Florida Keys Hurricane Mitigation

Group 8

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Introduction

- Irma Hurricane developed on August 30 near the Cape Verde Islands and formed a rapidly intensified to tertiary hurricane in the near future and subsequently cycled in intensity between levels two and three due to eye-wall replacement cycles and then sharply increased to five on September 5 Hurricane to become the longest remaining hurricane in the satellite era, making it the strongest hurricane in 12 years. After making a heavy hit in the Caribbean and finally entering the United States, Emma has caused 102 deaths and an economic loss of more than 62.8 billion U.S. dollars.
- Irma Hurricane landed in Florida on the 10th and brought powerful winds upon landing, killing at least 50 people and causing several blackouts.

Differences

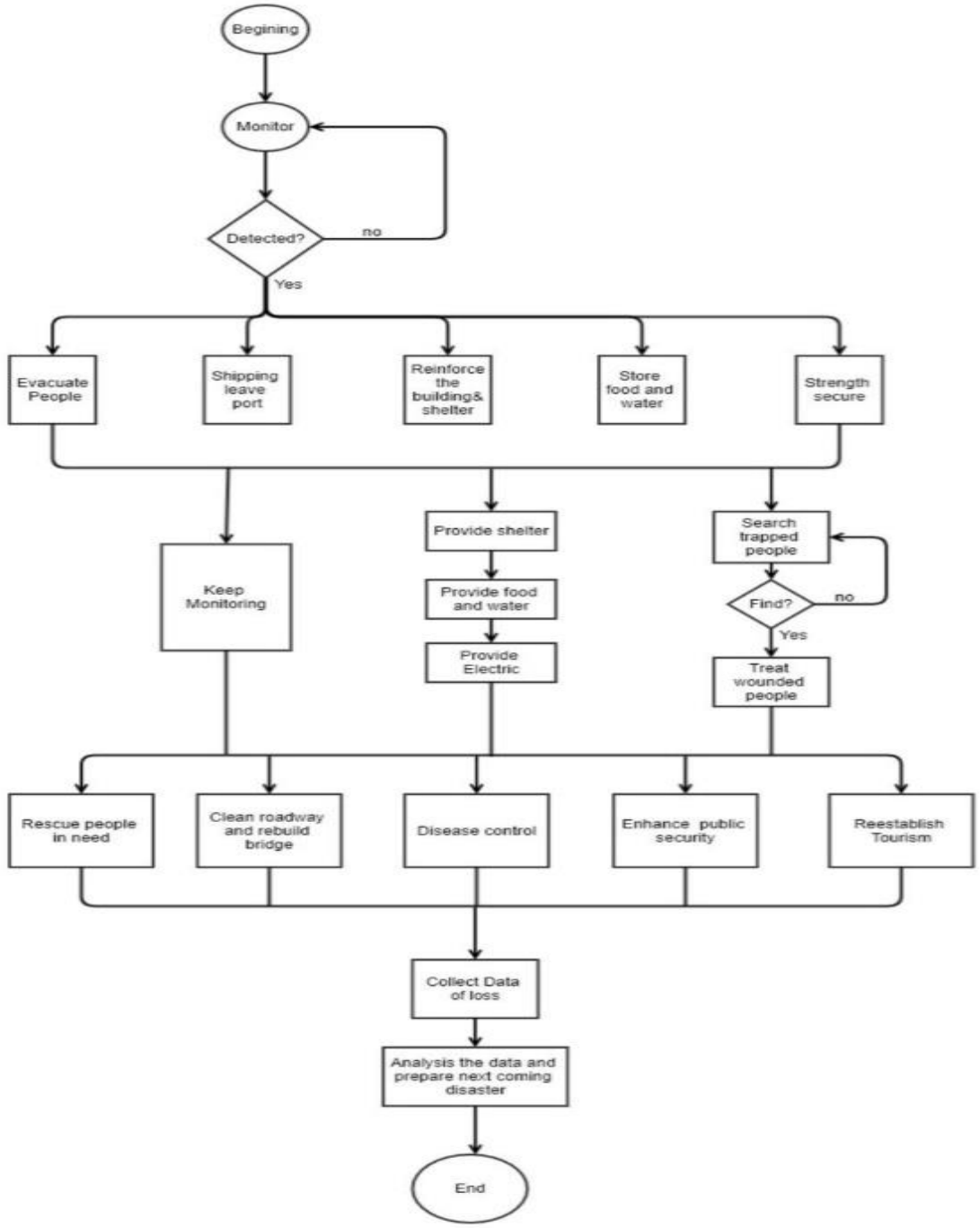
Why it caused much damage in Keys?

