



Yukon's Google Glass In-Service Road Safety Review Pilot

CCMTA Conference, Whitehorse, Yukon

June 2015

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Peterniak

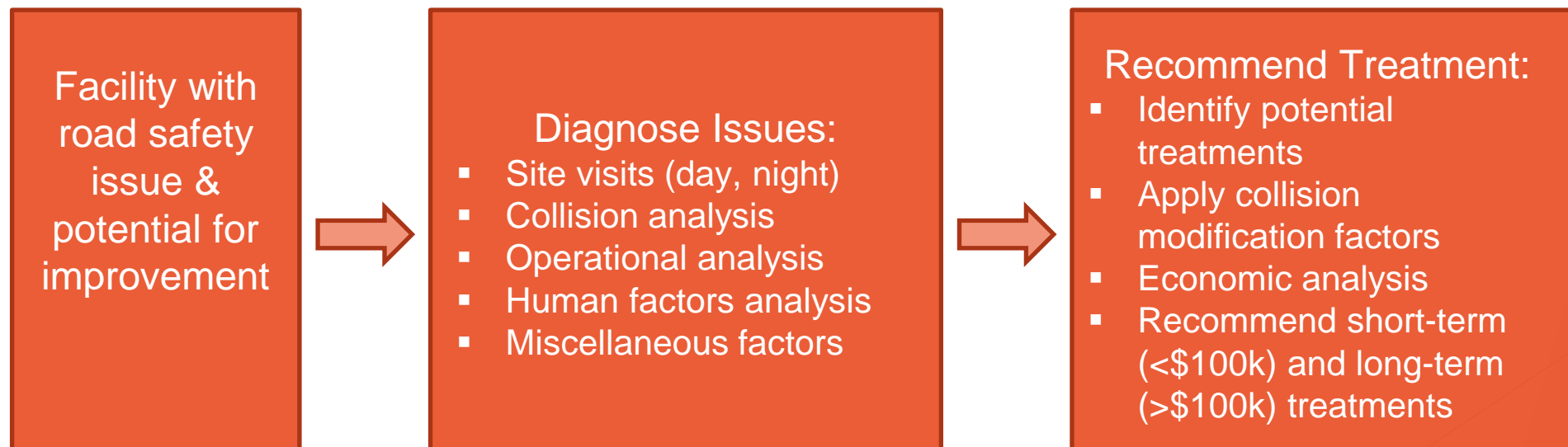
Presentation Overview

- Presentation overview (AP)
- In-service road safety reviews and road safety management (AP)
- Google Glass Pilot
 - Technology and Process (CM)
 - Evaluation (CM)
 - Participating jurisdictions (CM)
 - Preliminary results (CM)
- Yukon Pilot
 - Yukon road safety context (AP)
 - Site selection (AP)
 - Results by site (CM)
- Conclusions (AP)

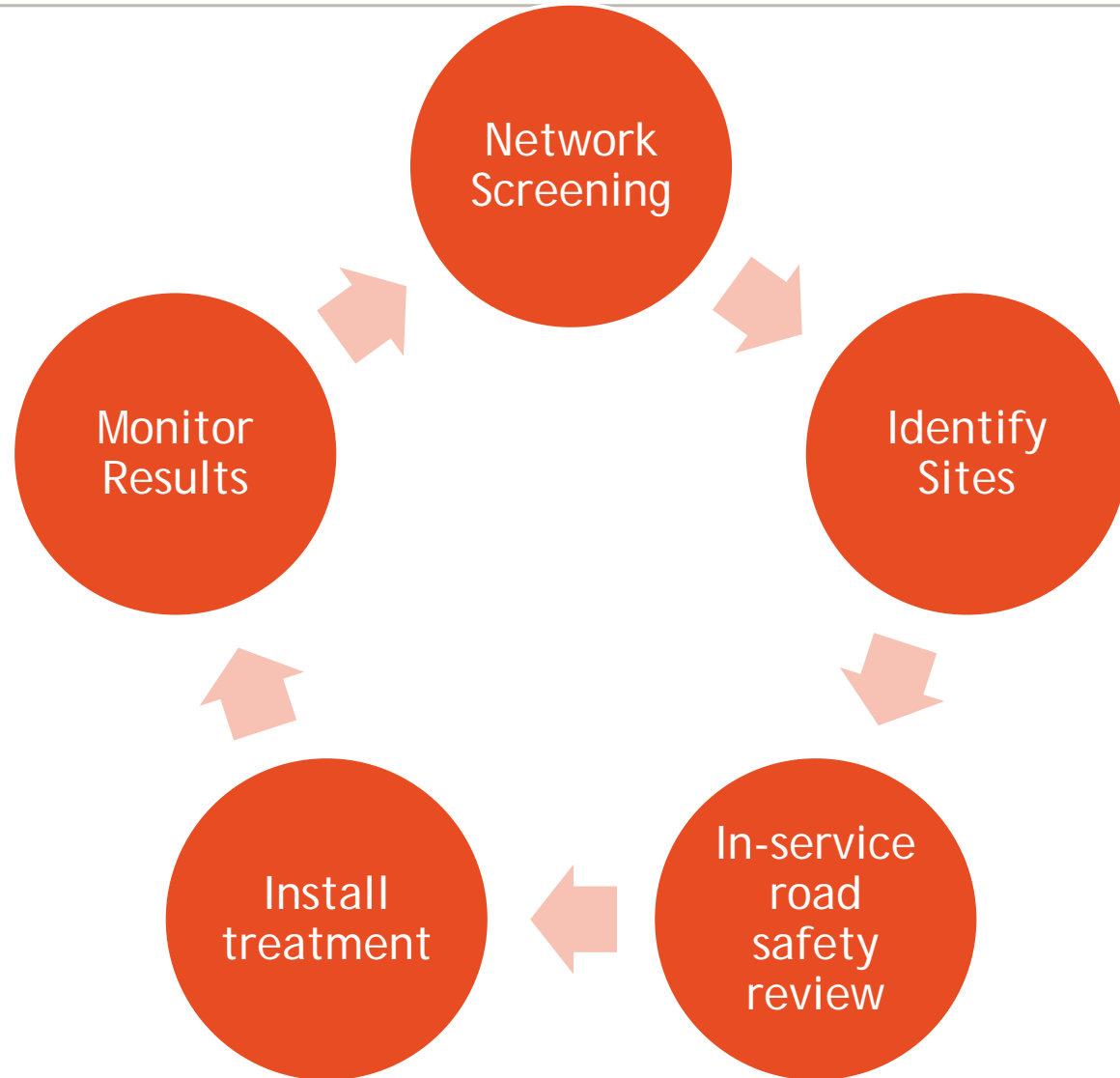
In-service road safety reviews and road safety management

What is an in-service road safety review?

- “An in-depth engineering study of an existing road using road safety principles with the purpose of identifying cost-effective countermeasures that would improve road safety and operations of all road users.” – Zein, S., (2004) *The Canadian Guide to In-Service Road Safety Reviews*, G.D. Hamilton Associates Consulting Ltd., Transportation Association of Canada.



Road Safety Management



Google Glass Road Safety Pilot

Yukon Government Highways and Public Works (HPW) was the first jurisdiction in the world to apply Google Glass technology to in-service road safety reviews.

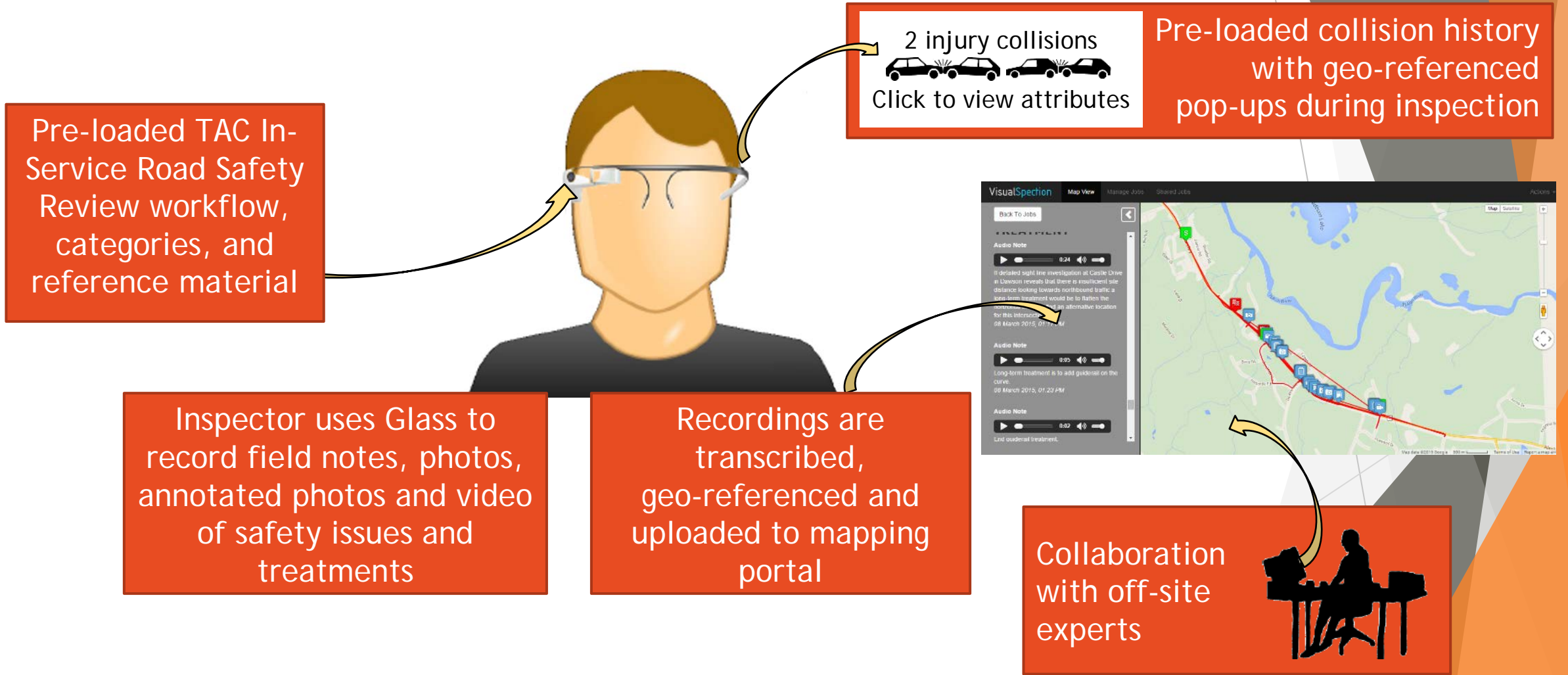
- HPW is committed to innovation in its vision/strategic plan, budgets, and culture
- Jurisdictions across Canada have participated after Yukon and the technology is being considered for audits and reviews globally by the World Bank and African Development Bank.

Technology and Process

- ❑ Smart eyewear with built-in GPS, camera, video, and audio recording capability – screen projected in front of Glass
- ❑ Customized for site inspections and data processing by VisualSpection
- ❑ Hands-free site inspections
- ❑ All data and images are transcribed, geo-referenced and uploaded in real-time to mapping portal



ISRSR using Google Glass Concept





VISUAL SPECTION

☰ 45.42161, -75.69541

Tap for options

Start
VISUAL SPECTION

45.42161, -75.69541

Tap for options





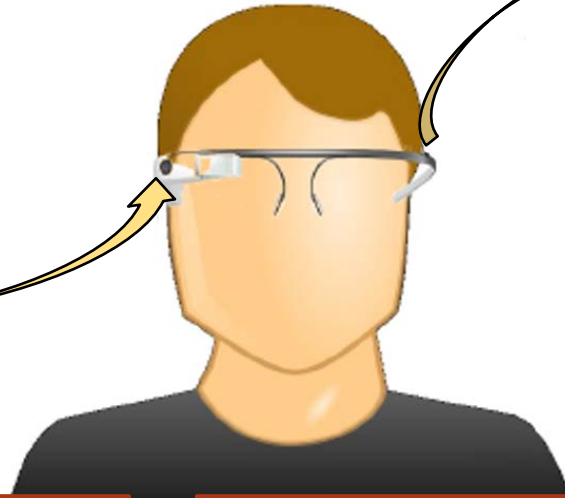
Tap to finish recording

Swipe down to cancel




ISRSR using Google Glass Concept

Pre-loaded TAC In-Service Road Safety Review workflow, categories, and reference material



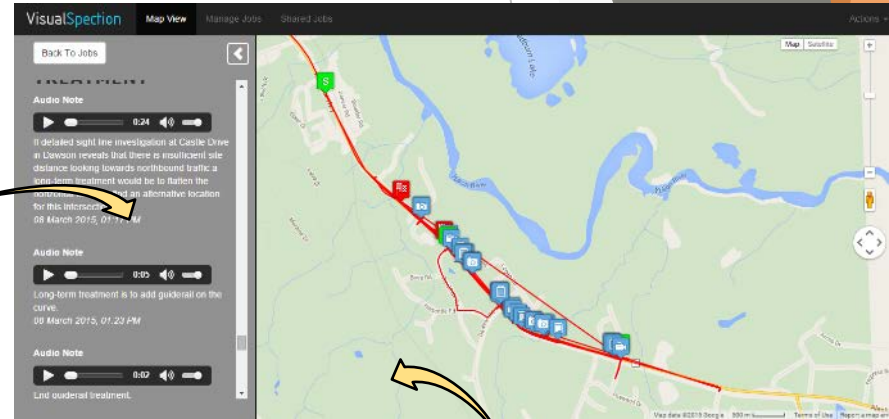
2 injury collisions
Click to view attributes



