



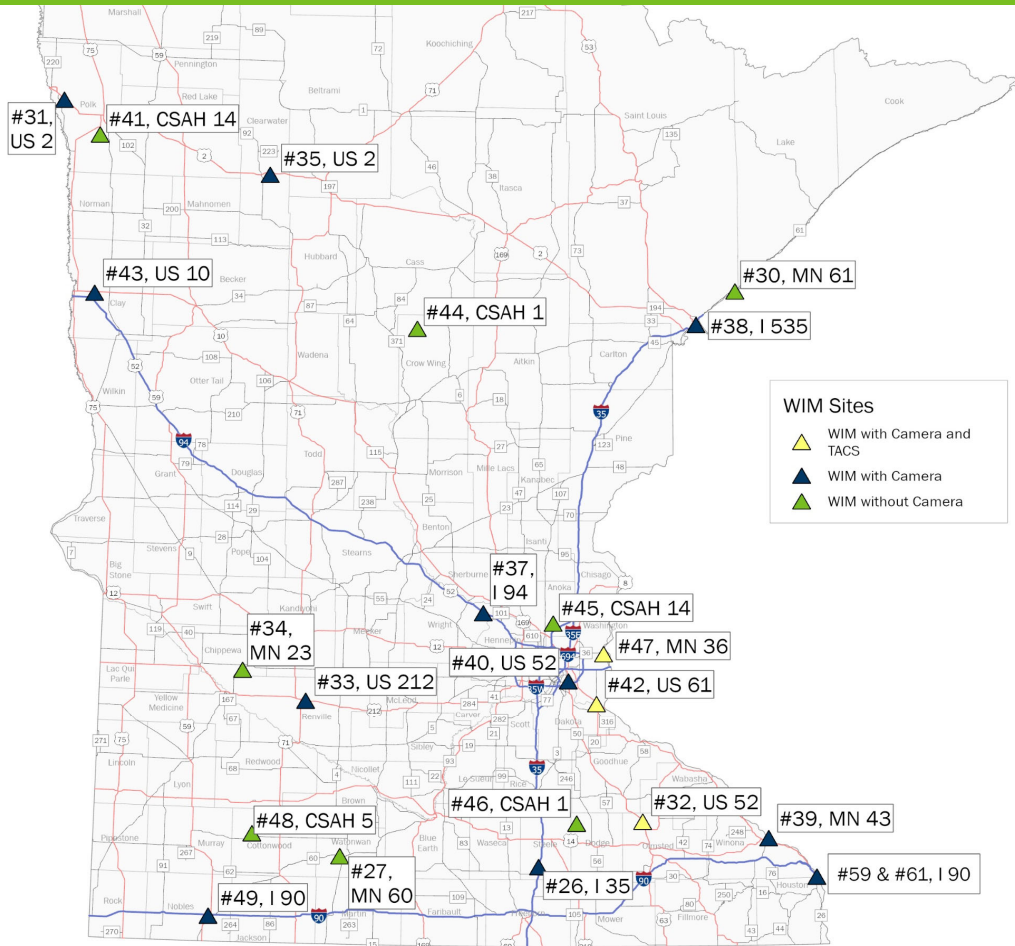
MnROAD WIM Site

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mndot.gov

MnDOT WIM Systems



- 22 WIM Sites
- 14 WIMs With Cameras
- 3 WIMs with Cameras and TACS (2024)

Virtual Weigh Station - Vehi...

