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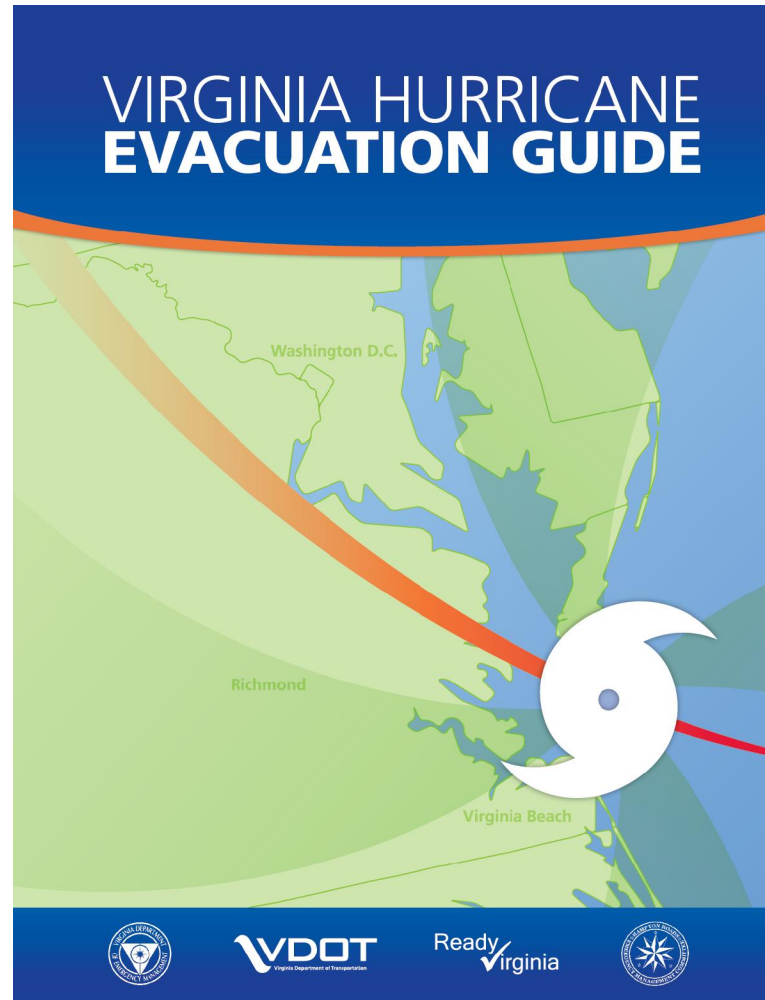
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HAMPTON ROADS HURRICANE EVACUATION ANALYSIS - A MESOSCOPIC TRAFFIC SIMULATION APPROACH

Presented to the Virginia Section, Institute of
Transportation Engineers

June 30, 2011

Hurricane Preparedness



Designated Evacuation Routes



How things have changed

- As part of Virginia's hurricane preparedness efforts, a traffic control plan (TCP) has been developed to facilitate efficient traffic flow out of the region
- Several earlier studies provided recommendations for improvements to the TCP
- In 2008, new surge models were released that significantly increased the numbers of evacuating vehicles under all categories of storms

	Demand						
Route	Cat 1-2 (Old)	Cat. 1 (new)	Cat. 3 (old)	Cat. 2 (new)	Cat. 4 (old)	Cat. 3 (new)	Cat. 4 (new)
US 58	7632	7088	21196	27384	48367	51612	89998
US 460	2519	9229	7624	31865	18434	57903	98644
Rt. 10	183	1253	594	3853	1931	6565	10735
I-64	18022	29069	33437	62387	66129	101855	182577
Rt. 17	2353	2969	6434	6783	13633	11460	20798
	30709	49608	69285	132272	148494	229395	402752



Abbreviated Transportation Model

- Model establishes the numbers of evacuating persons and vehicles
 - From each evacuation zone within each jurisdiction
 - To hotels, motels, and public shelters within the region and destinations outside the region
 - By route and major gateways



Hurricane Evacuation Study Transportation Analysis, Commonwealth of V
EVACUATION STATISTICS DATA

