FREIGHT MOBILITY RESEARCH INSTITUTE (FMRI) A **USDOT** University Transportation Center

Analysis of Hurricane Evacuation Data by Vehicle Classification

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Hurricane Irma

FMRI^{Freight Mobility} Research Institute



Aug 30, 2017 – Sep 13, 2017

Hurricanes



Climate.gov

Transportation & Emergency events





Source : flexiprep.com

- The number of emergency events throughout the world increase
- Evacuation is common during wildfires, hurricanes, local flooding etc.
- Freight is an inextricable part of disaster preparedness, response, mitigation, and recovery
- Natural disasters are disruption to global supply-chain.

The **goal** of this research is to investigate the movement of vehicles categories based on FHWA classification during hurricane Irma

Methodology





Data Collection

- > Florida Department of Transportation (FDOT)
- Traffic Counts
- Vehicle Classification
- Traffic Monitoring Stations (230)
- First Monday September 2017 Last Sunday November 20
- Federal Highway Administration (FHWA)
- Vehicles Classification Categories
- > National Oceanic and Atmospheric Administration (NC
- Information Hurricane Irma















4	A	В	С	D	E	F	G	H		J	K	L	М	Ν	0	Р	Q	R	S	Т	U	V	
1	DATE	460192	460305	460308	460315	460359	470173	470328	470337	470365	480048	490156	490243	490292	190349	8036 <mark>8</mark>	489949	490060	490369	500054	500220	50028	
2	2017-08-07 00:00:00	229	252	2753	1343	270	1331	1173	489	359	194	496	6036	325	505	1 17	2880	5874	306	278	1158	59	9 sig!) # total values
3	2017-08-08 00:00:00	252	263	2858	1397	269	1398	1274	467	354	253	564	6918	368	505	1 50	3171	7015	269	252	1288	65	-8-sig) # total volume
4	2017-08-09 00:00:00	223	232	2799	1264	271	1340	1237	490	341	233	545	6627	340	519	1 75	3001	6809	295	244	1243	66	sist) # total valuma a
5	2017-08-10 00:00:00	288	236	2891	1252	303	1376	1268	557	369	255	525	6931	420	520	1 <mark>65</mark>	2994	6802	312	261	1300	69 [°]	-Sig) # Local Volume a-
 6	2017-08-11 00:00:00	281	232	2999	1332	279	1343	1237	596	346	255	454	6348	368	535	1 46	3206	6113	389	240	1175	59	
Data	2017-08-12 00:00:00	171	208	1637	702	163	805	664	406	163	203	372	4885	228	304	56	1740	4496	359	117	619	44	
	2017-08-13 00:00:00	107	116	1137	440	99	665	515	292	120	138	294	4298	168	202	09	1192	4019	304	118	638	46	
9	2017-08-14 00:00:00	228	223	2791	1293	274	1259	1249	504	363	234	556	5966	378	517	1 73	2967	5834	279	273	1193	57	
10	2017-08-15 00:00:00	248	196	2797	1281	276	1271	1216	425	320	238	503	6817	399	483	1 <mark>9</mark> 3	3034	6816	251	259	1271	66	
1	2017-08-16 00:00:00	214	235	2748	1302	314	1210	1226	450	304	275	392	6933	354	538	1 90	3014	6861	271	255	1268	65	
12	2 2017-08-17 00:00:00	268	256	2804	1318	317	1327	1259	486	311	201	400	0930	299	473	14 <mark>41</mark>	3138	6938	284	210	1288	67	
13	3 2017-08-18 00:00:00	303	285	2831	1464	308	1364	1252	599	352	278	571	6230	406	551	1339	3132	6059	372	223	1126	60	
4	2017-08-19 00:00:00	176	149	1607	719	163	764	713	447	173	206	421	4656	278	321	731	1781	4337	323	131	699	44 •	
15	5 2017-08-20 00:00:00	106	133	1109	420	107	688	479	332	151	120	325	4155	163	193	562	1237	3877	348	81	572	45 [°]	
16	6 2017-08-21 00:00:00	264	222	2606	1325	292	1252	1220	409	337	215	515	5778	450	540	1327	2882	5815	267	188	1147	56	
	2017-08-22 00:00:00	224	253	2837	1275	258	1402	1229	471	318	260	504	6706	437	529	1412	2968	6760	264	271	1278	66	
31	3 2017-08-23 00:00:00	219	265	2714	1335	263	1296	1290	513	304	248	573	6718	428	504	1404	3111	6754	322	252	1329	67	
9	2017-08-24 00:00:00	251	252	2855	1326	306	1473	1356	549	339	296	433	6832	482	477	1395	3143	6949	319	246	1310	68	
20	2017-08-25 00:00:00	227	236	2855	1407	321	1390	1235	614	365	310	605	6142	449	467	1414	3373	6277	345	256	1307	60	
21	2017-08-26 00:00:00	165	140	1625	690	142	770	628	366	166	175	365	4204	235	330	876	1603	4026	260	112	681	43	
	2 2017-08-27 00:00:00	118	107	1056	429	78	637	451	287	120	117	304	3717	146	181	635	1097	3583	202	115	602	44	
	3 2017-08-28 00:00:00	248	271	2677	1311	269	1362	1331	412	359	277	507	5424	424	509	1309	3042	5594	252	286	1251	56	
24	2017-08-29 00:00:00	219	239	2702	1173	288	1295	1211	406	352	260	436	5640	430	484	1380	2968	6345	285	242	1326	63	
25	5 2017-08-30 00:00:00	234	248	2686	1201	285	1334	1284	474	344	267	274	5896	255	409	1200	2407	5894	296	291	1290	63	
26	6 2017-08-31 00:00:00	264	234	2892	1306	294	1364	1275	480	368	262	362	6288	277	454	1277	2810	6211	341	287	1233	66tf	-8-sig') # total volum
)7	2017_00_01 00.00.00	308	288	3017	118/	283	1/5/	13/0	725	3/18	205	/18	6350	378	552	1/01	3351	6253	166	306	1185	62	
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Flowchart - Evacuation