Pre-loaded collision history with geo-referenced pop-ups during inspection

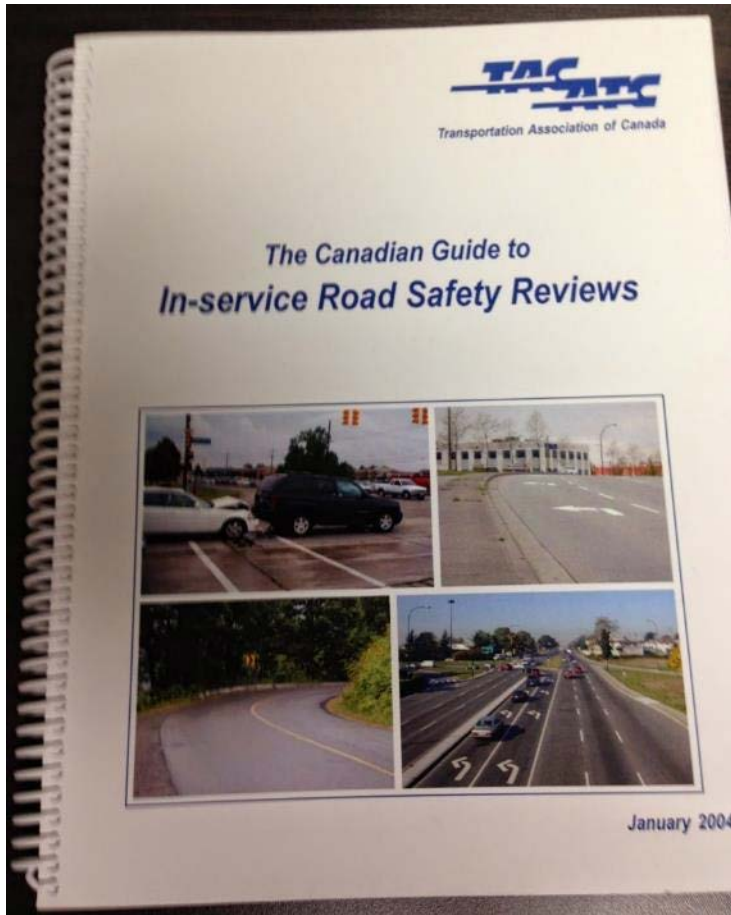
Inspector uses Glass to record field notes, photos, annotated photos and video of safety issues and treatments

Recordings are transcribed, geo-referenced and uploaded to mapping portal



Collaboration with off-site experts





Overview

Job: 2015-04-15 16:29:51 Tap for options

Geometric

Job: 2015-03-08 12:47:51 Tap for options

Human Factor

Job: 2015-03-08 12:47:51 Tap for options

Operational

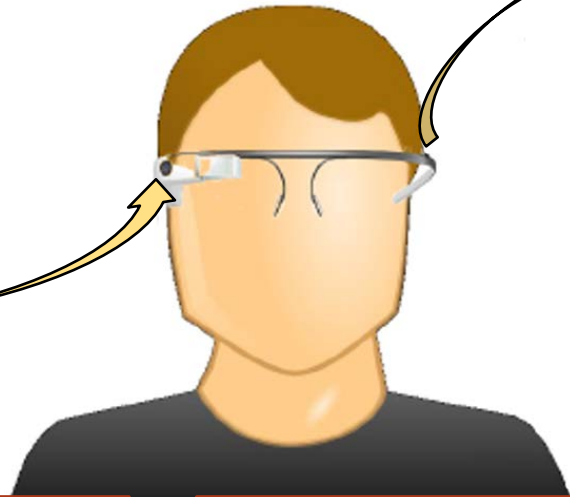
Job: 2015-03-08 12:47:51 Tap for options

Miscellaneous

Job: 2015-04-15 16:29:51 Tap for options

ISRSR using Google Glass Concept

Pre-loaded TAC In-Service Road Safety Review workflow, categories, and reference material



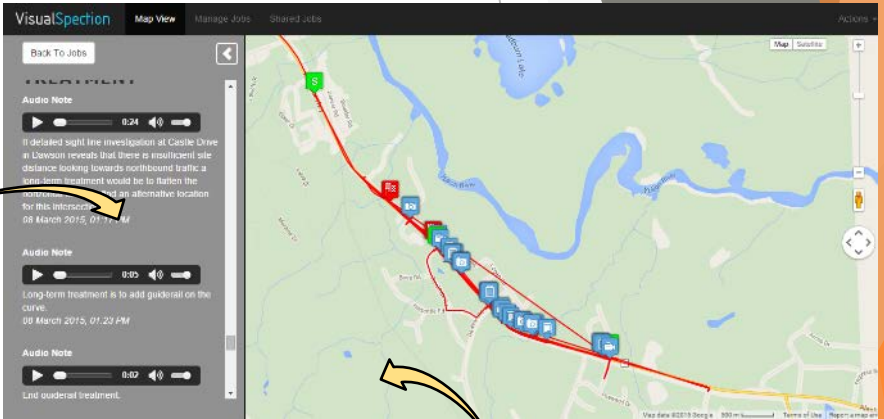
2 injury collisions
Click to view attributes



Pre-loaded collision history with geo-referenced pop-ups during inspection

Inspector uses Glass to record field notes, photos, annotated photos and video of safety issues and treatments

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Collaboration with off-site experts





 Options Turn OFF

Notifications are: **ENABLED**

Notes on device: 151

Radius set to: 500m

 20m 50m 100m 500m



6 Nearby Issues Detected

Tap for details

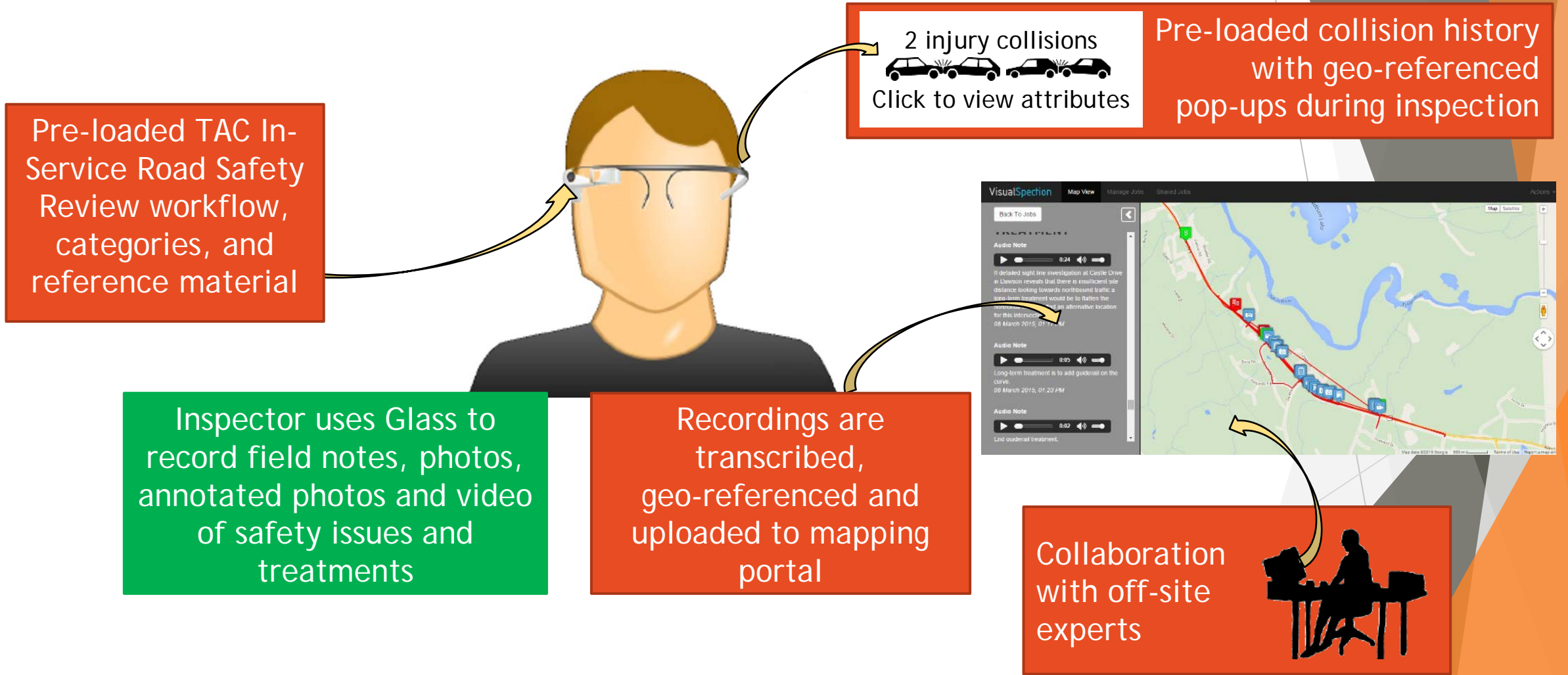
100XXXXX : FATAL:
DD-MMM-YYYY
Head On
No_Veh: 2
V1: Unknown, Weather Condition

Tap for more

13XXX: PDO:
DD-MMM-YYYY
Off Road Left
No_Veh: 1
V1: Going Straight Ahead, Driving Too
Fast For Road Conditions