- Because Irma Hurricane was the strongest in 12 years
- Keys area is surrounded by the sea, unable to stop the hurricane, and can not be drained
- Just has one highway to mainland
- Remote location, away from the mainland, communications and transport inconvenience

Brainstorm Section

Before	Coming	During	After
Hospital	Government(Moniter and report)	Telecom and Electricity supply	Reestablish toursim
Public Facilities	Evacuate people(ship, airplan, car)	Searching trapped people	Clean roadway
Public Transportation	Building(reinforce)	Open shelters	Provide house for refugees
Telecom	Boat(leave port)	Wounded people treatment and rescue	Rebuild House
Environment(protection)	Emergency(food,water)	Emergency(doctor, nurse, policeman)	Insurance
Tourism		News report	Hospital(doctor and medicine)
Harbour(ship management)			Data collection and analysis
Storage(shelter,food,water)			
Emergency(medicine, fireman,policeman)			

Flow chart


Begining
Monitor
Detected?
no
Yes
Evacuate People
Shipping leave port
Reinforce the building& shelter
Store food and water
Strength secure
Keep Monitoring
Provide shelter
Provide food and water
Provide Electric
Search trapped people
Find?
no
Yes
Treat wounded people
Rescue people in need
Clean roadway and rebuild bridge
Disease control
Enhance public security
Reestablish Tourism
Collect Data of loss
Analysis the data and prepare next coming disaster
End

