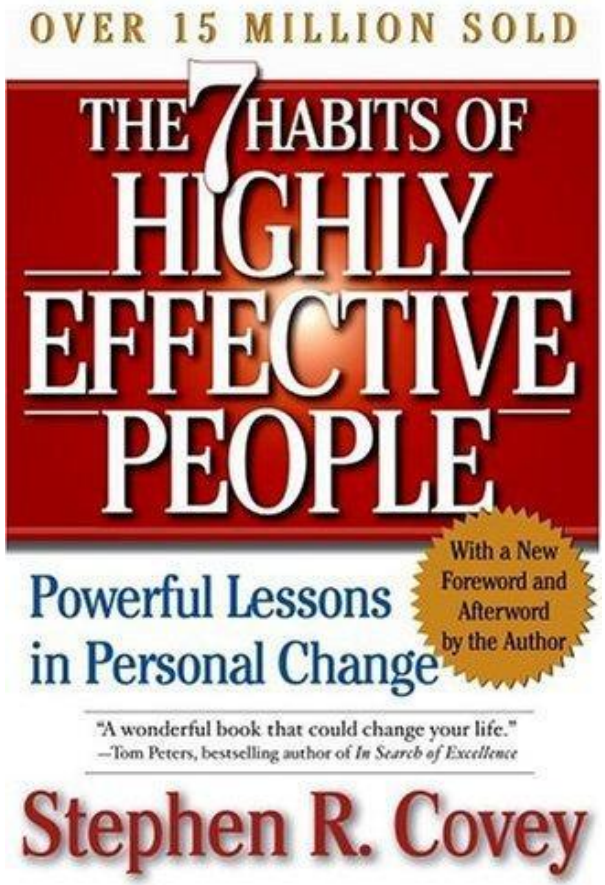
7 Questions of Highly Effective Engineers

