ON TO 2050

ATRI Truck Probe Data Analysis

An Early Progress Report

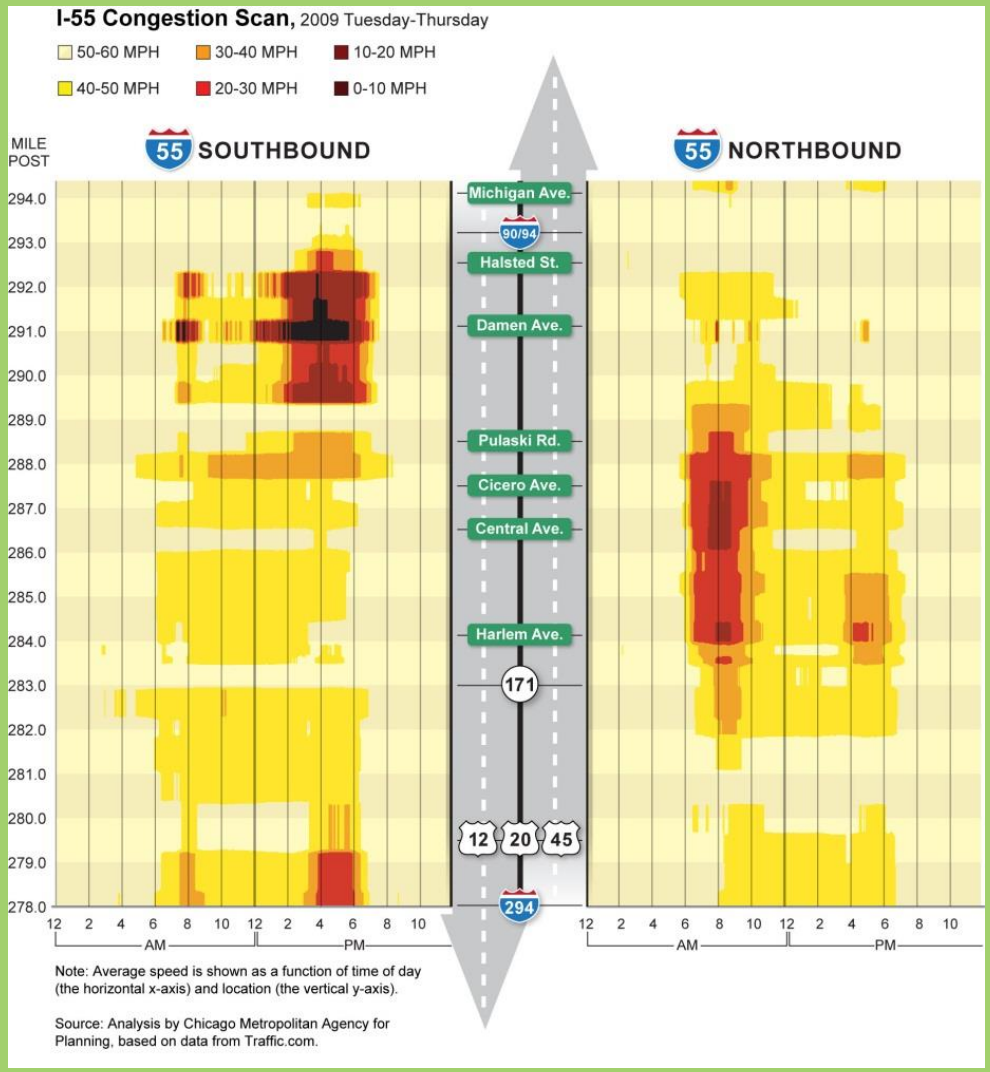
CMAP

Agenda

- **The Need for Truck Probe Data**
- **Description of Truck Probe Data**
- **Processing**
- **A Few Preliminary Findings**

The Need for Truck Probe Data

- **Historically, only very limited data has been available for truck operations.**
- **The highway speed, traffic volume, and origin-destination data available for passenger cars have been lacking for trucks.**