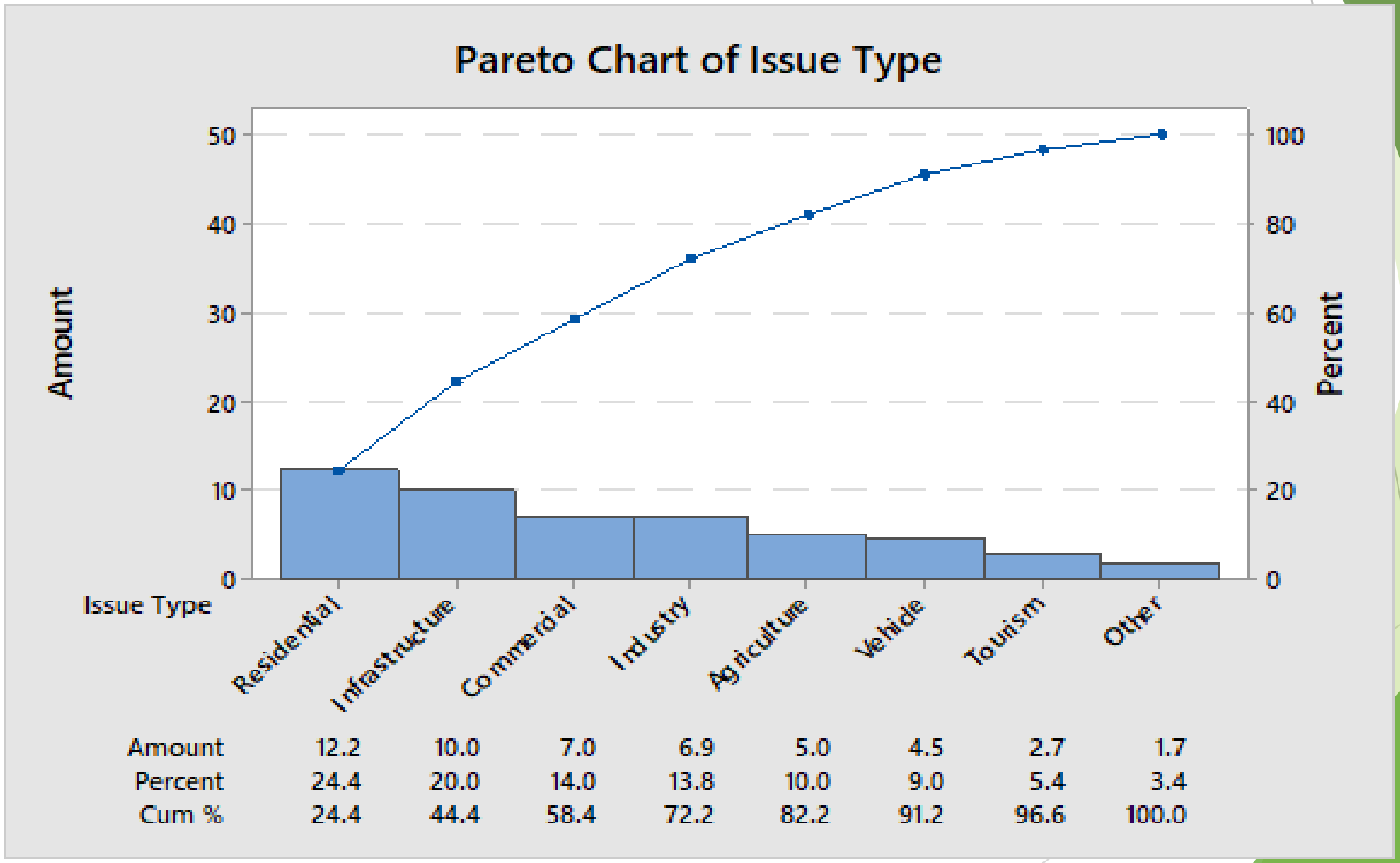
COPQ

Process	Internal Failure	External Failure	Appraisal	Prevention	Hidden Quality Cost
Energy Supply(electric and fuel)	Generators are too old and unsound Bad quality Low-lying position (easy to be flooded)	No idea to storage No-inspect, maintenance generators No good repairmen because of remote location(island) Limited storage capacity	Reliability of all equipment Safety Storage capability repairmen	Sustaining Moving Maintenance Storage	Power interruption Lack fresh water etc. Increase in price
Monitor Hurricane Early warning	Instrument low precision Equipment failure	False Notification No power	Test equipment	Better technology Increase intensity of inspection Back up energy	
Build/robust/repair houses and shelters	Material cost The quality of buildings bad No enough space to build	Houses are flooded Lack power Traffic paralysis because of Flooding	Structure stability Safety Location	Sustaining Repairing Inspection Advance preparation	Labor cost Equipment Power Compensation
People evacuation	Vehicle broken	Rumor Traffic jam	Efficiency Drill	Toll highway Vehicle repair	Accident
Communication	Equipment failure No enough scope	Flooding Hurricane	Test equipment	Better technology Increase intensity of inspection Back up energy	Damage