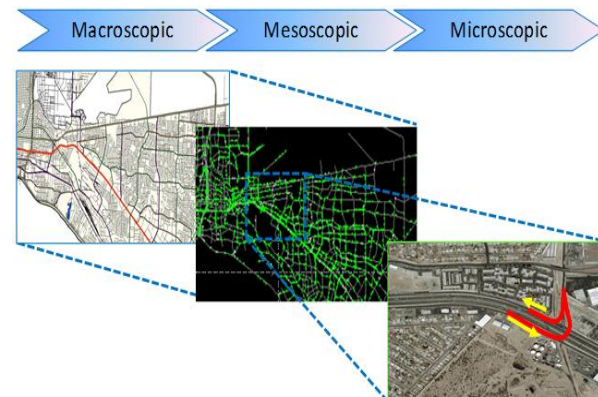
City of: Newport News

Evacuation Zones	Evacuati				
	Category 1 Evac Veh Low Occ	Category 1 Evac Veh High Occ	Category 2 Evac Veh Low Occ	Category 2 Evac Veh High Occ	Category 3 Evac Veh Low Occ
1. Back Bay	873	884	873	884	873
2. Lake Tecumseh	2,248	2,256	2,248	2,256	2,248
3. Lake Rudee	422	650	422	650	422
4. Broad Bay	4,306	4,695	4,306	4,695	4,306
5. Lynnhaven Bay	4,248	4,358	4,248	4,358	4,248
6. Chub Lake	3,098	3,104	3,098	3,104	3,098
7. Mount Trashmore Park	3,547	3,552	3,547	3,552	3,547
8. Old London Bridge	212	236	212	236	212
9. Kempsville Heights	1,565	1,568	1,565	1,568	1,565
10. Blackwater	337	350	337	350	337
11. Pleasant Ridge / Creeds	5	5	508	508	508
12. West Neck Corner	17	19	1,503	1,509	1,503
13. Camp Pendleton	187	375	7,670	8,046	7,670
14. Sandee Lake / Cape Henry Shores	195	462	3,761	4,296	3,761
15. Thalia	130	232	3,294	3,497	3,294
16. Little Creek Navy Base	14	14	1,399	1,399	1,399



Mesoscopic simulator

- DynusT is a mesoscopic simulation-based dynamic traffic assignment software (used to be called Dynasmart)
- The software development and support was funded by the FHWA
- Has been used for evacuation studies in Texas and Arizona



DynusT model of the Evacuation Network



Network information

- The evacuation network model in DynusT has the following attributes
 - Number of nodes: 6,412
 - Number of links: 11,843
 - Number of signals: 214
 - Number of OD zones: 383
 - Total length of network: 5,976miles (sum of all link lengths)