RE: Adaptive Signals

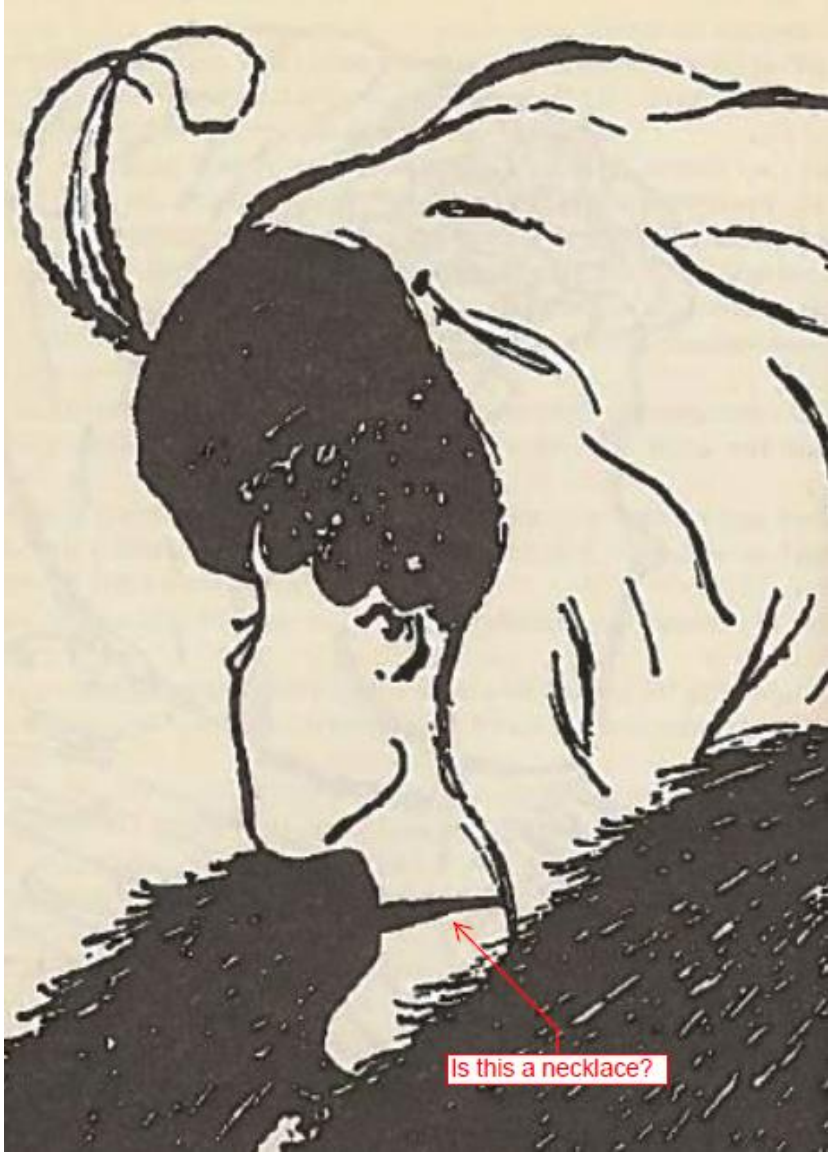
WILLDAN

extending your reach

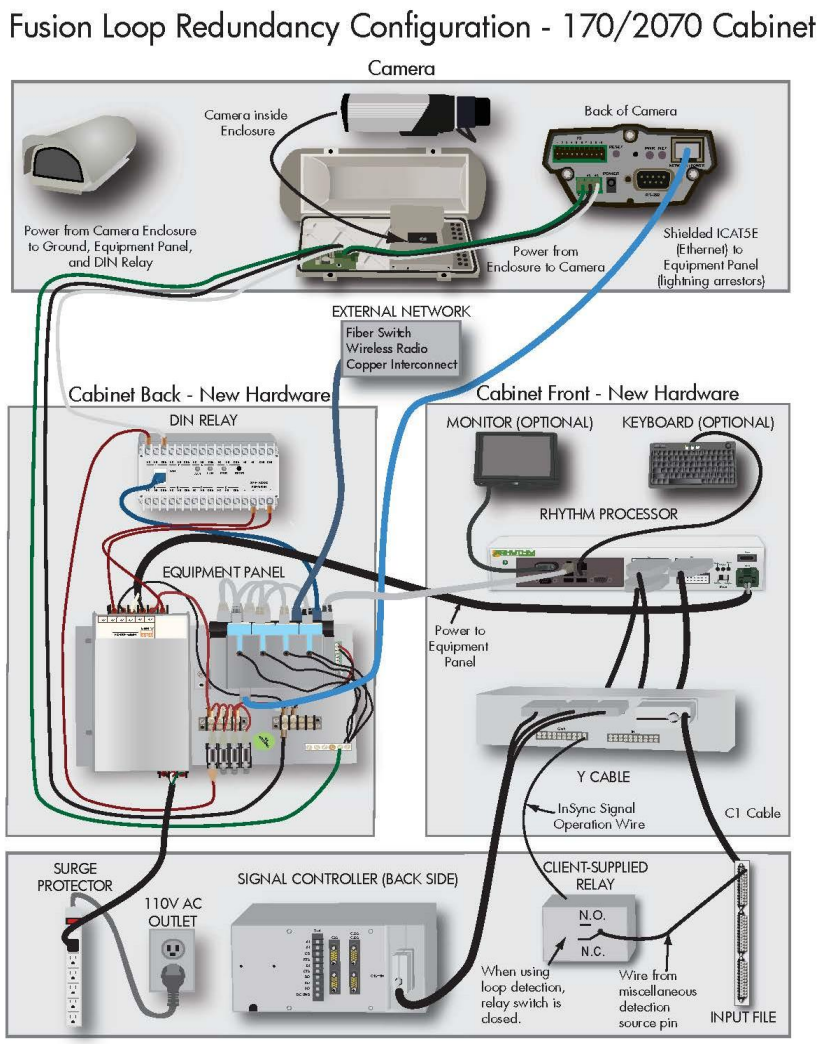
Title Inspired by…



Paradigm Shift Inspired by…



Let’s apply the 7 Questions to this…



7 Questions of Highly Effective Engineers

Question #1: WHY build it?

7 Questions of Highly Effective Engineers

Possible answers:

1) To improve coordination during unexpected spikes in traffic.

