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Department of
Transportation

iteris[®]

Mobile RWIS
Integration into MDSS

APWA Western Snow
and Ice

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Mobile Friction Sensor Pilot Study

- Four sensor vendors involved: Teconer, Lufft, High Sierra and Vaisala.
- This data will be fed into MDSS and the treatment rec algorithm.
- The question: Do sensors help reduce material usage and, if so, which vendor has the best product?

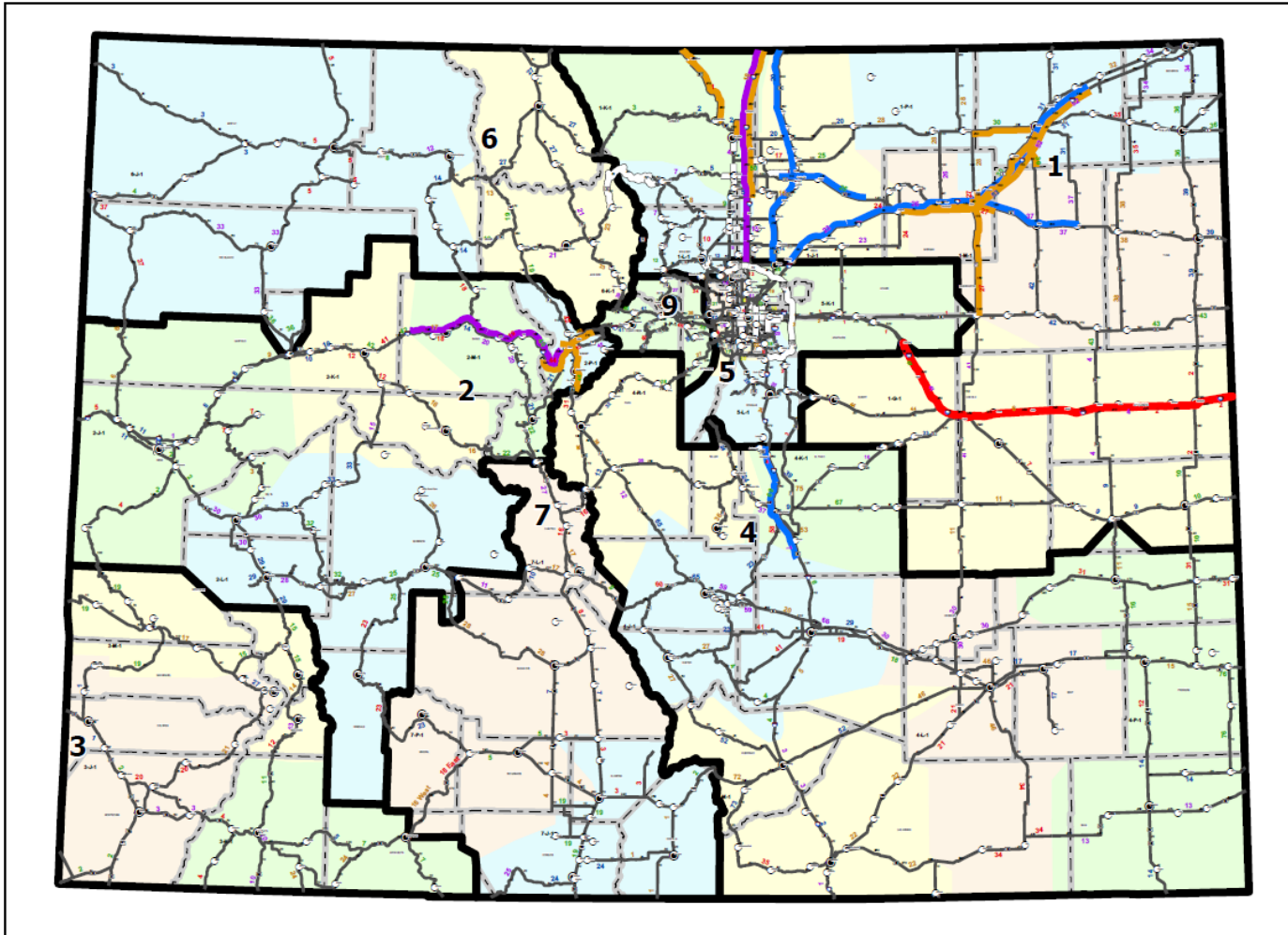




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Mobile Friction Sensor Deployment

