

Synergistic Traffic Counting:
How to Save \$\$\$ when Performing Ramp (and other) Counts

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If you were able to reduce the number of counts performed by 100, how much monetary savings would that (roughly) correspond to?



FHWA's Ramp Balancing Procedure

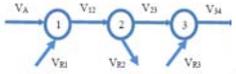


FIGURE 1 Freeway/ ramp network.

□ Vehicular flow conservation gives:

$$V_{12} = V_A + V_{R1}$$

$$V_{23} = V_{12} - V_{R2}$$

$$V_{34} = V_{23} + V_{R3}$$

□ Hence, in order to obtain all 7 counts, we ONLY need to measure 4 ($V_A, V_{R1}, V_{R2}, V_{R3}$).



Synergistic Traffic Counting

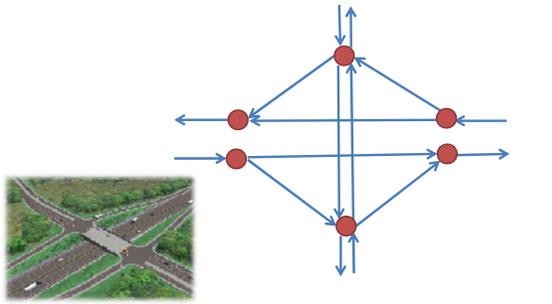
- ❑ FHWA's ramp balancing procedure is **limited to very special network topologies**.
- ❑ We developed a generalization of the ramp balancing procedure for **arbitrary network topologies**.
- ❑ Given a set of road segments of interest, how to determine the **minimum** number of locations to monitor, **making use of the synergy** among the monitored segments.
- ❑ Details highly technical. Provide examples instead.



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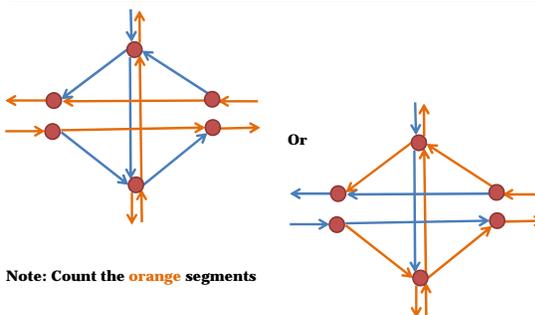
Example: Diamond Interchange



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Example: Obtain All Traffic Counts

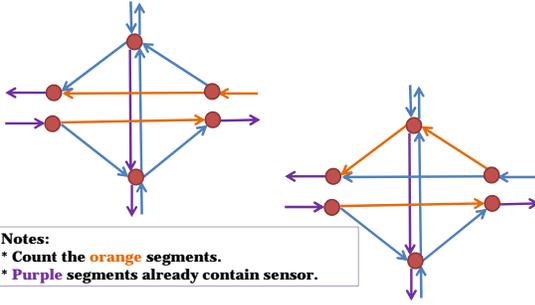


Note: Count the orange segments

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Ramp Counts Only: Example 1

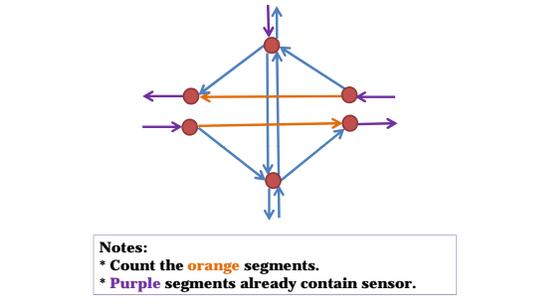


Notes:
* Count the orange segments.
* Purple segments already contain sensor.

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Ramp Counts Only: Example 2

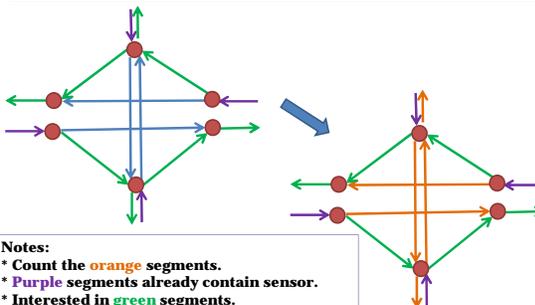


Notes:
* Count the orange segments.
* Purple segments already contain sensor.

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Example: Ramp and Other Counts

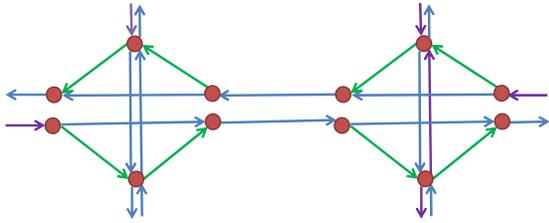


Notes:
* Count the orange segments.
* Purple segments already contain sensor.
* Interested in green segments.