2) Grants available to pay 88%

7 Questions of Highly Effective Engineers

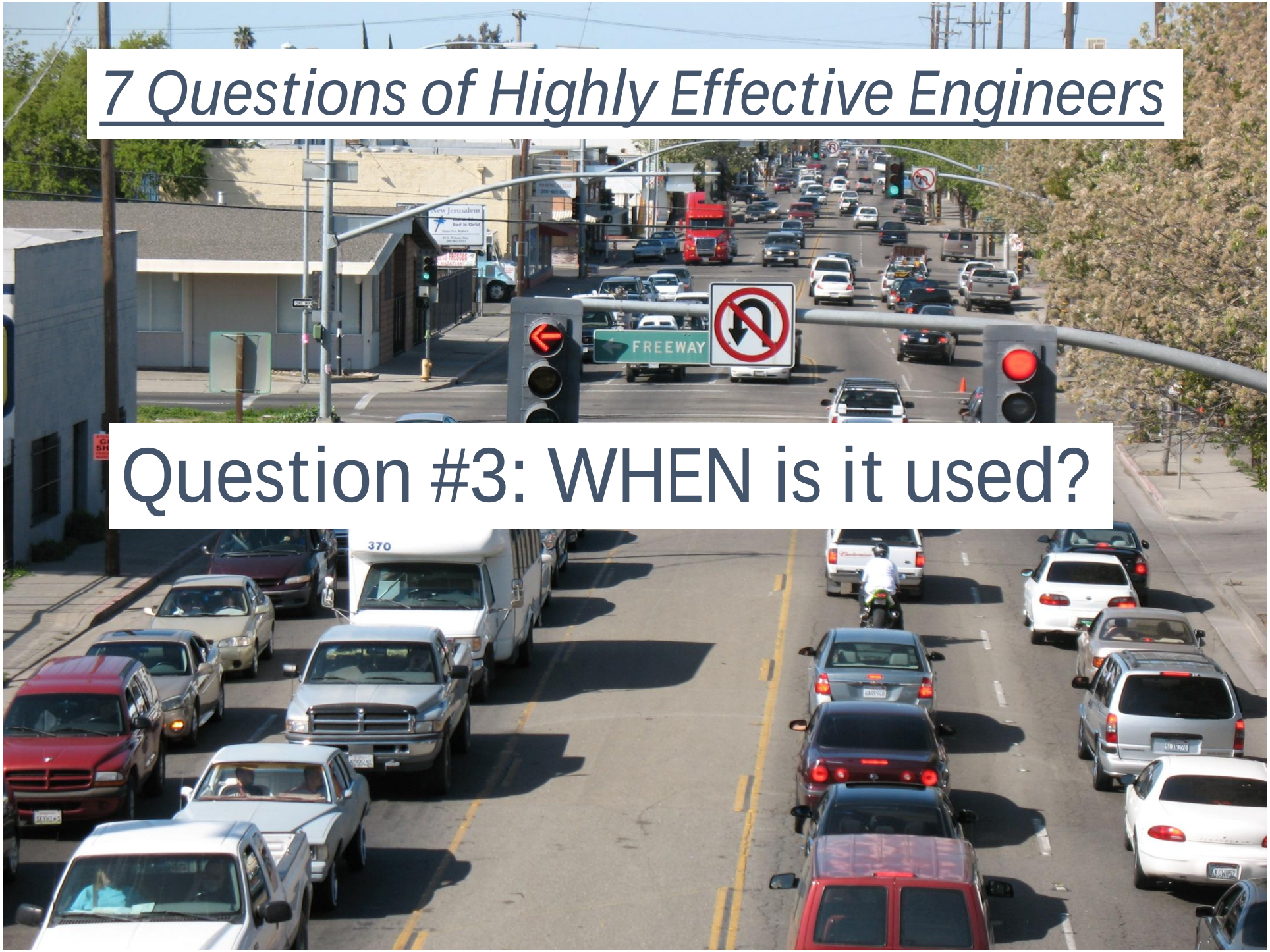
Question #2: WHERE is it needed?

7 Questions of Highly Effective Engineers

A minimum 2-mile long through corridor with at least 5 coordinated signals on a roadway with:

a) 1 lane in each direction & homes on both sides
b) 2 lanes in each direction with ADT>30,000
c) 3 lanes in each direction with ADT>40,000
d) 1 lane in one direction with ADT>1,000

7 Questions of Highly Effective Engineers



Question #3: WHEN is it used?

7 Questions of Highly Effective Engineers

A minimum of….

1) Once an hour
2) Once a day
3) Once a week
4) Once a month

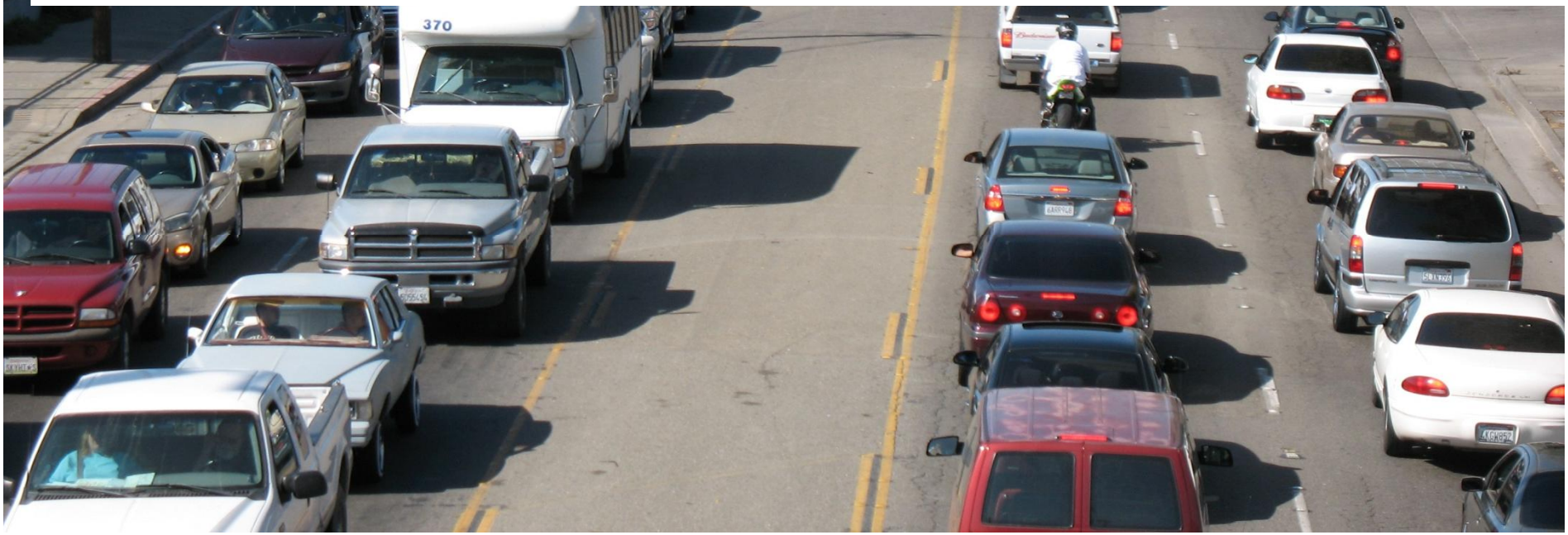
7 Questions of Highly Effective Engineers

