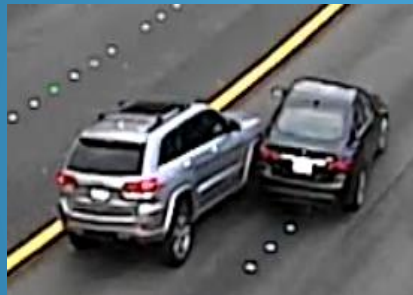
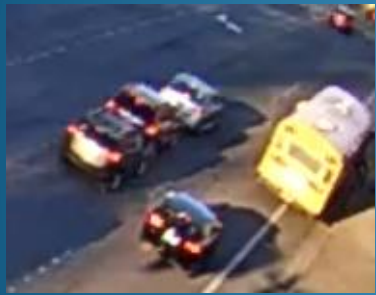
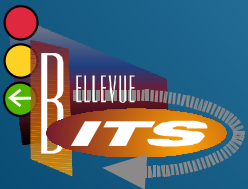


The Use of ITS Technologies in Collision Response & Investigation



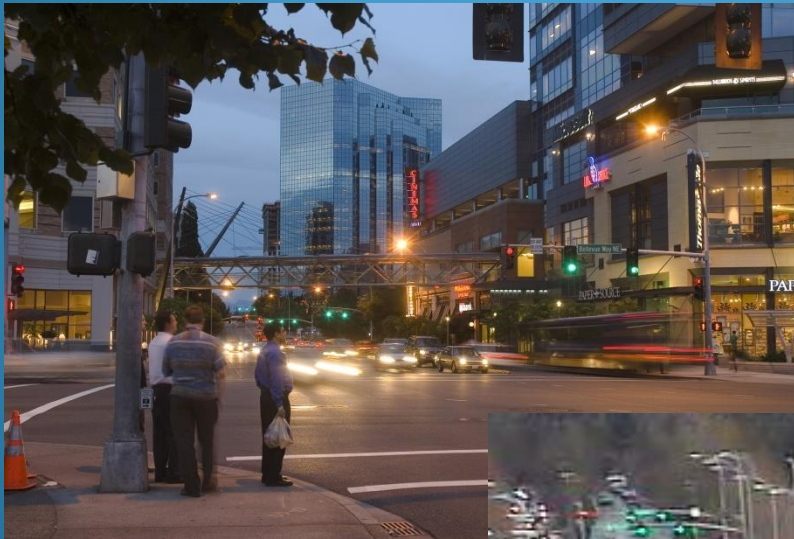
ITS Washington
Raid Tirhi, PE
December 14, 2022



Traffic Operations

Primary Goal

Moving all transportation modes in the most efficient yet safe manner

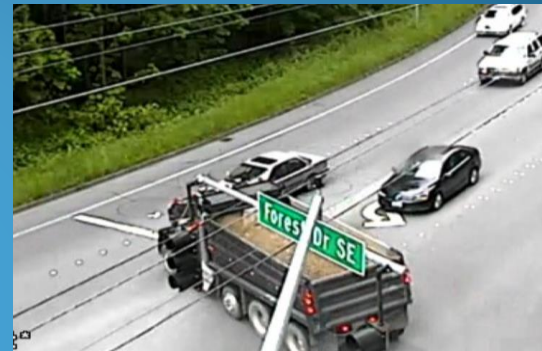


Collision Causes

Roadway Design Issues



Vehicle Malfunction



~~94% Erroneous Driver Behavior~~

> 99% Erroneous Human Behavior



NORCOM Notifications

-----Original Message-----

From: paging@norcom.org [mailto:paging@norcom.org]

Sent: Wednesday, May 16, 2018 2:12 PM

To: Tirhi, Raid <RTirhi@bellevuewa.gov>

Subject: BLVUTraffic Group Page

Priority Call for BLVUPD in Progress: CFS #290 TA at RICHARDS RD / SE EASTGATE WAY
<http://bit.ly/2KrpvGb>