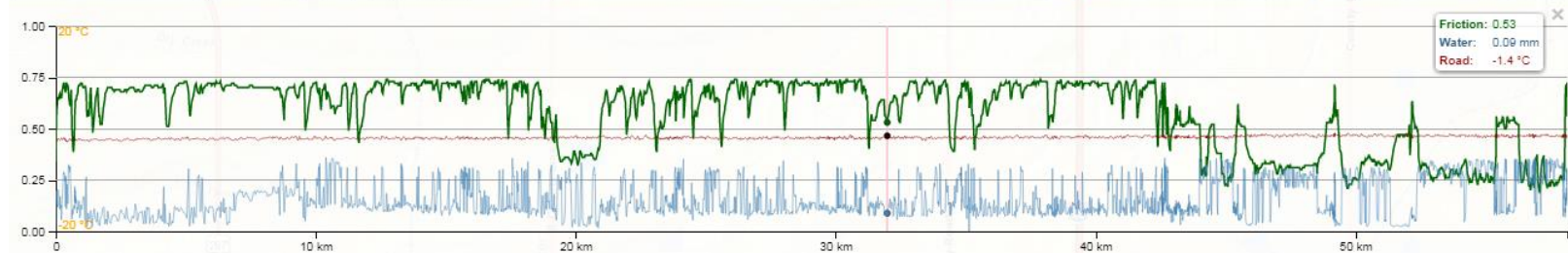
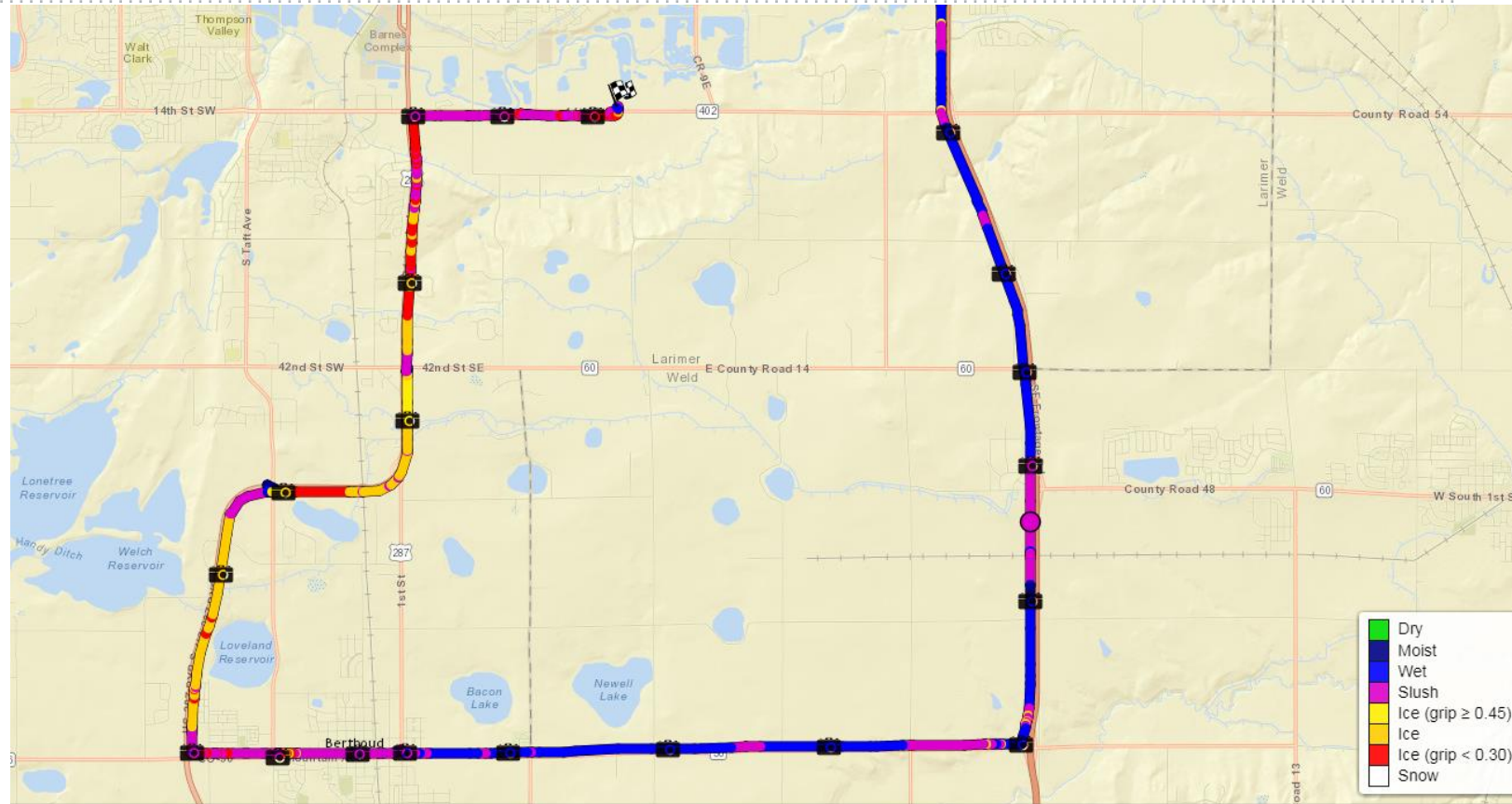
Statewide Mobile Friction Sensor Deployment





