

A utility-based approach to modeling systemic resilience of highway networks with an application in Utah

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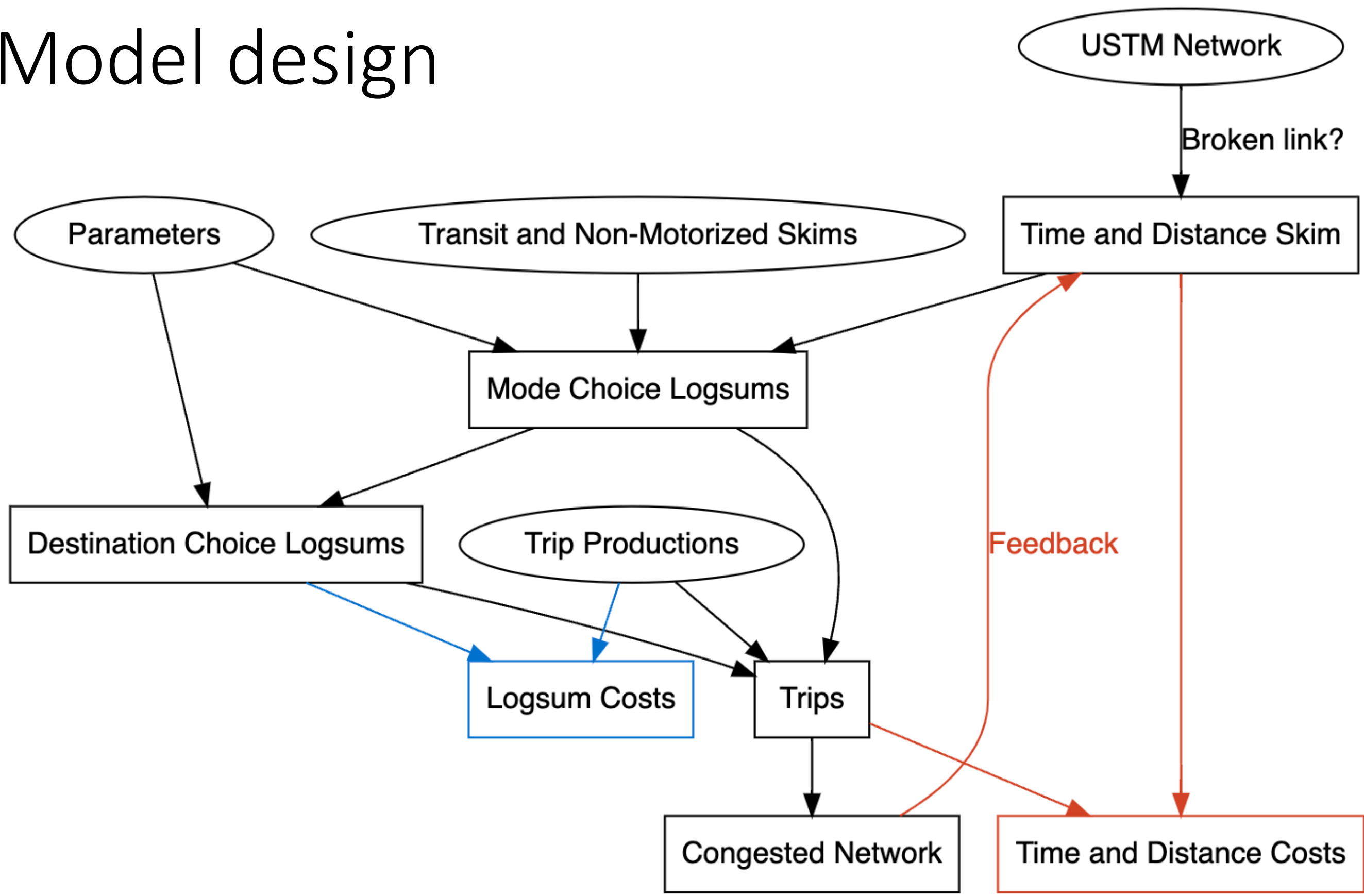
Abstract

The resilience of transportation networks is an important consideration in management and planning, but practical techniques to identify systemically critical links are limited. Further, current practical techniques ignore that when transportation networks are damaged or degraded, people potentially change destinations and modes as well as travel routes. In this research, we develop a model to examine network highway resilience based on changes to mode and destination choice logsums, and apply this model to 41 scenarios representing the loss of links on the statewide highway network in Utah. The results of the analysis suggest a fundamentally different prioritization scheme than would be identified solely through a methodology based on increased travel times.

Using accessibility logsums instead of excess travel times leads to a different prioritization of critical facilities.

- Built a statewide trip-based model
- Sensitive to route, mode, and destination options
- Robust to changes in parameters

1 Model design



2 Detail for I-80 at Tooele / Salt Lake Line

Purpose	Utility Logsum			Travel Time		
	Other Counties	Inside Tooele	Total	Other Counties	Inside Tooele	Total
Passenger						
HBO	\$2,637	\$28,290	\$30,927	\$8,595	\$75,862	\$84,457
HBW	\$4,039	\$113,660	\$117,699	\$7,868	\$234,009	\$241,877
NHB	\$2,141	\$44,911	\$47,051	\$5,875	\$100,245	\$106,120
External / Freight						
Internal Freight				\$24,617	\$26,083	\$50,700
Inbound / Outbound Freight				\$59,758	\$1,190	\$60,948
Recreation				\$176	\$190	\$366
Through Freight				\$251,508		\$251,508
Through Passenger				\$56,103		\$56,103
Comparable Total	\$8,817	\$186,860	\$195,677	\$22,338	\$410,116	\$432,454
Total	\$8,817	\$186,860	\$195,677	\$414,499	\$437,580	\$852,079

3 Rankings of the most critical projects are different by method

Route	Location	Logsum		Travel Time	
		HBW, HBO, NHB	HBW, HBO, NHB	Freight, External, etc.	Total
I-15	Utah / Salt Lake county line	\$587,126	\$827,014	\$387,138	\$1,214,152
I-80	Salt Lake / Tooele county line	\$195,677	\$432,454	\$419,625	\$852,079
I-84	Weber Canyon	\$133,705	\$100,415	\$87,561	\$187,976
I-80	Parley's Canyon	\$96,614	\$77,320	\$164,493	\$241,813
I-15	Orem	\$68,707	\$137,034	\$105,174	\$242,208
I-215	Taylorsville	\$51,327	\$79,619	\$2,750	\$82,370
US-91	Box Elder Canyon	\$39,676	\$55,515	\$106,704	\$162,219
SR-189	Provo Canyon	\$39,088	\$43,095	\$13,098	\$56,193
I-15	SLC 2100 S	\$32,508	\$98,707	\$43,222	\$141,929
I-15	Bountiful	\$28,787	\$56,806	\$53,575	\$110,381

4 The rankings are robust