The Need for Truck Probe Data

- **Providing Real-World Data to Validate and Calibrate CMAP's New Tour-Based and Supply Chain Freight Models**
  - Identifying Stops along Truck Tours (Primary use of the data)
- **Understanding Freight Congestion to Inform Freight Plan Development**
- **Understanding Truck Operations to Inform Policy and Program Development**
  - Off-Peak Delivery Programs
  - Truck Permitting
  - Truck Routing

Description of Truck Probe Data

- **Truck position and speed data from wireless on-board communications systems used by the trucking industry.**
- **About 500,000 trucks nationwide**
- **Class 7 and Class 8 trucks (gross vehicle weight > 26,000 pounds).**
- **Typically excludes private carriers, delivery vehicles.**

Description of Truck Probe Data: ATRI Data at CMAP

- **CMAP subscribes to the National Performance Measurement Research Dataset, providing truck speeds on the National Highway System every five minutes, where speed readings exist. But this data is limited (only speeds)**
- **CMAP purchased raw ATRI probe data for three two-week periods in 2014 covering the 21-county CMAP modeling area. Two datasets were provided for each period; with approximate five-minute and one-minute periods. Each dataset had millions of records. The location for each record was generalized to the CMAP zone.**

Description of Truck Probe Data: ATRI Data at CMAP

- **CMAP processes the ATRI truck probe data on a file server: 2.67GH (2 processors); 64-bit operating system; 144 GB RAM (moved from earlier workstation).**
- **Primarily processes data using PostgreSQL database system, version 9.5. Some processing on ArcGIS and analysis using Excel.**

Processing

- **PostgreSQL:**
  - Used for regional transportation data archive, National Performance Measurement Research Database, and the ATRI probe data;
  - Free;
  - Open-source;
  - Well-documented;
  - Maintained at https://www.postgresql.org/.

Processing

- **Typical Raw Record Layout:**
  - TruckID
  - ReadDateTime_from
  - Speed_from
  - Zone_from
  - ReadDateTime_to
  - Speed_to
  - Zone_to
  - Distance_traveled
- **Initial evaluation: En route or not, high/medium/low speed**
- **Data was typically not sufficient to identify stops on truck tours from a single record.**

Processing

- **Add Record ID, etc., for recordkeeping**
- **Use PostgreSQL window functions to add data from previous and successive records.**

```
SELECT *,
        LEAD(stopevaluation,+8)
        OVER (ORDER BY truckid, readdate_from) as p8_stopevaluation
        INTO August2014rworking_stopsEvaluation7
        FROM August2014rworking_stopsEvaluation6;
```

- **Resulting tables, with ~100 fields, include an analysis record and a “window” into the table with data from 16 neighboring records.**

Processing

- **Each record's window was evaluated to determine whether, for a minimum of 20 minutes, the truck didn't leave a zone and was traveling at low speeds.**
  - The trick is to identify stopping points along a truck tour without identifying congested conditions as such stopping points.
  - Multiple iterations of analysis are required.
- **Special cases needed to be considered:**
  - External Trips (involved joining zone data to the file)
    - To/from a zone on the edge of the region
    - Minimum 2 hours elapsed if exit and re-entry zone are different
    - Minimum 6 hours elapsed if exit and re-entry zone are the same
    - Try to identify external trips without identifying food/fuel or terminal breaks on the edge of the model area.