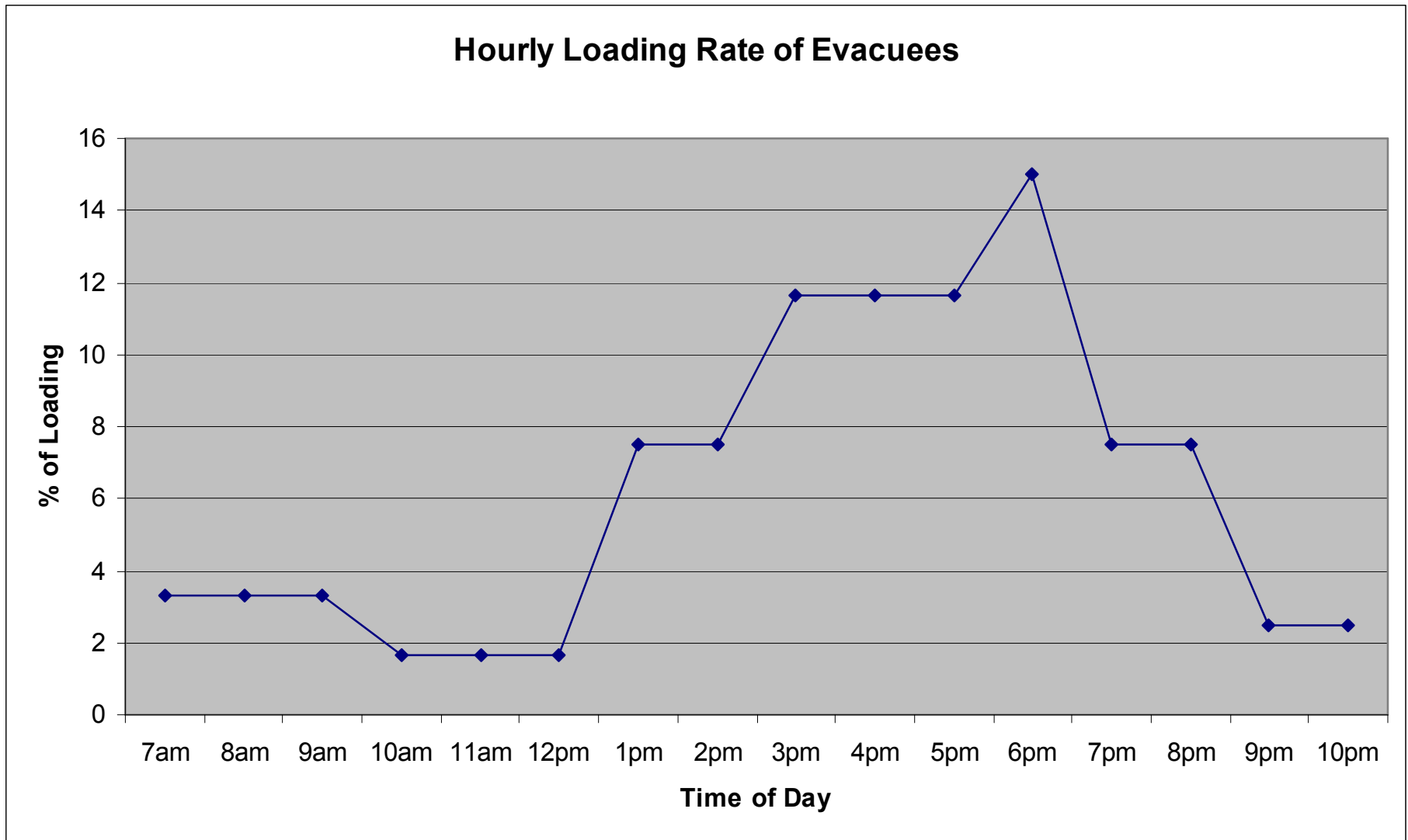


Demand information

Storm Category	1H	2H	3H	4H
Out of region	53,070	138,756	236,631	411,299
Friends/Family/Relatives	66,668	129,279	223,764	172,448
Public shelter	6,884	18,646	40,507	62,671
Background traffic	294,859	294,859	250,807	250,807
Total Vehicles	421,481	581,540	751,709	897,225



Response curve (hourly loading rate)



Evacuation Scenarios

Scen.	Storm Int.	Traffic Control	Participation Rate	Priority
1a	2	I 64 Reversal without I 664 crossover, tunnel close, no demand using I664	100%	1
1b	2	I 64 Reversal without I 664 crossover , tunnel open to regular lane		
2	2	I 64 Reversal with I 664 crossover, tunnel open to reverse lane of I64	100%	1
3*	1	No lane reversal on any roadway (base case)	100%	1
4	1	No lane reversal on any roadway (base case)	70%	1
5	1	No lane reversal on any roadway (phased evacuation from old ATM)	70%	2
6	2	I 64 Reversal without I 664 crossover	70%	2
7a	3	I 64 Reversal without I 664 crossover, tunnel closed	100%	2
7b	3	I 64 Reversal without I 664 crossover, tunnel open to regular lane	100%	2
8	3	I 64 Reversal with I 664 crossover	100%	2
9	2	I 64 Reversal with I 664 crossover	70%	2
10	2	I 64 Reversal with I 664 crossover and Rt. 58 reversal	100%	3
11	3	I 64 Reversal with I 664 crossover and Rt. 58 reversal	100%	3
12	4	I 64 Reversal with I 664 crossover and Rt. 58 reversal	100%	3
13	2	I 64 Reversal with I 664 crossover and Rt. 58 reversal	70%	3