To evaluate when Adaptive is effective, we need:

a) Minimum two weeks of ADT counts
b) Documented cycle failures
c) Travel time runs under typical conditions
d) Travel time runs under spiked conditions

7 Questions of Highly Effective Engineers

Question #4: WHAT are the alternatives?



7 Questions of Highly Effective Engineers

Alternatives to Adaptive include:

a) Do nothing and don't apply for the grant

-BIGGER is not always better

b) Retime corridor (~$4K/intersection)

c) Traffic responsive at 2/3 the cost (e.g., $50K per intersection vs $75K for adaptive)

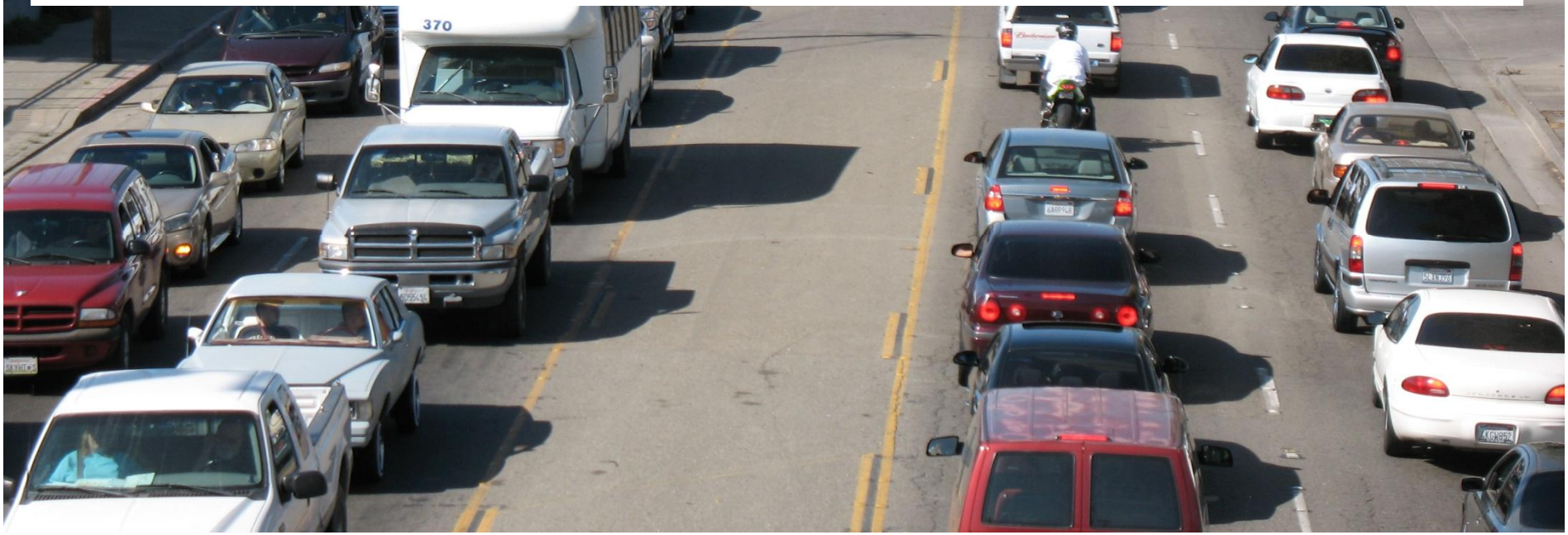
d) Remote monitoring of key intersection(s)

Oakland AIR-BART Pre-Nov. 2014: $3 fare

Oakland AIR-BART $484M Later: $6 fare

7 Questions of Highly Effective Engineers

Question #5: HOW to measure success?



