Comparison of the Quality of Service in Arlington, Dallas, Fort Worth CBD- A Two Fluid Model Approach

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Introduction

- In 1982, average fraction of stopped time in Dallas was 37.8%. Wasted 20 gallons/year/veh.
- In 2004, motorist in DFW area wasted 120 gallons/year/veh.
- In 2003/2004 the City of Fort Worth, Texas made extensive modifications in its network.
- Quantifiable tools are needed.

Background

- Two-fluid model was proposed by Herman and Prigogine in 1979.
- In 1984, Ardekani and Herman applied the model to different Texas Cities.
- In 1985, Williams used NETSIM to determine the relationship between model parameters and network elements.
- In 2004, Jones found that the model is also valid at the arterial street scale.

Two-fluid Model

- 1.The average running speed in a network is proportional to the n^{th} power of the fraction of the running vehicles.
- 2.The fractional stop time of a test vehicle circulating in a network is equal to the average fraction of stopped vehicles during the same period.

Two-fluid Model (continued)

$$V_r = V / f_r = V_m f_r^n = V_m (1 - f_s)^n$$

$$f_s = T_s / T$$

$$T_m = 1 / V_m$$

Two-fluid Model (continued)

$$T_r = T_m^{1/n+1} \times T^{n/n+1}$$

$$LogT_r = \frac{1}{n+1} LogT_m + \frac{n}{n+1} LogT$$

- T_m is average minimum trip time per mile
- T is the trip time per unit distance
- T_r is the running time per unit distance
- n is the parameter representing the level of vehicular interaction

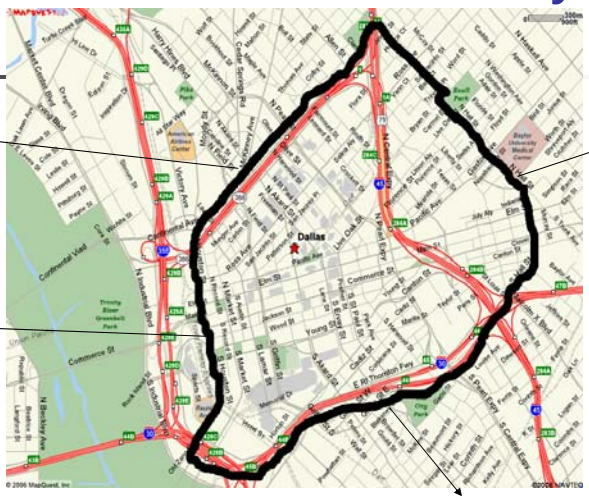
Two-fluid Model (continued)

- The smaller the values of T_m and n are, the better the network is.
- Parameter n represents the level of vehicle interactions as demand increases.
- Better geometric conditions lead to smaller n.
- T_m describes network under light demand condition.
- Poorly timed and poorly coordinated traffic signals result in high T_m values.

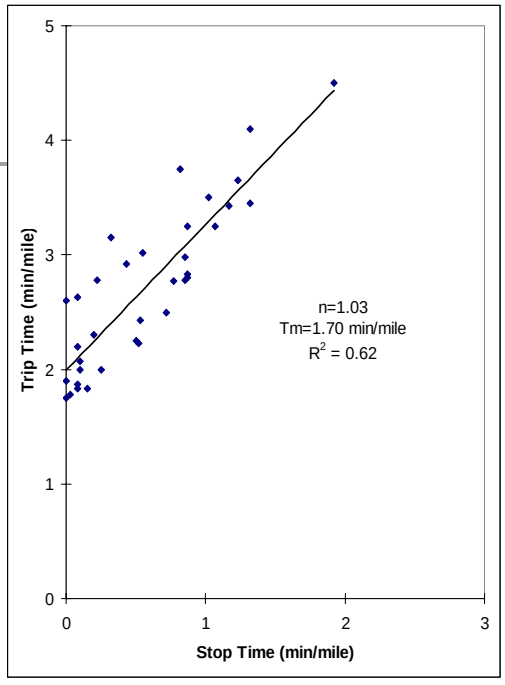
Data uses

Arlington		Dallas		Fort Worth	
Previous	New	Previous	New	Previous	New
1994	2003	1983	2003	1999	2004