Tap for more

ISRSR using Google Glass Concept



 Field note

Geometric

Job: 2015-03-08 12:47:5 Issue

Tap for options



 Photo

Geometric

Job: 2015-03-08 12:47:5 Issue

Tap for options



 Annotated Photo

Operational

Job: 2015-04-15 16:29:5 Issue

Tap for options



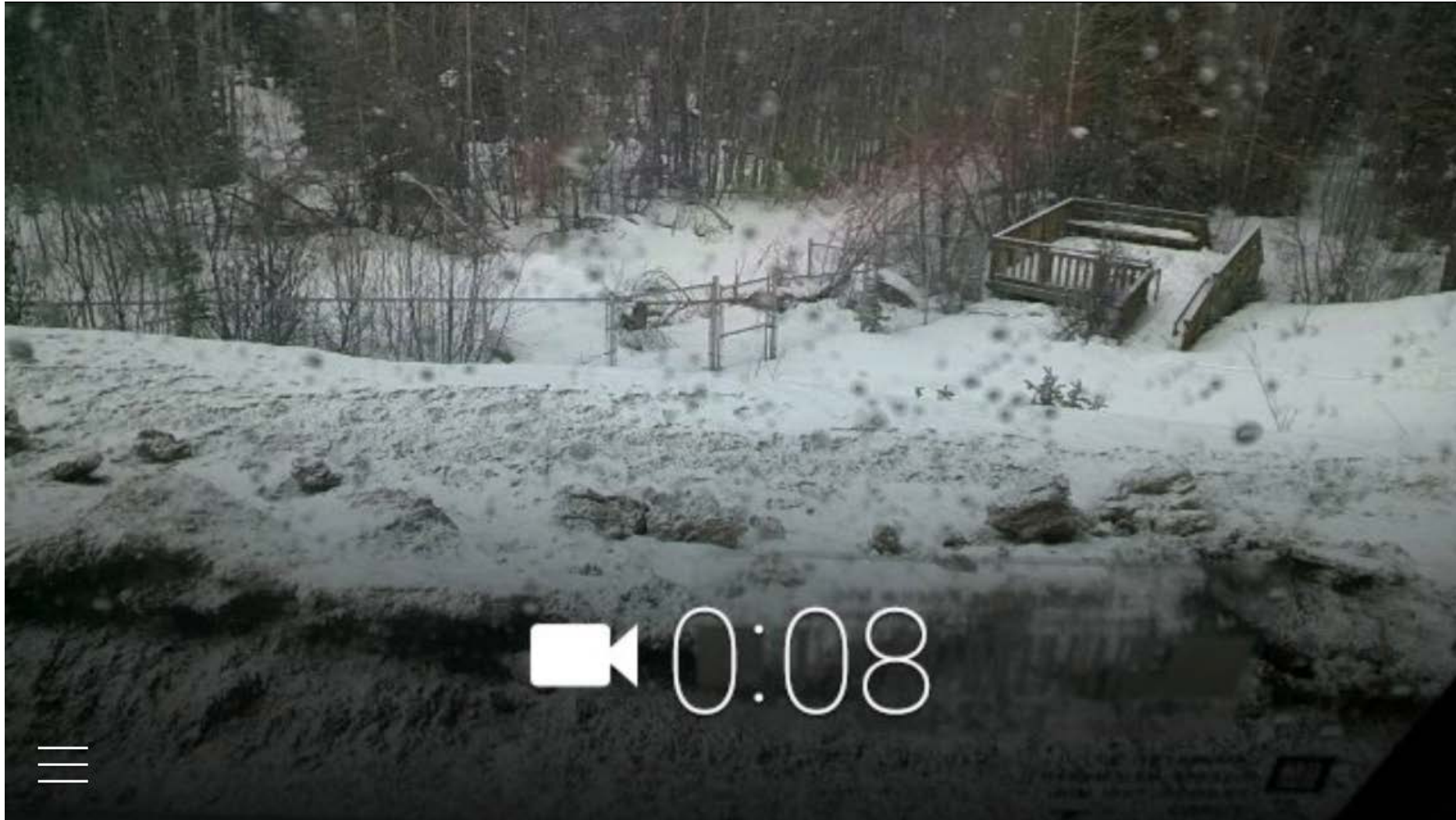
 Video

Geometric

Job: 2015-03-08 12:47:5 Issue

Tap for options



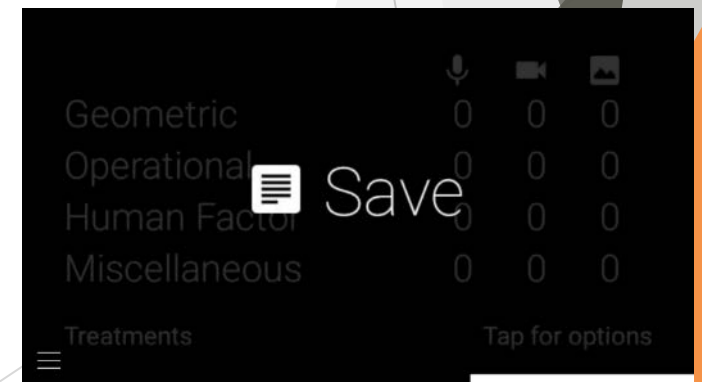
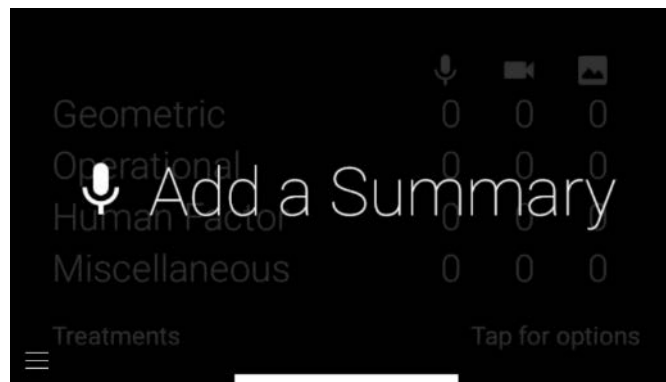
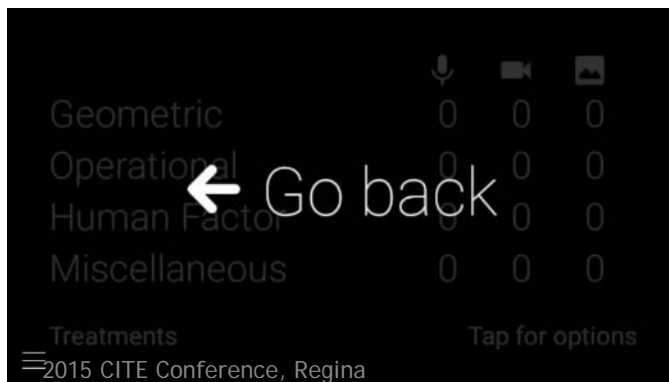
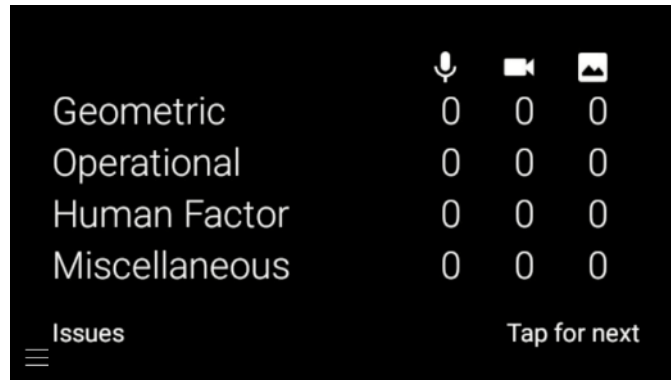
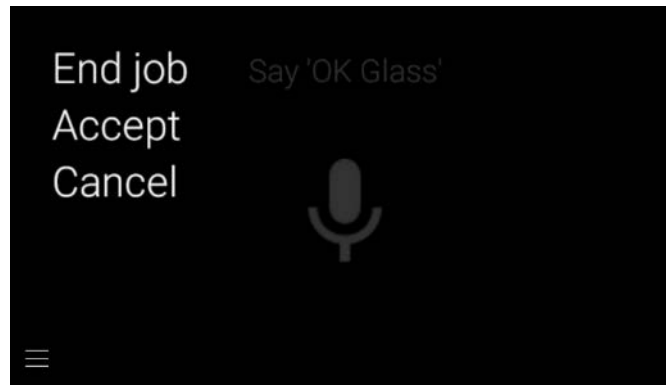




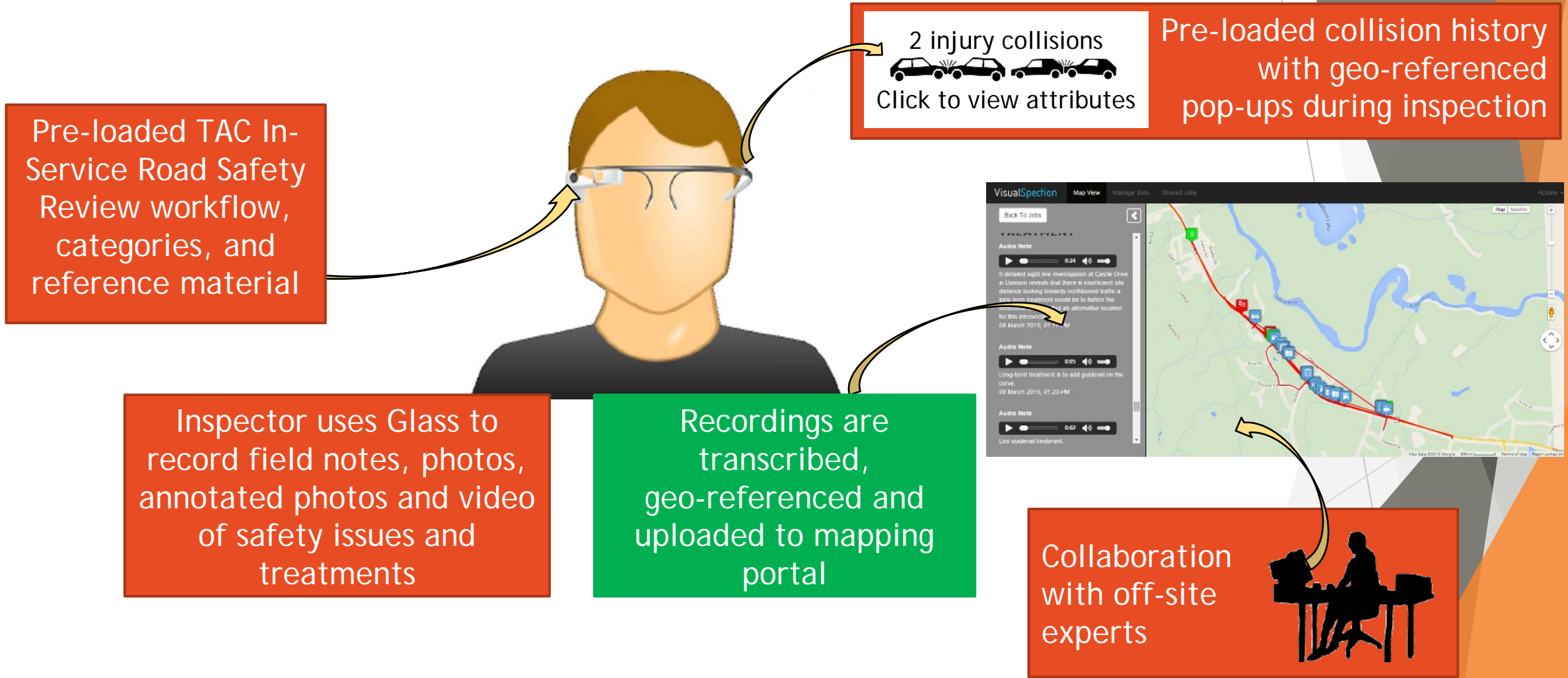
Stop recording

 0:24





ISRSR using Google Glass Concept



Search terms

Search

Action

No job selected.



<input type="checkbox"/>	Name	Latitude	Longitude	Videos	Notes	Photos	Created By	Start Time ↓	End Time
<input type="checkbox"/>	Alaska Highway Kathleen Ave to 12th Ave Night Visit			15	17	9	freeseeds	30 March 2015, 09:59 PM	
<input type="checkbox"/>	Alaska Highway Kathleen Ave to 12th Ave Day Visit			26	25	10	freeseeds	30 March 2015, 09:58 PM	
<input type="checkbox"/>	RECEIVE COPY			3	4	3	freeseeds	30 March 2015, 04:40 PM	
<input type="checkbox"/>	2015-03-26 10:11:19	49.80283827050883	-97.14918371296017	1	2	1	freeseeds	26 March 2015, 10:11 AM	
<input type="checkbox"/>	2015-03-26 10:02:30	49.80280237740213	-97.14875219329271	2	1	5	freeseeds	26 March 2015, 10:02 AM	26 March 2015, 10:10 AM
<input type="checkbox"/>	2015-03-24 11:35:57	49.80286115319449	-97.14882379406797	2	2	2	freeseeds	24 March 2015, 11:35 AM	24 March 2015, 11:43 AM
<input type="checkbox"/>	Alaska Highway near Teslin km 1248 to 1258 night visit	60.168718560654824	-132.7318203729882	9	12	7	freeseeds	08 March 2015, 08:41 PM	08 March 2015, 09:26 PM
<input type="checkbox"/>	Alaska Highway Near Teslin km 1242-1252 Day visit 2015-03-08 18:46:32	60.16847158782184	-132.72919289767742	14	44	1	freeseeds	08 March 2015, 06:46 PM	08 March 2015, 08:02 PM
<input type="checkbox"/>	Alaska Highway breaker to Engelman	60.61850904492719	-134.97044222441966	11	36	7	freeseeds	08 March 2015, 12:47 PM	08 March 2015, 02:13 PM
<input type="checkbox"/>	Alaska Hwy., Weichert and Clemente visit	60.618564816950155	-134.97035316492796	0	0	0	freeseeds	08 March 2015, 12:47 PM	
<input type="checkbox"/>	Alaska Highway breaker to Engelman Davis at	60.6191146385729	-134.97132916712255	0	0	0	freeseeds	08 March 2015, 12:46 PM	08 March 2015, 12:46 PM
<input type="checkbox"/>	Alaska height weight Laker to Nichelmann visit	60.638546804287465	-135.00274671332897	0	0	0	freeseeds	08 March 2015, 12:44 PM	08 March 2015, 12:45 PM
<input type="checkbox"/>	Alaska Highway from 12th Ave. to Kathleen Davis visit Park for	60.774442995898426	-135.1540712825954	15	14	5	freeseeds	08 March 2015, 10:29 AM	08 March 2015, 11:40 AM
<input type="checkbox"/>	Alaska Highway 12 Avenue to Kathleen Davis at three	60.75998697895557	-135.13994702138007	6	9	5	freeseeds	08 March 2015, 09:53 AM	
<input type="checkbox"/>	Alaska Highway 12 Avenue to Kathleen the concert visit number two part two	60.77587114652691	-135.1553475951172	2	1	0	freeseeds	08 March 2015, 09:34 AM	
<input type="checkbox"/>	Alaska Highway from 12th Ave. to Kathleen daytime visit	60.76063443912264	-135.1391760540522	3	1	0	freeseeds	08 March 2015, 09:08 AM	08 March 2015, 09:33 AM
<input type="checkbox"/>	Alaska Highway night visit from Engelman to Blaker	60.60452790465206	-134.92434343323112	3	21	3	freeseeds	07 March 2015, 08:46 PM	07 March 2015, 09:51 PM
<input type="checkbox"/>	Testing video function	60.73381645604968	-135.07436432875693	1	0	0	freeseeds	07 March 2015, 04:20 PM	07 March 2015, 04:21 PM
<input type="checkbox"/>	2 mile Hill will update it to	60.72770546196096	-135.09194671188956	13	2	1	freeseeds	07 March 2015, 12:06 PM	07 March 2015, 12:57 PM
<input type="checkbox"/>	Two Mile Hill Day Visit	60.73423521593213	-135.09547633118927	25	17	13	freeseeds	07 March 2015, 10:35 AM	07 March 2015, 12:02 PM
<input type="checkbox"/>	Test	60.734079061076045	-135.09794077835977	0	0	0	freeseeds	07 March 2015, 10:31 AM	07 March 2015, 10:32 AM
<input type="checkbox"/>	Amanda tomorrow Hill	60.734027554281056	-135.09797774255276	1	0	2	freeseeds	07 March 2015, 10:13 AM	07 March 2015, 10:31 AM
<input type="checkbox"/>	Hope this test to	0.0	0.0	0	0	1	freeseeds	07 March 2015, 09:32 AM	07 March 2015, 10:11 AM
<input type="checkbox"/>	Regina tomorrow Hill	60.72041666934639	-135.0994726549834	2	3	0	freeseeds	07 March 2015, 09:01 AM	

[Back To Jobs](#)

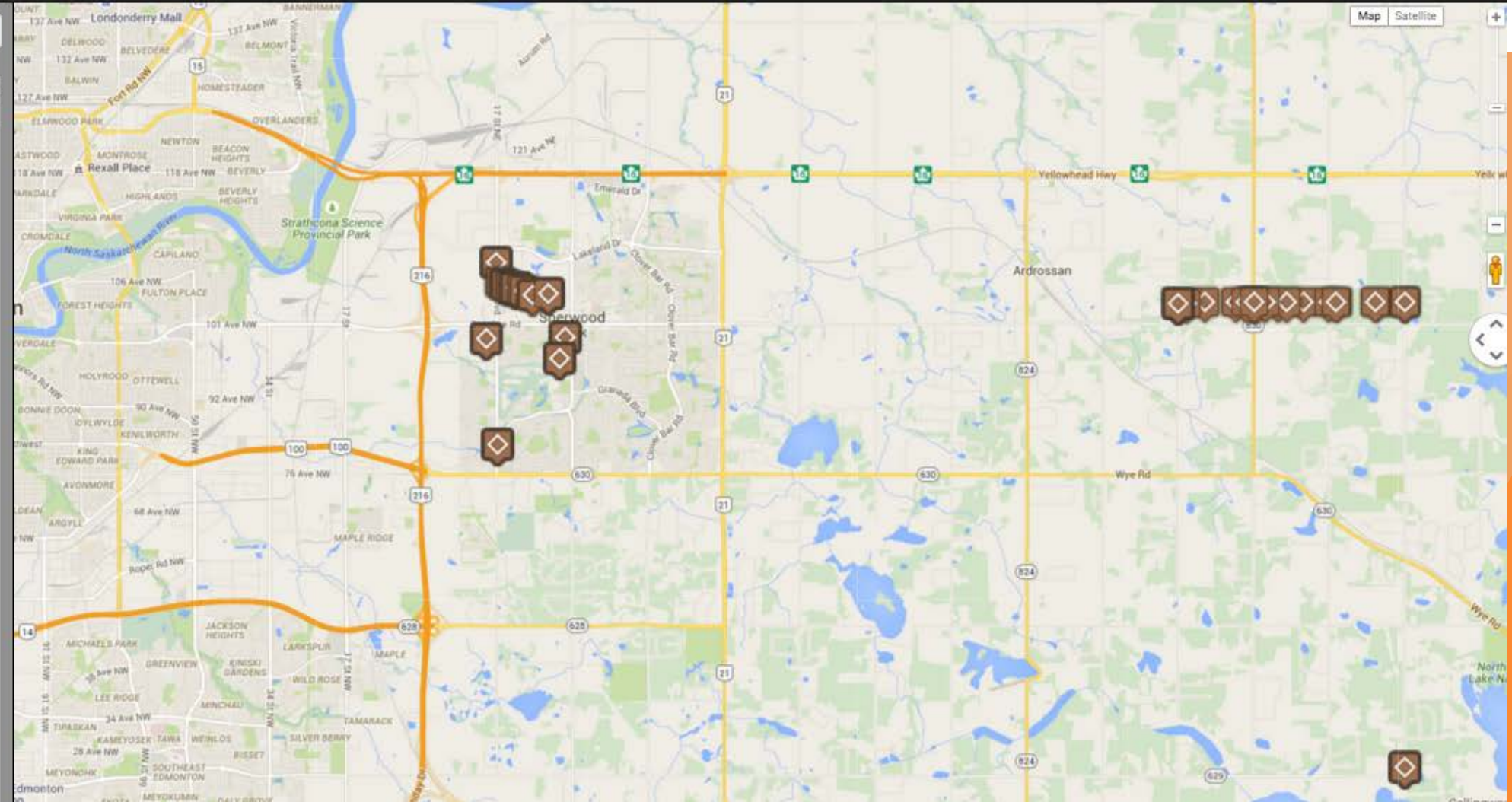
CONFIGURATION

Right angle collisions are overrepresented at the study site compared with the network average (PR 6.9). Failing to proceed in safety and failing to stop were the most common primary causes of right angle collisions.