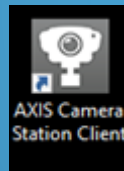
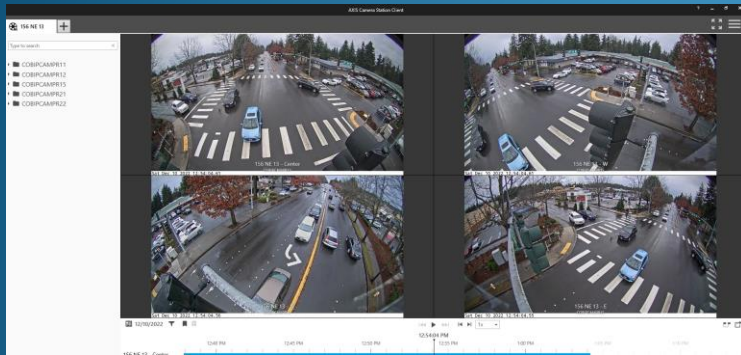
15:46:11 agrannis 2ND T29
 15:43:29 esilveira ENTERED EVI LIC/ATM0314 VIN/4T1BG22K71U837994 WAC/18V0071173 OCA/5040

Agency	Call ID	Location	Status
BLVUPD	1100000001	1100000001	Active
BLVUPD	1100000002	1100000002	Active
BLVUPD	1100000003	1100000003	Active
BLVUPD	1100000004	1100000004	Active
BLVUPD	1100000005	1100000005	Active
BLVUPD	1100000006	1100000006	Active
BLVUPD	1100000007	1100000007	Active
BLVUPD	1100000008	1100000008	Active
BLVUPD	1100000009	1100000009	Active
BLVUPD	1100000010	1100000010	Active
BLVUPD	1100000011	1100000011	Active
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BLVUPD	1100000016	1100000016	Active
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BLVUPD	1100000098	1100000098	Active
BLVUPD	1100000099	1100000099	Active
BLVUPD	1100000100	1100000100	Active



ITS Technologies

Camera Systems



Adaptive Traffic Signal System- SCATS

Region - BELVU1 - Version 6.9.3.15 User 0 - Level 0 11/26/2018 1:04:34 PM

Active Plan	Stretch	Split	Features	Next phase
1	A 17%	AS FG FS NS NG PD TG	B	
	B 10%	AS FG FS NS NG PD TG	C	
	C 15%	AS FG FS NS NG PD TG	D	
	D 35%	AS FG FS NS NG PD TG	E	
	F 13%	AS FG FS NS NG PD TG	E	
	E 10%	AS FG FS NS NG PD TG	A	

Special facilities: Y Z Z+ Allow double cycling

XSF: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

Cycle length threshold for double cycle, AS and FS: 0 seconds

Allow late demands at all cycle lengths or below: 100 seconds

Locked to Lock period: Timed lock Period: 0:01:00

Time remaining: All queued entries

Dwell: A B C D E F

Timed dwell Period: 03:00 No skip

Permanent dwell

Remove on arrival

Dwell period:

Time remaining:

Applied by:

Show All Dwells... Close

Days: Hours: Mins: Secs:

3 0

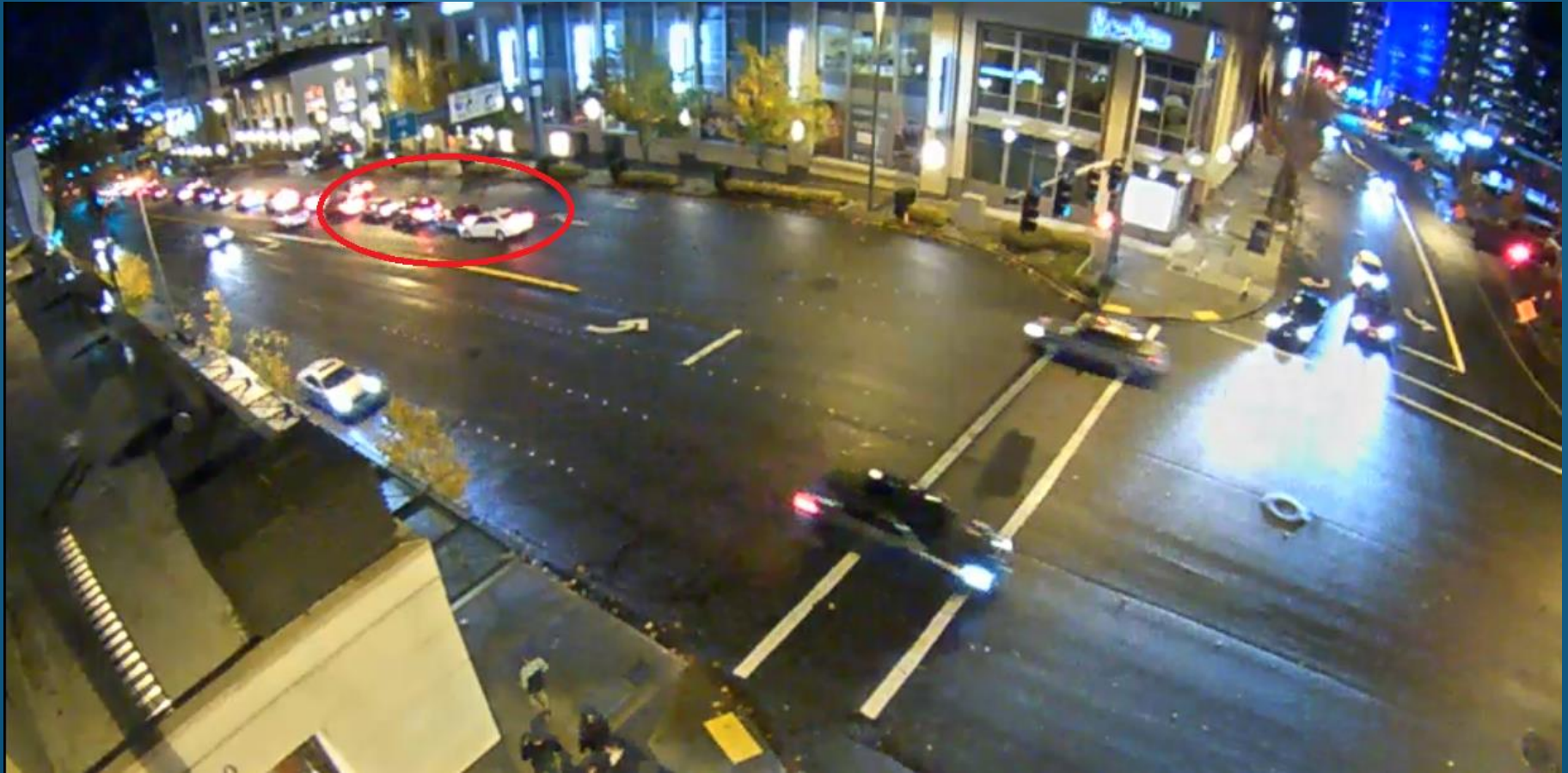
OK Cancel

Signal phasing/timing tweaks



➤ Public Information

Long term signal timing tweaks



Engineering solutions

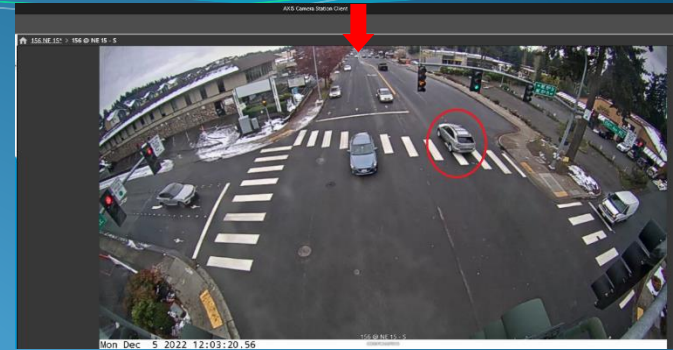
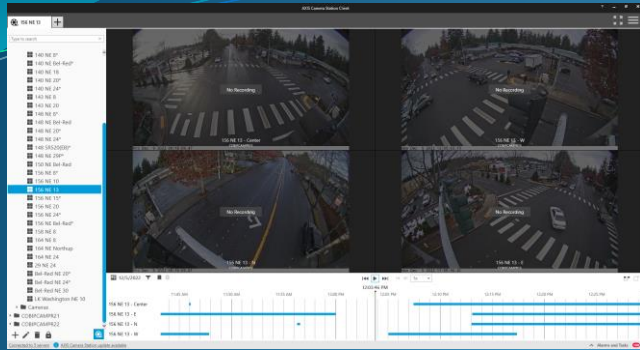