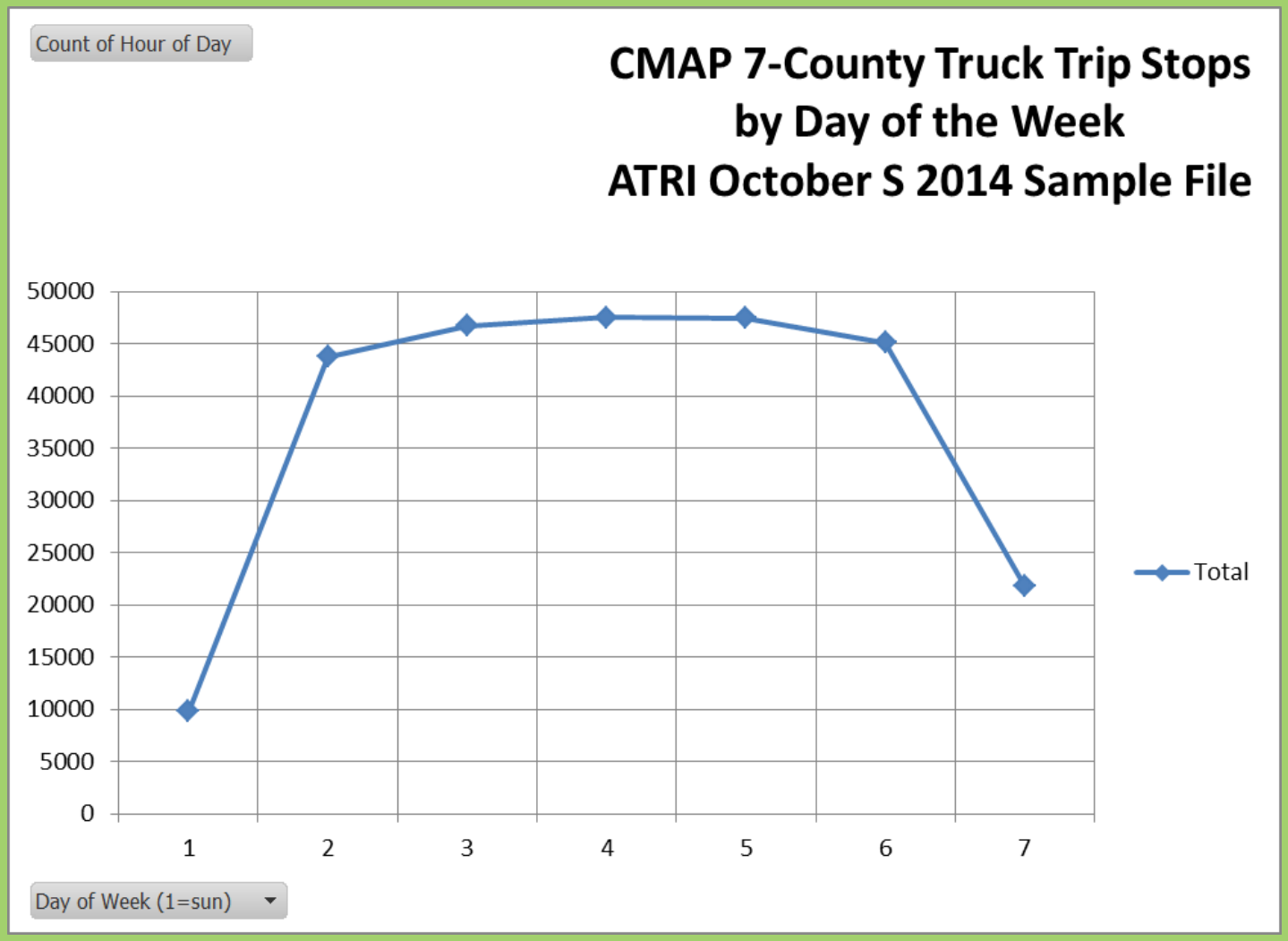
Processing

- **More special cases:**
  - New truck IDs; one file's IDs change every 24 hours.
  - Zero speeds – removed from larger file during reprocessing
  - More than one reading per minute – removed from larger file during reprocessing