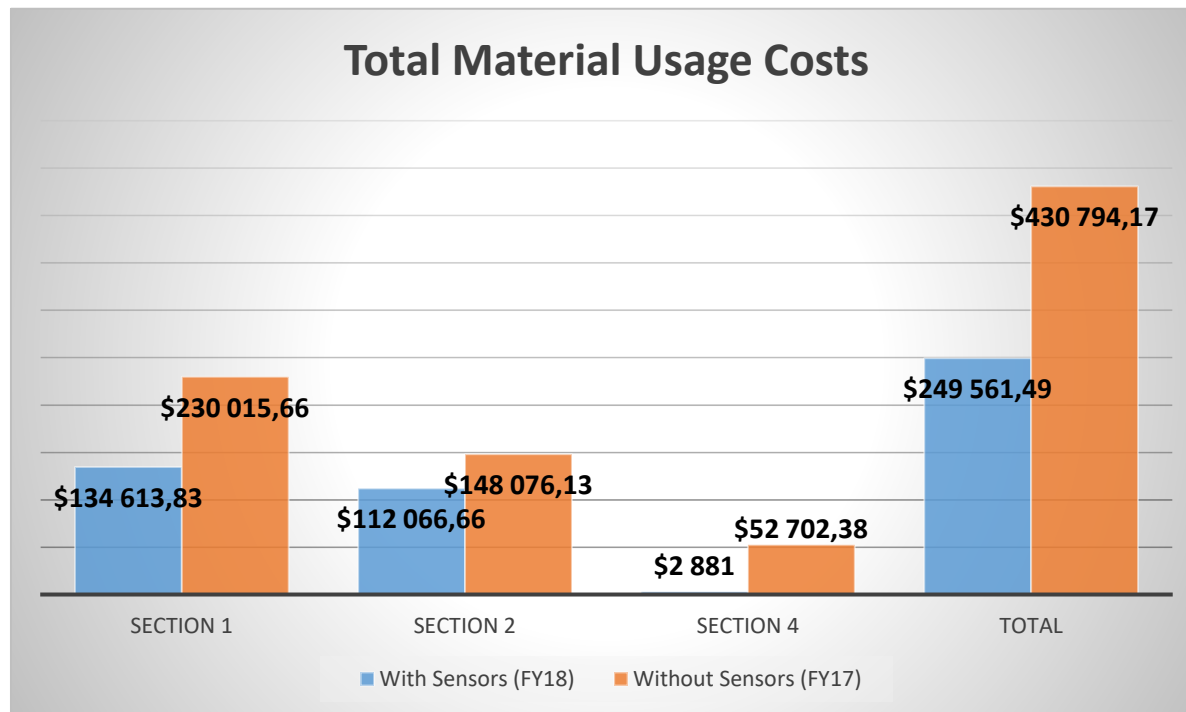
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Teconer Mobile Sensor Interface