Summary Vehicles VWS

Display Results

Vehicle	Class	Axle	Length (ft)	Speed (mph)	GVW (lb)	Max GVW (lb)	Time	Location	Action
7062	9	5	66.3	65	64,906	80,030	2015-02-26 06:13:14 AM CST	SB Driving - Lane 4 Owatonna - Interstate 35	bypass
Max GVW (%) 81 (kips) 20.8 33.1 11.1									
7055	9	5	75.3	69	76,483	80,030	2015-02-26 06:19:01 AM CST	NB Driving - Lane 1 Owatonna - Interstate 35	bypass
Max GVW (%) 96 (kips) 33.9 30.0 12.5									
7034	9	5	72.9	71	81,057	80,030	2015-02-26 06:16:50 AM CST	NB Driving - Lane 1 Owatonna - Interstate 35	report
Max GVW (%) 101 (kips) 20.3 20.0 28.2 12.6 overweight, over GVW									
7032	9	5	66.7	63	33,735	80,030	2015-02-26 06:16:42 AM CST	SB Driving - Lane 4 Owatonna - Interstate 35	bypass
Max GVW (%) 42 (kips) 10.0 13.8 9.9									

Navigation: [Previous] [Next] [Pause] [Refresh]

Which Trucks should be Screened??

- WIM system is not 100% Accurate
- Due to Accuracy limitations of system, **ONLY** screen vehicles weighing **10%** over legal GVW and/or legal Axle Weight.

– For Example:

- **IF** legal GVW=80000lb **THEN ONLY** screen vehicles with measured WIM **GVW>88000** ($1.1 * 80000 = 88000$) lb
- **IF** legal GVW=88000lb **THEN ONLY** screen vehicles with measured WIM **GVW>96800** ($1.1 * 88000 = 96800$) lb
- **IF** legal Tandem Axle Wt=34000lb **THEN ONLY** screen vehicles with measured WIM **Tandem Axle Wt>37400** ($1.1 * 34000 = 37400$) lb

10% over or
1.1*Legal Wt



check: Is truck Group axle weight 10% over weight(1.1*legal wt)

$1.1 * 34000 = 37400$

40592 > 37400

Pull over truck-overweight

check: Is GVW truck 10% over weight(1.1*legal wt)?


$1.1 * 80000 = 88000$

90511 > 88000

Pull over truck-over GVW


Virtual Weigh Station - Vehicle 49363 - Windows Internet Explorer
http://69.69.108.14/#view:1139854


File Edit View Favorites Tools Help

PDF 

Vehicle	Class	Axle	Length (ft)	Speed (mph)	GVW (lb)	Max GVW (lb)	Max GVW (%)
49363	9	5	60.1	63	90,511	80,030	113

2015-02-19 08:47:31 AM CST
SB Driving - Lane 4
Cottage Grove - Highway 61

 report


(kips) 36.9 40.6 13.1

⚠ overweight, over GVW

WIM Results

WIM Compliance

Axle	Separation (ft)	Left Weight (lb)	Right Weight (lb)	Total Weight (lb)	Allowable Weight (lb)	Weight Violation	Group Type	Group Weight (lb)	Group Allowable Weight (lb)
1	0.0	7,130	5,935	13,065	20,000	axle group combination violation	single	13,065	20,000
2	13.8	11,138	9,548	20,686	16,998	tandem axle violation, axle group combination violation	tandem	40,592	33,996
3	4.3	10,428	9,478	19,906	16,998	tandem axle violation, axle group combination violation			
4	31.0	9,297	9,337	18,634	16,998	tandem axle violation, axle group combination violation			
5	4.1	9,087	9,134	18,221	16,998	tandem axle violation, axle group combination violation	tandem	36,855	33,996