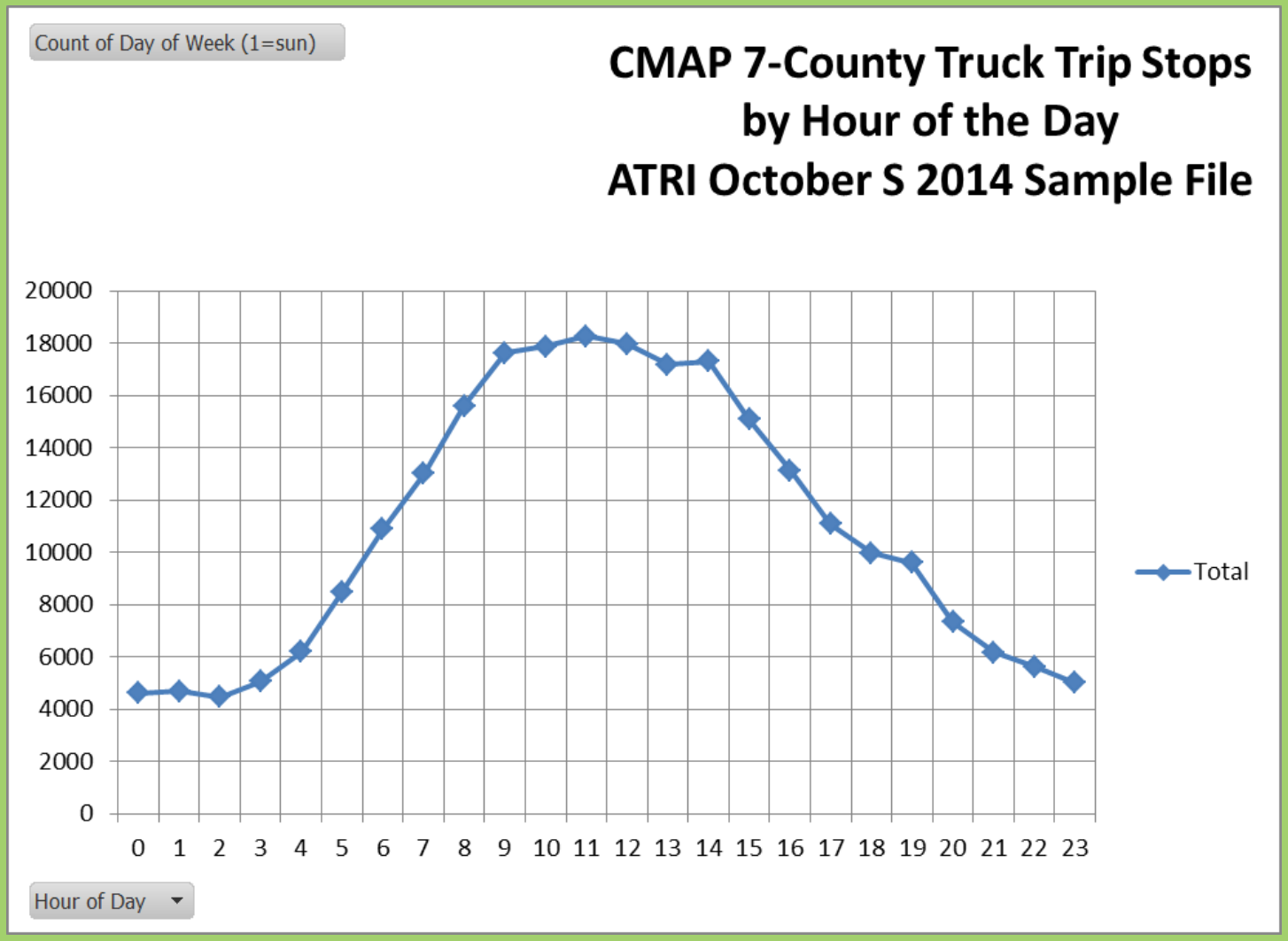
Processing

- **Issues:**
  - Needed to optimize PostgreSQL for the installation. PostreSQL is released to run anywhere, but not well.
  - Moved the PostgreSQL database from a workstation to improve performance and to allow multiple users.
- **Boons:**
  - PostgreSQL handles date functions well
  - Window functions, looking forward and back in the table, were particularly useful.

