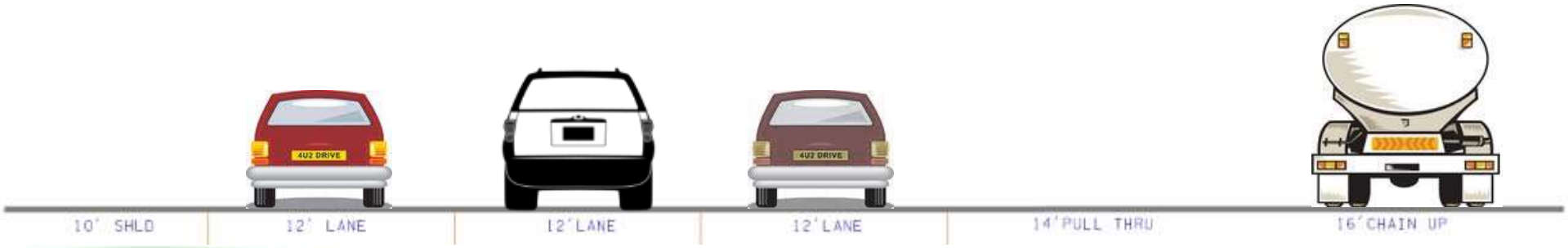
Play

“The Not So Good”

Chain-Up Signing Winter 13-14

Signing will direct trucks to form a single lane guide you to open spaces along the 9000’ stretch.





Washington State Department of Transportation

Source: WSDOT

Winter 2013 – 2014 Advanced Messaging

Advanced VMS 3.75 mi

Advanced VMS 2.25 mi

Advance Meter VMS 400'

When Traction Tires Required become required advanced messaging will be used to usher passenger vehicles to the left lane and trucks over 10,000 GVW to use the right lane

Once I-90 phase 1C is completed three full size VMS in ½ mile spacing will provide more enhanced messaging.

Organized Chain-Up: The Future

Phase 1 starts with the Traction Tires Required. This requires vehicles over 10,000 GVW to use chains. We start to direct passenger vehicles to the left lane and trucks to the far right for chain up parking.

Washington State Department of Transportation

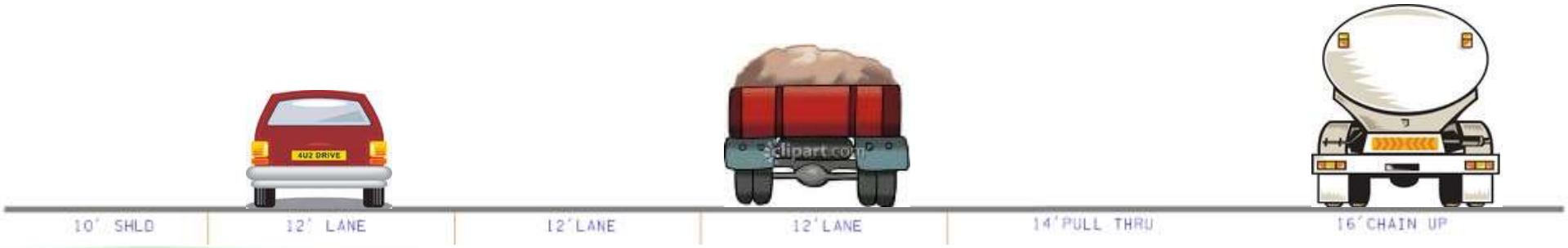
Source: WSDOT

Organized Chain-Up: The Future

Phase 2 starts about 8 minutes after the start, long enough for arriving traffic to see the passenger vehicles use left lane and chains required for trucks.