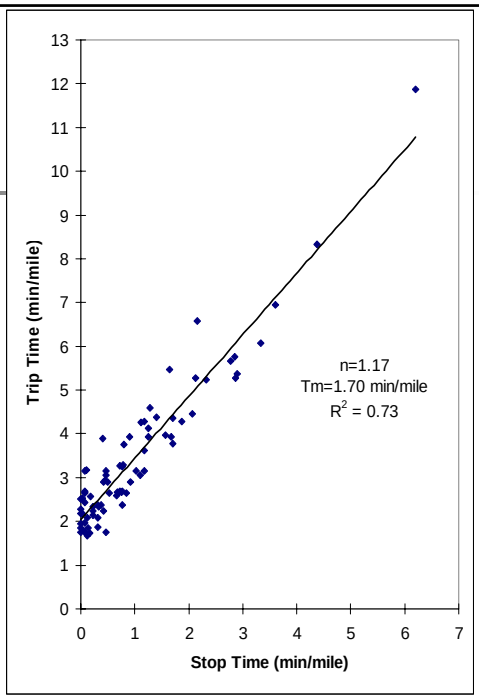
Dallas Network Boundary



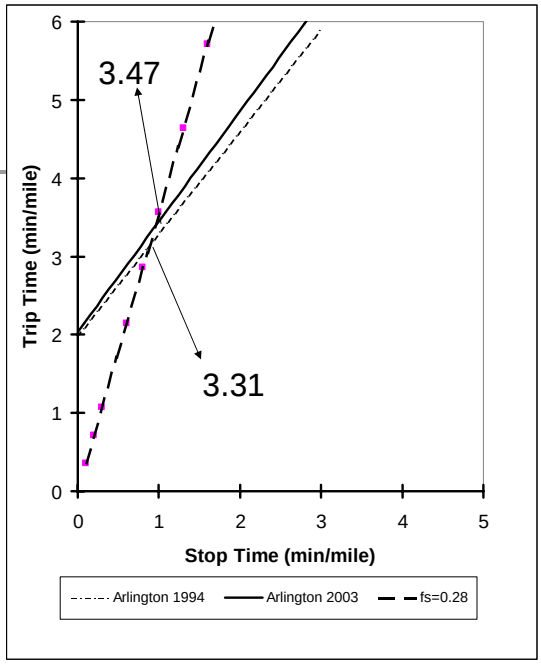
Arlington Network 1994



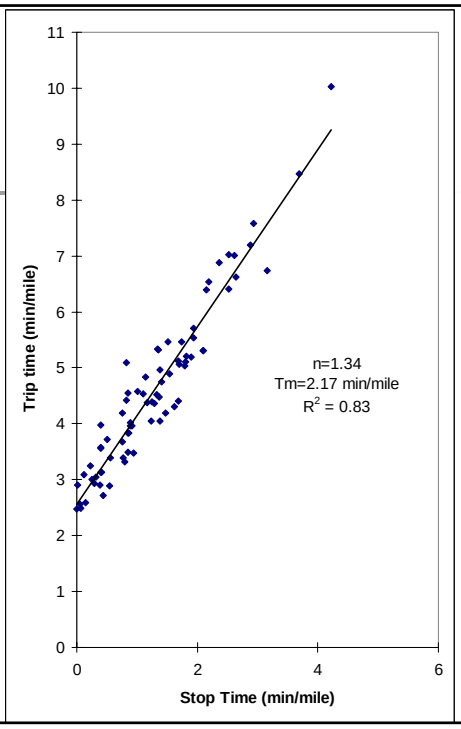
Arlington Network 2003



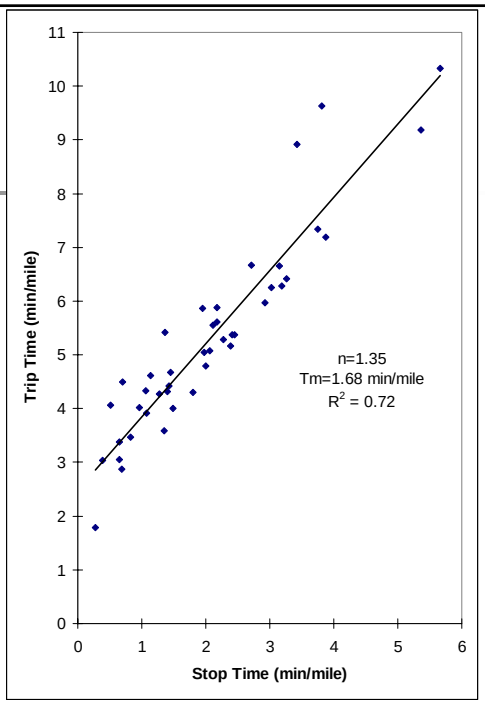
Compare Arlington 1994 vs 2003



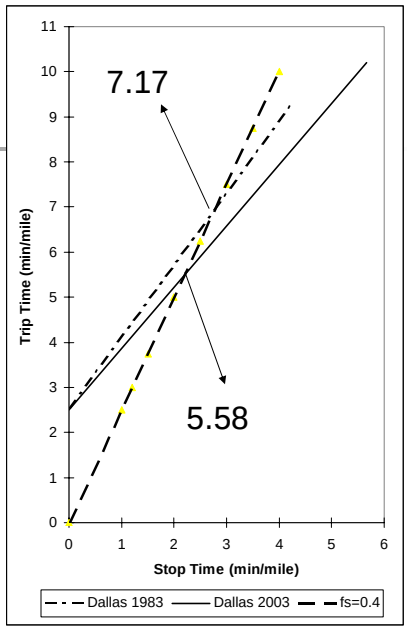
Dallas Network 1983



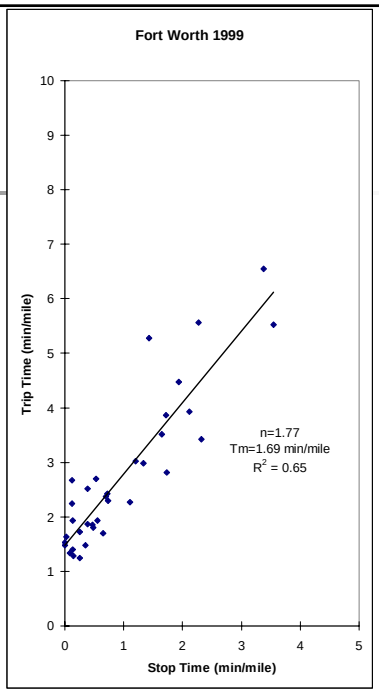
Dallas Network 2003



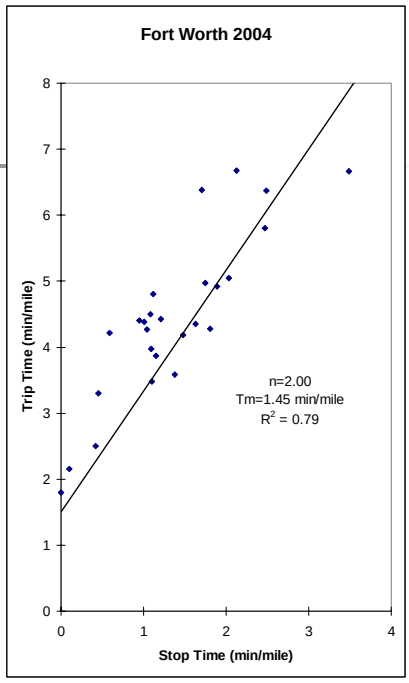
Compare Dallas 1983 vs 2003



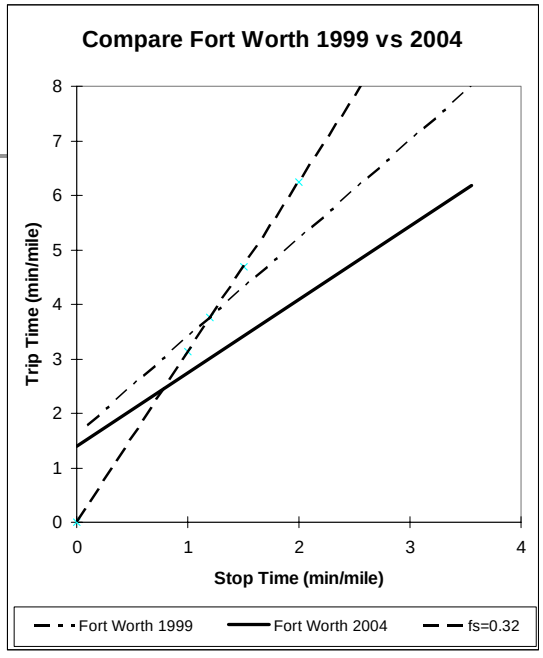
Fort Worth Network 1999



