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)

\[ T_r = T_m^{1/n+1} \times T^{n/n+1} \]
\[ \log T_r = \frac{1}{n+1} \log T_m + \frac{n}{n+1} \log T \]

- 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

<table>
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<tr>
<th></th>
<th>Arlington</th>
<th>Dallas</th>
<th>Fort Worth</th>
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<td></td>
<td>Previous</td>
<td>New</td>
</tr>
<tr>
<td>Previous</td>
<td>New</td>
<td>New</td>
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</tr>
<tr>
<td></td>
<td>1999</td>
<td></td>
<td>2004</td>
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</tbody>
</table>
Dallas Network Boundary

- SH 366
- Hall St
- Houston St
- I-30

Arlington Network 1994

n=1.03
Tm=1.70 min/mile
R^2 = 0.62
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

<table>
<thead>
<tr>
<th>Network</th>
<th>Year</th>
<th>$T_m$ (min/mile)</th>
<th>$n$</th>
<th>$V_m$ (mph)</th>
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<tbody>
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<tr>
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</table>

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