MnROAD- Minnesota Road Research Facility



I 94 eastbound
to Minneapolis

I 94 westbound
to St. Cloud

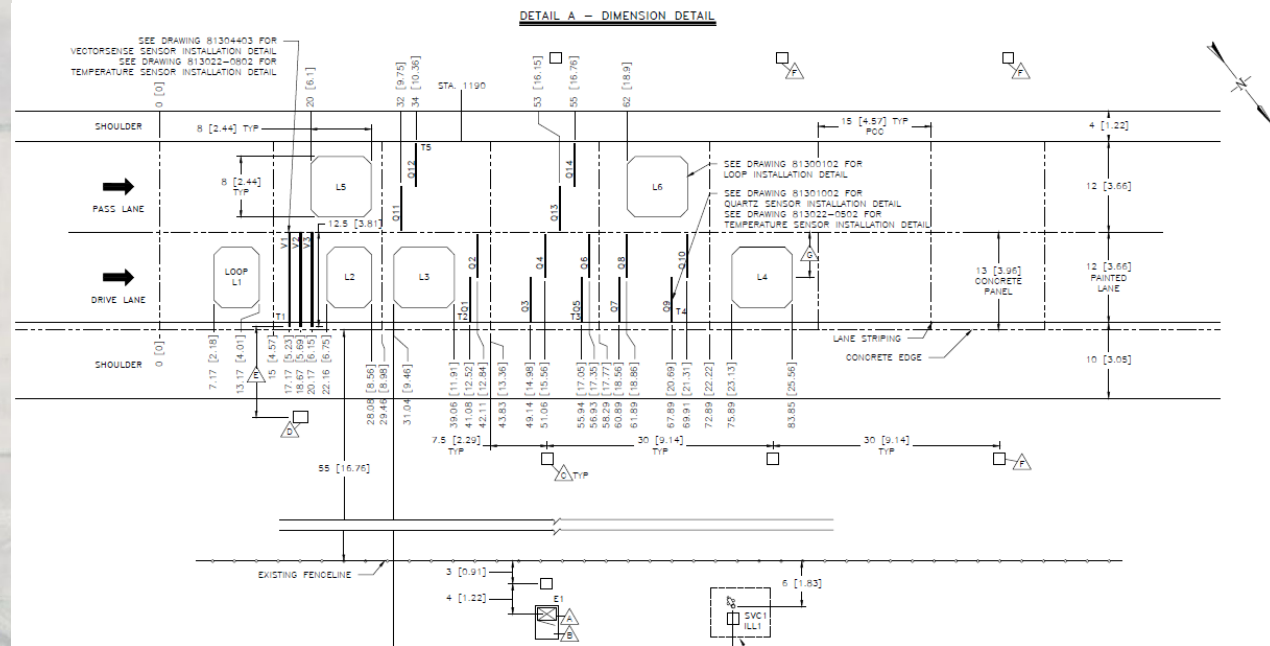
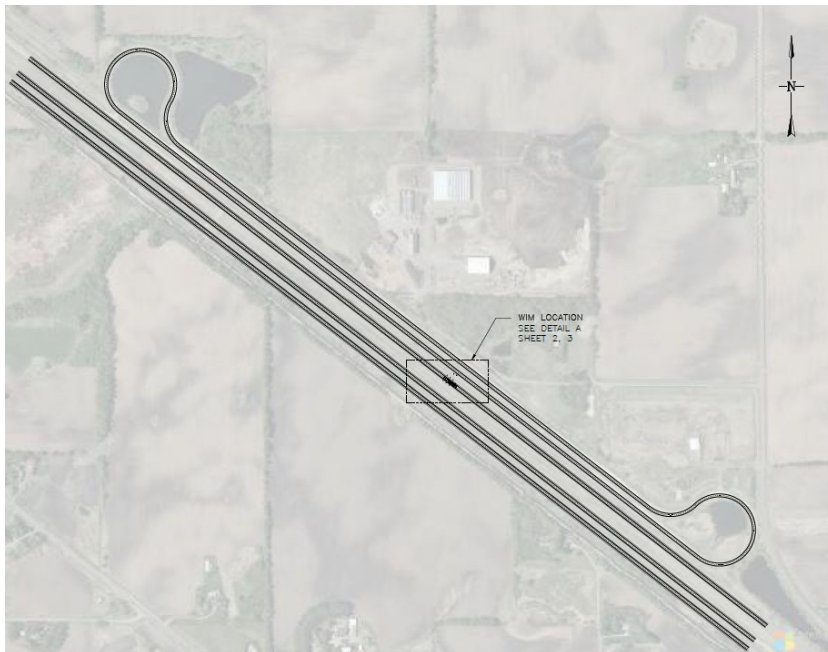
MnROAD Site
Office and
Operations

MnROAD I 94 Original
westbound (1972)

MnROAD Low
Volume Road

MnROAD I 94 Mainline

MnROAD WIM System Design Layout



WIM System Design Goals

- Main goals of this project is to gain:
 - Better accuracy and sensor redundancy,
 - Optimize sensor spacing length for gaining highest accuracy in measurements, and
 - Understanding the impact from wheel wander on traffic classification measurements and how it plays a role in damage to pavement systems.