Preliminary Results
Stops by Day of Week



Preliminary Results: Stops by Time of Day



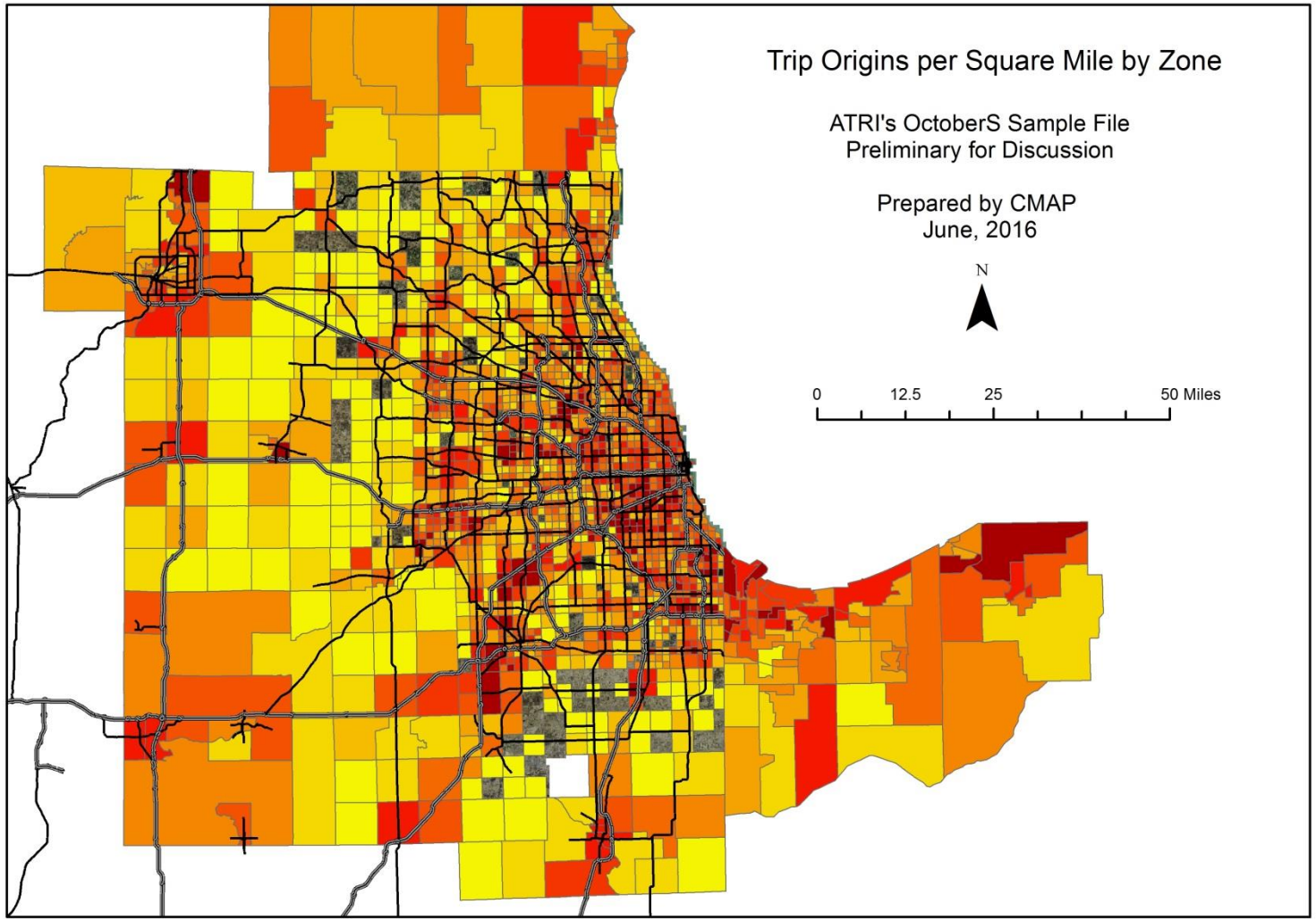
Preliminary Results: Stops by Hour of Day and Day of Week