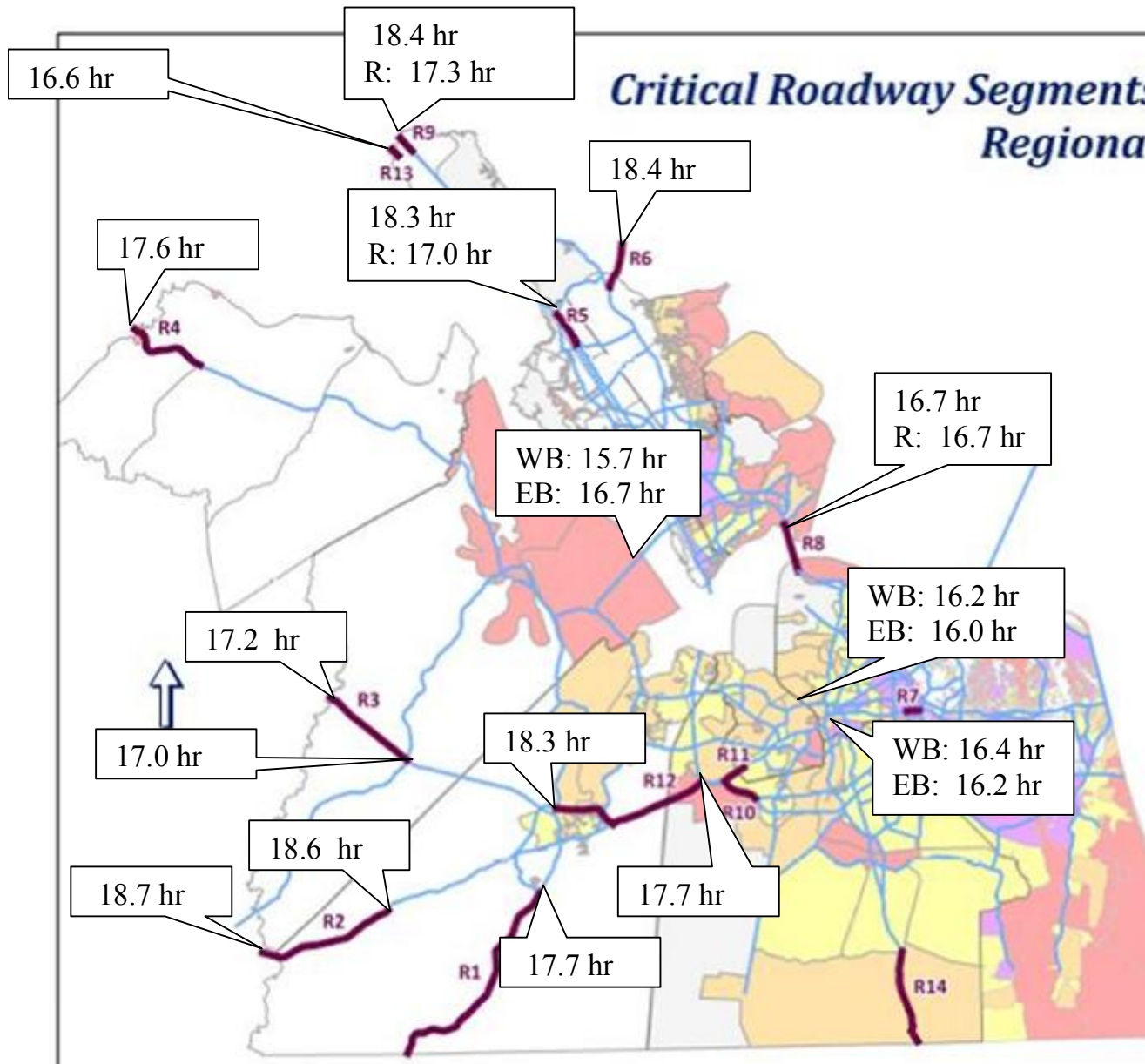
Preliminary Scenario Results

- Scenario 1a: Category 2 storm, I 64 Reversal and I 664 MMBBT tunnel closed
- Scenario 1b: Category 2 storm, I 64 Reversal, I 664 MMBBT tunnel open to I 64 regular lane
- Scenario 2: Category 2 storm, I 64 Reversal, I 664 MMBBT tunnel open to reverse lane