Organized Chain-Up: The Future

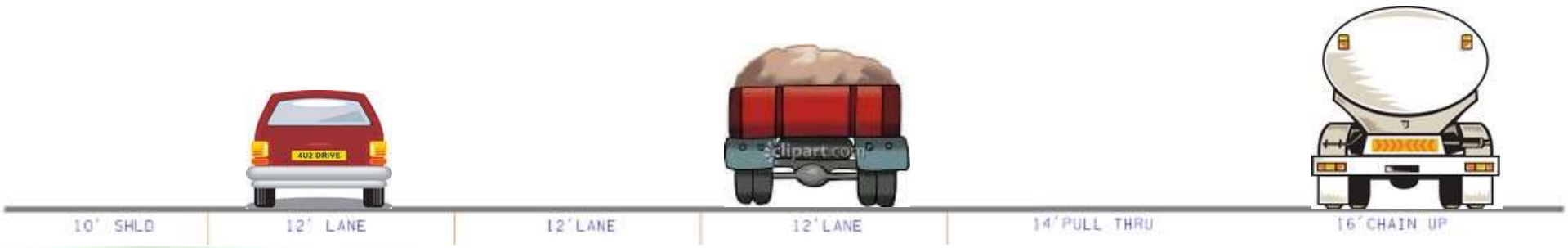
Phase 3 starts after the far right is filled to capacity. Now we start to fill the right lane of the interstate similar to the first lane.



Organized Chain-Up: The Future

Phase 4 starts after the left chain up area is filled to capacity. We now start to meter trucks into the chain up area at approximately 1 truck out = 1 truck in.

Meter VMS 400' Advance



Washington State Department of Transportation

Source: WSDOT

Organized Chain-Up: Special Cases