Fort Worth Network 2004



Compare Fort Worth 1999 vs 2004

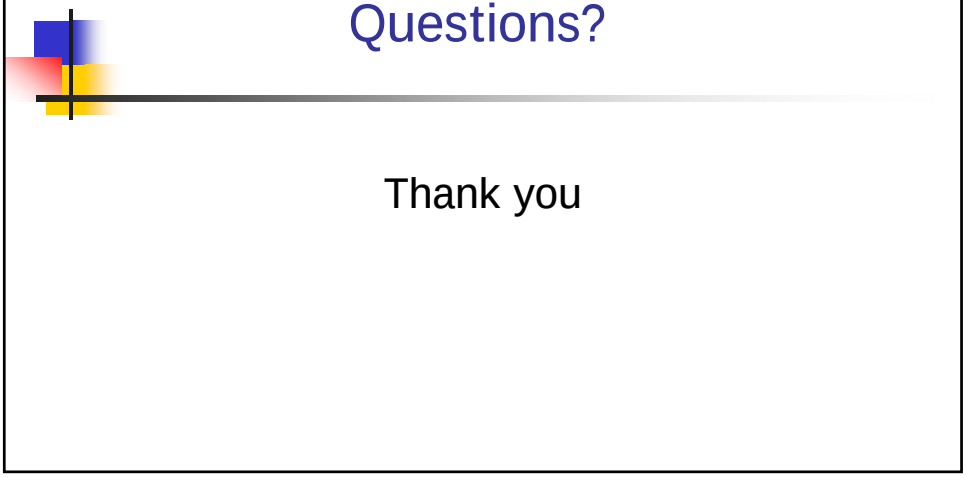


Summary of Results

Network	Year	T_m (min/mile)	n	V_m (mph)
Arlington	1994	1.70	1.03	35
Arlington	2003	1.70	1.17	35
Dallas	1983	2.17	1.34	28
Dallas	2003	1.68	1.35	36
Fort Worth	1999	1.69	1.77	36
Fort Worth	2004	1.45	2.00	41

Conclusions

- Minor change in trip time→ significantly affect time & gas consuming and air pollutions.
- Very cost-effective to implement.
- Lane-closure should be described in detail in future studies.


Questions?
Thank you