Passing-left turn collisions are overrepresented at the study site compared with the network average (PR 6.4). Failing to stop was the primary cause of the passing-left turn collision.

Sideswipe-opposite direction collisions are overrepresented at the study site compared with the network average (PR 3.8). Failing to stop and losing control were the primary causes of sideswipe-opposite direction collisions.

Right angle collisions are overrepresented at the study site compared with the network average (PR 6.9). Failing to proceed in safety and failing to stop were the most common primary causes of right angle collisions.



Back To Jobs



About 100 m north of the study segment for maybe 800 or 700 m side slope looks steeper than 3 to 1 and it could be flattened.
08 March 2015, 01:02 PM

Audio Note

Play Audio

This is a access to someone's private driveway
08 March 2015, 01:18 PM

Audio Note

Play Audio

Approximate site distance limit for Dawson and Castle Drive intersection. (This point was used to estimate sight distance was about 360m, or sufficient, and is related to several other comments that the distance may be insufficient at this location).
08 March 2015, 01:18 PM

Audio Note

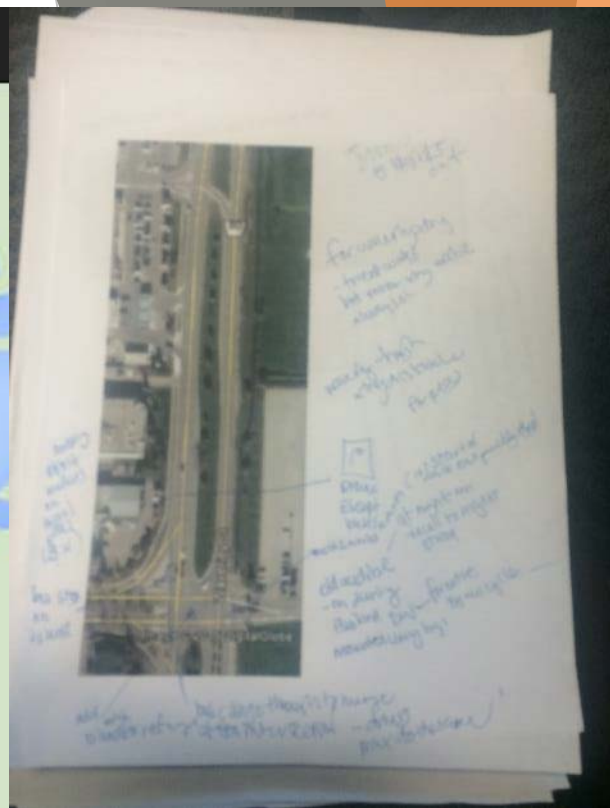
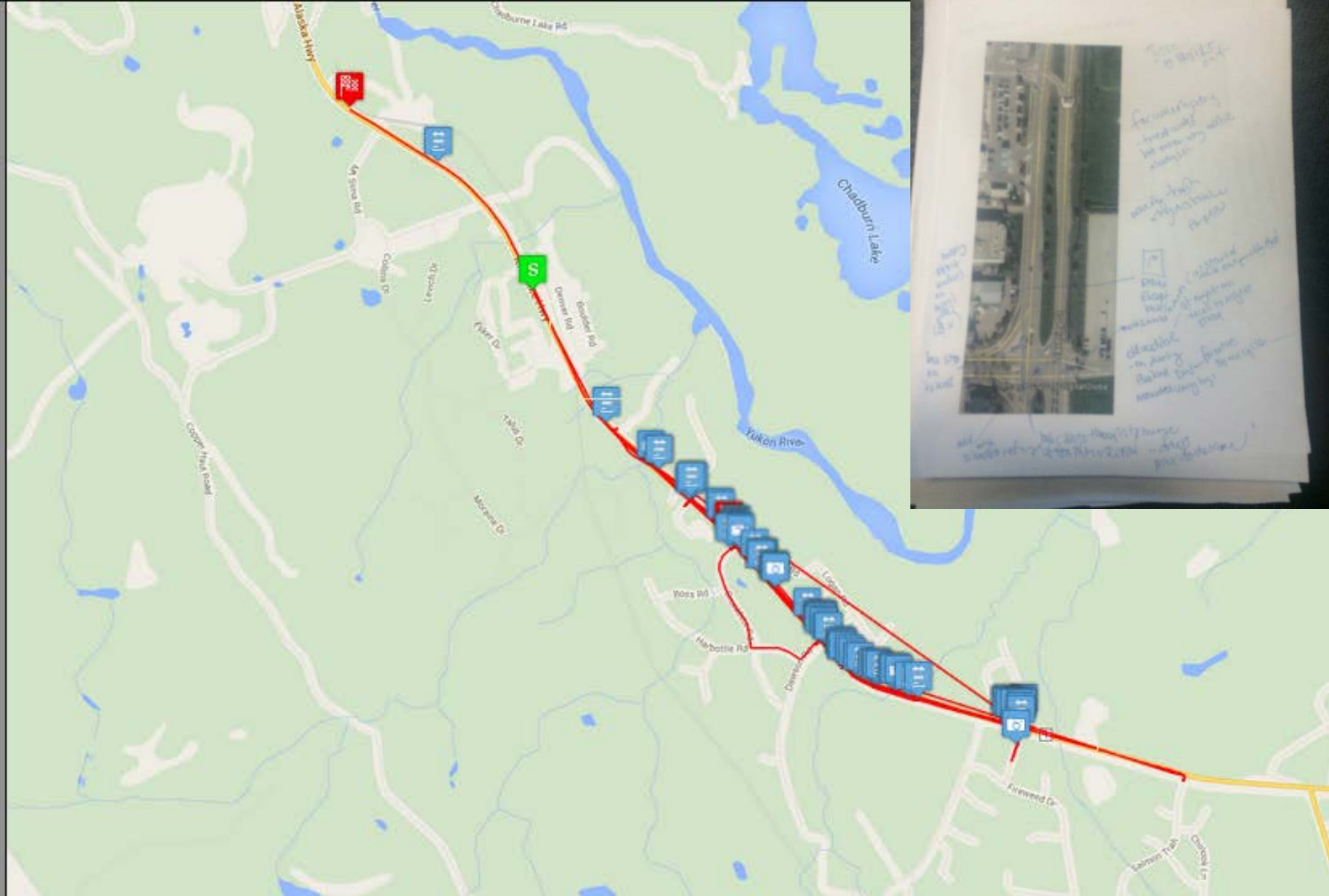
Play Audio

About 30 m of critical five flow on the east side of the highway.
08 March 2015, 01:29 PM

Audio Note

Play Audio

Approximately 30 m segment of critical side slope on the east side of the highway
08 March 2015, 01:30 PM



Back To Jobs

Alaska Highway breaker to Engelman

Start Time 08 March 2015, 12:47 PM

Stop Time 08 March 2015, 02:13 PM

Latitude 60.61850904492719

Longitude -134.97044222441966

Distance 24,406 metres

Created By fmsends

Edit Delete

Filter... Filter

Hide route line

Captured Data

GEOMETRIC / ISSUE

Audio Note

0:22

About 100 m north of the study segment for maybe six or 700 m side slope looks deeper than it looks like 3 to 1 and it could be flat 08 March 2015, 01:02 PM

Audio Note

0:24

Detailed site line investigation at Castle Drive in Dawson reveals that there is insufficient site distance looking towards northbound traffic a long term treatment would be to flatten the horizontal curve or find an alternative location for this intersection 08 March 2015, 01:11 PM

Audio Note

Internet Explorer



Back To Home

Alaska Highway breaker to Engelman

Start Time: 08 March 2015, 12:47 PM

Stop Time: 08 March 2015, 02:55 PM

Latitude: 63.0304300492710

Longitude: -154.8054700481900

Distance: 24.406 meters

Owned By: Forward

Exit Delete

Filter Filter

1/1/2015 10:00 AM

Captured Data

GEOMETRIC / ISSUE

Audio Note

0:22

About 100 meters of the study segment for...
...
08 March 2015, 01:07 PM

Audio Note

2:04

Observed via the intersection of...
...
08 March 2015, 01:17 PM

Audio Note

Geometric / Issue - Field Note

0:06

GPS Coordinates:
60.00712556854770, -154.84680452000854

Transcript:
About 50 m of the critical flow on the east side of the highway

Close





Annotation:



Transcript:

Poles on the east side of the highway are about 4 m or 4.5 m from the edge of the road.



GPS Coordinates:

60.778738763183355, -135.16209804

Transcript:

Multiuse trail that is your adjacent to Alaska Highway appears to have a significant use

Close

Evaluation Criteria

- Evaluate performance of Google Glass for road safety reviews
 - Time spent on pre- and post- site visit data processing
 - Experience regarding hands-free data collection
 - Functionality of remote participation
 - Prepare and distribute survey and facilitate conference call with participating jurisdictions at wrap-up

Participating Jurisdictions

Phase 1

- Yukon HPW
- City of Calgary, AB
- York Region, ON
- Ontario Ministry of Transportation
- Strathcona County, AB
- City of Ottawa

Phase 2

- City of Vancouver
- City of Surrey
- ICBC
- 8 additional spots available

Yukon



Ottawa



Strathcona County



York Region



Phase 1 Preliminary Results -1

- Benefits
 - Collision data in field provides additional insight
 - Save about 4 hours on site visits (2 ppl * 2 visits * 1 hr saved/visit)
 - Save about 9.5 hours producing in-service review report
 - Everything is retained
 - No distractions in the field with writing or linking observation to locations
 - Fast uploads for videos under 10s
 - Update to fully voice-driven

Phase 1 Preliminary Results -2

□ Drawbacks

- Bug fixes with portal and Glass application
- Glass battery limitations require use of 16000 mAh pack
- Transcription moderate but improving
- Uploads can be slow for videos over 10 s
- Frequent tap/touch in first version of application (voice-driven mode introduced)
- Voice-driven operates poorly in high wind conditions (working on filters)
- Portal required substantial improvements to play video smoothly (now made)

Yukon Pilot

Highways and Public Works Strategic Plan:

Vision:

Leaders in...

- Building Foundations.
- Inspiring Innovation.
- Exceeding Expectation.

Our Values:

Innovate...

- We seek creative solutions.
- We challenge the status quo.
- We embrace continuous improvement.