MnROAD WIM System Installation

Installation Schedule:

- Summer 2022 - Building of Rigid Pavement Test Section 2225, trenching for conduit below base material and installation of two hand holes.
- April and May 2023 – Setup of further conduit and hand holes with connection under fence to LVR for cabinet location.
- Pad built and cabinet mounted in June 2023.
- WIM system installation week of July 10 and 16 in 2023.

Calibration:

- Calibration scheduled for September 27 and 28, 2023.
- Start of live traffic data collection October 5, 2023.



WIM System Calibration

Calibration Runs

Two Lane Site

	Speed					
	Commercial vehicle Average Speed (V_m) Drive lane 65mph Pass lane 70mph		5mph Less Than Commercial Vehicle Average Speed		5mph Greater Than Commercial vehicle Average Speed	
	Min. # Of Passes	Max. # of Passes	Min. # Of Passes	Max. # of Passes	Min. # Of Passes	Max. # of Passes
Lane 1	3	5	3	5	3	5
Lane 2	3	5	3	5	3	5
TOTAL PASSES	6	10	6	10	6	10

Verification Runs

Two Lane Site

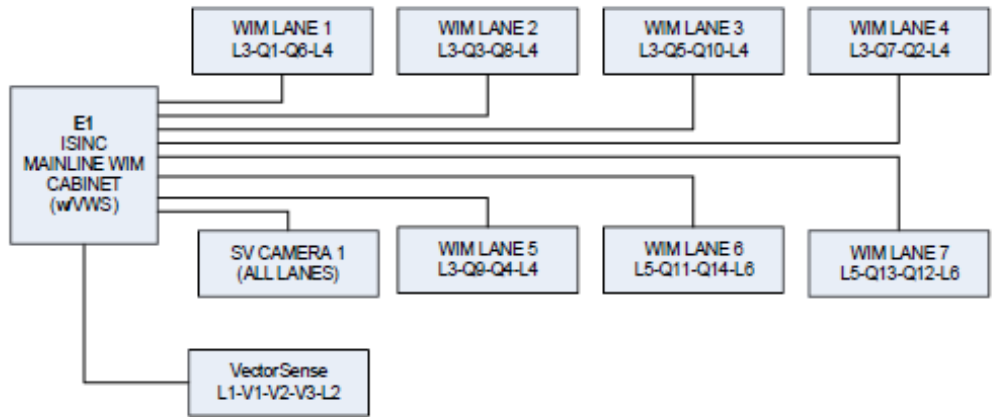
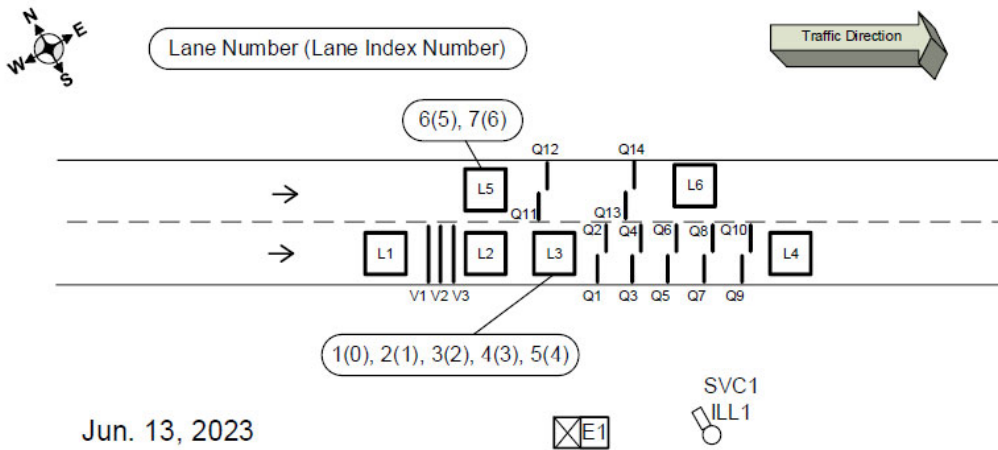
	Speed					
	Commercial vehicle Average Speed (V_m) Drive lane 65mph Pass lane 70mph		5mph Less Than Commercial Vehicle Average Speed		5mph Greater Than Commercial vehicle Average Speed	
	Min. # Of Passes	Max. # of Passes	Min. # Of Passes	Max. # of Passes	Min. # Of Passes	Max. # of Passes
Lane 1	7	9	7	9	6	8
Lane 2	7	9	7	9	6	8
TOTAL PASSES	14	18	14	18	12	16