We will have phases for special cases including:

- Pass closures
- Need to plow one of the chain up areas
- Stuck vehicles and more

Special messaging is developed as cases are identified.

Organized Chain-Up: How it all runs

The South Central Region has both a 365-24/7 Transportation Management Center (**TMC**) located in Yakima, and a winter time 24/7 Traffic Operations Center (**TOC**) located on Snoqualmie Pass at the West end of the Gold Creek chain area.

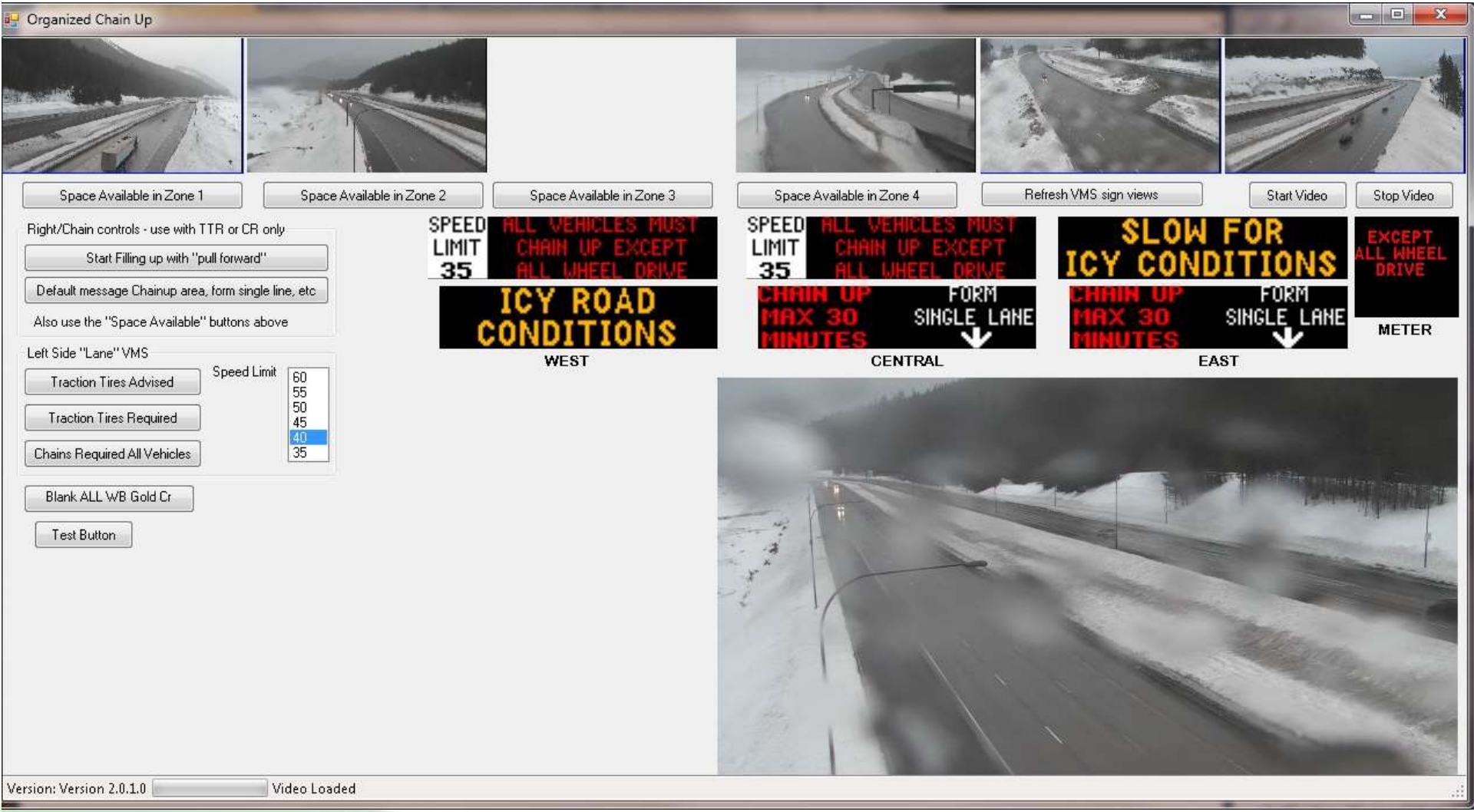
Default control with TOC, with TMC backup.