Ped Minus Flashing Yellow Arrow with a Ped Jump



Fri Dec 10 2021 12:37:15.23

Collision Investigations



SCATS History Reader - [Y:\History\BELVU2_20221205.hist]

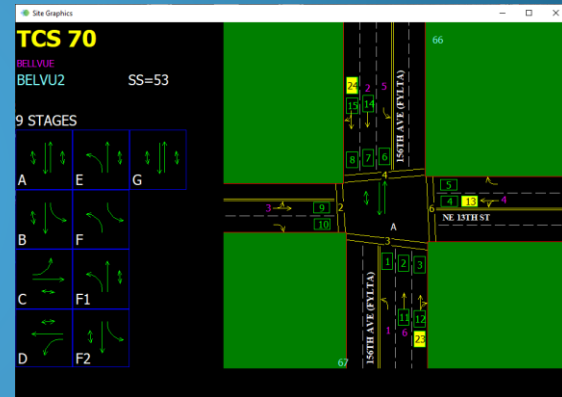
File Window Help

Site: 70

Phases Cycles Timeline Statistics

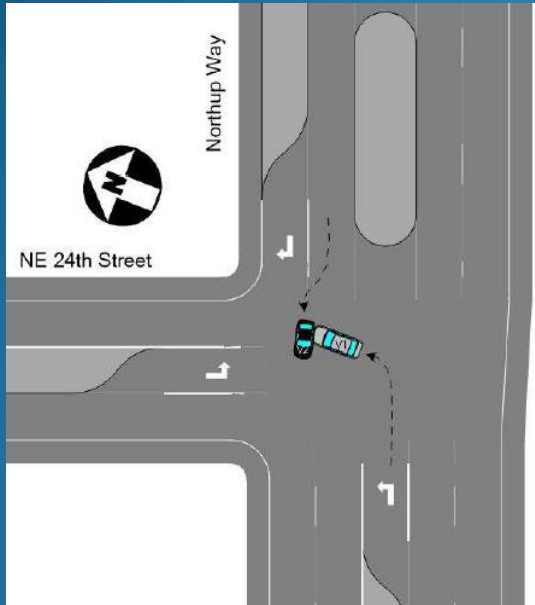
Date	Start Time	End Time	Duration	Phase	Gap
Mon 5-Dec-2022	12:00:25	12:00:50	25	A	
Mon 5-Dec-2022	12:00:50	12:01:14	24	C	
Mon 5-Dec-2022	12:01:14	12:01:28	14	B	Yes
Mon 5-Dec-2022	12:01:28	12:02:15	47	A	
Mon 5-Dec-2022	12:02:15	12:02:24	9	D	Yes
Mon 5-Dec-2022	12:02:24	12:02:38	14	B	Yes
Mon 5-Dec-2022	12:02:38	12:03:51	73	A	
Mon 5-Dec-2022	12:03:51	12:04:15	24	C	
Mon 5-Dec-2022	12:04:15	12:04:33	18	D	
Mon 5-Dec-2022	12:04:33	12:04:58	25	B	Yes
Mon 5-Dec-2022	12:04:58	12:05:27	29	A	
Mon 5-Dec-2022	12:05:27	12:05:51	24	D	
Mon 5-Dec-2022	12:05:51	12:06:14	23	B	Yes

History file loaded



- Camera at subject intersection lost com
- Upstream camera barely shows the collision but no signal displays
- Collision happened at about 12:03:47pm.
- From the traffic signal history file, the collision happened during the westbound signal phase Stage "A" which includes a Flashing yellow Arrow (FYA).
- The time stamps of both systems are based on an atomic clock and are synched within a second.
- **SB left vehicle did not yield on a FYA.**

FYA- Collision Investigation



D1 stated that they were EB on Northrup Way at the intersection of NE 24th Street. D1 stated that the sun was low in the sky making it difficult to see. D1 stated that he put his head out the window to check for WB traffic. D1 stated that he made a left turn on a flashing yellow light and collided with V2 in the intersection. D1 stated that he did not see V2 until after the collision. It should be noted on video I was able to zoom in on D2 and confirmed that he did look out the driver window attempting to clear the intersection prior to entering it.