Speeds used for Calibration and Verification:

- 55 mph, 60 mph, 65 mph, 70 mph for driving and 60 mph, 65 mph, and 70 mph for passing lane. For a total of 21 calibration runs and 27 verification runs.

WIM System Communication Setup



The lanes are named defined as follows:

Lane Number(Index)	iSINC Name	Displayed Name (GUI)	Location
1(0)	DRV_1	Drive 1	Driving Lane 1
2(1)	DRV_2	Drive 2	Driving Lane 2
3(2)	DRV_3	Drive 3	Driving Lane 3
4(3)	DRV_4	Drive 4	Driving Lane 4
5(4)	DRV_5	Drive 5	Driving Lane 5
6(5)	PAS_1	Passing 1	Passing Lane 1
7(6)	PAS_2	Passing 2	Passing Lane 2

The following classification/compliance scheme will be used: MN_in_2019 PJ((0

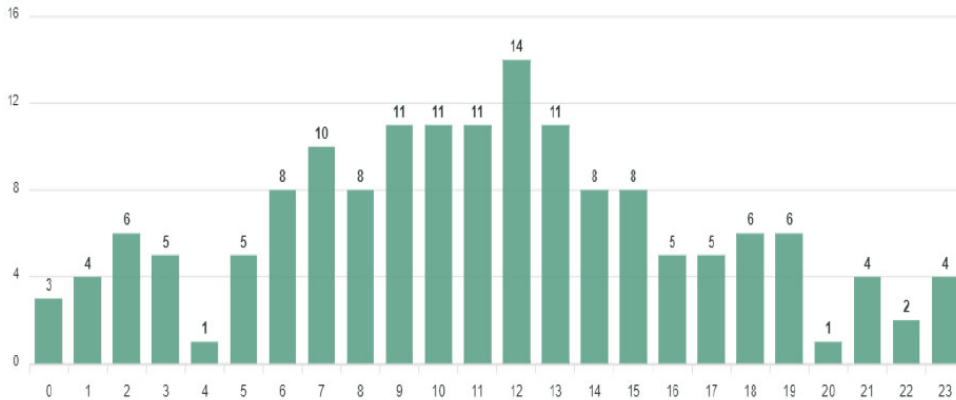
Vehicle classification is broken down as per the following table:

Class	Range
Error	0
Passenger	1-4
Commercial	5-13
Undefined (commercial)	14

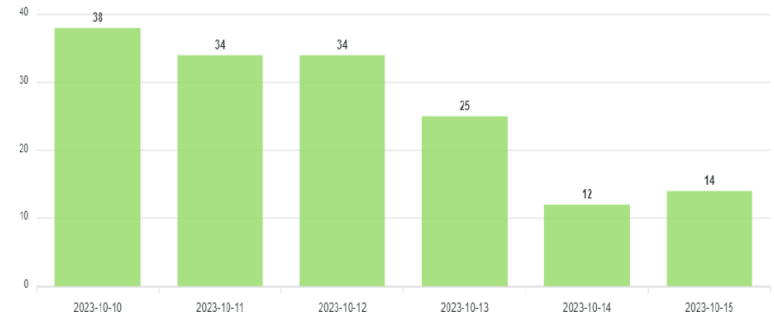
TACS Data Collection

Vector vehicle ID	WIM vehicle Number	WIM class	timestamp	axle	lane position (cm)	axle width (cm)	type
636990	52407	9	2023-10-11T00:00:05.307-05:00	1	94	225	single
636990	52407	9	2023-10-11T00:00:05.307-05:00	2	84	240	dual
636990	52407	9	2023-10-11T00:00:05.307-05:00	3	83	241	dual
636990	52407	9	2023-10-11T00:00:05.307-05:00	4	75	247	dual
636990	52407	9	2023-10-11T00:00:05.307-05:00	5	74	249	dual
636991	52412	9	2023-10-11T00:00:46.257-05:00	1	86	228	single
636991	52412	9	2023-10-11T00:00:46.257-05:00	2	85	228	wide
636991	52412	9	2023-10-11T00:00:46.257-05:00	3	84	228	wide
636991	52412	9	2023-10-11T00:00:46.257-05:00	4	68	242	wide
636991	52412	9	2023-10-11T00:00:46.257-05:00	5	66	245	wide

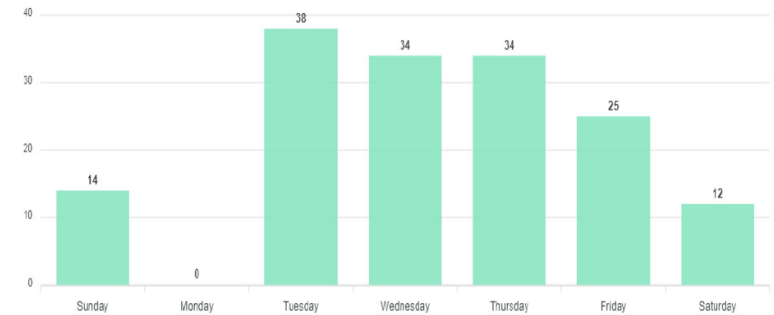
Vehicles with Anomalies per Hour



Vehicles with Anomalies per Day



Vehicles with Anomalies per Day of the Week



3.5% of HCV axles are Super Singles
Seems a lot of anomalies are from Super Singles

WIM System Data Collection

Data Collection:

- 7 lanes where left and right weights are separated based on sensor used in array.
- Lane 1 - Sensor 1 is right weight recorded and Sensor 6 is left weight recorded for each axle.
- Lane 4 - Sensor 7 is right weight recorded and Sensor 2 is left weight recorded for each axle.
- Raw data output of lane data provides ability to examine multiple spacings between sensors and accuracy differences between single to quintuple threshold in driving lane.
- Passing lane allows for single and double threshold comparison.