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Network of 2 Diamonds: Example 1

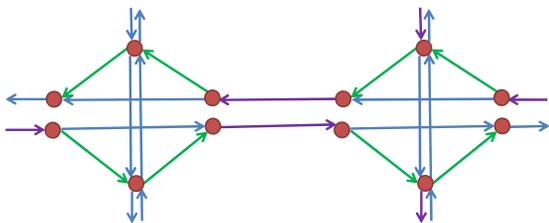


- Notes:
- * Purple segments already contain sensor.
 - * Interested in green segments.

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Network of 2 Diamonds: Example 2

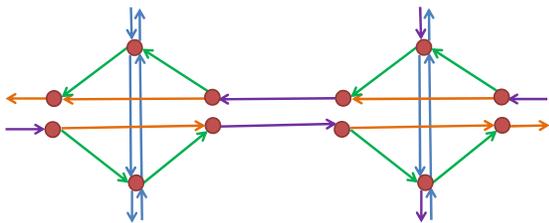


- Notes:
- * Purple segments already contain sensor.
 - * Interested in green segments.

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Network of 2 Diamonds: Example 2 (ctd)

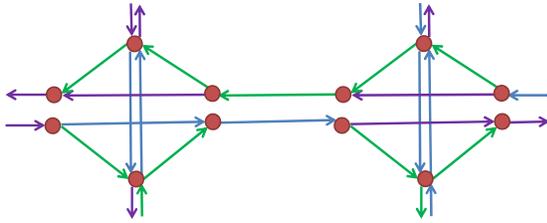


- Notes:
- * Count the orange segments.
 - * Purple segments already contain sensor.
 - * Interested in green segments.

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Network of 2 Diamonds: Example 3

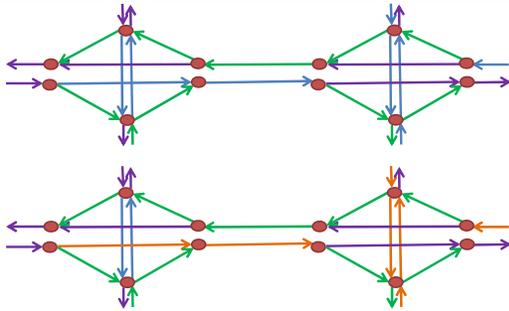


Notes:
* Purple segments already contain sensor.
* Interested in green segments.

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Network of 2 Diamonds: Example 3 (ctd)



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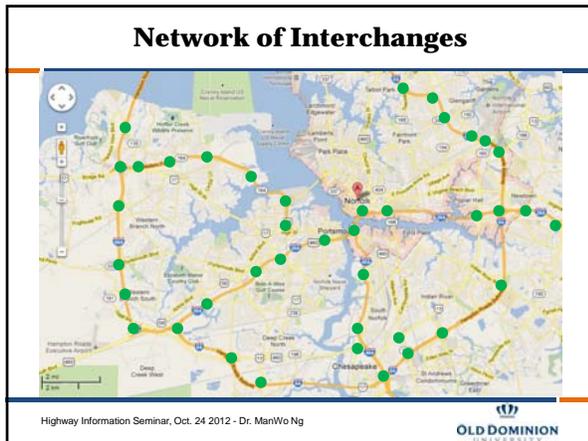


Other Interchanges...



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Variation of the Problem: Entire Region

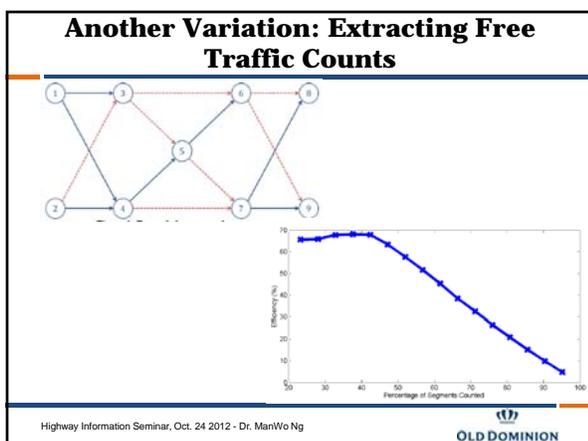
- Technique also applicable to entire urban road networks.
- A portion of the Norfolk, VA network has been used as a test.
- (Only) around 50% of the 8000 segments needed to be counted



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Summary & Conclusions

- Synergistic traffic counting is a powerful technique to significantly reduce the cost of obtaining ramp and other traffic counts.
- Alternatively, using the same budget, one can obtain significantly more traffic counts than current practice.
- In performing traffic counts, a "systems approach" is needed.
- Exact savings depend on:
 - Network topology.
 - Existing sensor inventory.
 - The number (and location) of segments one is interested in.
- Methodology is independent of sensor technology.

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Practice Ready

- Technique is practice-ready
 - Valuable feedback from City of Virginia Beach, Norfolk, Suffolk, HRTPO, NATMEC attendants, Danny Jenkins & Tianjia Tang.
- Technique can be used to develop a long-term master plan for sensor installation to plan for synergy.
- I would be glad to work with anyone interested in the implementation of this technique.

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Thank you!

Questions/ Thoughts?
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