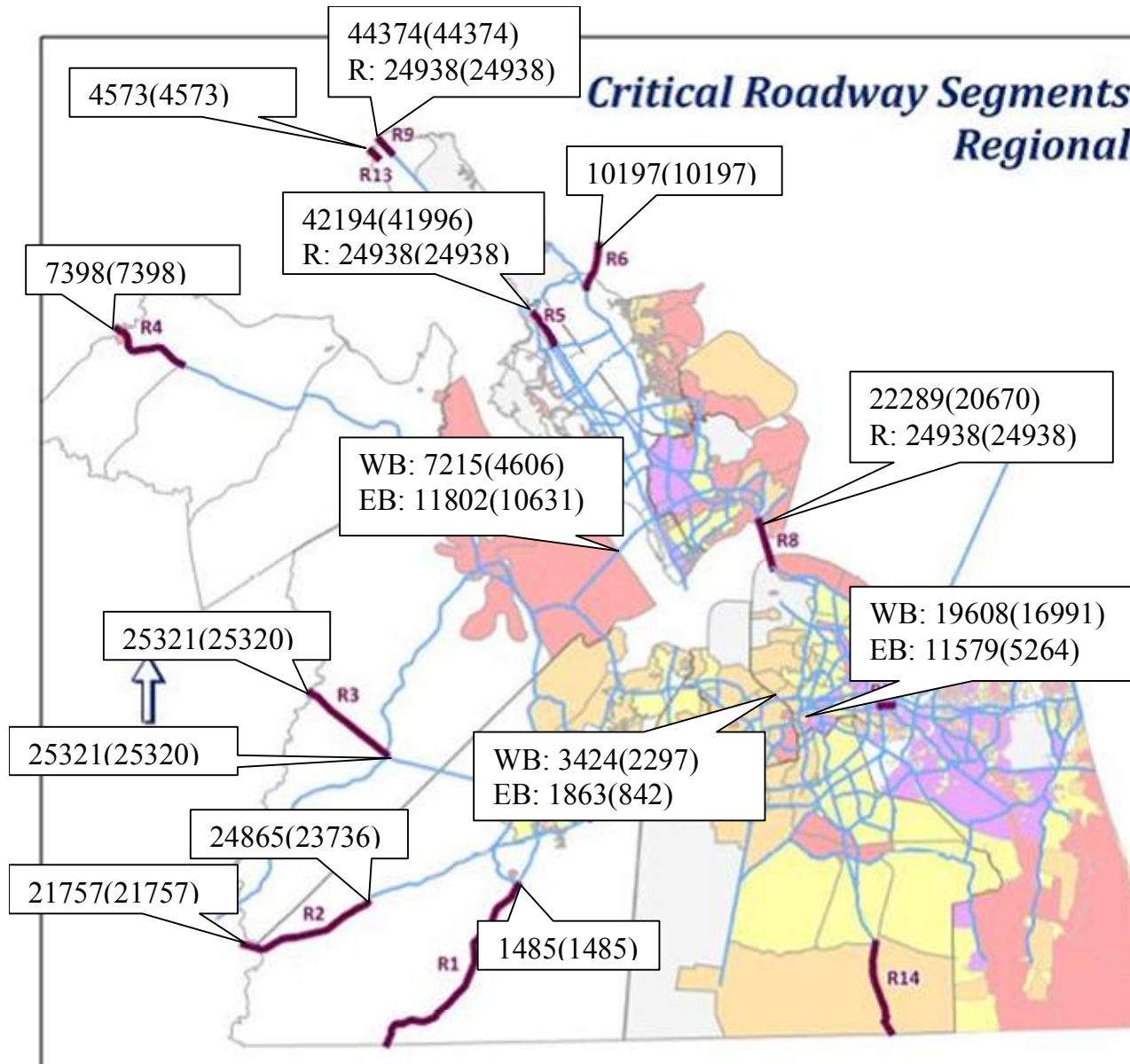
Run times of 48 hours - For 15 iterations of user equilibrium traffic assignment with a 2300min (~38 hours) simulation time