7 Questions of Highly Effective Engineers

Measures of Effectiveness for Adaptive include:

a) Reduced delay on travel time runs

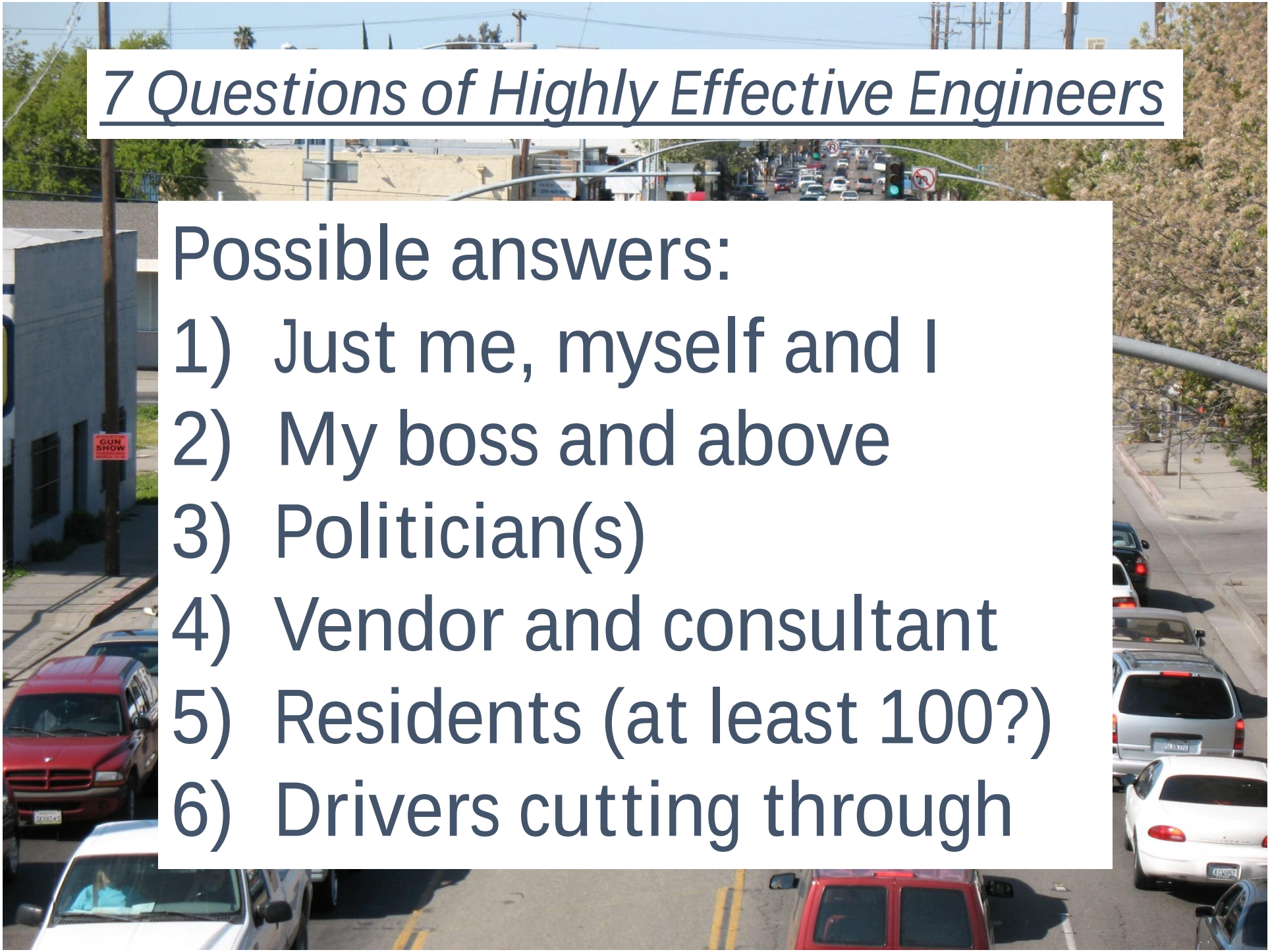
b) Less cycle failure at key intersection(s)

c) Fewer complaints regarding coordination

d) Lots of thumbs up on City's Facebook post

7 Questions of Highly Effective Engineers

Question #6: WHO cares?