List of Concerns from COPQ

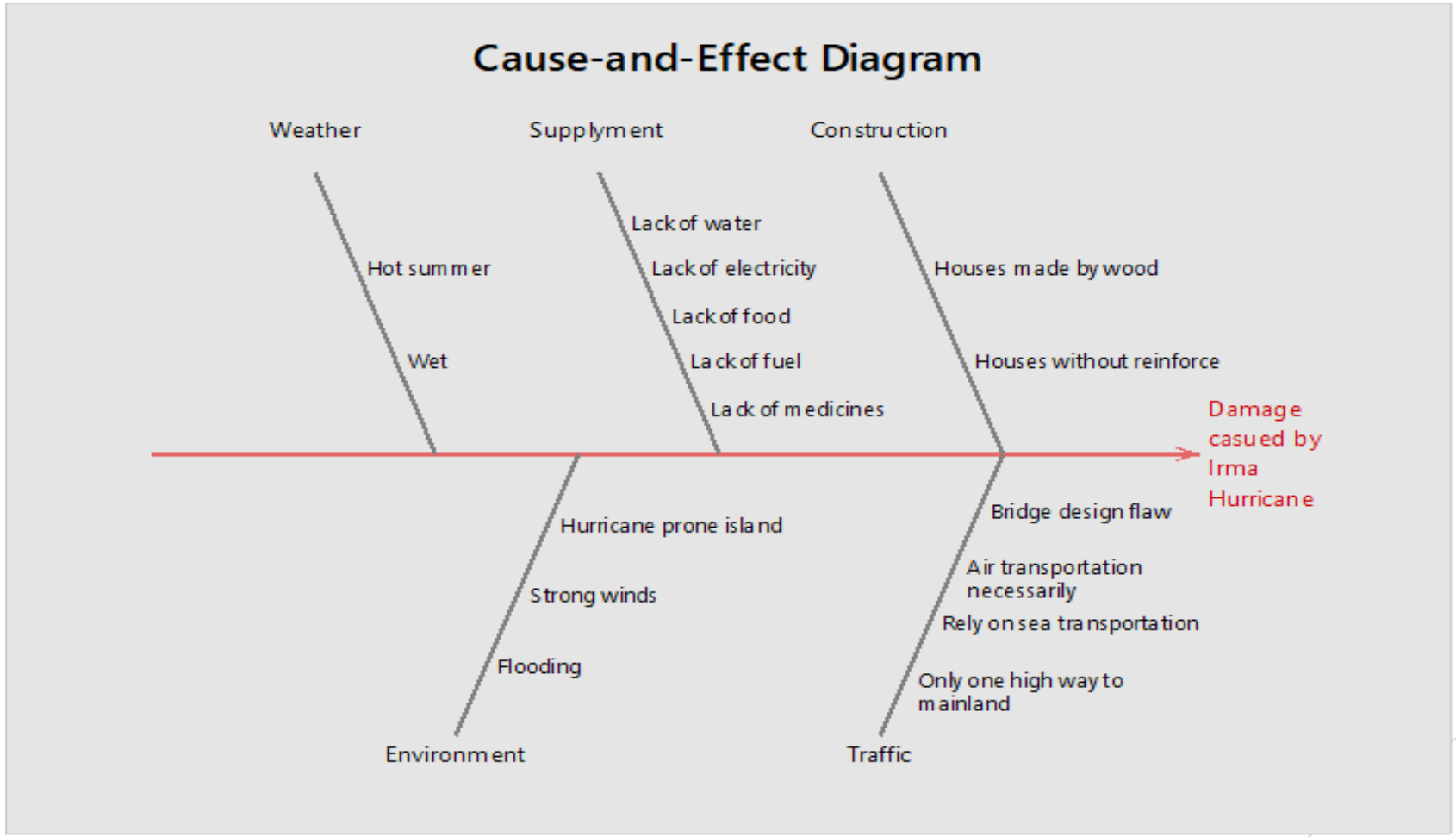
- Infrastructure
- Technology
- Monitor weather condition
- Buildings and shelters Construction problems
- Equipment availability
- Traffic (cars, ships and airplanes)
- People evacuation
- Communication

Pareto Chart



Amount	12.2	10.0	7.0	6.9	5.0	4.5	2.7	1.7
Percent	24.4	20.0	14.0	13.8	10.0	9.0	5.4	3.4
Cum %	24.4	44.4	58.4	72.2	82.2	91.2	96.6	100.0

Ishikawa cause-and-effect diagram




Define
Measure
Analyze
Improve
Control
Six Sigma

Define:

- Not enough people to keep the order
- Lack of resource
- Bad quality of building
- Too late to rescue
- Communication is blocked

Measure:

- Verify the project need
- Document the process
- List possible X’s that impact Y
- Plan for data collection

List of X’s that impact Y

Questions X	Did not solve Y
Not enough people to keep the order	Encourage people to keep in order
Lack of resource	Storage enough resource
Bad quality of building	Use advanced building material and structure
Too late to rescue	Be ready to rescue anytime
Communication is blocked	Enhance the rescue quality