Mission:

The Department of Highways and Public Works:

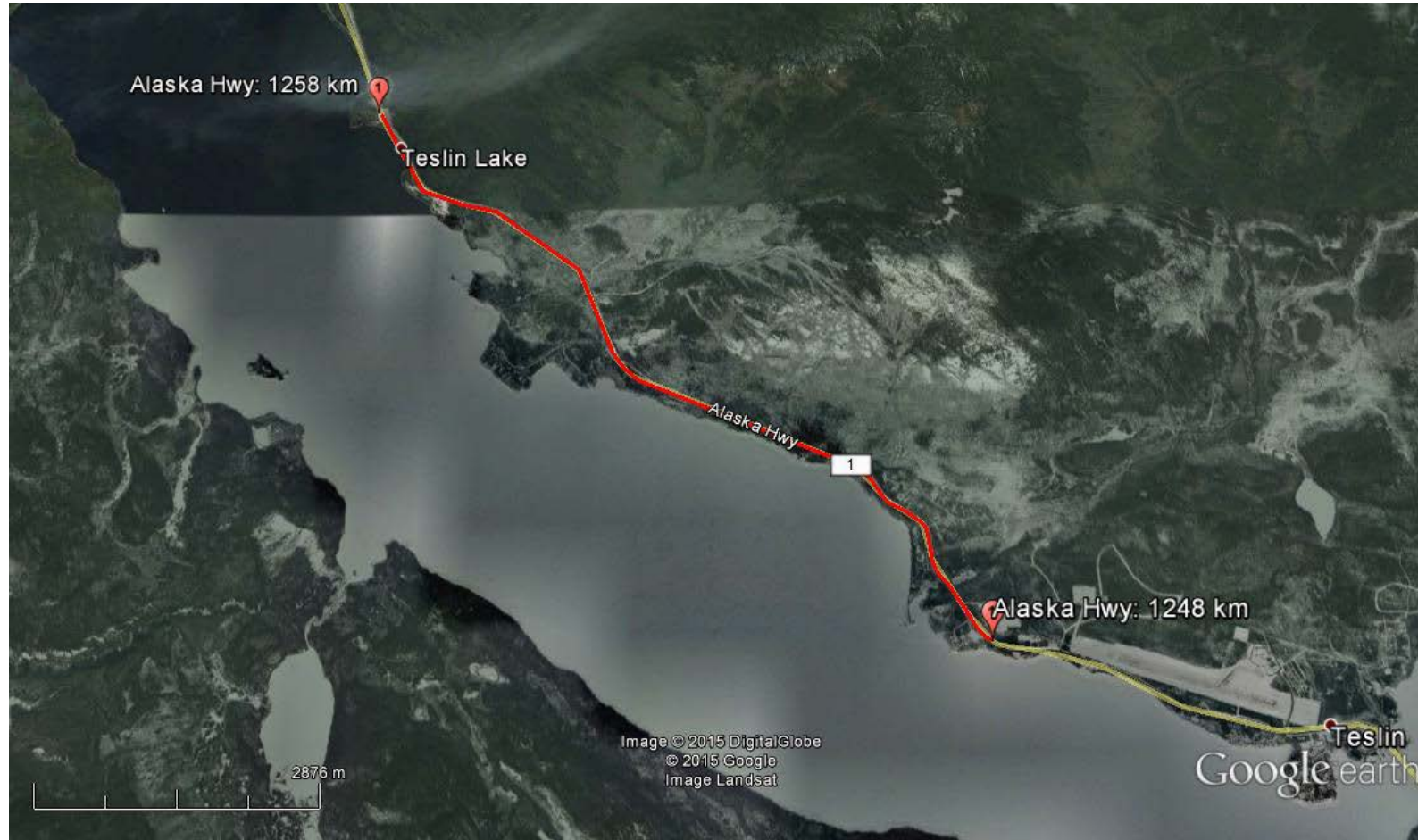
- Builds and maintains transportation infrastructure, systems and programs to ensure safety for travellers and support economic growth within the Territory.

Yukon Site Selection

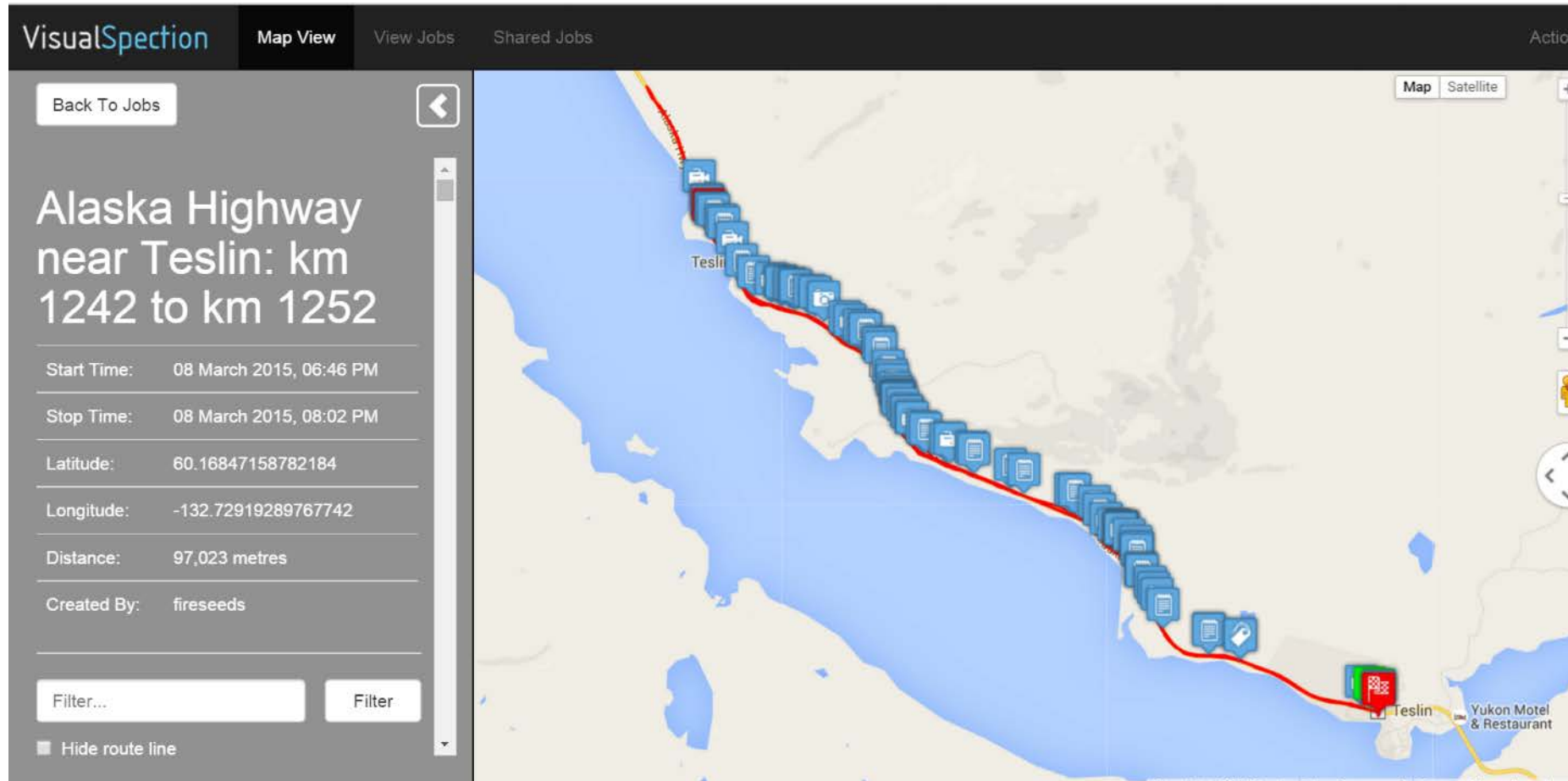
- Collision data and rates
- Priority corridors and existing functional plans
- Resident input
- Maintenance staff input

- Fireseeds North combined all of the above in a high level network screening to recommend sites that were approved by Highways and Public Works.

Alaska Highway N. of Teslin (10km)



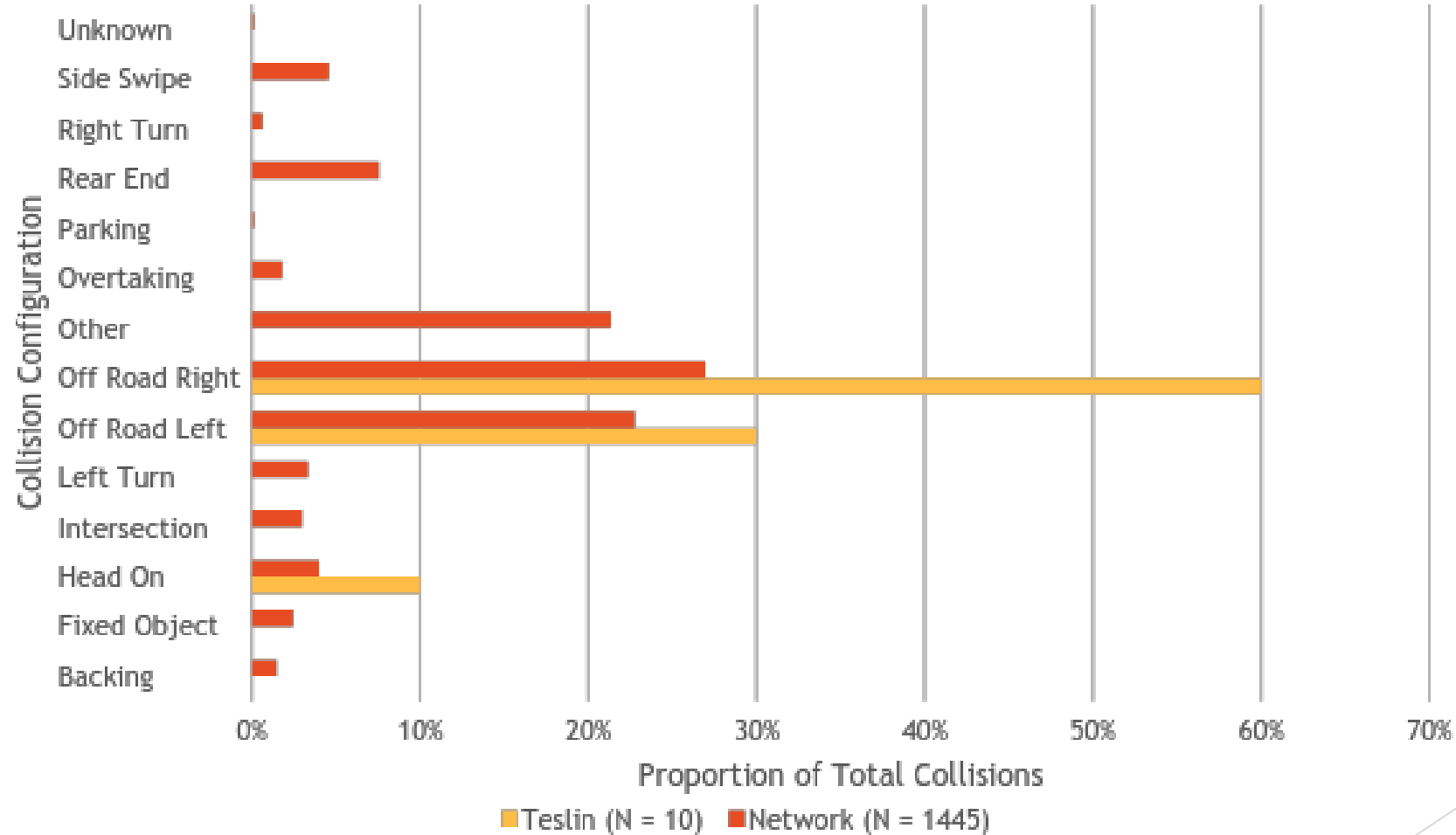
Alaska Highway N. of Teslin (10km) – Field Observational Analysis



Alaska Highway N. of Teslin (10km) – Total Collisions



Alaska Highway N. of Teslin (10km)



Alaska Highway N. of Teslin (10 km)

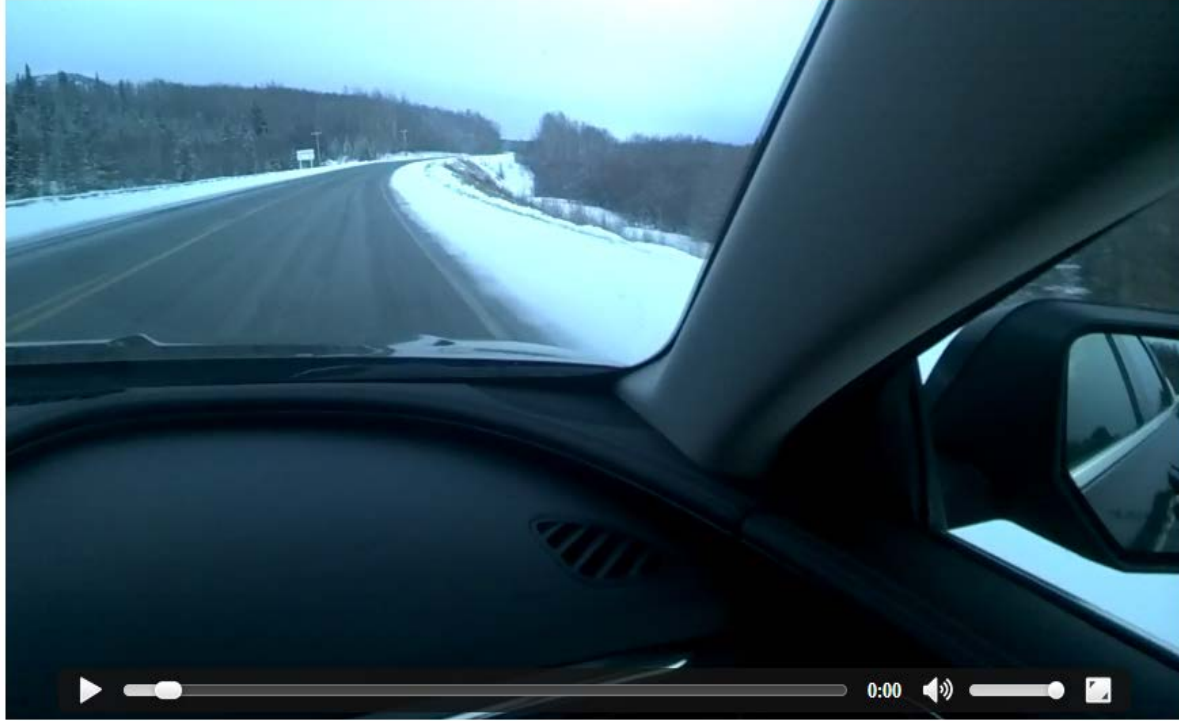
□ Key Issues & Treatments

- Critical Sideslopes → Flatten and Protect (CMF .53)
- Curve Delineation → Lines, Post-mounted reflective delineators (CMF .63)
- Intersection Conspicuity → Reflective markings
- Bump → Repair and Maintenance
- Head-on/fatigue/increased curvature after long stretch → Centre Rumble Strips (CMF .63)