7 Questions of Highly Effective Engineers

Possible answers:

1) Just me, myself and I
2) My boss and above
3) Politician(s)
4) Vendor and consultant
5) Residents (at least 100?)
6) Drivers cutting through

7 Questions of Highly Effective Engineers

Early findings from a 2014 Deployment

Per Signal Tech… "*I was called out to this intersection today due to it was not servicing any L/T's or Side street. I observed operation and noticed that the left turn had to wait 80 seconds for a call. I contacted "Adaptive Co." tech support. He was also seeing the same issue. I disabled the adaptive system and monitored the intersection= Good. All calls were getting their service. There seems to be a problem with the adaptive system. We checked some things in the cabinet. Tech suggested we leave the adaptive disabled in the software and run on detection due to vehicles running the intersection. Adaptive Co. will troubleshoot on Monday morning."*

7 Questions of Highly Effective Engineers

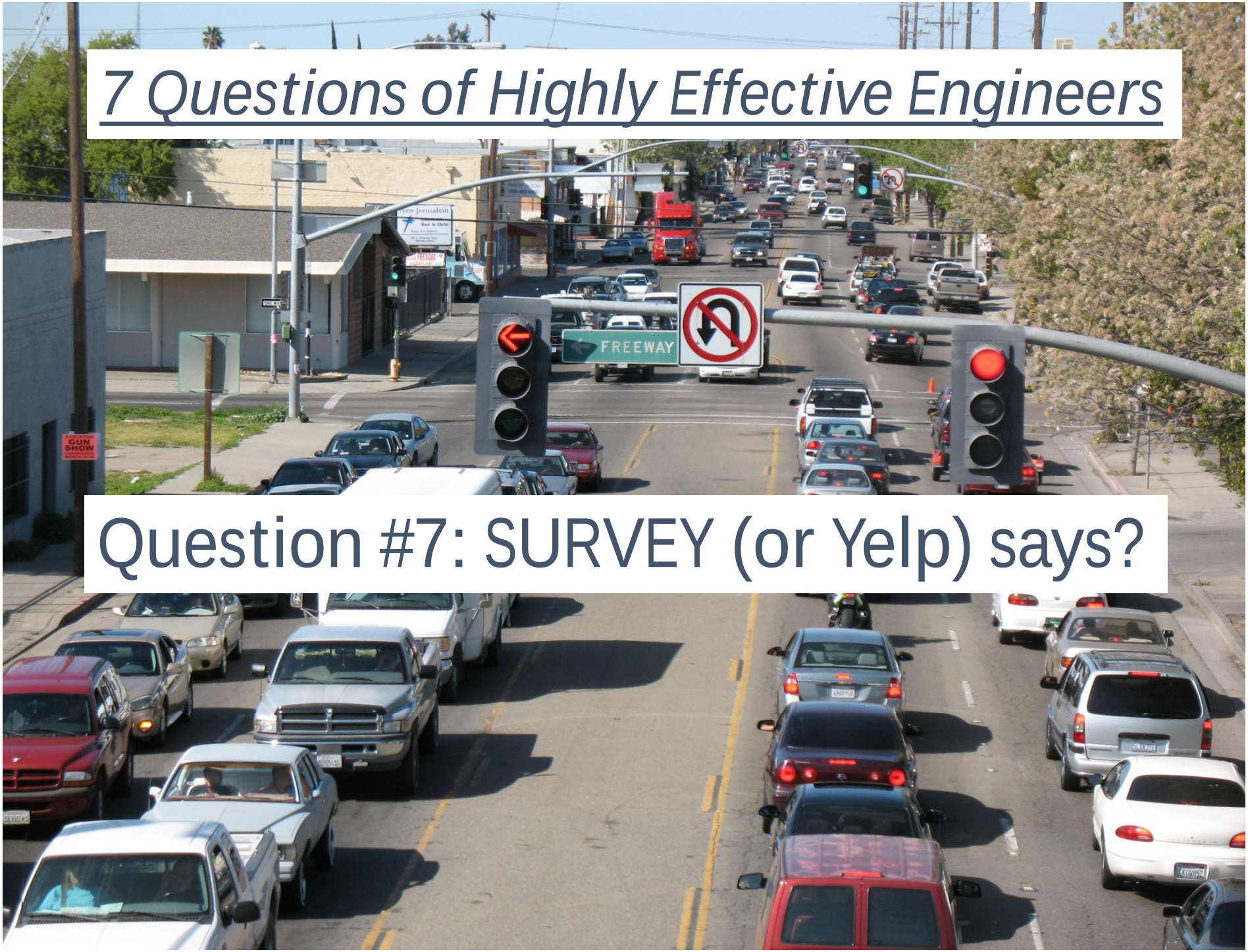
More findings from the same 2014 Deployment

•Adaptive System Doesn't Count Traffic Accurately

•Per Engineer, Adaptive Initially Made Things Worse: *"The longest green was about 25 sec., and the shortest green was about 15 sec. The LT queue was about 900+ feet at the most. Before project the LT queue was about 600 ft".*

– i.e., Adaptive made the LT queue longer by 12 cars

7 Questions of Highly Effective Engineers



Question #7: SURVEY (or Yelp) says?