D2 stated that they were WB on Northrup Way nearing the intersection of NE 24th Street. D2 stated that V1 turned into the path of V2. D2 attempted to avoid the collision but was unable to. D2 stated that V1 collided with the driver side door of V2 causing V2 to spin.

A traffic signal control box belonging to the City of Bellevue was also impacted. City of Bellevue signals responded to the scene to evaluate the equipment.

I reviewed Bellevue Transportation camera footage from the intersection. The footage showed V1 in the left turn lane. D1 looked out their open window after stopping. V1 proceeded into the intersection and struck V2. V2 is observed swerving to avoid the collision but was unable to. A copy of the footage was booked into Quetel digital evidence.

V1 Damage: V1 had damage (ripped/bent metal) to the front driver side fender/hood/bumper. No airbags were deployed. the vehicle was towed by Crossroads Towing

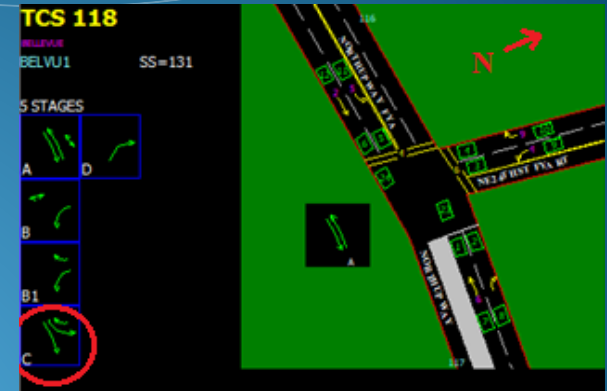
V2 Damage: V2 had damage to the driver side door (bent metal). The vehicle was towed by Crossroads Towing

Based on statements and vehicle damage D1 caused the collision by failing to obey the traffic control device. I issued D1 an infraction for RCW 46.61.050.

Collision Investigation: FYA → Run Red



Tue Oct 11 2022 08:48:38.83



SCATS History Reader - [Z:\History\BELVU1_20221011.hist]

File Window Help

Site: 118

Phases Cycles Timeline Statistics

Date	Start Time	End Time	Duration	Phase	Gap
Tue 11-Oct-2022	08:47:13	08:47:48	35	A	Yes
Tue 11-Oct-2022	08:47:48	08:47:58	10	B	
Tue 11-Oct-2022	08:47:58	08:48:41	43	A	Yes
Tue 11-Oct-2022	08:48:41	08:48:51	10	C	Yes
Tue 11-Oct-2022	08:48:51	08:49:13	22	A	Yes
Tue 11-Oct-2022	08:49:13	08:49:24	11	B	
Tue 11-Oct-2022	08:49:24	08:49:47	23	A	Yes
Tue 11-Oct-2022	08:49:47	08:49:58	11	B	
Tue 11-Oct-2022	08:49:58	08:50:28	30	A	Yes

History file loaded



Tue Oct 11 2022 08:48:39.83



Tue Oct 11 2022 08:48:40.76

FYA- Follow & Clearance



Mon Jul 18 2022 19:19:49.91

FYA- Follow



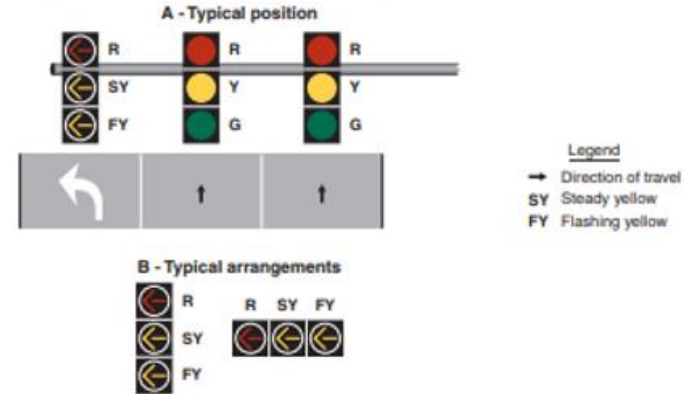
Tue Oct 4 2022 22:09:53.07

FYA Collisions

8-year footage history

All Collisions	2,417
T-Bone Collisions	321 (13%)
FYA Collisions	197 (8%)
FYA Contributing Factors	
Follow	Clearance
30%	22%