All equipment connected with fiber back to TOC, with a “Flat” loop built in to bypass any one downed switch. Phase 2 will provide a microwave path out the back-end in case of fiber separation.

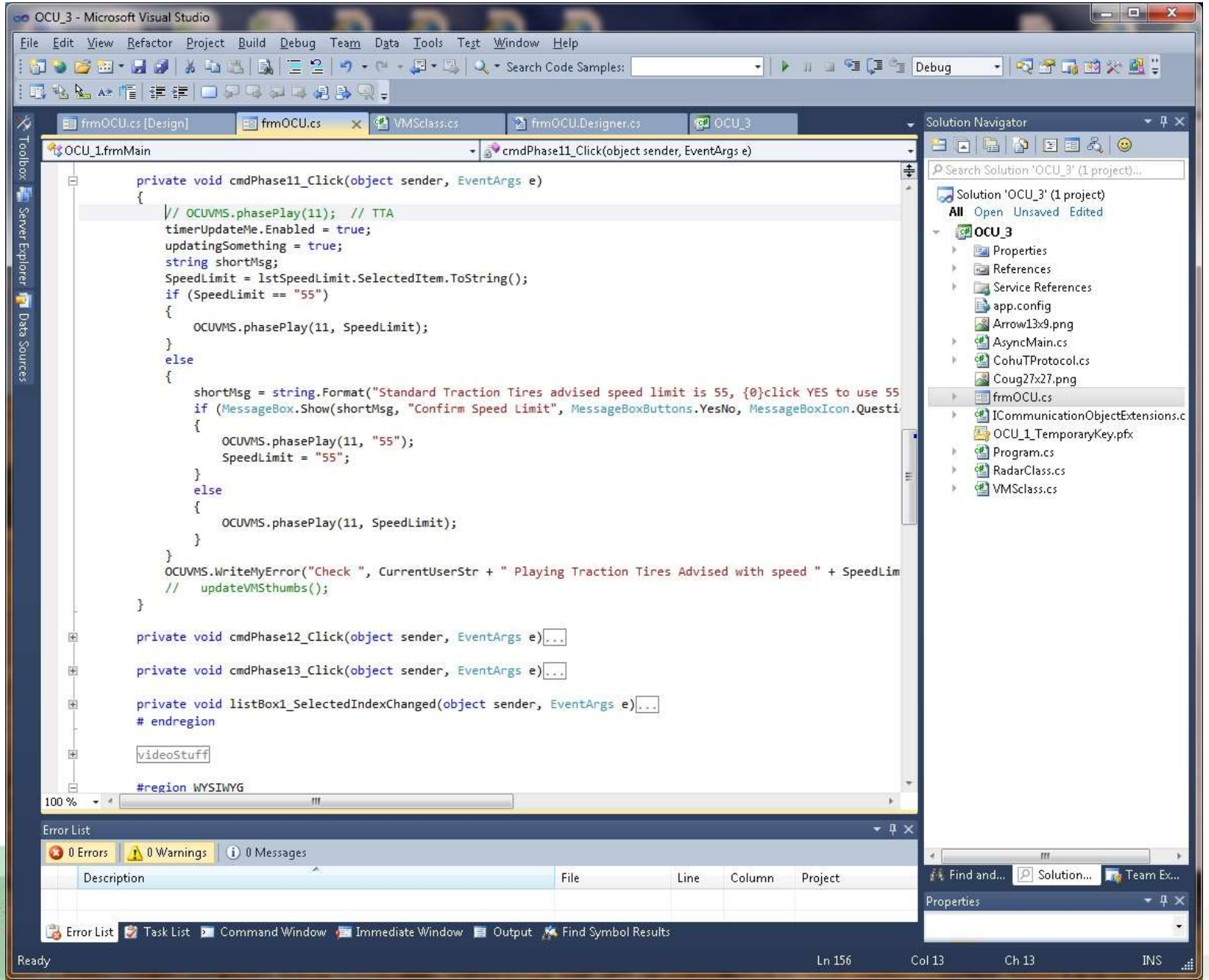
Licensed redundant microwave communications back to TMC.

Desire to have the system be mostly “automated” with override/manual control.

Organized Chain-Up Software Interface



Organized Chain-Up: Software C#



Source: WSDOT

What Obstacles Are We Overcoming

There will be misconceptions and educational opportunities along the way:

- Learning curve may take several seasons
- Adjustments may be required as we gain experience with the system
- This process is one of a kind, therefore new to everyone
- Worse case, we shut it off and we return to unorganized chain-up

With support and effort we will move closer to accomplishing our goals of increased flow, reduced congestion, greater safety and less delays

Organized Chain-Up: Special Cases

We will have phases for special cases including:

- Pass closures
- Need to plow one of the chain up areas
- Stuck vehicles and more

Special messaging is developed as cases are identified.

Enforcement will be Important

Enforcement will require coordination between Washington State Patrol (WSP) and the TMC / TOC traffic managers.