Alaska Highway N. of Teslin (10 km) – Critical Sideslopes

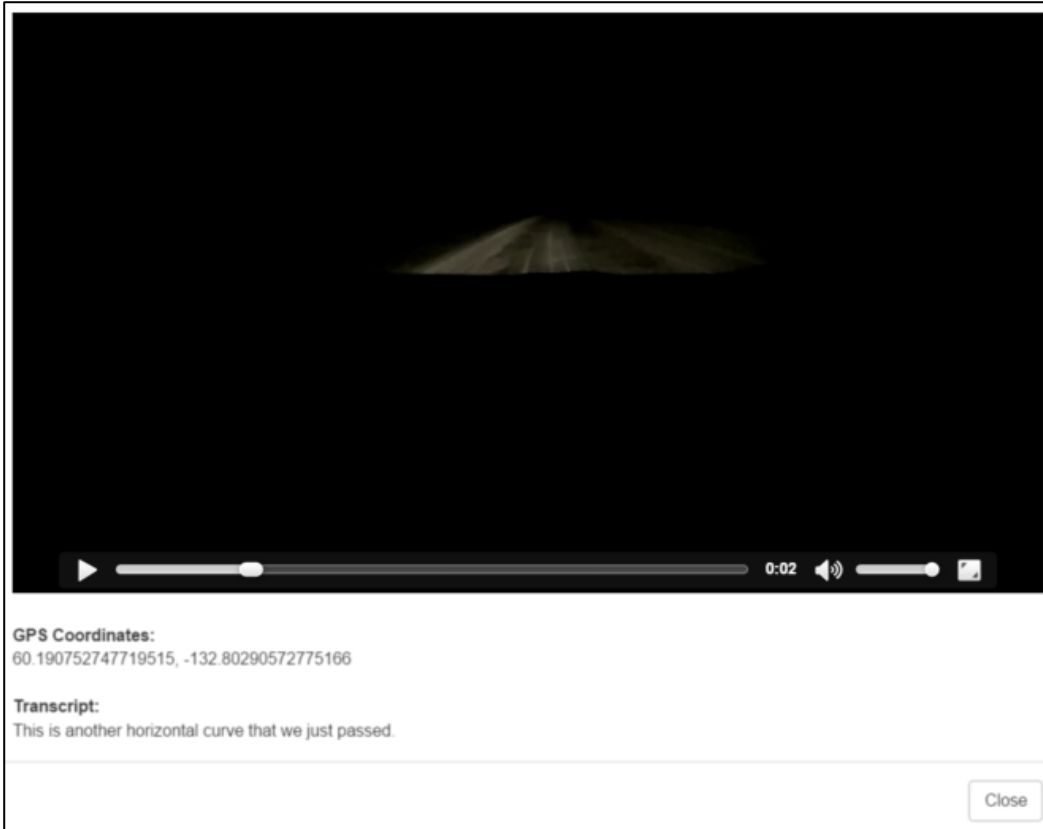
Start	End	L	Side	Treat
60.181465, -132.79012	60.18146, - 132.7901 (100 metres south)	100 m	SB	Flatten
60.182216, -132.79113	60.18375, - 132.7934	200 m	NB	Protect

Geometric / Issue - Video



GPS Coordinates:
60.22130385506898, -132.88304893299937

Alaska Highway N of Teslin (10 km) Curve Delineation

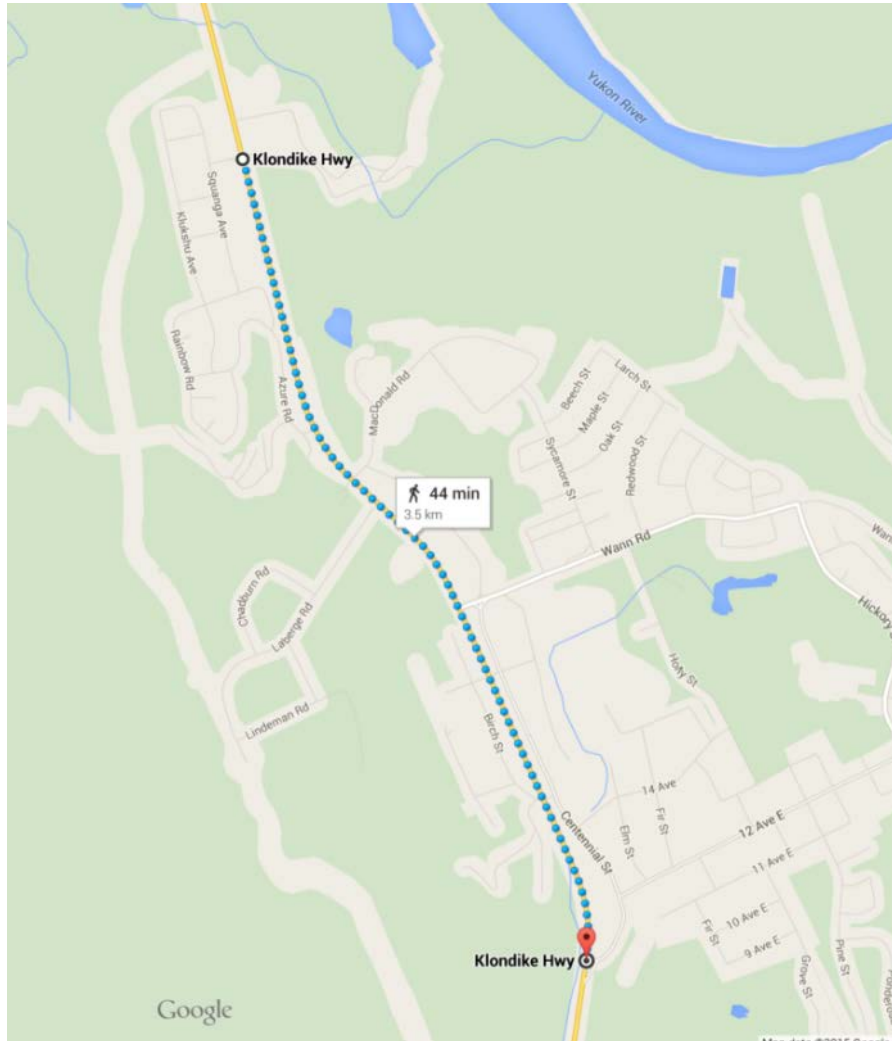


Alaska Highway

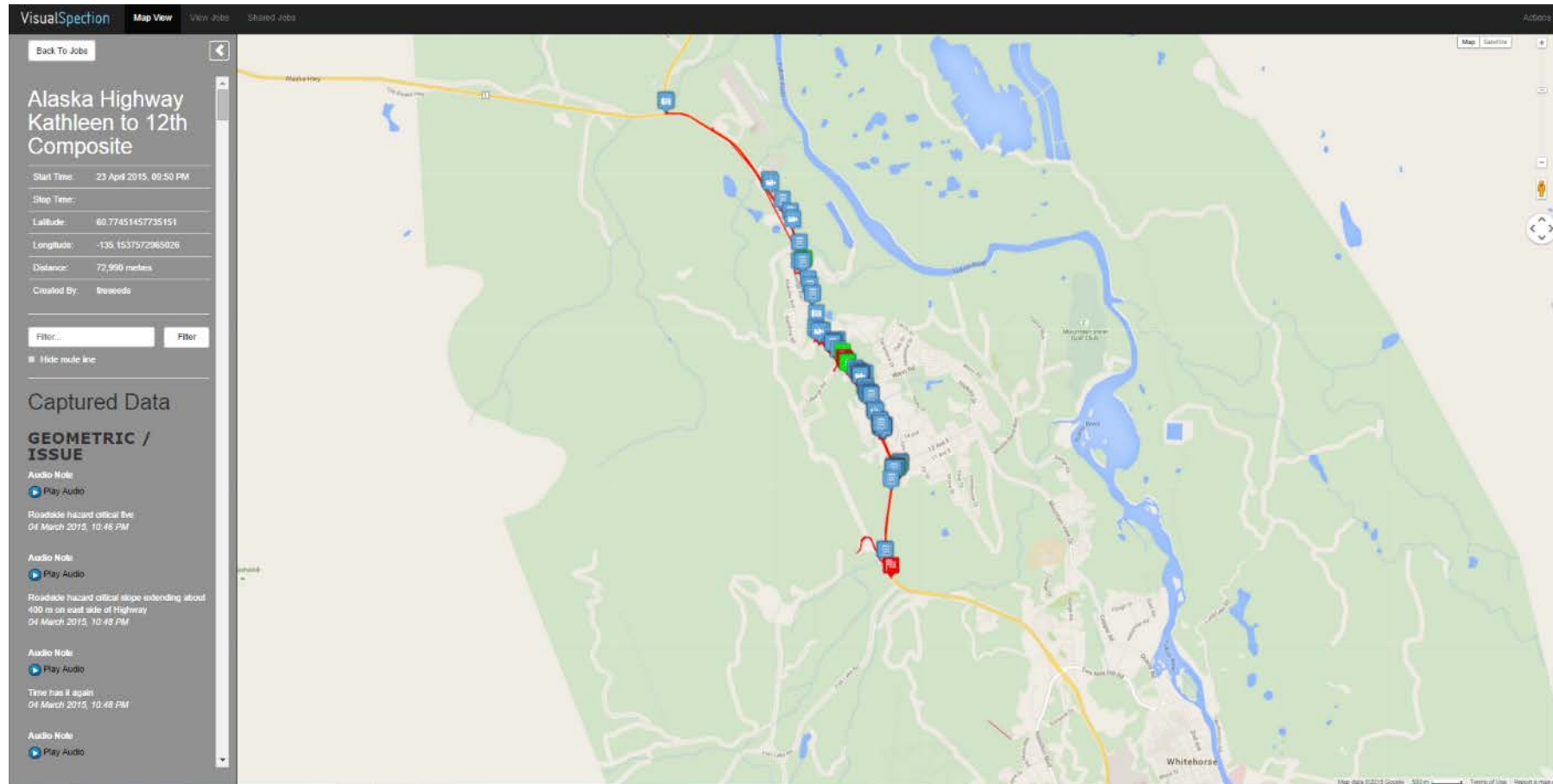


toolkit.irap.org

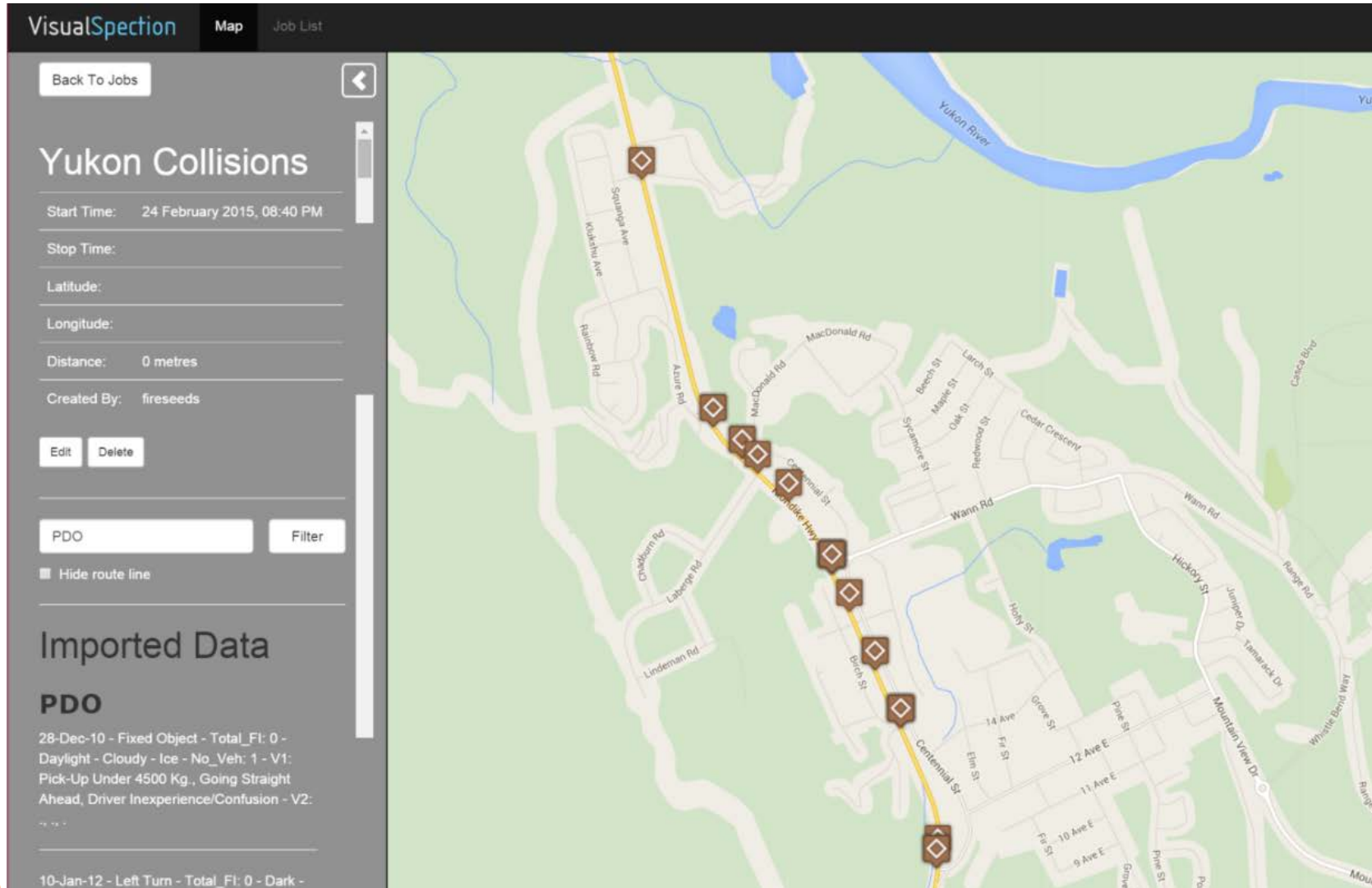
Alaska Highway - 12th Ave to Kathleen Rd