Mobile Friction Sensor Results



- Patrols with sensors in FY18 were compared to FY17 without sensors
- Storm events were normalized to help compare usage
- Sensors helped reduce total solid and liquid usage across all sections - \$180,000 in savings
- Solid and liquid usage went down 21% and 56%, respectively
- Priority list has been created for the next phase of deployment



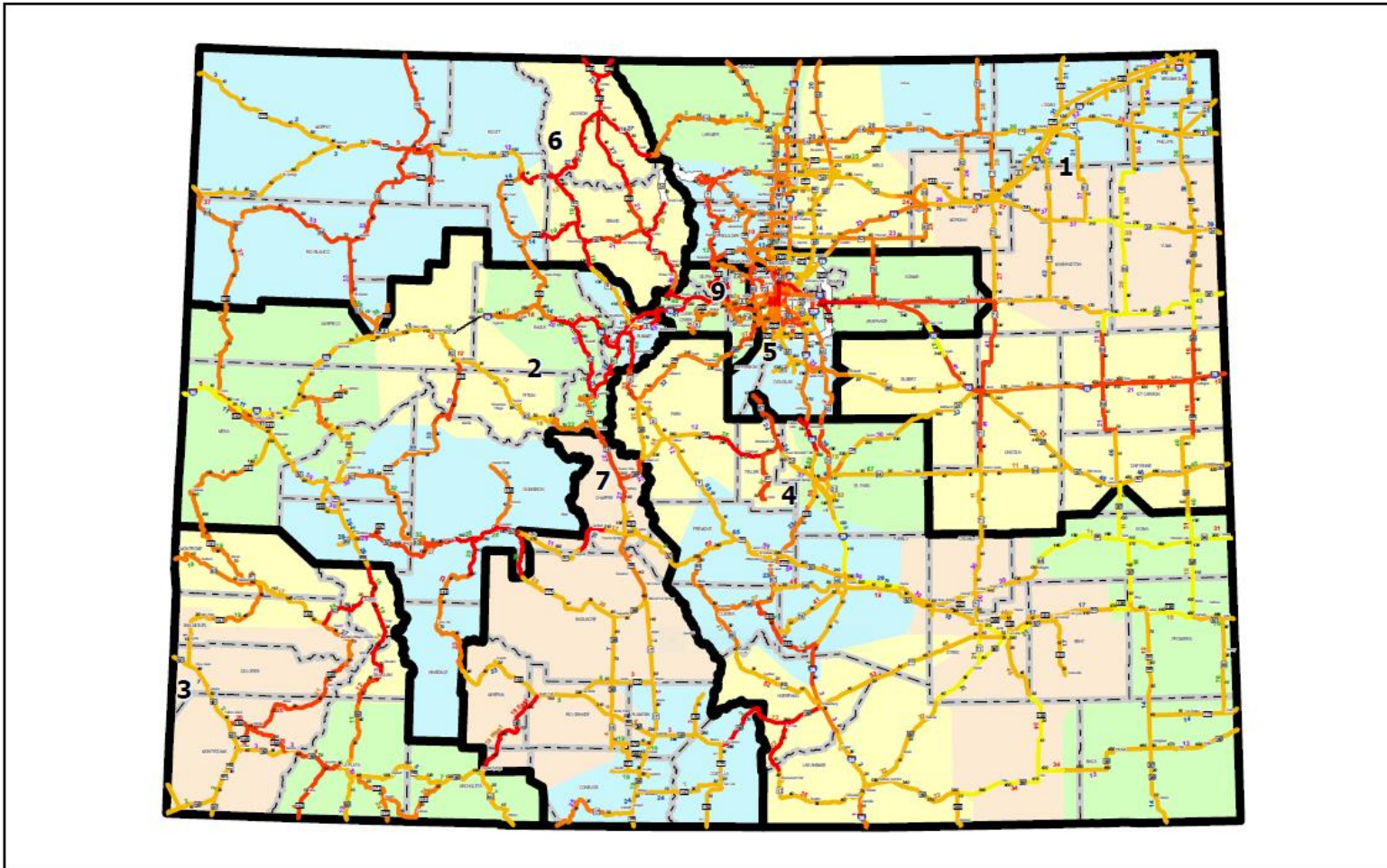
Sensor Deployment Strategy

2018-19 Priority List	Sensor Rank	Primary Route	Secondary Routes	Patrols	Maint. Section	Max ADT	WX Suitability Scale	Historic Material Usage Scale	Existing ITS Coverage Risk	Crash/LOSS Scale	Known WX Problem Area Scale	Total Risk Score	Risk/Reward Grade	Bustang Route?	Complete?
	1	070A	36/40/79	1/2	5	207000	5	5	5	2	3	20	A	N	N
	2	025A	83/85/86	3/24/25/26	5	126000	5	4	4	3	4	20	A	Y	N
	3	025A	47/50	4/5/6/20/68	4	76000	3	4	5	3	3	18	B	N	N
	4	070A	6/70B/141	1/5/8/9/11	2	34000	4	4	3	2	4	17	B	N	N
	5	040A	9/14/131/134	12/13/14/21/23	6	24000	3	4	4	3	3	17	B	N	N
	6	050A	90/92/348/550	25/27/28	2	22000	3	4	5	3	2	17	B	N	N
	7	285D	9/24/67	28/32/38	4	13000	3	3	3	3	5	17	B	N	N
	8	285C	24/50/291	8/9/10/17/27	7	8400	3	3	4	3	4	17	B	N	N
	9	070A	6/88/287	4/10/15	5	152000	5	4	1	3	3	16	B	N	N
	10	025A	10/12/160	1/2/3	4	13000	3	4	2	3	4	16	B	N	N
	11	070A	6/103/119	35/41/45	9	83000	3	5	1	3	3	15	B	Y	N
	12	024G	21/94	9/10/39/53/67	4	61000	4	3	3	2	3	15	B	N	N
	13	070A	6/82	10/12/42	2	28000	4	3	3	2	3	15	B	Y	N
	14	040A	13/318	3/5/8/12	6	15000	2	4	3	4	2	15	B	N	N
15	025A	88/225/470	4/7/8	5	260000	5	3	1	2	3	14	C	Y	N	
16	076A	22/44/85/270	19/28	5	85000	5	4	1	3	1	14	C	N	N	
17	050A	92/141/348	2/29/30	2	30000	4	3	3	2	2	14	C	N	N	
18	160A	141/145/184	1/2/3/4/20	3	23000	2	3	3	3	3	14	C	N	N	
19	013A	40/64/317	5/33/36	6	17000	2	4	3	3	2	14	C	N	N	
20	034B	59/61/385	37/38/39	1	8000	2	1	5	2	4	14	C	N	N	
21	025A	70/76	11/13	5	157000	5	3	1	2	2	13	C	Y	N	
22	C470	8/121/285	9/17/30	5	111000	5	3	1	2	2	13	C	N	N	
23	160A	140/172/550	4/5/10/11/24	3	37000	3	3	3	2	2	13	C	N	N	
24	082A	133	12/15/16	2	27000	3	4	1	3	2	13	C	N	N	
25	160A	17/112/285	3/4/5/7	7	20000	2	2	2	2	4	12	C	N	N	
26	050A	45/47/96/115	20/29/59	4	50000	2	3	2	2	2	11	C	N	N	
27	040H	59/71/94	22/46/40	1	5000	2	2	4	1	1	10	C	N	N	
28	287A	50/116/160	12/14/16	4	18000	1	2	4	1	1	9	D	N	N	



Historic Material Usage (Solids)