7-County Area
October 2014
ATRI S Sample

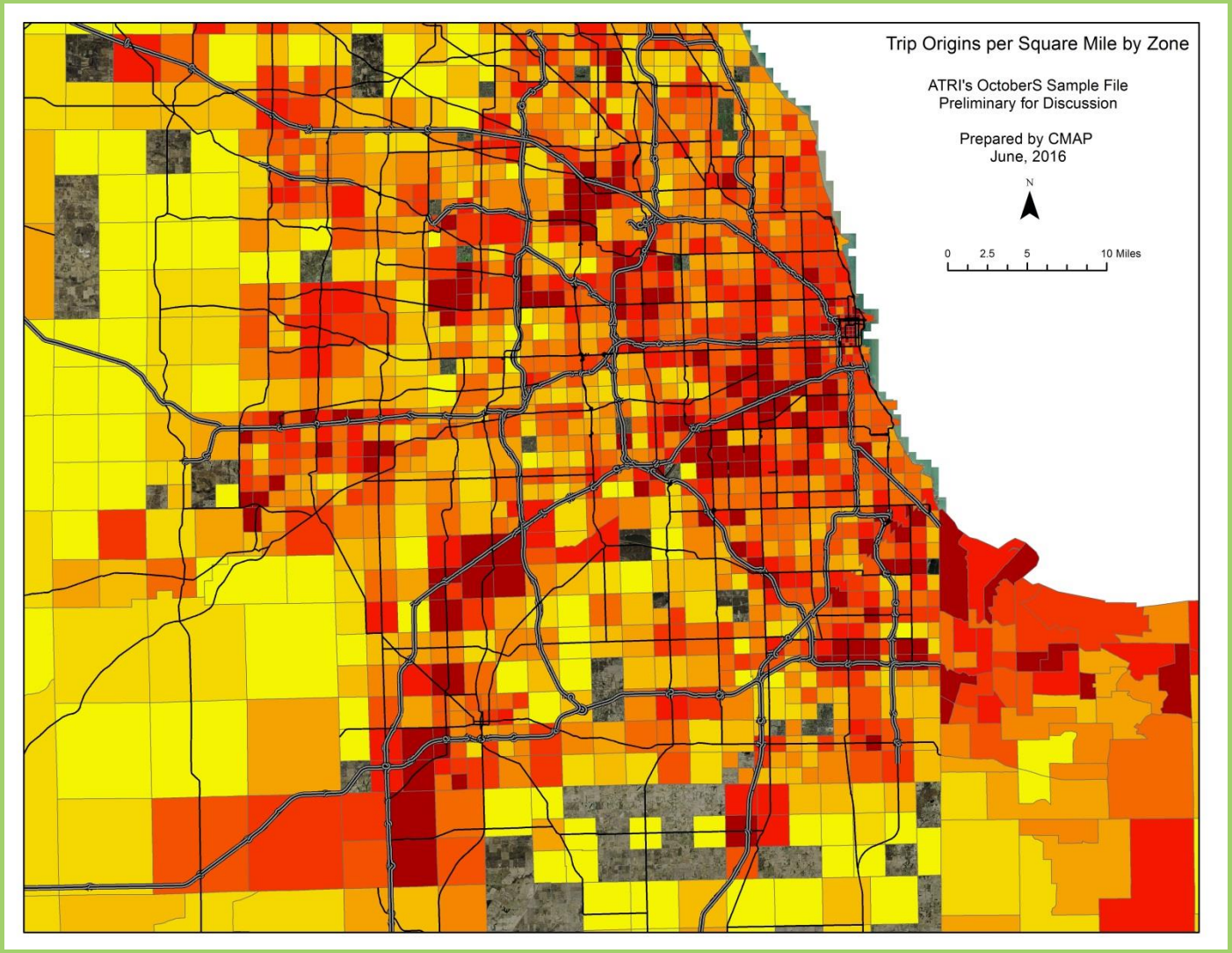
Count Column Labels								
Row	1	2	3	4	5	6	7	Grand Total
0	255	449	836	897	776	776	644	4633
1	253	500	792	908	781	819	655	4708
2	231	484	749	877	757	750	629	4477
3	249	668	858	917	834	900	632	5058
4	253	858	986	1143	1122	1093	738	6193
5	298	1374	1541	1438	1493	1482	857	8483
6	306	1766	1949	1977	1892	2083	922	10895
7	406	2273	2256	2384	2283	2376	1052	13030
8	398	2714	2758	2890	2884	2837	1123	15604
9	502	3079	3185	3242	3348	3195	1099	17650
10	506	3193	3227	3299	3443	3197	1027	17892
11	540	3239	3324	3385	3411	3361	1014	18274
12	512	3191	3373	3371	3455	3171	905	17978
13	472	3129	3208	3254	3242	3002	878	17185
14	447	2789	3052	3065	3049	2789	2120	17311
15	480	2679	2632	2736	2824	2498	1247	15096
16	420	2276	2427	2333	2397	2196	1094	13143
17	489	1898	1918	1964	1965	1871	977	11082
18	448	1728	1765	1860	1728	1649	795	9973
19	496	1523	1607	1569	1638	1412	1375	9620
20	494	1207	1318	1248	1287	1150	647	7351
21	497	990	1108	1049	1039	947	555	6185
22	458	933	1017	945	954	806	512	5625
23	412	850	895	829	890	773	364	5013
Grand	**9822**	**43790**	**46781**	**47580**	**47492**	**45133**	**21861**	**262459**