7 Questions of Highly Effective Engineers

Out of 299 Agencies, only 19% have Adaptive

153 Agencies Responded to….

“What does your agency consider the most significant barrier to implementing adaptive control?

7 Questions of Highly Effective Engineers

Most Significant Barriers to Implementing Adaptive (from low to high)…

- Complexity to operate and maintain (8%)
  - What is the annual O & M cost?
- Incompatibility with existing system (8%)
  - Beware of intersecting systems

7 Questions of Highly Effective Engineers

Most Significant Barriers to Implementing Adaptive…

- Cost to operate and maintain (16%)

  -O & M costs increase with # of different systems

- Uncertainty about benefits (28%)
  - Besides travel time runs and cycle failures, what MOE is there?

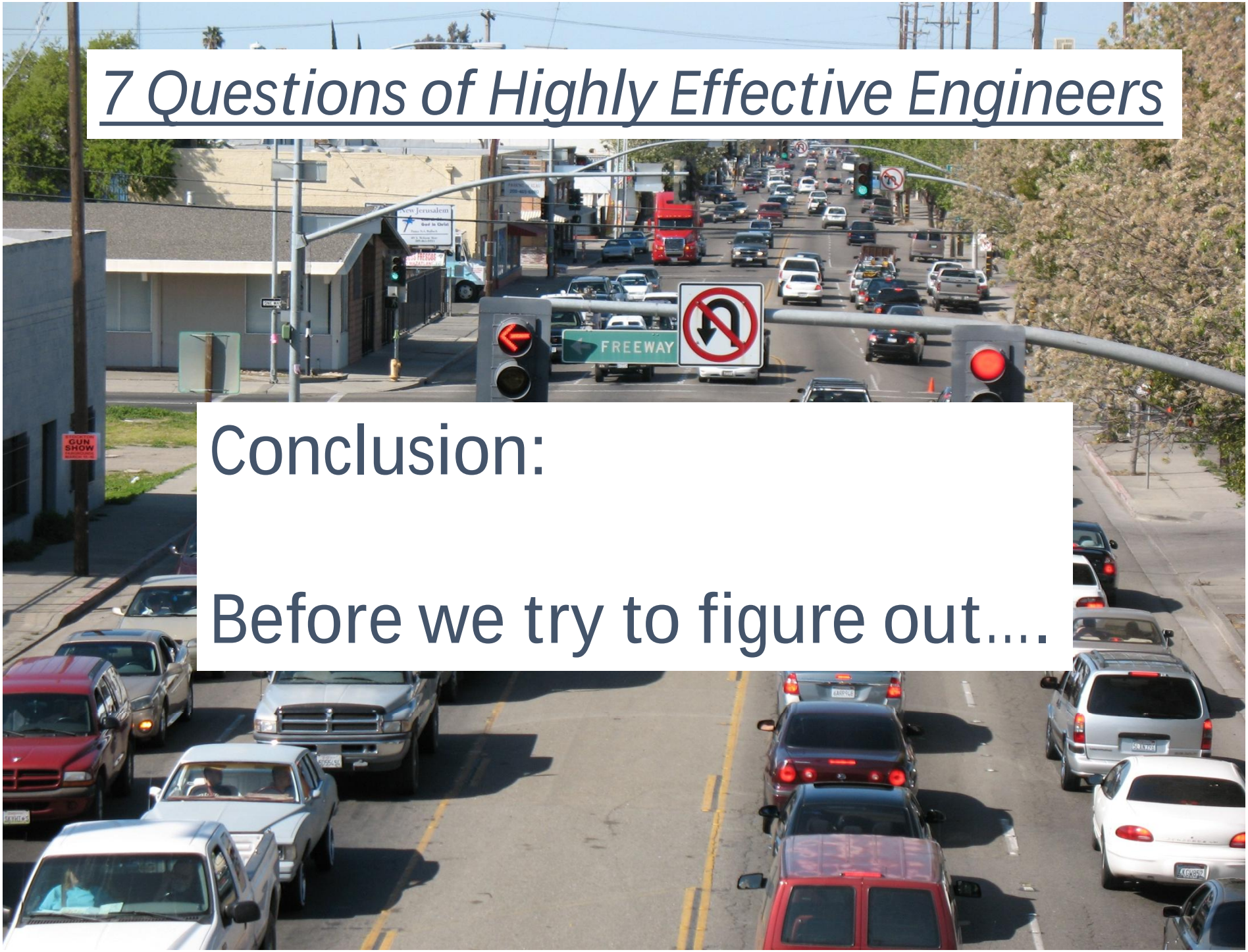
7 Questions of Highly Effective Engineers

Survey says that the #1 Reason Why Agencies Don't Implement Adaptive Is…

- Cost to Deploy (39%): Remember $75K/int.!
  - -Total Project Cost for 3 Adaptive Systems~$4M
  - -Local Match for 3 Adaptive Systems~$440K