Statewide Historic Solid Material Usage

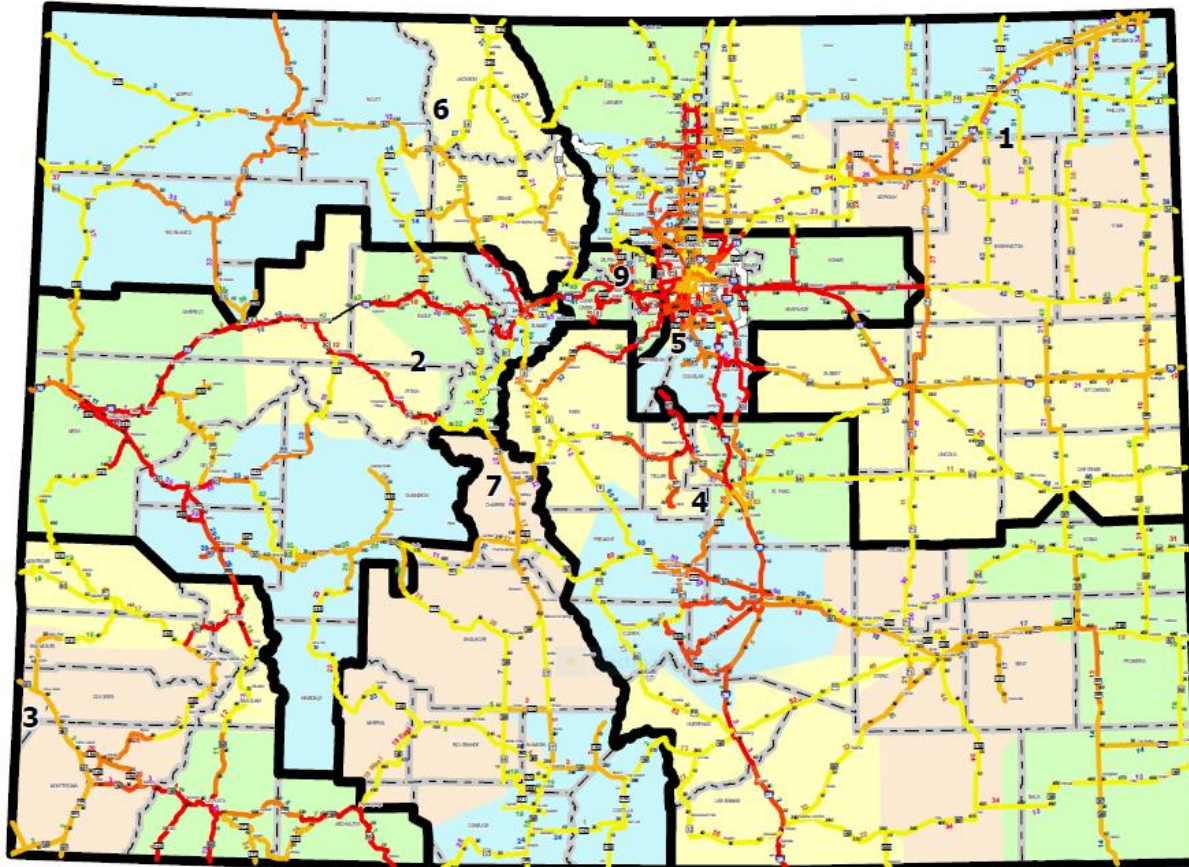


- Significantly Below Average Usage (<24%)
- Below Average Usage (25 - 74%)
- Average Usage (75 - 125%)
- Above Average Usage (126-175%)
- Significantly Above Average Usage (>175%)



Historic Material Usage (Liquids)

Statewide Historic Liquid Material Usage

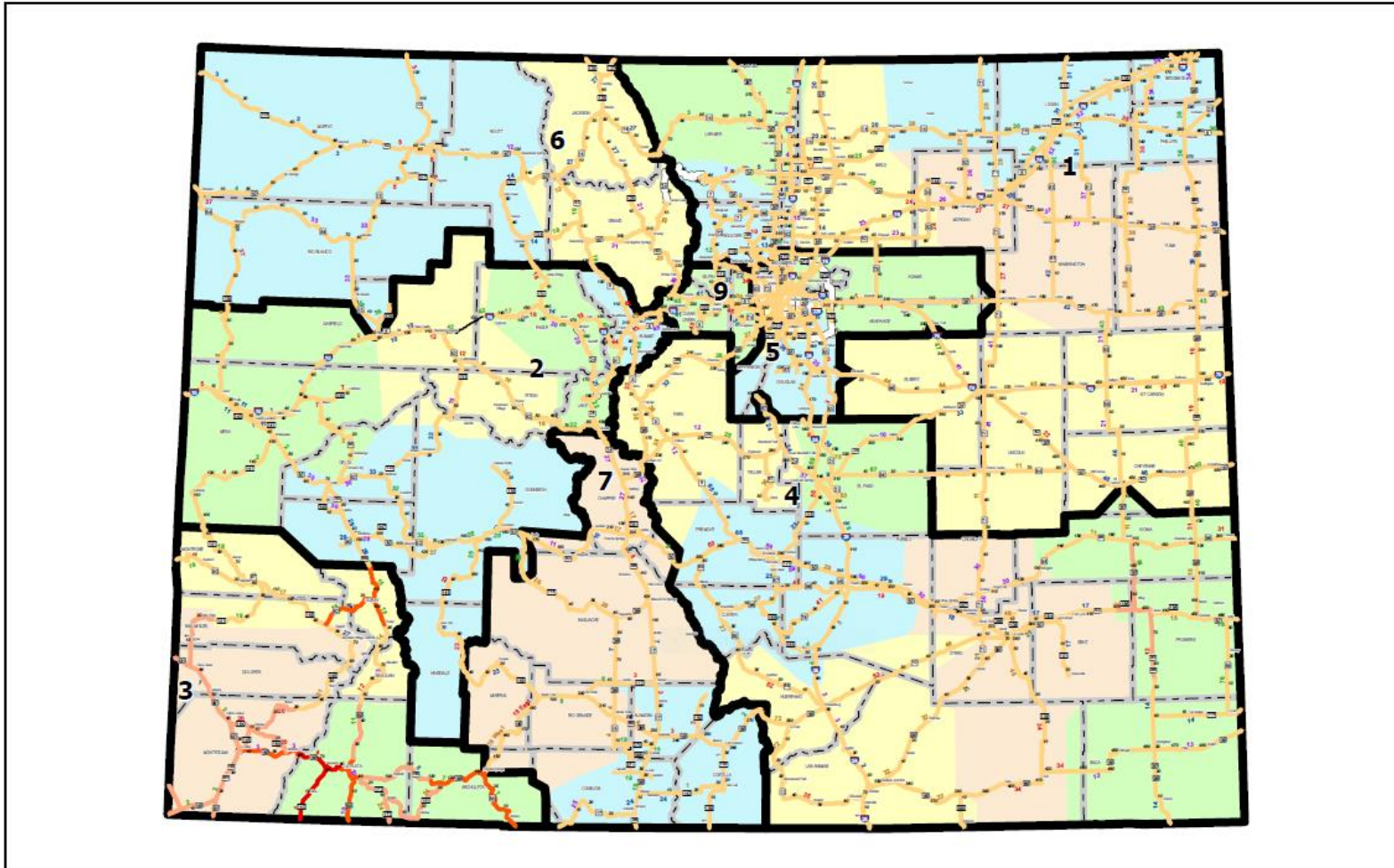


- Significantly Below Average Usage (<24%)
- Below Average Usage (25 - 74%)
- Average Usage (75 - 125%)
- Above Average Usage (126-175%)
- Significantly Above Average Usage (>175%)