Alaska Highway - 12th Ave to Kathleen Rd - Field Observational Analysis

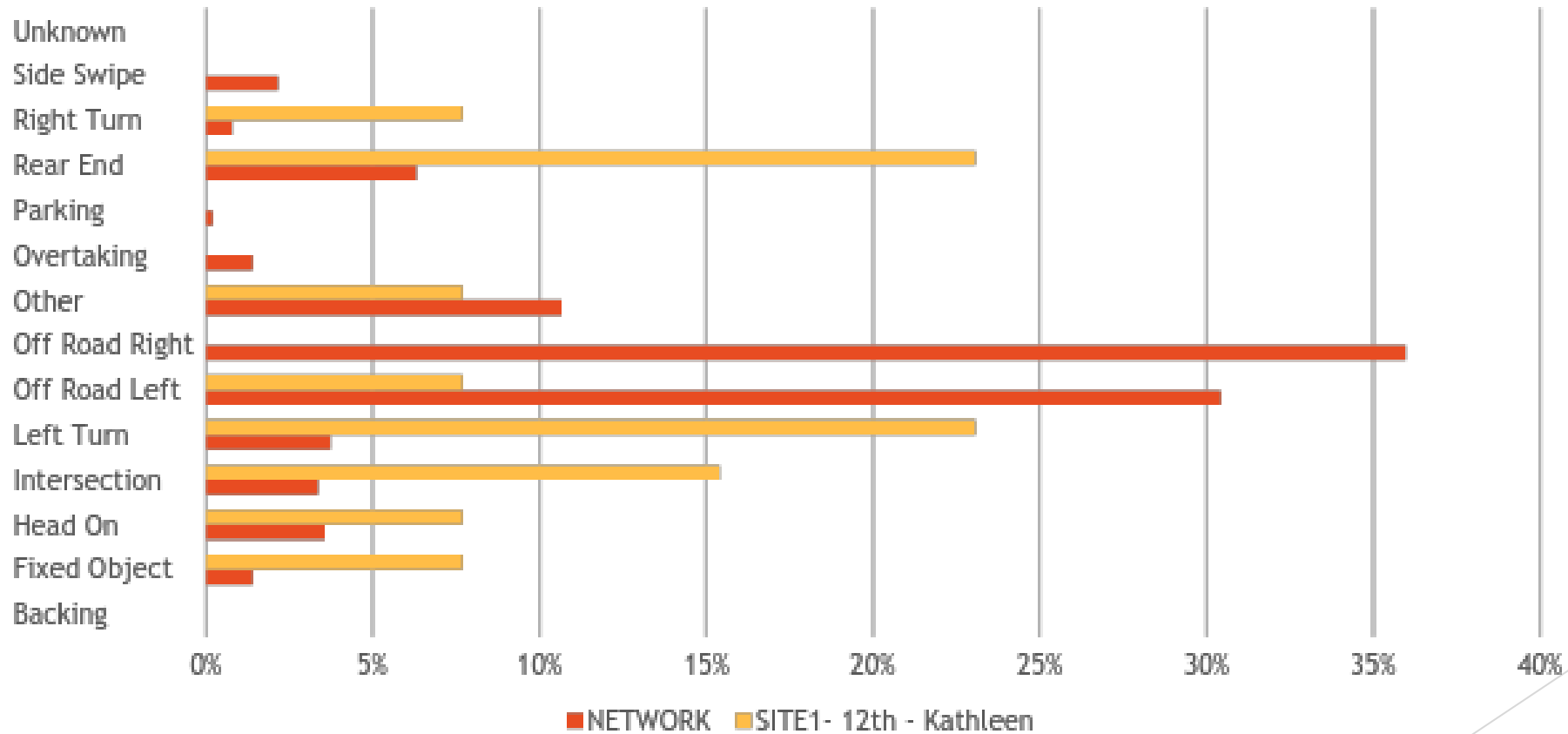


Alaska Highway - 12th Ave to Kathleen Rd - Total Collisions



Alaska Highway - 12th Ave to Kathleen Rd - Distribution by Configuration

Distribution of FI Collisions by Configuration - Alaska Hwy from 12th Ave to Kathleen Ave



Alaska Highway - 12th Ave to Kathleen Rd

□ Key Issues & Possible Treatments

- Turning Gaps → Signalized intersection (CMF .85); right in/ right outs
- Sign Improvements → Crosswalk, enlarged lane designation, street names
- GM2 Crosswalk Expectancy (at Birch and at 17th) → Remove crosswalks or upgrade to overhead flashing system or install median refuge (CMF .54)
- Critical Sideslopes → Install roadside barrier (CMF .53) and expand shoulder as required
- Fixed Objects → Remove concrete barrier
- Terminals of Pedestrian Crossing → Build out staging area and maintain it free of large snow banks
- Private Access Configuration on Birch → Move access 40 m further from highway (CMF .93)
- Auxiliary Lane Consistency → Develop more consistent approach to auxiliary lanes

Alaska Highway - 12th Ave to Kathleen Rd - GM2 Crosswalk Expectancy



- At Birch and/or 17th:
- Remove Crosswalks, or
- Add pedestrian activated overhead flashers to corridors, or
- Convert to uncontrolled crossing if median refuge area provided.

Alaska Highway - 12th Ave to Kathleen Rd – Fixed Object Hazards

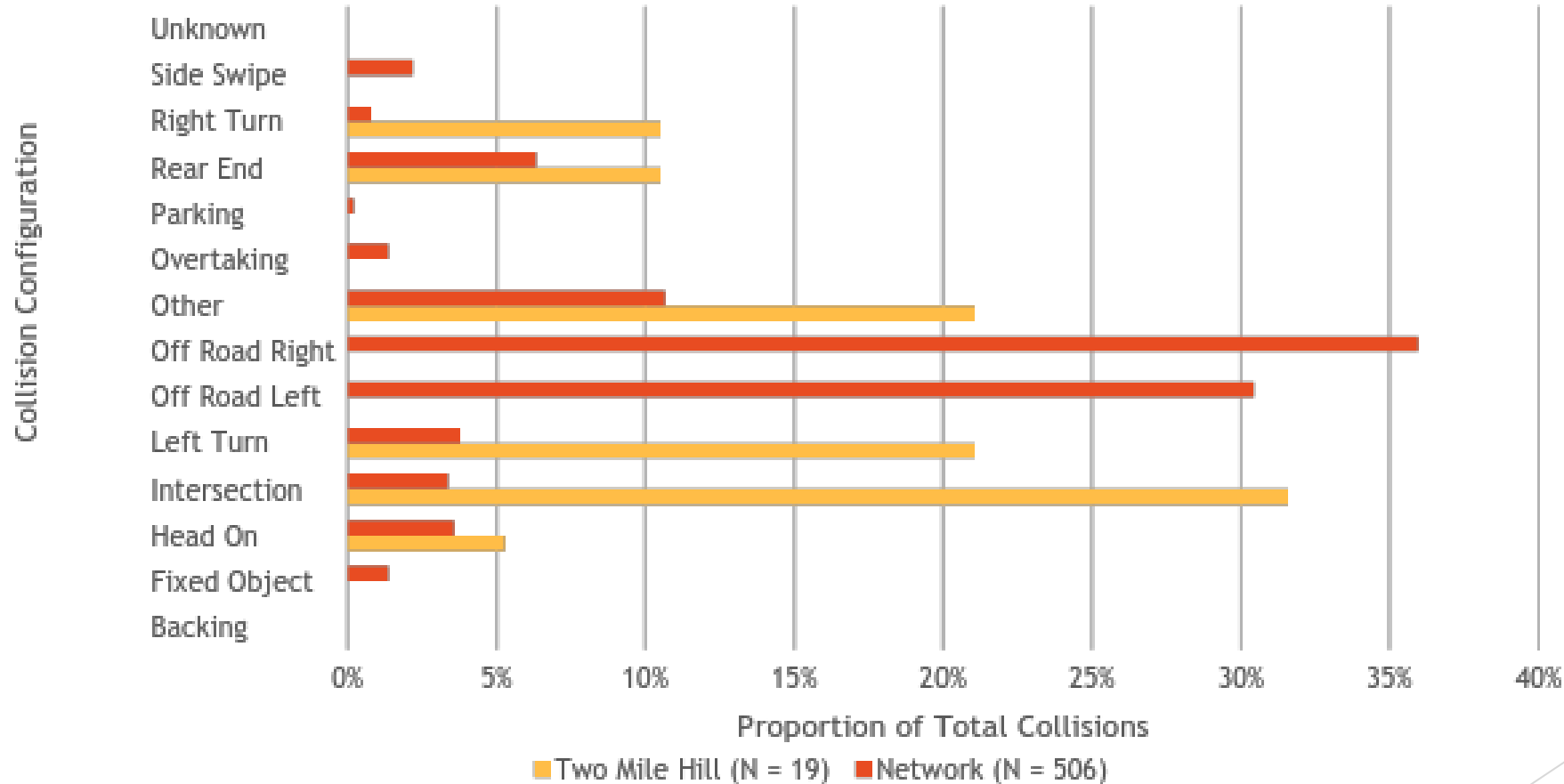


- Concrete barriers placed inside clear zone just north of Wann Rd

Alaska Highway and Two Mile Hill Intersection



Alaska Highway and Two Mile Hill Intersection



Alaska Highway and Two Mile Hill Intersection

□ Key Issues & Possible Treatments

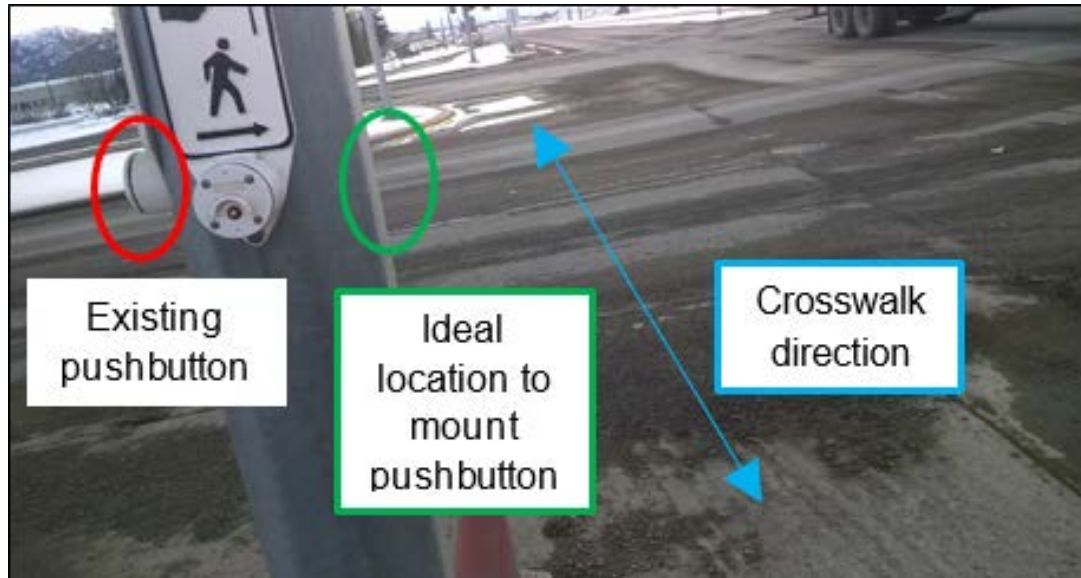
- Clear Zone Safety → Install attenuators at overhead sign structures (CMF .31)
- Crosswalk Inadequacies → Audible signals, tactile markings, repaint zebra markings, remount pushbuttons, realign curb ramps, provide pedestrian refuge at medians
- Active Transportation → Directional orientation signs, bike route markers, increase width
- Signs → Crash attenuator for fixed overhead sign structure (CMF .31), apply consistent left arrangement, periodically clean signs, replace signs in unsatisfactory condition

Alaska Highway and Two Mile Hill Intersection

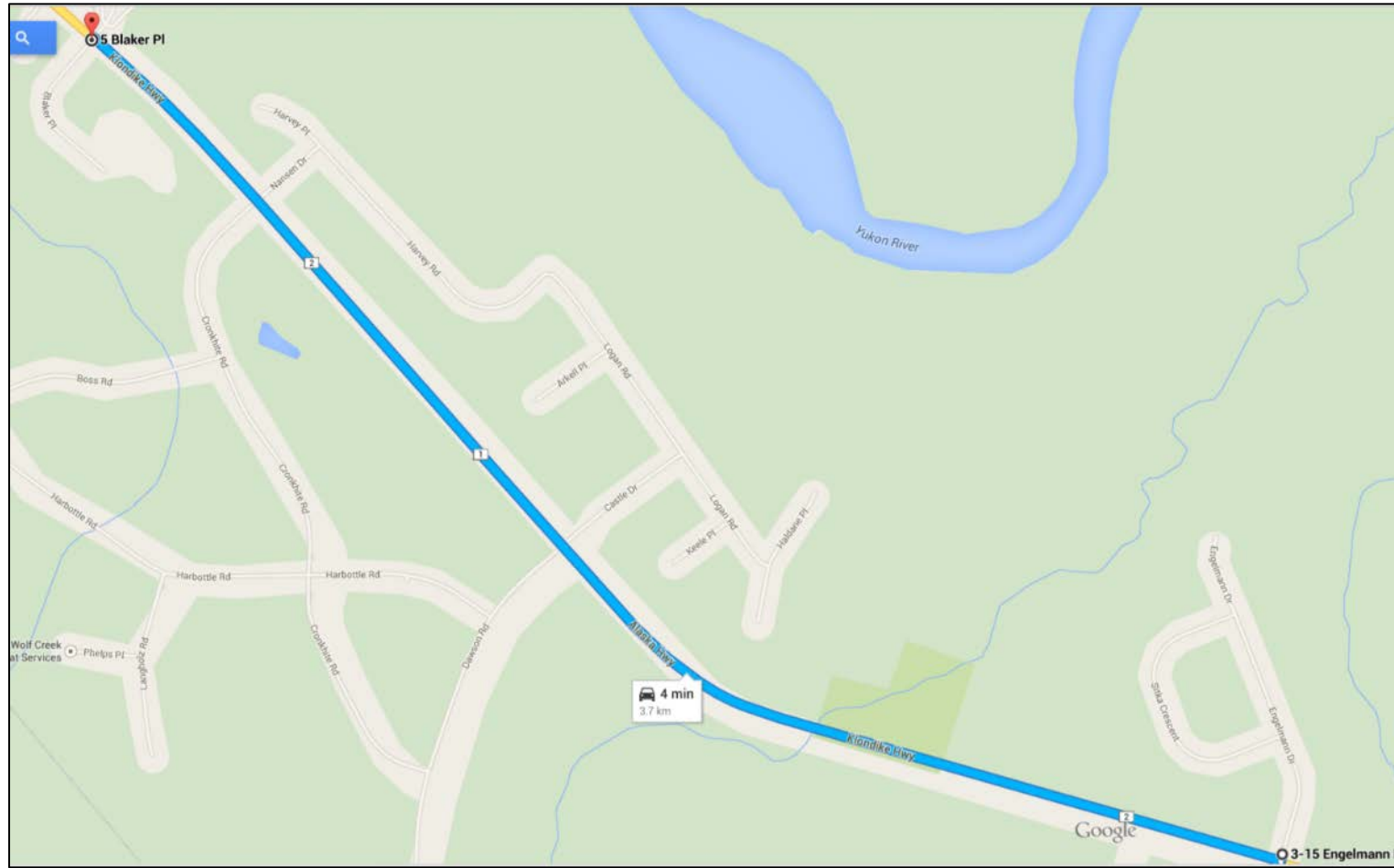
□ Key Issues & Treatments

- Lane Designation Positive Guidance → Oversized overhead lane designation arrows, periodically reapply pavement lane markings
- Delineation of Southbound Approach → Extend raised island, reapply pavement markings
- Delineation of Eastbound Bikeway → Separate street and bike lane