CMAP

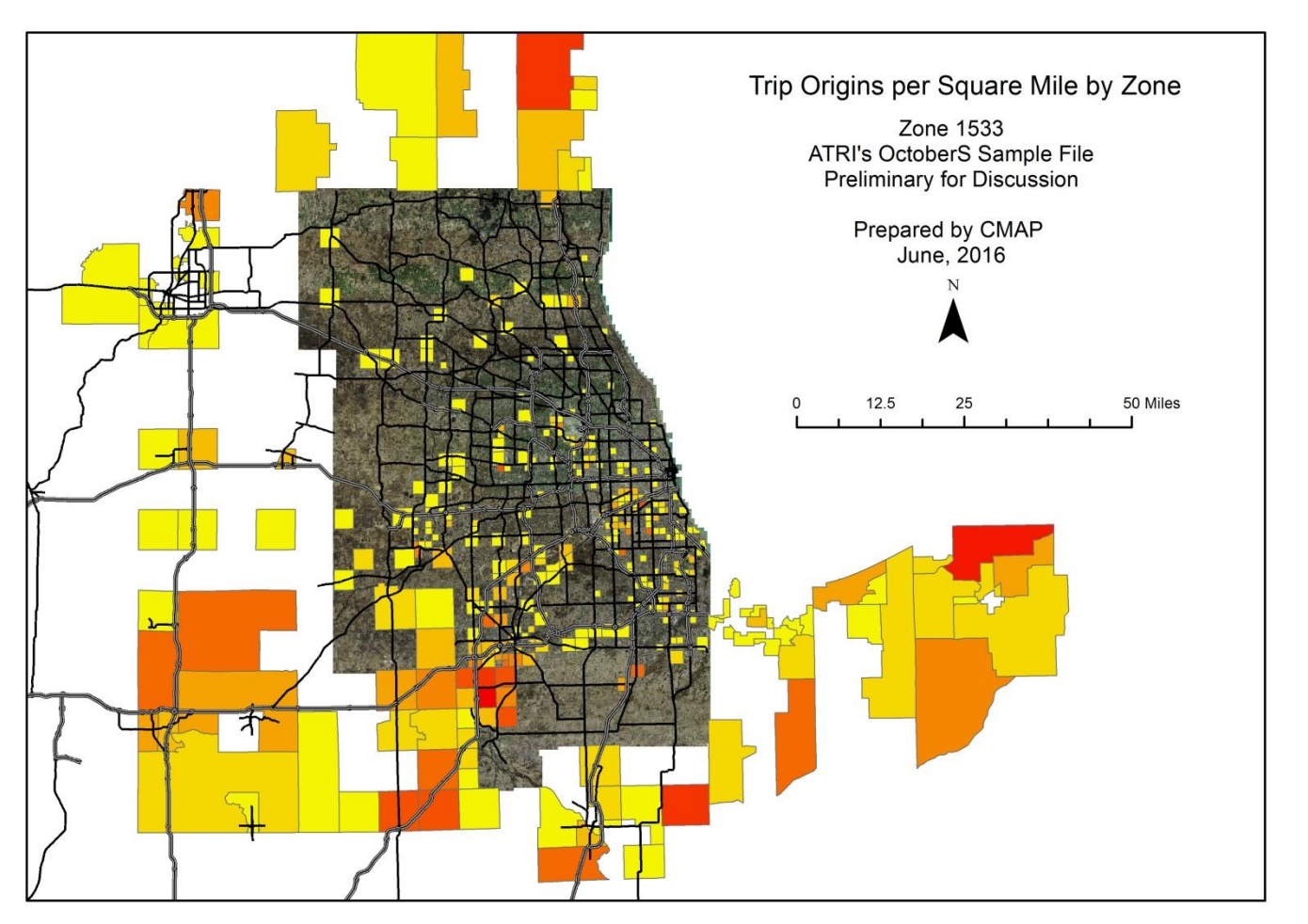
Preliminary Results: Origins by Zone



Preliminary Results: Origins by Zone



Preliminary Results: Origins by Zone for Zone 1533 (includes LPC)