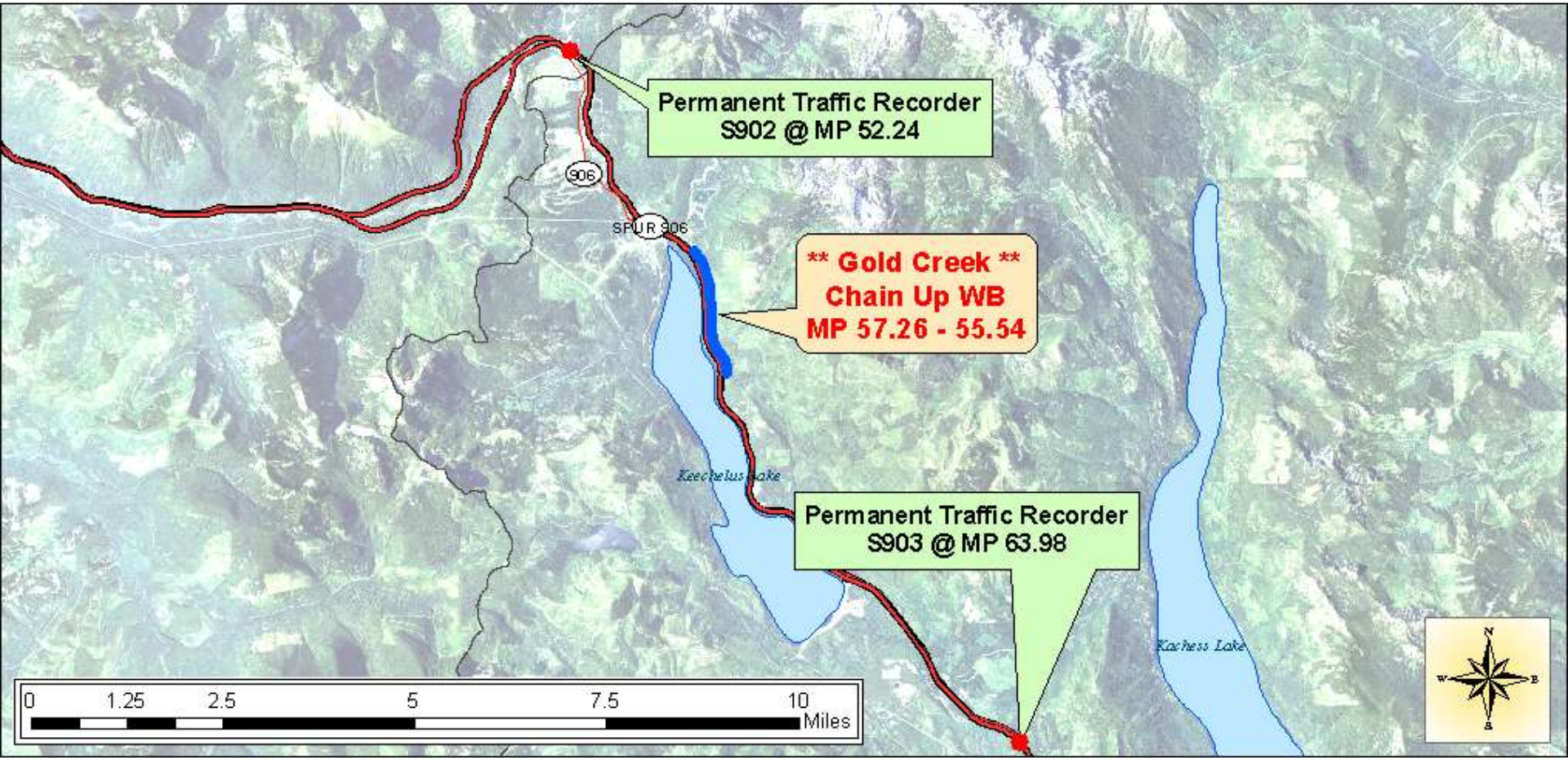
Keeping the pull thru lane open and cleared of vehicles is key.

Although technology, particularly video monitoring, and variable message signs can assist with this process, there may be a number of practical, or procedural issues that could benefit from effective enforcement and implementation.