independent, two-tailed student t-test

Results



Statistical Table Evacuation

P-values for hurricane Irma in Florida

						_		
2017	2018	Class.	Class.	Class 2	Class 3	Class 5	Class 8	Class 0
	2010	2 & 3	5&8&9	Cluss. 2	Cluss. 5	Cluss. 5	Cluss. o	Cluss. 9
9/7	9/6	0.400	0.960	0.400	0.800	0.800	0.020 a	0.700
9/8	9/7	0.090	0.012 ^a	0.100	0.030 ^a	0.005 ^a	0.600	0.010 ^a
9/9	9/8	0.000 ^a	0.000 ^a	0.000 ^a	0.000 ^a	0.003 ^a	0.008 a	0.000 ^a
9/10	9/9	0.000 ^a	0.000 ^a	0.000 ^a	0.000 a	0.000 ^a	0.000 a	0.000 ^a
9/11	9/10	0.000 ^a	0.000 ^a	0.000 ^a	0.000 a	0.000 a	0.000 a	0.000 ^a
9/12	9/11	0.480	0.000 ^a	0.600	0.200	0.100	0.300	0.000 ^a
9/13	9/12	0.910	0.300	0.990	0.600	0.700	0.600	0.100
9/14	9/13	0.670	0.910	0.700	0.600	0.900	0.500	0.990

^a Statistically significant at the P < 0.05 level







Heat Maps





Results cont.











- Changes in traffic patterns for commercial use vehicles occurred earlier and lasted longer than changes for personal use vehicles.
- South Florida was less severe and returned to pre-evacuation values sooner than other regions.
- High number of trips during landfall day suggested that people started reentry as soon as possible, beginning on the same day as landfall.
- Evacuees preferred to drive long hours to get away from the restricted area compared to making stops close to the borders.
- Future research could investigate why commercial driving patterns were different from that of personal use vehicles and how evacuation planners could better accommodate their needs.

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Thank you for your attention! Questions?

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