WIM System Example Data

Hour	Minute	Seconds	Vehicle N	Class	GVW_kip	Length_ft	Speed_mph	Violation	Axle 1 RW	Axle 1 LW	Axle 2 RW	Axle 2 LW	Axle 1-2 S	Axle 3 RW	Axle 3 LW	Axle 2-3 S	Axle 4 RW	Axle 4 LW	Axle 3-4 S	Axle 5 RW	Axle 5 LW	Axle 4-5 S	Axle 6 RW	Axle 6 LW	Axle 5-6 S	Axle 7 RW
1	0	17	12507	2	5	17.5	71.5	0	1.3	1.4	1.1	1.2	10													
1	0	38	12516	5	9.4	26.9	64	0	1.8	1.8	2.9	3	14.2													
1	0	45	12525	9	40.8	75.4	70.2	0	5.8	6.1	4.6	3.9	17	4	4.3	4.3	3.4	2.8	32.9	3.2	2.7	4				
1	0	59	12530	10	58.3	83.5	70.2	0	5.6	5.3	4.6	4.8	16.3	4.7	4.3	4.4	5.7	5	20.4	5.3	5.1	9.1	4.7	3.1	22.8	
1	1	3	12539	2	3.6	14.6	70.2	0	1	1.1	0.7	0.7	8.9													
1	1	13	12544	9	74.7	76	67.1	1	6.5	6.5	8.8	7.5	16.5	8.5	6.8	4.3	8.3	6.5	35	7.9	7.4	4.1				
1	1	42	12551	3	6.8	21.1	73.9	64	1.2	2.3	1.3	2	12.5													
1	2	14	12556	2	3.6	14.7	64.6	0	1.1	1.1	0.7	0.7	8.6													
1	2	26	12565	2	4.7	17	73.3	0	1.3	1.2	1	1.1	10													
1	2	48	12574	9	69.8	74.7	62.1	0	6	6.2	7.8	7.5	16.4	6.9	7.3	4.4	7.7	6.3	32.9	7.4	6.6	4.1				
1	2	52	12579	2	4.7	13.7	72.1	0	1.2	1.2	1.1	1.1	8.7													
1	3	1	12584	2	6.2	17.4	71.5	0	1.5	1.5	1.6	1.6	9.9													
1	3	4	12589	2	3.9	15.5	77.1	0	1.1	1.1	0.9	0.8	9.2													
1	3	46	12594	9	67.6	73	70.2	0	6	6.1	6.7	7.5	19.8	6.8	6.9	4.3	5.9	7.8	33.3	6.1	7.7	4.1				
1	4	9	12601	2	3.8	15.4	69	0	1	1	0.9	0.8	8.8													
1	4	20	12610	2	3.3	16.1	77.7	0	1	1	0.7	0.6	9.4													
1	4	28	12615	9	66.9	75	64	0	5.7	5.3	6.5	5.8	14.6	6.7	5.5	4.3	8.9	6.5	30.1	8.6	7.4	4.1				
1	4	32	12622	2	3.7	16	68.4	0	1.1	1.1	0.8	0.8	9													
1	4	40	12627	2	3.2	15.2	74.6	0	0.9	1	0.7	0.6	8.8													
1	4	47	12632	9	63.9	71.8	70.8	0	5.7	5	7.7	5.9	18.7	7.1	5.6	4.4	6.9	6.3	29.4	7	6.5	4.1				
1	5	14	12639	11	65.9	76.6	64.6	0	5.1	5.3	10	8.6	13.1	7.7	6.5	21.7	6.1	6.6	9.3	4.7	5.2	22.3				
1	5	23	12648	2	4	16.1	77.1	0	1.1	1.2	0.8	0.9	9.3													
1	5	38	12653	9	77.1	75.9	70.8	0	6.5	5.9	8.6	7.7	16	7.9	7.4	4.4	8.7	8	36.8	8.8	7.6	4.1				
1	5	47	12662	9	56.9	70.9	62.8	0	5.1	4.9	6.1	5	12.1	6	4.5	4.3	6	5.1	32.9	7.5	6.8	4.1				
1	6	55	12669	9	61.5	76.9	65.9	0	6.3	5.7	6.5	5.8	17.3	6.5	5.1	4.3	6.6	6	36.3	7.1	5.9	4.1				
1	7	19	12674	9	42	70.8	67.1	0	5.6	5.4	5	4.5	12.5	4.4	4.8	4.3	3.2	3	33.8	3.1	3	4.1				
1	7	26	12681	9	40.5	76.5	70.8	0	6	5.7	4.1	3.5	17	3.8	3.8	4.3	4	3.3	35.3	3.3	2.9	4.1				
1	7	36	12688	9	56.7	75.6	69.6	0	6.1	6.3	6.2	4.8	17.6	5.4	5.4	4.3	6	5.2	32.5	6.1	5.1	4.1				

Acknowledgements

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