Preliminary Results: Region County-to-County Flows, October 2014, Table S

Origin:	Destination: Chicago	Suburban Cook	McHenry	Lake	Kane	DuPage	Will	Kendall
Chicago	31,518	10,460	238	741	863	1,801	3,243	204
Suburban Cook	10,013	33,672	702	1,995	1,839	4,938	5,758	313
McHenry	322	779	2,469	382	417	192	156	42
Lake	810	1,868	437	4,844	204	463	467	61
Kane	884	1,788	418	220	4,521	1,633	1,068	622
DuPage	1,794	5,000	229	436	1,644	10,184	2,557	360
Will	3,426	5,675	164	446	1,037	2,574	21,788	500
Kendall	188	343	43	73	677	432	558	1,340

Preliminary Results: County-to-County External, Regional Origin Flows, October 2014, Table S

Origin:	Destination: Grundy	Boone	DeKalb	Kankakee	Winnebago	Ogle/Lee (parts)	LaSalle
Chicago	909	82	213	714	704	509	824
Suburban Cook	1,509	135	375	1,223	1,708	667	1,182
McHenry	27	61	50	90	267	55	73
Lake	146	15	25	73	239	59	93
Kane	283	135	251	87	799	318	416
DuPage	574	60	250	210	402	271	339
Will	2,782	45	271	1,636	1,025	374	1,600
Kendall	296	1	107	66	148	99	332

Preliminary Results: County-to-County External, Regional Origin Flows, October 2014, Table S (Continued)

Origin:	Destination: Lake - IN	Porter/LaPorte	Kenosha/ Racine	Walworth	Sum
Chicago	3,851	3,447	2,608	162	63,091
Suburban Cook	4,899	4,385	2,884	393	78,590
McHenry	95	166	220	413	6,276
Lake	436	439	1,857	207	12,743
Kane	480	552	481	159	15,115
DuPage	730	819	798	89	26,746
Will	2,315	2,705	1,517	148	50,028
Kendall	182	266	86	15	5,252

Preliminary Results: County-to-County External Flows, October 2014, Table S (Continued)

Origin:	Destination: Grundy	Boone	DeKalb	Kankakee	Winnebago	Ogle/ Lee (parts)	LaSalle	Lake - IN	Porter/ LaPorte	Kenosha/ Racine	Walworth
Grundy	3,388	13	35	292	193	145	1,260	513	1,062	369	39
Boone	10	981	141	3	439	471	194	172	317	36	58
DeKalb	64	136	1,763	44	407	451	394	173	118	134	68
Kankakee	249	2	15	5,513	91	28	228	653	867	260	25
Winnebago	238	497	368	149	16,533	2,004	2,430	1,129	1,671	603	709
Ogle/Lee (parts)	94	477	481	51	1,657	3,862	1,139	237	342	416	367
LaSalle	1,291	157	433	243	2,273	1,238	14,826	778	2,023	366	302
Lake - IN	539	161	174	673	1,085	186	811	16,318	6,231	1,486	211
Porter/ LaPorte	1,232	481	128	875	1,406	356	1,962	6,035	25,099	1,809	229
Kenosha/ Racine	349	15	136	271	655	177	259	1,530	2,124	22,354	1,027
Walworth	36	44	95	32	982	340	359	151	144	1,083	7,218

Preliminary Results: External Trips

- **Internal Chicago-Region Trips: 194,833**
- **External Trips with Chicago-Region Trip End: 125,579**
- **External Trips with No Chicago-Region Trip End: 189,644**
- **Percent of Trips that Left Modeling Area: 25.2%**
- **Recall that: preliminary results represent a sample of trucks moving in CMAP modeling area over a two-week period.**

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