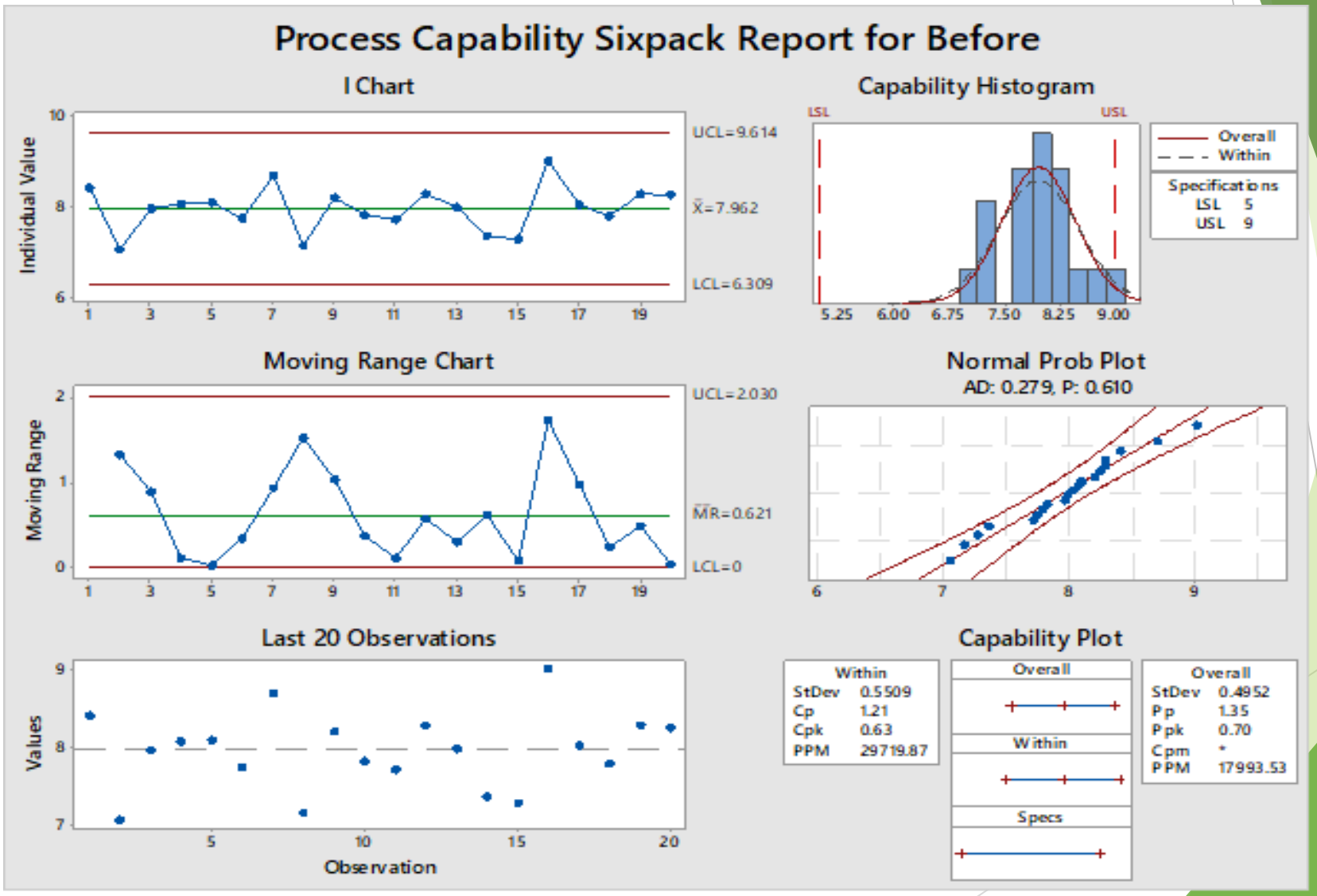
Analyze:

- Data collection plan
- Hypothesis test

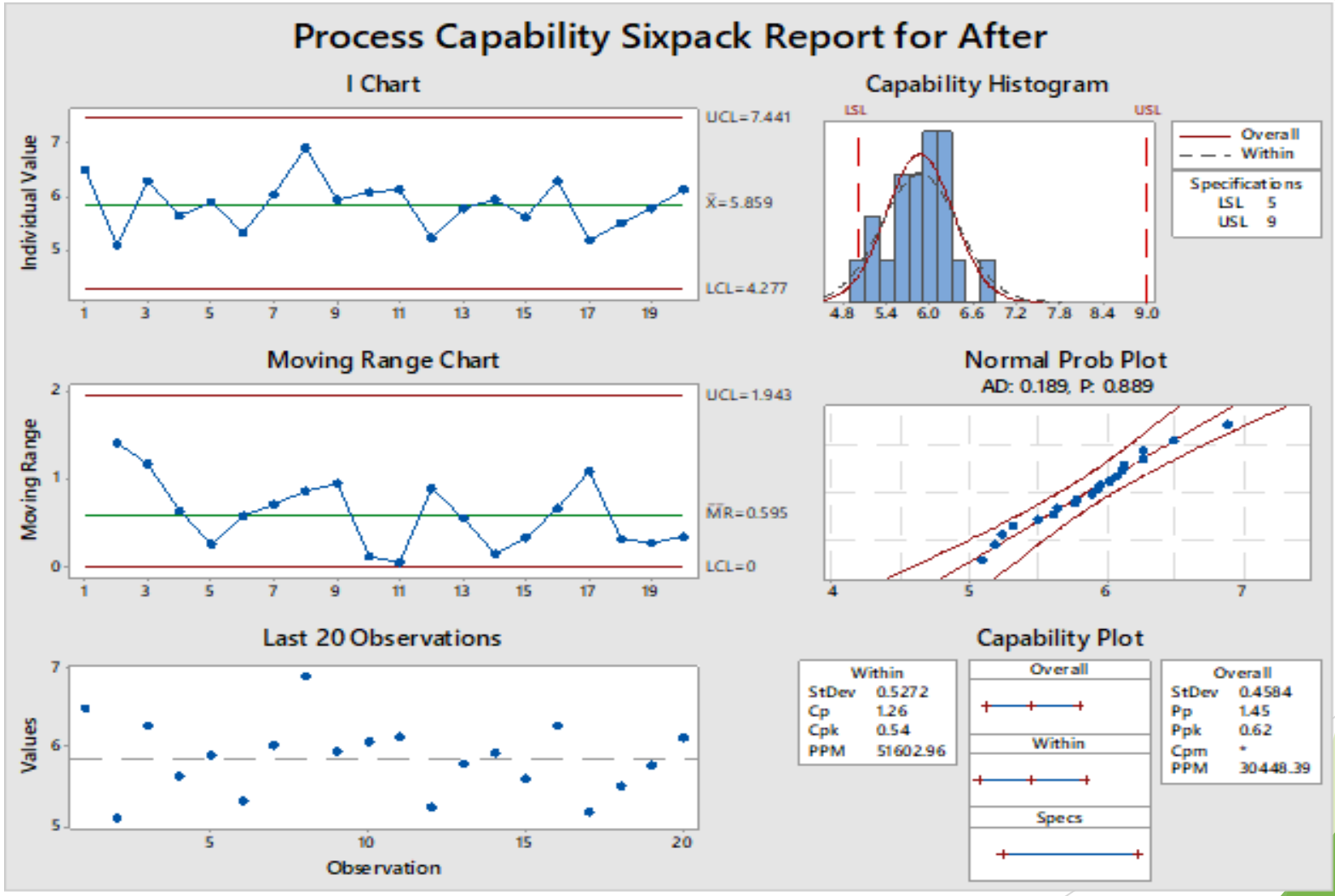
Descriptive Statistics : travel time to Keys

Before	After
8.40533	6.49457
7.06508	5.09739
7.96415	6.27106
8.07425	5.63962
8.09350	5.89359
7.74661	5.31623
8.69553	6.02518
7.16234	6.88813
8.20017	5.95057
7.82663	6.07462
7.71591	6.12581
8.29274	5.23718
7.98704	5.78376
7.35938	5.93171
7.27478	5.60792
9.01157	6.27064
8.02983	5.18574
7.79178	5.50285
8.28759	5.77360
8.24766	6.11263

Descriptive Statistics: Before



Descriptive Statistics: After



Improve:

- Improvement strategy
- Process FMEA
- DOE

Example : Poor quality of traffic congestion

- FMEA: Poor quality of traffic congestion
- DOE: Testing the performance of people to keep order
- Improvement Strategy: According to degrees of congestion, prepare different number of people

Control(use 5s method):

- Sort: identify the numbers of car in different region
- Set in order: make sure drivers obey the traffic rules
- Shine: police officer should deal with the traffic conjunction very quickly
- Standardize: keep monitors always in work to find the situation immediately
- Sustain: let people obey the traffic rules

Design

- Emergency situation should be discovered by monitoring system timely.
- Arrange resident or tourists evacuate completely and timely.
- Relief supplies must be sustainable and sufficient.
- Ensure communication unimpeded.