Historic Material Usage (Brine)

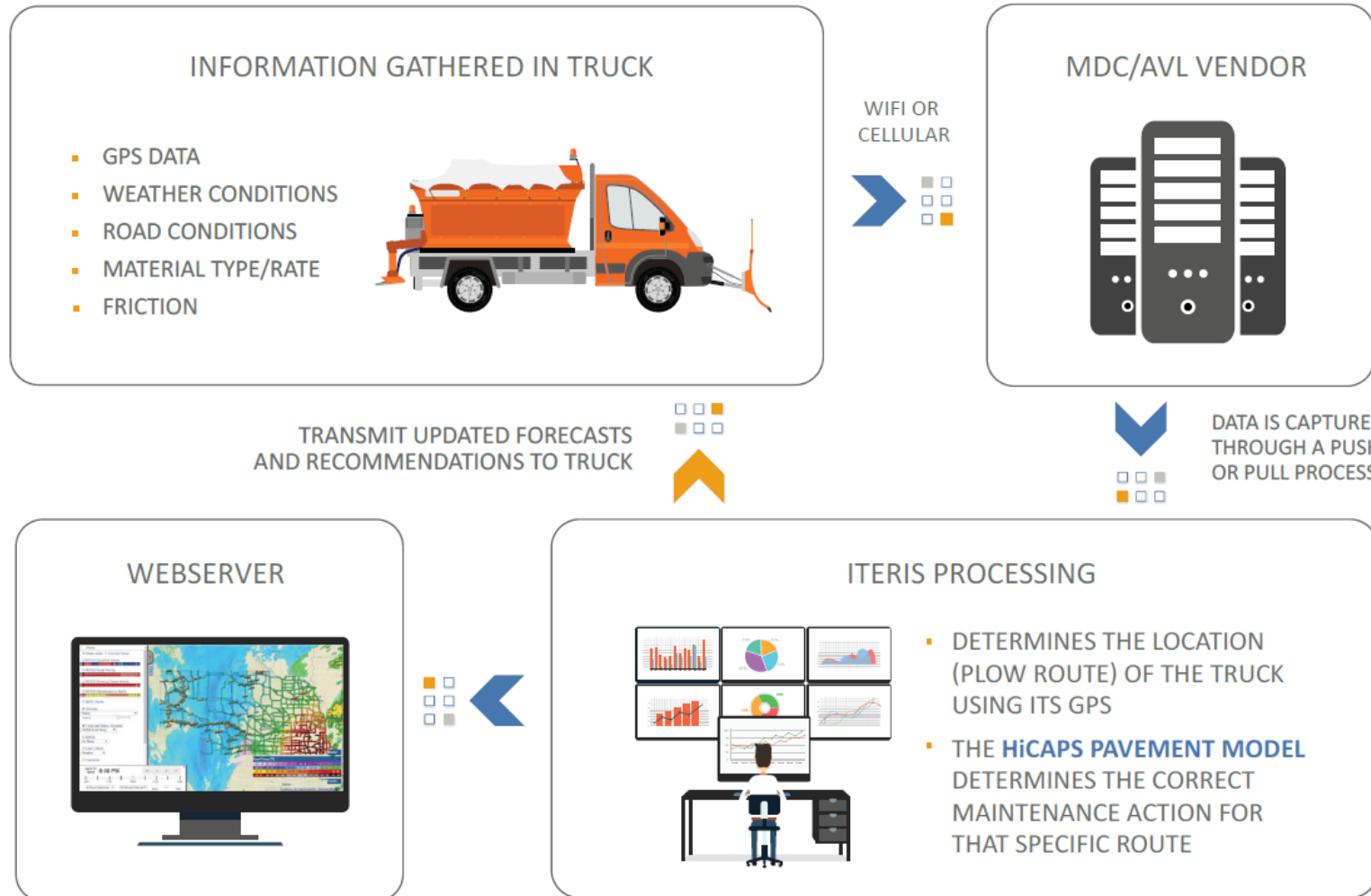
Statewide Historic Salt Brine Usage



- Little or No Salt Brine Usage (0-99.9k gallons)
- Minimal Salt Brine Usage (100-400k gallons)
- Moderate Salt Brine Usage (400-699.9k gallons)
- Significant Salt Brine Usage (>700k gallons)