Figure 4D-7. Typical Position and Arrangements of Separate Signal Faces with Flashing Yellow Arrow for Permissive Only Mode Left Turns



- B. During the permissive left-turn movement, a flashing left-turn YELLOW ARROW signal indication shall be displayed.
- C. A steady left-turn YELLOW ARROW signal indication shall be displayed following the flashing left-turn YELLOW ARROW signal indication.
- D. It shall be permitted to display a flashing left-turn YELLOW ARROW signal indication for a permissive left-turn movement while the signal faces for the adjacent through movement display steady CIRCULAR RED signal indications and the opposing left-turn signal faces display left-turn GREEN ARROW signal indications for a protected left-turn movement.
- E. During steady mode (stop-and-go) operation, the signal section that displays the steady left-turn YELLOW ARROW signal indication during change intervals shall not be used to display the flashing left-turn YELLOW ARROW signal indication for permissive left turns.
- F. During flashing mode operation (see Section 4D.30), the display of a flashing left-turn YELLOW ARROW signal indication shall be only from the signal section that displays a steady left-turn YELLOW ARROW signal indication during steady mode (stop-and-go) operation.
- G. If the permissive only mode is not the only left-turn mode used for the approach, the signal face shall be the same separate left-turn signal face with a flashing YELLOW ARROW signal indication that is used for the protected/permissive mode (see Section 4D.20) except that the left-turn GREEN ARROW signal indication shall not be displayed when operating in the permissive only mode.

<https://deldot.gov/projects/traffic-signal/pdfs/DeIDOT%20Left-Turn%20Phasing%20-%202021%20Update.pdf>

Special Protected-Permitted (Flashing Red Arrow)

Protected-permitted operation with a flashing red arrow has been implemented at many signalized intersections in Delaware. Normally a left-turn green arrow is displayed first ("protected" part of phase), followed by a yellow arrow, then a circular red indication or red arrow, and finally a flashing red arrow ("permitted" part of phase). Legally, drivers are required to completely stop and then proceed during the flashing red arrow interval when there is an adequate gap in opposing traffic. This type of left-turn operation is generally between standard protected-permitted and protected-only phasing with respect to both efficiency and crash risk.



Coal Creek Pkwy



Mon Feb 21 2022 07:33:24.39

Coal Creek Pkwy



Thu Nov 4 2021 13:32:15.67

Education



Bellevue Transpo @BvueTrans · 7h

Crashes usually increase at the start of rainier weather. A few reminders to keep you and other road users safe if you are driving:

- Slow down during rainy conditions
- Check your tire tread to see if you need to replace your tires – A worn tire won't provide as much traction!



1



1



Bellevue Transpo @BvueTrans · 7h

- Check your windshield wipers
- Keep your headlights clean
- Make sure your vehicle's defrost works
Did you know: Oil from vehicles accumulates on the road during the summer, making streets extra slippery this time of year!



1



1



Bellevue Transpo @BvueTrans · 7h

These images from our traffic cameras are examples of drivers losing control on Bellevue streets. Please slow down and be extra cautious!



4



3



Being Proactive



Mon Jan 3 2022 19:16:15.53

Green next lane- Distraction



Wed Sep 2 2020 16:03:20.23

The Future of Connected & Autonomous Vehicles



D1 was determined to be the cause of the collision and will receive a notice of infraction in the mail for negligent driving 2nd degree. (Tesla driver assistance features are not fully automated and require an attentive driver which D1 decided not to be).



Tue Oct 18 2022 11:26:55.61

U.S. DOT SBIR Fiscal Year 2022

Edge Server-based AI Application for Dilemma Zone and Traffic Conflict Events Detection

December 2022



Dilemma zone events:
CAR, 22: 34: 09.90, 3.36s

Thank You

Presented By
Raid Tirhi, Senior ITS Engineer

ITS-Washington Meeting
December 14, 2022

