Interstate Highway

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Background

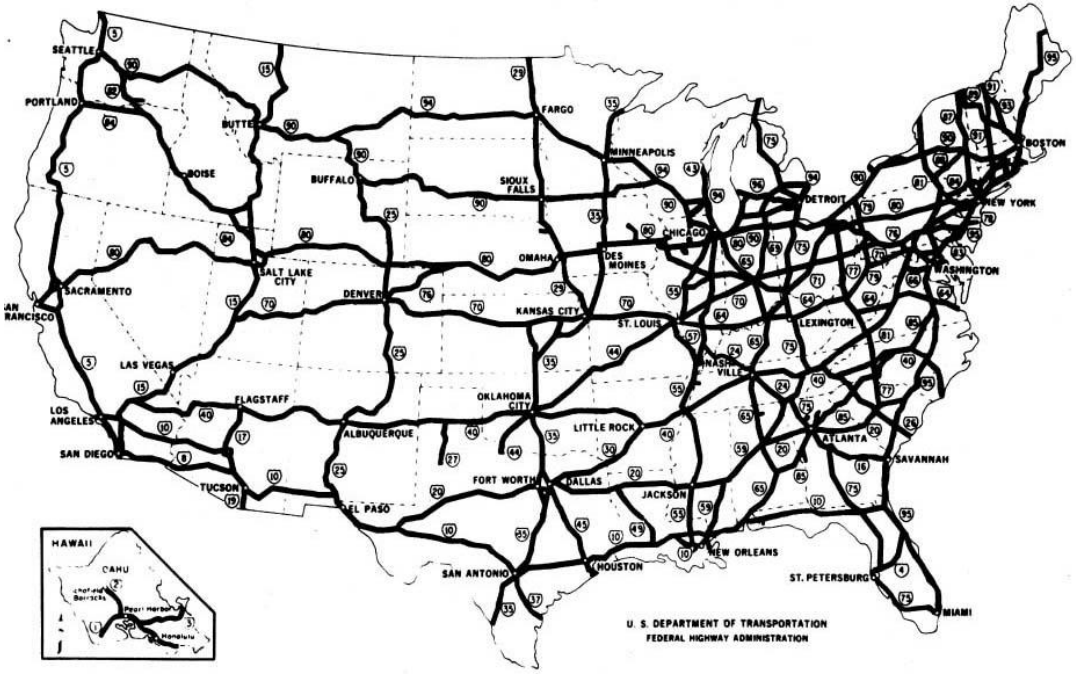
Interstate highway is several highways connect all of the states of US, as of 2016, the total length is 48,181 miles. The interstate highway was firstly constructed on 1956 and as of 2016, the total cost is approximately 499 billion dollars.

Our mission is to analyze the potential problems of interstate highway from the internal perspective and external perspective and explore the solutions to prevent the failures and solve the problems by using quality analysis methods.

Interstate Highway Map

Interstate Highway Map before

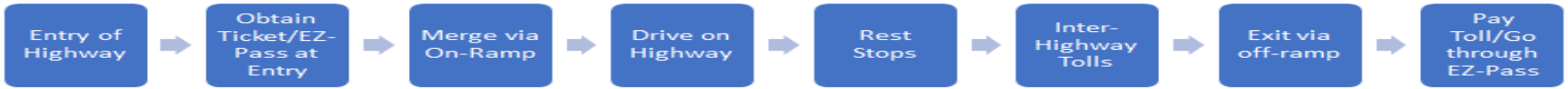
Oct. 24 2014.