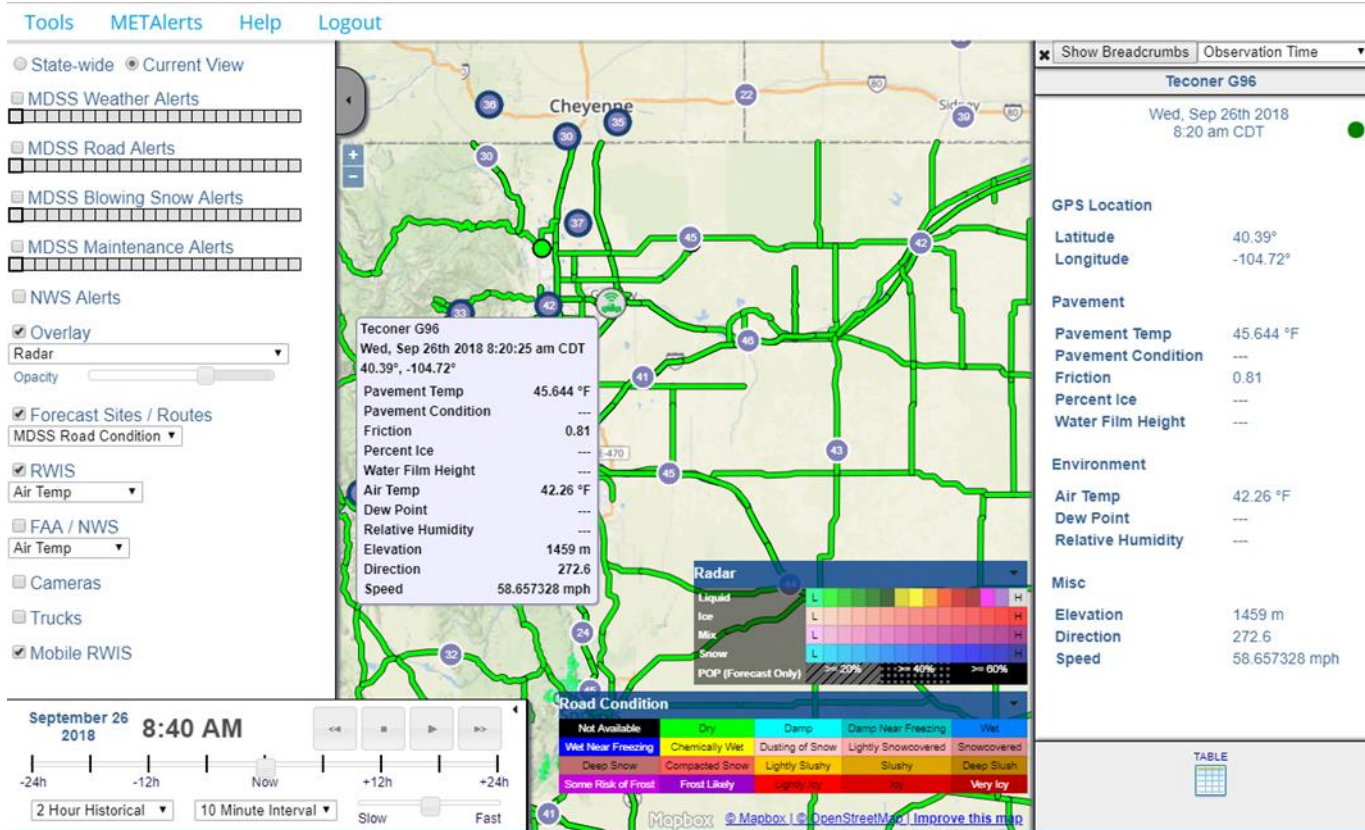
AVL/MDC Data Schematic for MDSS





WebMDSS and Mobile Sensors

www.webmdss.com



- Ability to display mobile RWIS data, in real-time
- Breadcrumb capabilities for all variables available
- Detailed historical data
- Ability to display camera imagery



WebMDSS and Mobile Sensors

Teconer G96	
Wed, Sep 26th 2018 8:20 am CDT	
GPS Location	
Latitude	40.39°
Longitude	-104.72°
Pavement	
Pavement Temp	45.644 °F
Pavement Condition	---
Friction	0.81
Percent Ice	---
Water Film Height	---
Environment	
Air Temp	42.26 °F
Dew Point	---
Relative Humidity	---
Misc	
Elevation	1459 m
Direction	272.6
Speed	58.657328 mph