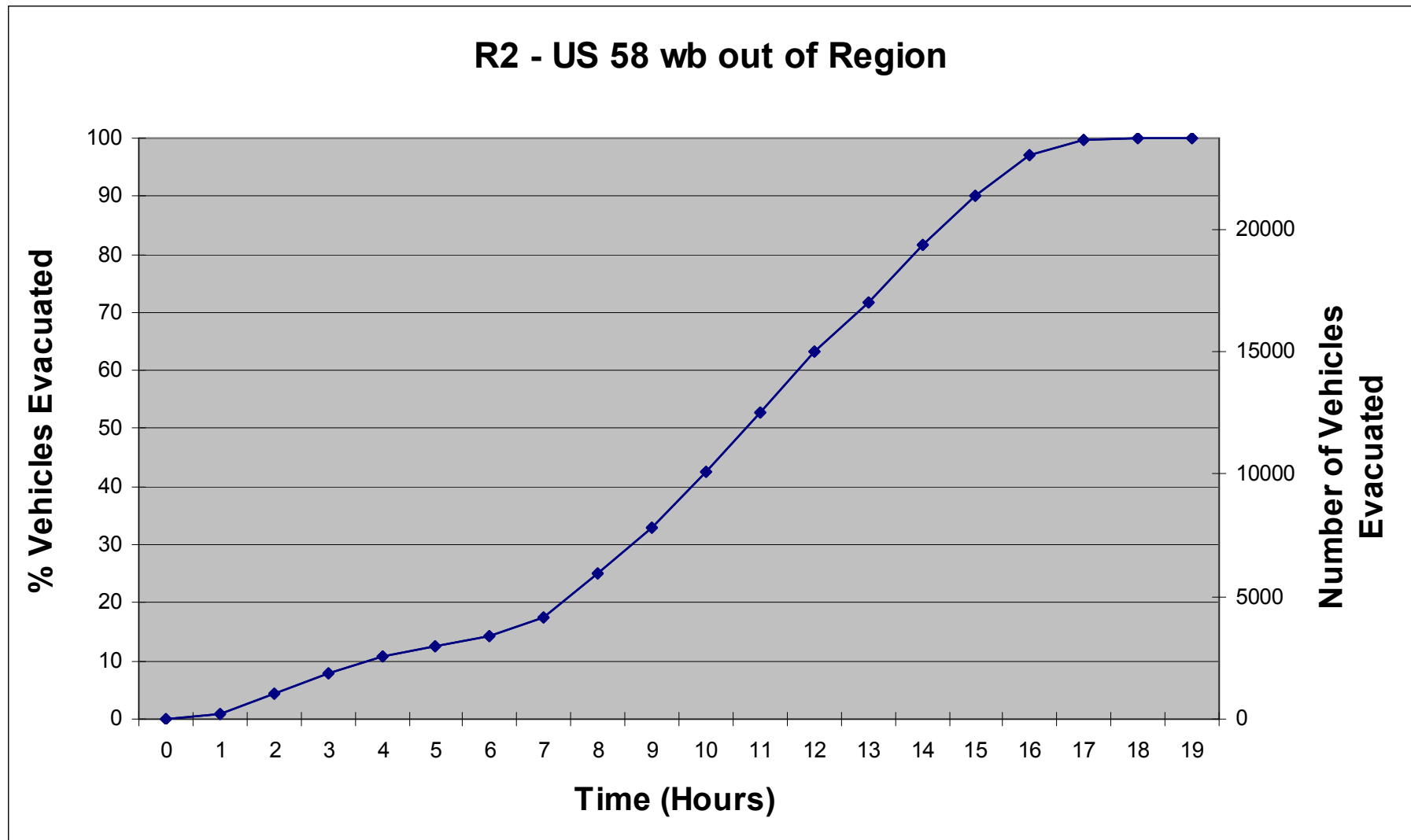
Scenario 1a: Category 2 storm, I 64 Reversal and I 664 MMBBT tunnel closed (Clearance Times)