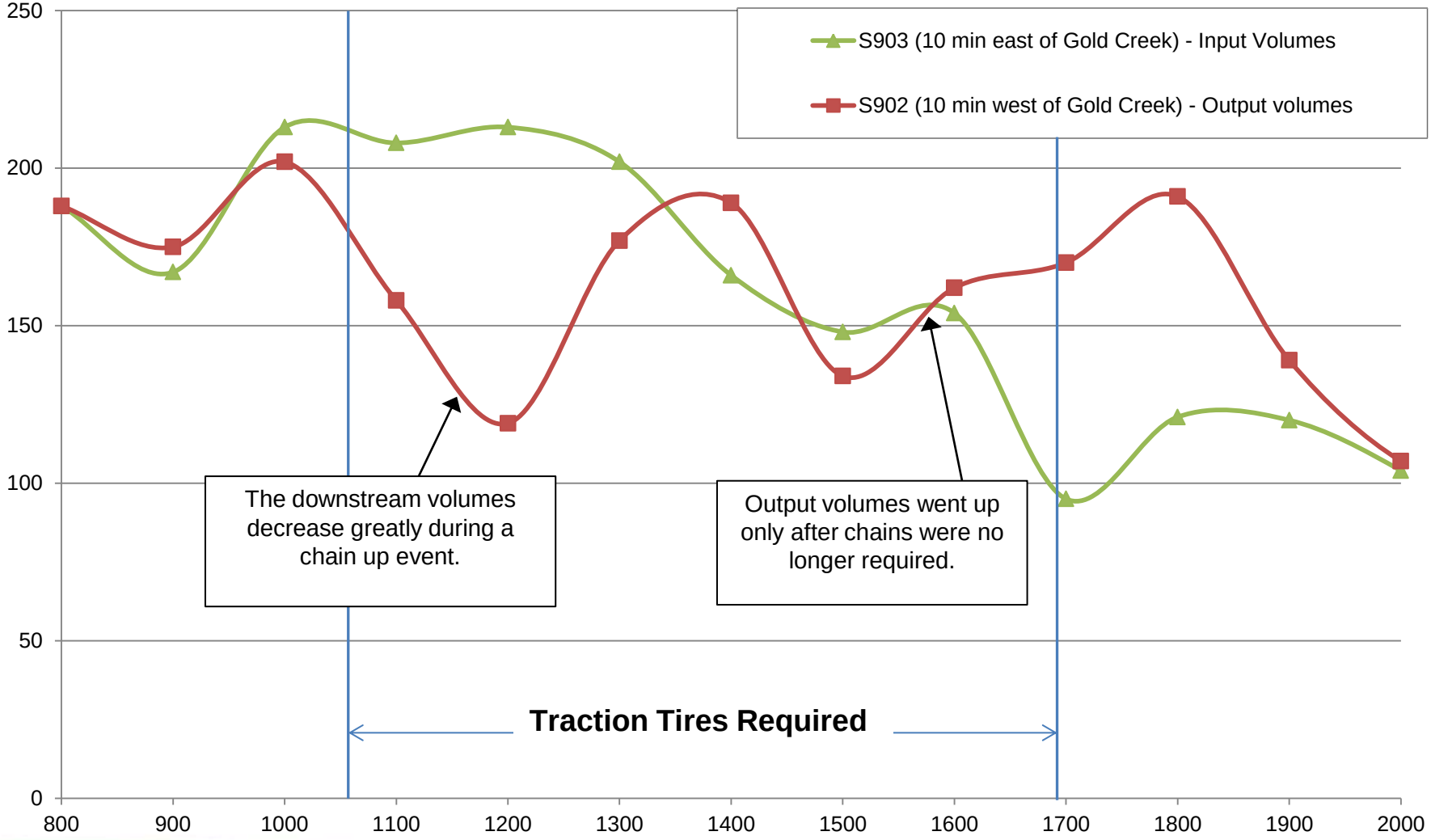
Source: http://media.bonnint.net/seattle/7/709/70938.jpg

I-90 Snoqualmie Pass

Permanent Traffic Counters



Truck Volumes during the 12/6/12 Snow Event



Washington State Department of Transportation

Source: WSDOT

Public Outreach Efforts

- Information on the organized chain-up system and how it works at:
  - Truck Stops
  - Weigh Stations
  - Rest Areas
  - Presentations
- Web site and portfolios information
- WSP joint participation to help enforcement of “Save the Space”

Operational Pictures

090vc05688 - Gold Creek #4 SCR_ITS
29 Jan 2014 08:34:13 Pacific Standard Time

Notice where they drive.