• Location Data

• Pavement Data

• Atmospheric Data

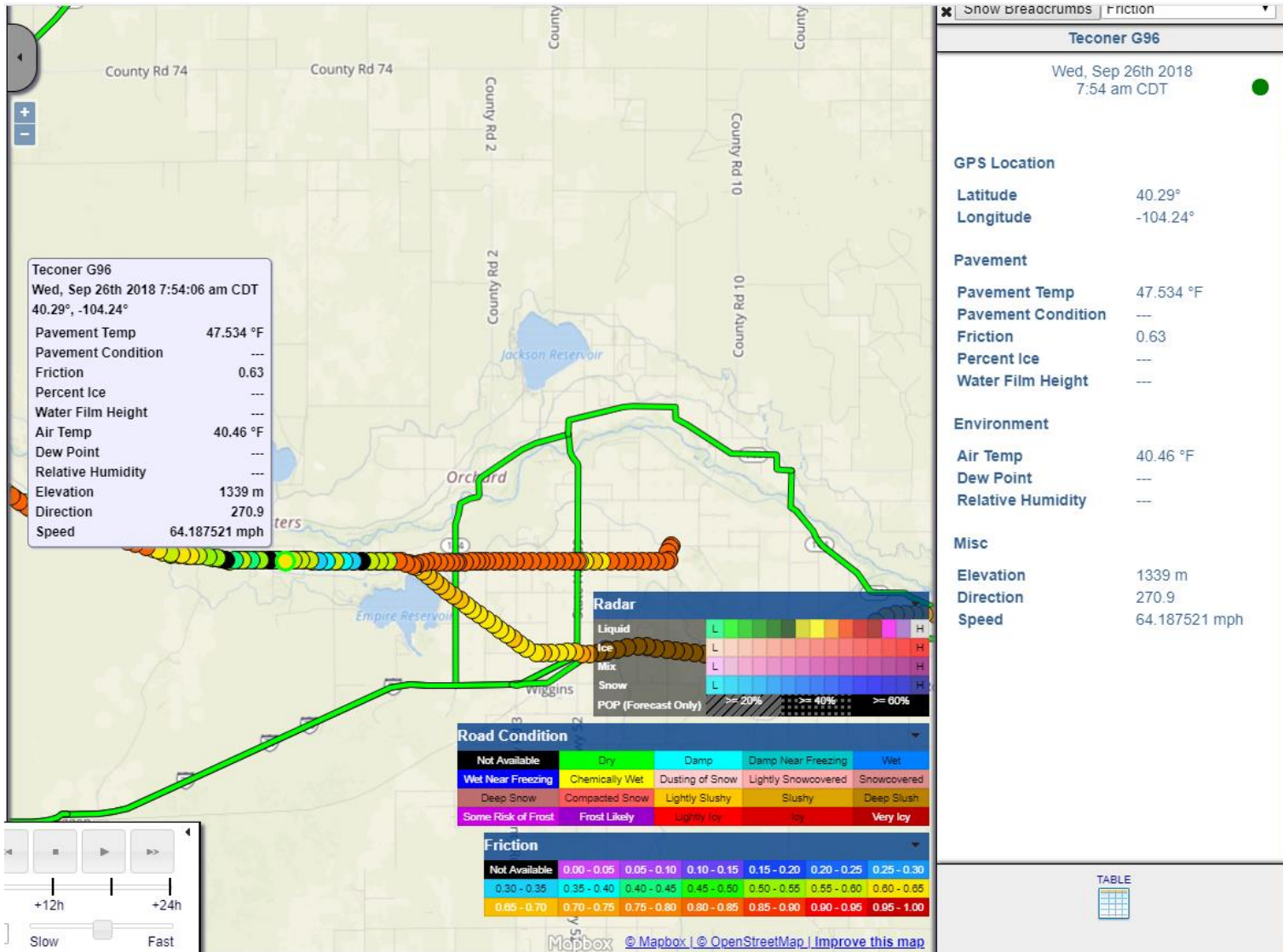
• Additional Data



WebMDSS and Mobile Sensors

www.webmdss.com

- Breadcrumbs of each variable





WebMDSS and Mobile Sensors

	Start Date	End Date	Device	<input type="button" value="Generate Report"/>
	09-25-2018	09-26-2018	Teconer G96 ▼	
	9:30am	9:30am		

Teconer G96
Sep 25 2018 9:30:00 am CDT to Sep 26 2018 9:30:00 am CDT

Search:

Date	Lat / Lon	Pavement Temperature (°F)	Pavement Condition	Friction	% Ice	Water Film Height (mil)	Air Temperature (°F)	Dew Point (°F)	Relative Humidity (%)	Elevation (m)	Direction	Speed (mph)
Sep 25 2018 11:26:44 am CDT	40.6208,-103.1807	73.202		0.81			63.68			1181		0
Sep 25 2018 11:26:47 am CDT	40.6208,-103.1808	72.518		0.81			63.68			1178		0
Sep 25 2018 11:27:03 am CDT	40.6189,-103.1820	69.296		0.81			63.5			1166		
Sep 25 2018 11:27:17 am CDT	40.6186,-103.1828	67.298		0.81			63.5			1164	253.2	22.431457
Sep 25 2018 11:27:33 am CDT	40.6181,-103.1859	67.406		0.81			63.14			1172	265.7	41.942475
Sep 25 2018 11:27:48 am CDT	40.6191,-103.1894	66.092		0.81			62.96			1192	292.1	41.693927
Sep 25 2018 11:28:02 am CDT	40.6202,-103.1921	65.102		0.81			62.78			1178	300.9	41.445379
Sep 25 2018 11:28:17 am CDT	40.6214,-103.1952	66.488		0.81			62.6			1170	298.0	43.4959
Sep 25 2018 11:28:32 am CDT	40.6225,-103.1980	65.912		0.81			62.24			1174	296.3	34.983131
Sep 25 2018 11:28:47 am CDT	40.6235,-103.2002	66.506		0.81			62.06			1176	298.8	31.254911
Sep 25 2018 11:29:03 am CDT	40.6242,-103.2020	64.436		0.81			61.52			1179	297.0	27.96165
Sep 25 2018 11:29:18 am CDT	40.6251,-103.2040	63.14		0.81			61.16			1183	298.2	28.272335
Sep 25 2018 11:29:33 am CDT	40.6261,-103.2064	67.19		0.81			60.8			1185	299.5	31.503459
Sep 25 2018 11:29:47 am CDT	40.6266,-103.2077	70.556		0.81			60.44			1181	299.3	11.992441
Sep 25 2018 11:30:02 am CDT	40.6267,-103.2078	70.232		0.81			60.26			1175		0
Sep 25 2018 11:30:18 am CDT	40.6269,-103.2082	69.674		0.81			60.08			1170	307.7	12.862359
Sep 25 2018 11:30:33 am CDT	40.6274,-103.2094	70.682		0.81			59.72			1169	298.9	18.268278
Sep 25 2018 11:30:48 am CDT	40.6275,-103.2097	71.222		0.81			59.54			1170	288.0	8.326358
Sep 25 2018 11:31:03 am CDT	40.6262,-103.2107	70.736		0.81			59.36			1172	211.2	27.091732
Sep 25 2018 11:31:18 am CDT	40.6254,-103.2120	71.114		0.81			59.18			1177	279.5	19.88384
Sep 25 2018 11:31:33 am CDT	40.6255,-103.2142	71.222		0.81			59			1171	269.7	30.074308
Sep 25 2018 11:31:47 am CDT	40.6255,-103.2165	71.402		0.81			59			1181	270.0	30.44713
Sep 25 2018 11:32:02 am CDT	40.6253,-103.2187	71.258		0.81			59			1177	264.5	25.227622
Sep 25 2018 11:32:16 am CDT	40.6255,-103.2198	67.406		0.81			58.82			1178	273.1	9.258413
Sep 25 2018 11:32:33 am CDT	40.6255,-103.2202	72.194		0.81			58.82			1178	275.5	11.495345



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