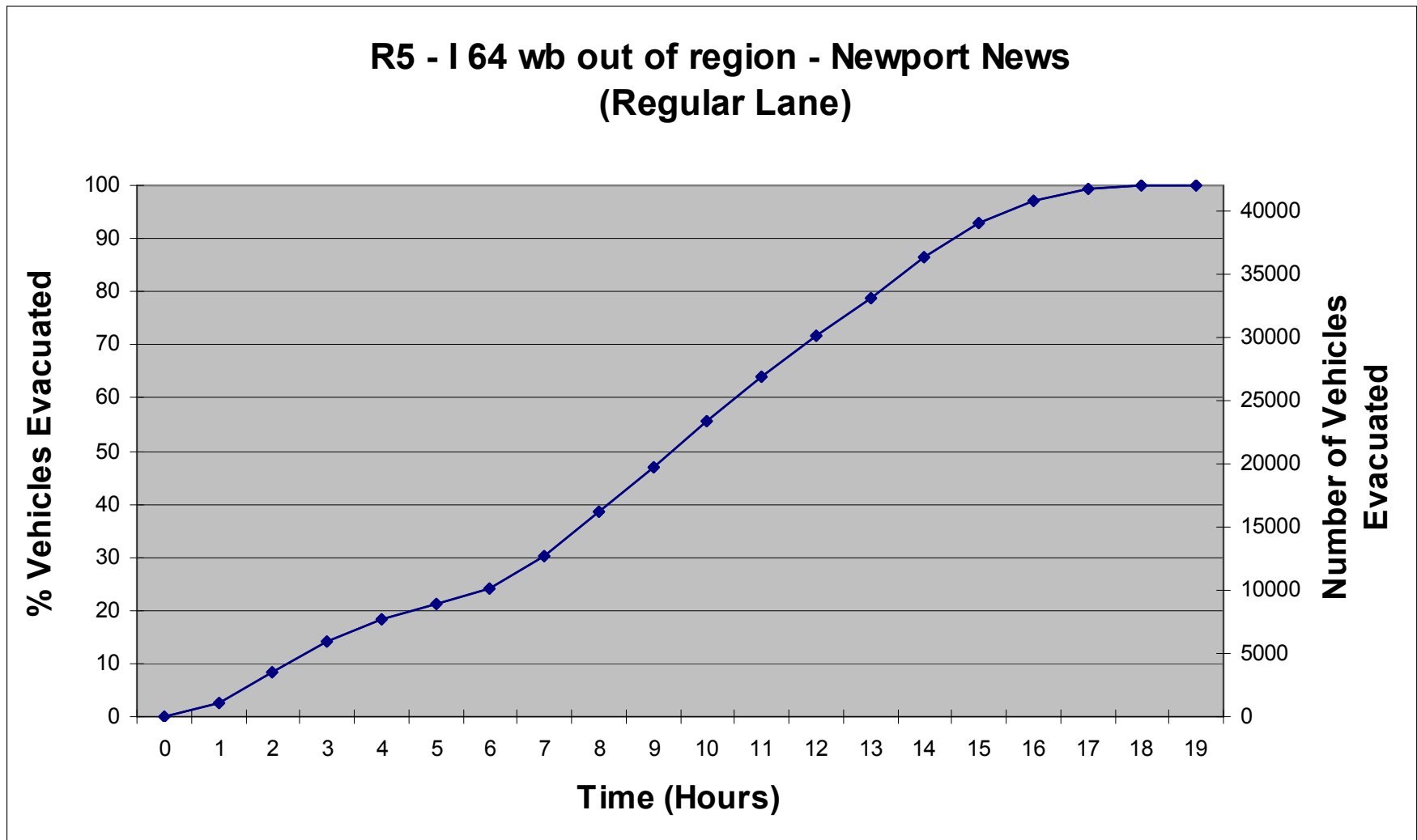
Scenario 1a: Category 2 storm, I 64 Reversal and I 664 MMBBT tunnel closed (Total Vehicles)



Percent evacuated by the hour



Percent evacuated by the hour



Next Steps

- Complete evaluation of remaining scenarios
- Identify potential countermeasures and recommendation for changes to the TCP



Questions

Cathy McGhee, P.E.

Cathy.McGhee@vdot.virginia.gov

434-293-1973