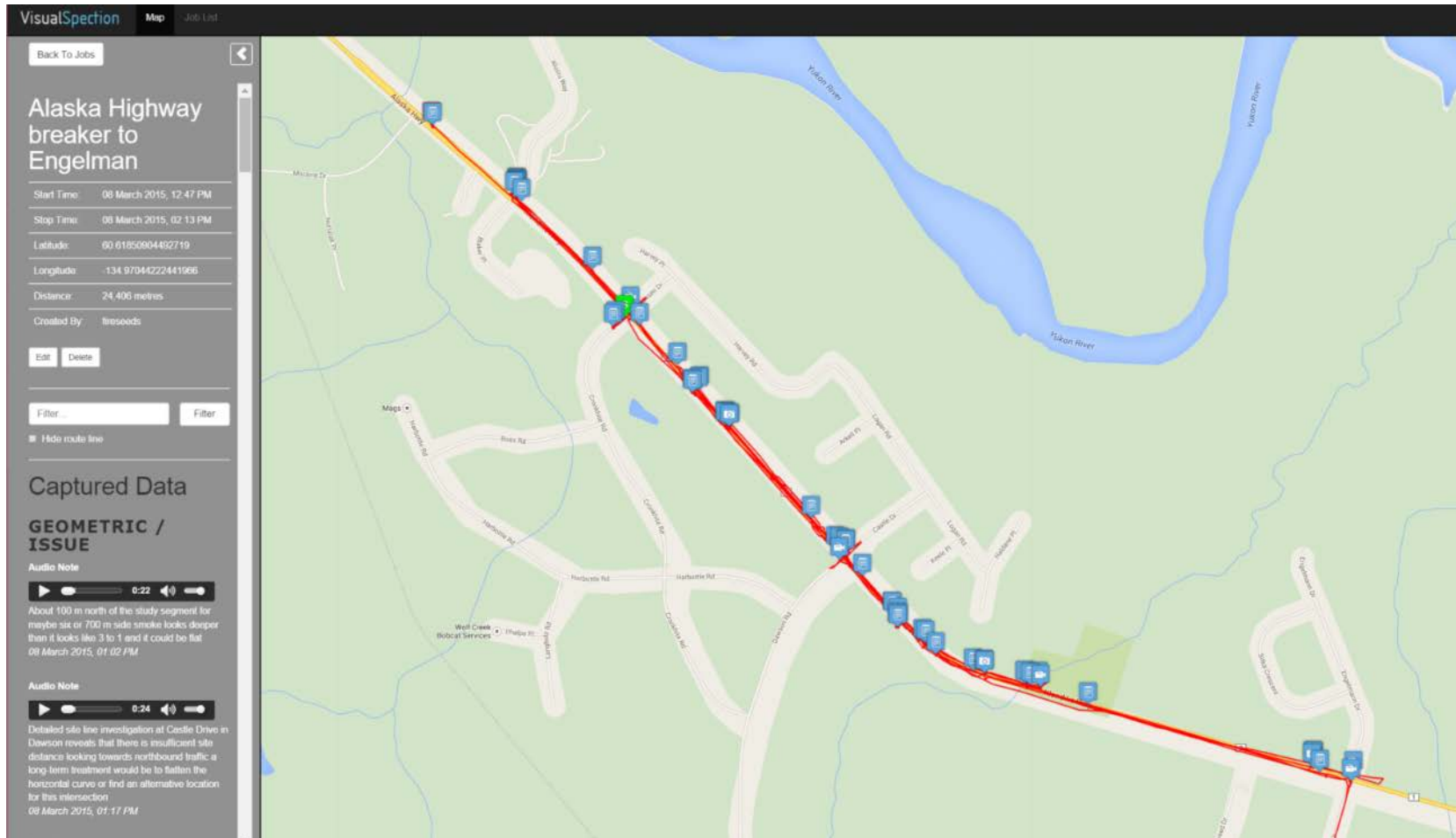
Alaska Highway and Two Mile Hill Intersection – Crosswalk Improvements



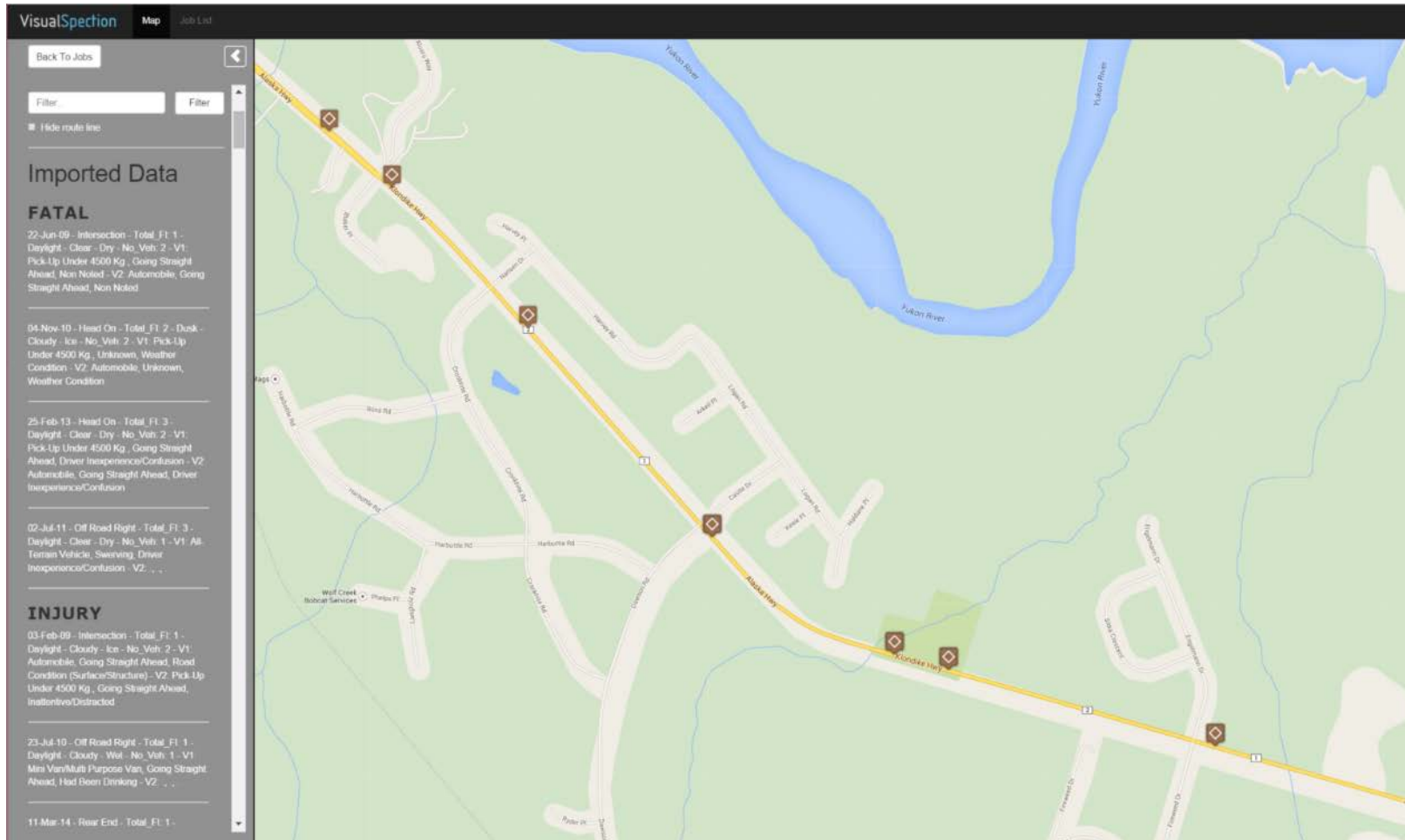
Alaska Highway - Blaker to Engelmann



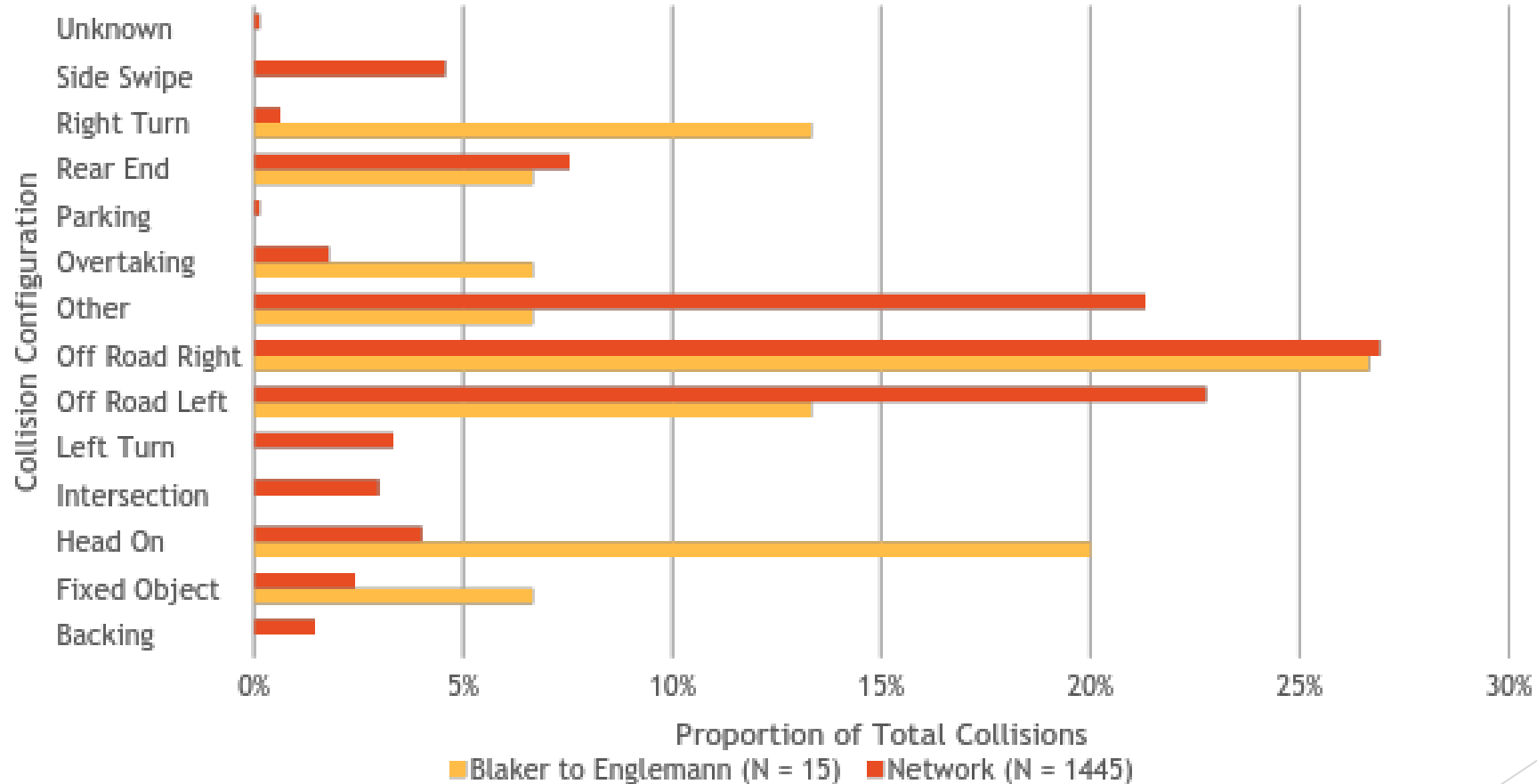
Alaska Highway – Blaker to Engelmann – Field Observational Analysis



Alaska Highway – Blaker to Engelmann – Total Collisions



Alaska Highway - Blaker to Englemann - Distribution of Total Collisions by Configuration



Alaska Highway – Blaker to Engelmann

□ Key Issues & Treatments

- Critical Sideslopes → Curve delineation markers (CMF .81), shoulder rumble strips (CMF .84), roadside barrier (CMF 0.56)
- Deteriorated Signage → Replace signs (CMF .946)
- Illumination → Provide Illumination between Engelmann and Dr. and Castle Dr. (CMF 0.72)
- Auxiliary Lane Use → Correct signs and pavement markings

Alaska Highway – Blaker to Engelmann – Critical Sideslope

High, steep, unprotected slope with hydro poles at base

High, steep, unprotected slope with water hazard and tourist deck structure at base

High, steep, unprotected slope

Curve on downgrade traveling southbound;
outside of curve has high, steep,
unprotected slope



Alaska Highway – Blaker to Engelmann – Deteriorated Signage



- Stop sign at Cronkite has deteriorated retroreflectivity

Conclusions

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- Google Glass was successfully implemented in the ISRSR process by collecting information about potential road safety concerns in a user friendly manner