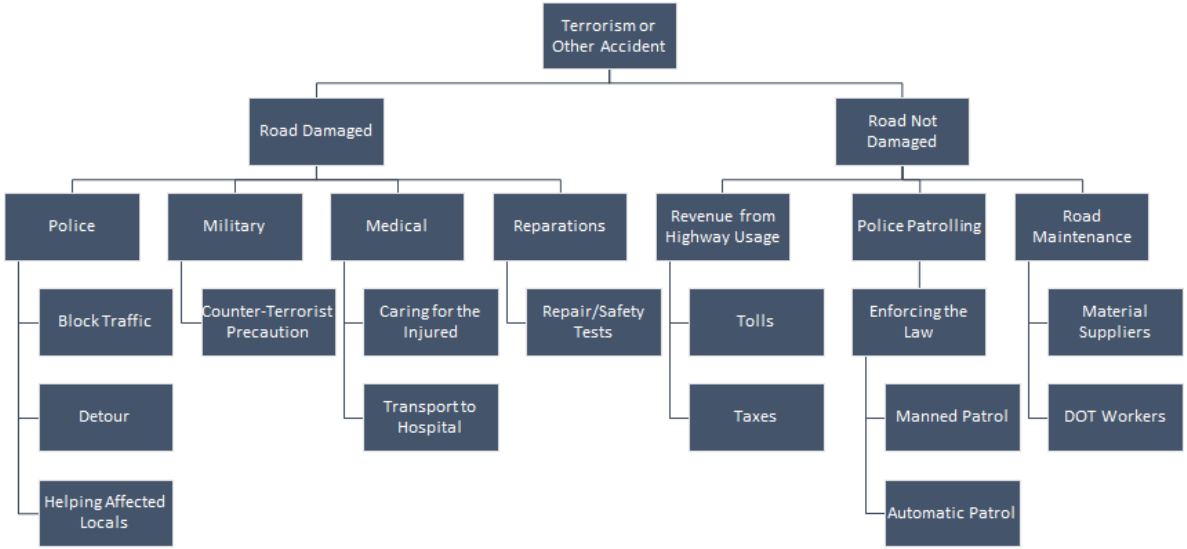
Brainstorming

interstate Highway users	Before	In Emergency	After
government	resting area	Above-average congestion	maintaince
truck drivers	emergency stop lane	evacuation	public report
travelers	manned and automatic tolls	response on time	training
shipping companies	camera recording every vehicle enter and exit	transportation	
police officers	education	medical support	
highway construction works	monitoring	emergency broadcast	
military	training	block entrance	

Process Flowchart (in progress)



Organizational Flowchart (in progress)