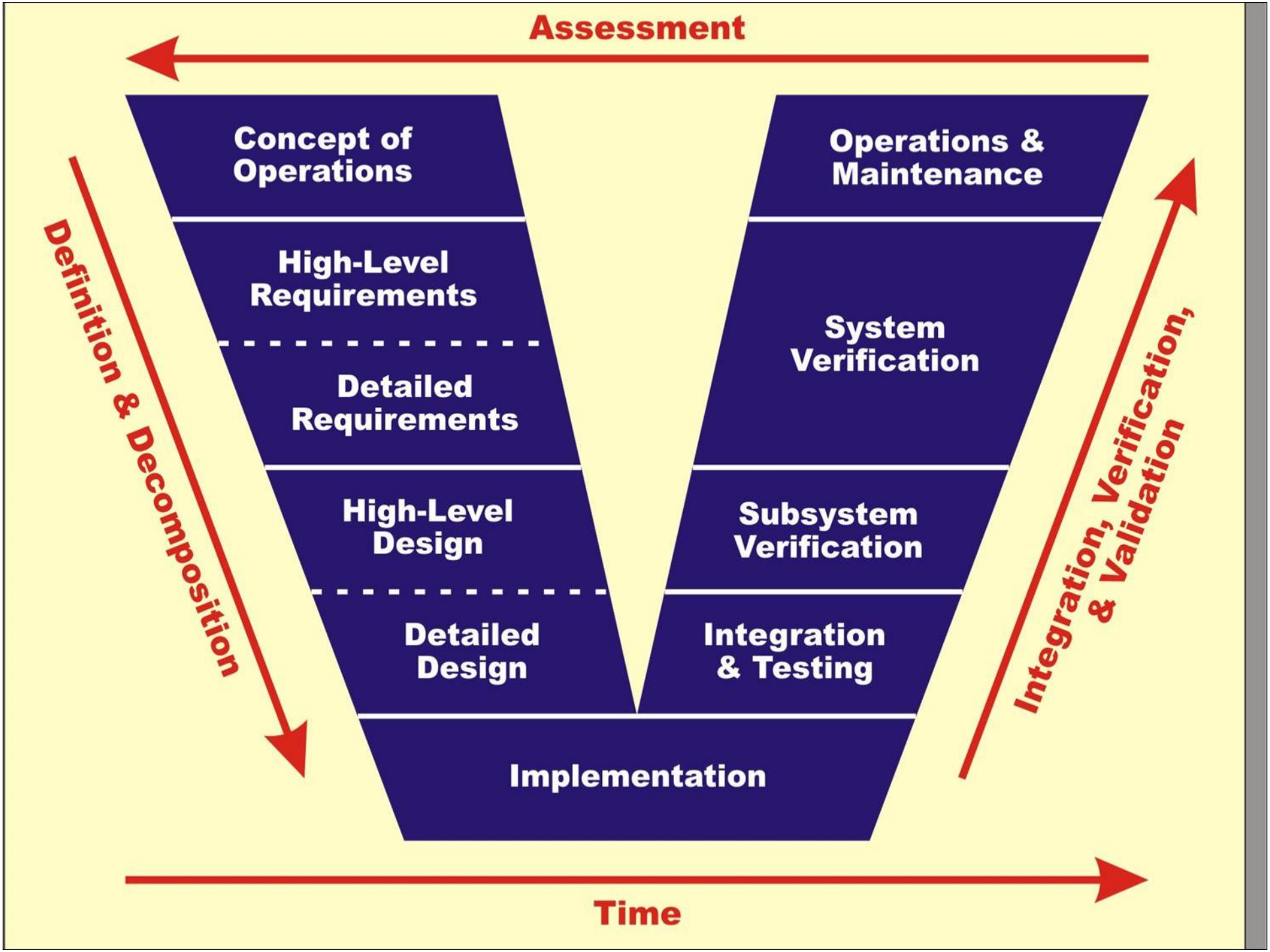
    i.e., a Full-Time Licensed Engineer for 4 years, or the retiming of 110 intersections at $4K/signal

7 Questions of Highly Effective Engineers



Conclusion:

Before we try to figure out….


Assessment
Concept of Operations
High-Level Requirements
Detailed Requirements
High-Level Design
Detailed Design
Implementation
Integration & Testing
Subsystem Verification
System Verification
Operations & Maintenance
Definition & Decomposition
Integration, Verification, & Validation
Time

7 Questions of Highly Effective Engineers

We should ask…

1. WHY build it?
2. WHERE is it needed?
3. WHEN is it used?
4. WHAT are the alternatives?
5. HOW do we measure success?
6. WHO cares?
7. SURVEY says?

May we all be Highly Effective Engineers!

For more info:

Gordon Lum, TE (glum@willdan.com)
Willdan Engineering, 510-695-7434