090vc05688 - Gold Creek #4 SCR_ITS
8 Jan 1970 02:34:59 Pacific Standard Time

Sometimes hard to see anything!


SWIFT
090vc05737 - Gold Creek #6 SCR_ITS
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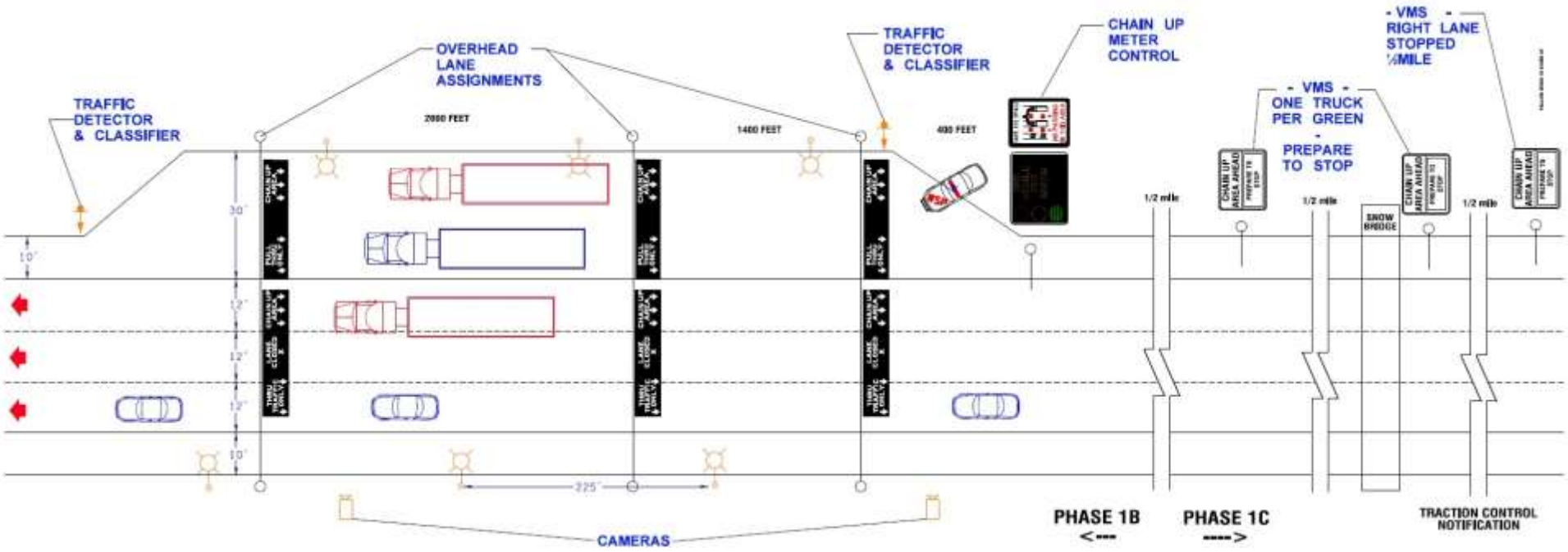
Organized Chain-Up: Final Design

An overview of the Gold Creek organized chain-up System



Washington State Department of Transportation

Source: WSDOT

Lessons Learned

- Be ready for the phone calls when you do something new.
- Try to get Management, and Stakeholders (State Patrol) on board early.
  - Failure to do so can result in curtailed deployment and results.
- Operation with partial system hampers whole system
- Not having advanced VMS installed for messaging may our biggest hurdle at this time.
- Don’t count on secondary construction project timelines coming in on time, they have their own and don’t run on yours.
- Plan on the “Engineers” running the “new” system a few times before handing over to the TMC operators.
- Try to avoid the Farpotshket’ing

For more information

http://www.wsdot.wa.gov/winter/chainup.

James Todd Daley, P.E.
WSDOT South Central Region
Assistant Regional Traffic Engineer
daleyt@wsdot.wa.gov

Source: WSDOT