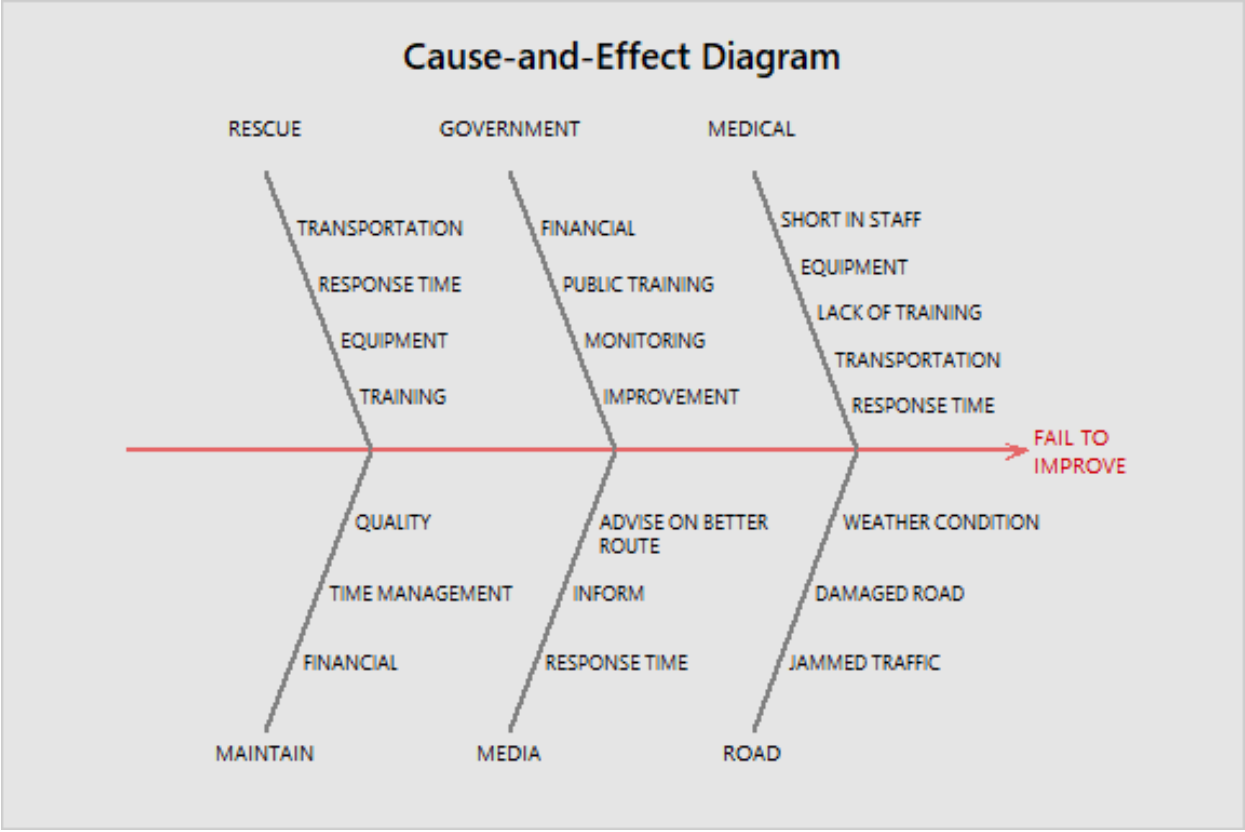
Cost of Poor Quality

COPQ	Internal	External	Appraisal	Prevention
evacuation	-traffic jamed -road destroyed	-people panic -lack of transportation	-check the real-time traffic status of the road	-clear the traffic -emergency lanes saprate from the highway
monitoring	-lack of technology -lack of highway enforcement	-weather -complex situations	-check the hardware of monitor -training	-update the software and hardware for equipment -assessment of law enforcement officer
Road Maintenance	-high cost on maintance workers	-bad weather	-training the basic technical worker -always check the weather forecast	-let experienced workers maintenance the road on better weather
Security	-pavement aging -metal structure rusting	-extreme weather like heavy snow -terrorism -overspeeding	-check the real-time traffic status of the road -check the highway crime rate	-broadcast and close the highway in danger -improve the ability of law enforcement officer
highway resting area	-high cost -hard to hire workers	-low consumer flow rate	-do the market survery on consumer satisfication, worker induction intention. -do the cost analysis on construction	-Base on the survey analysis results, decide the optimal location, design income and expense system.
toll gate	-high cost -hard to hire workers	-some out-of-state vehicle forced pass the non-officer tollbooth	-check the rate of forced pass -evaluate the cost of construction and workers	-build the licence plate shared system -reduce the cost on

Affinity Diagram

MEDICAL	ROAD	GOVERNMENT	MEDIA	RESCUE	MAINTAINCE
short in staff	jammed traffic	financial	response time	transportation	financial
equipment	damaged road	public training	inform	response time	time management
lack of training	weather condition	monitoring	advise on better route	equipment	quality
transportation		improvement		training	
response time					

FISHBONE CHART



Quality Assessment: List of individuals to Interview

Head of Police Department

Head of Road and Transportation Department

Head of Medical Department

Head of Military

Head of Fire & Rescue Departments

Quality Assessment: Questions for individuals to Interview

Head of Police Department

Is there an officier on patrol around that area that reach the site of accident as soon as possible？

Is there enough local police able to secure the accidental area？

Head of Road and Transportation Department

Is the detour road already been assigned in order to keep the transportation available?

Is the road situation already been noticed on the Road sign screen or toll stations?

Quality Assessment: Questions for individuals to Interview

Head of Medical Department

Are the ambulances ready for the long distance rescue？

Are the doctors already been acknowledge the expected situations?

Head of Military

If there are terrorists attack, does the armed level already been acknowledged？

Is there a team ready for the emergency response ？

Quality Assessment: Questions for individuals to Interview

Head of Fire & Rescue Departments

Are there enough experts to salvage victim from the car accident or the ruins of the building?

Are there enough fire truck ready for the accident?

Quality Assessment: Answers for individuals to Interview

Head of Police Department

No, we need to assign a group of officers go to the reach the accident area as soon as possible.

No, we don't have enough officer work in this area we may need police department from other cities to have a combined action.

Head of Road and Transportation Department

Yes, but the officers are on the way to place the sign and do the vehicle detour guide.

Yes, but there still some road don't have a traffic notification screen.

Quality Assessment: Answers for individuals to Interview

Head of Medical Department

The local hospital don’t have enough expert that can go on salvage. We may need other hospital’s help.

The Victim probably die of excessive loss of blood, but there is not enough blood in the storage.

Head of Military

We don’t have the armed level of the terrorist. we can only assigned a group first to investigate the situation.

Quality Assessment: Answers for individuals to Interview

Head of Fire & Rescue Departments

We need more technical tool in order to apply the salavage.

Quality Assessment: The Results

Victims can't get the treatment timely

Traffic congestion

Rescue problem (tools, Technic)

Unnecessary casualties(Unable fire down)

Chaotic situations

Improvements to Current System (Suggestions)

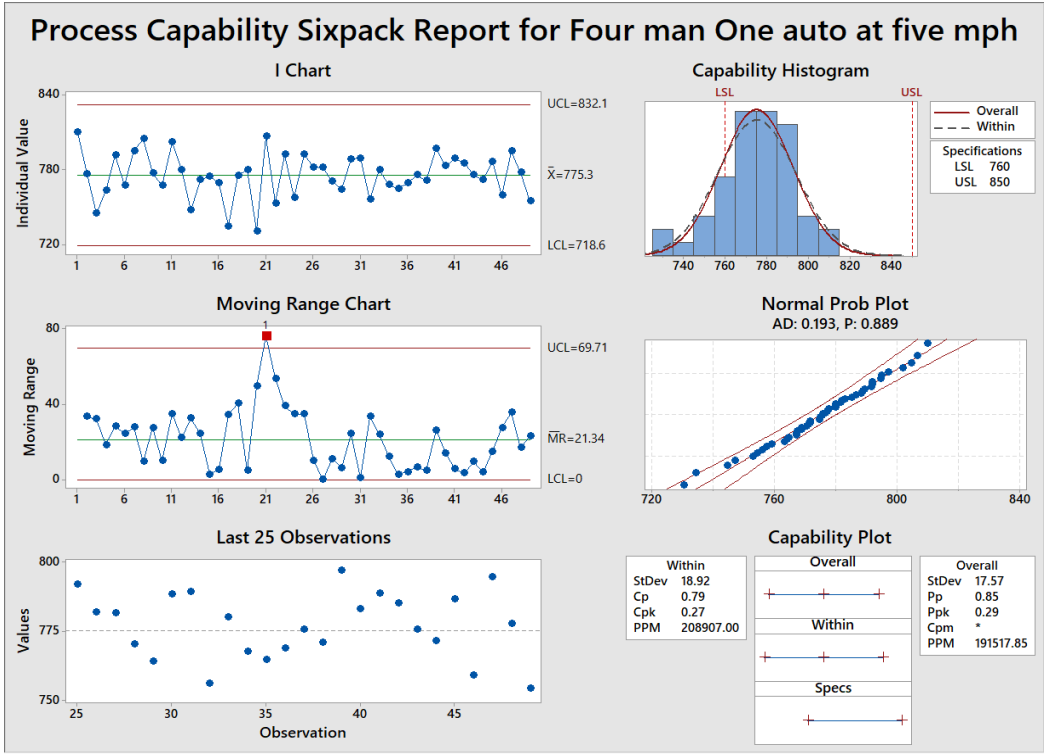
- Many aspects to change that would work
- Toll booths for six pack analysis
- Automating a 5 laned toll from the more common 4 manned lanes and 1 automation lane
- Increasing automated toll speed from 5mph to 20mph

Assumptions in Process Capability Analysis

- A “manned” toll stop takes 12 seconds on average
- 5 mph automation takes ~2 sec
- 20 mph “ “ ~1 sec
- Variance in these times is unavoidable but setting a standard for theoretical analysis
- Counting how many vehicles go through a toll every half hour during a day
- Constant traffic flow
- Too many vehicles will cause traffic clogging at tolls (USL)
- Too few will provide lack of desired revenue for funding (LSL)

Process Capability (4 Manned 1 Auto)

- Random data with mean 780;
- and variance 20
- LSL= 760; USL=850
- $\bar{x}$= 775.3; σ=17.57
- Cp=0.79; Cpk=0.27



Process Capability (5 Auto)

- Random data with mean 1800
- and variance 25
- LSL= 1700; USL=1900
- $\bar{x}$= 1803; σ=31.82
- Cp=1.00; Cpk=0.98