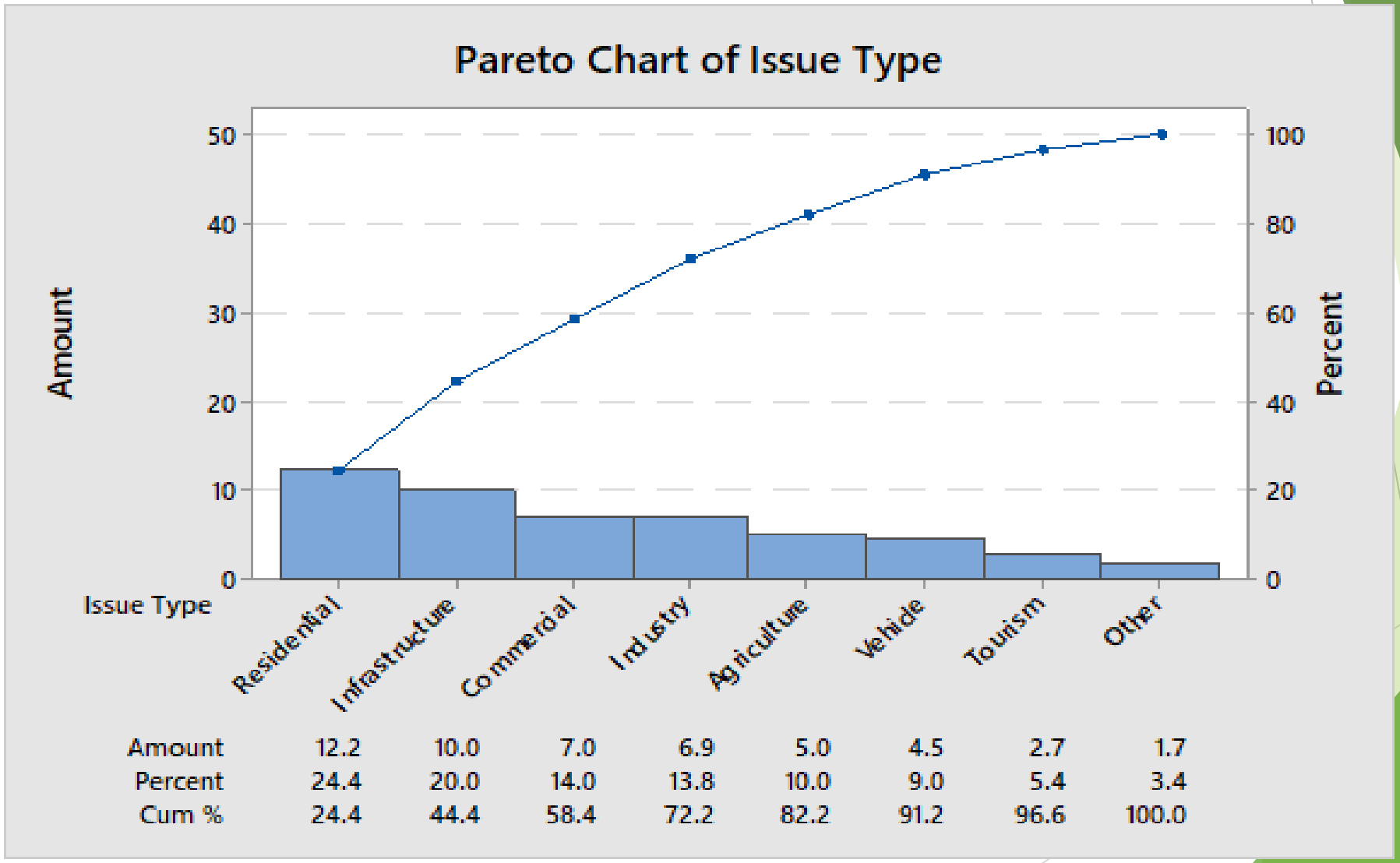
Verify

- Verification test should be done.
- Do we have enough funds to make all system available.
- Transition documentation.
- In DFSS after the analyze and design step which are the main parts of problem solving we move to optimize or verify phase, if they are minimal problems in reduce damage we can consider this system as a concept of solution and in these parts we will try to develop the concept in minimization of loss.

Result

- Enough peacekeepers to ensure everything in order.
- Sufficient supplement of resource.
- Building reinforcement.
- Better plan and arrangement to make evacuate timely and completely.
- Emergency telecommunication equipment ensure communication unimpeded.

Pareto Chart



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Customer Needs

Custom which was impacted by the Hurricane

- People
- Transportation
- Infrastructure
- Commerce
- Industry
- Agriculture
- House
- Tourism

Customer need / Custom	Information	Water	Food	Fuel	Energy	Telecom	Material
People	9	9	9	0	0	9	0
Transportation	0	0	0	9	9	0	9
Infrastructure	0	0	0	0	9	0	0
Commerce	5	5	5	0	5	5	0
Industry	0	0	0	5	5	0	0
Agriculture	5	1	0	1	0	0	0
House	0	0	0	0	0	0	9
Tourism	9	5	5	5	0	9	0

Product Features

- Local Output
- Transport
- Store
- Fund
- Data
- Equipment
- Quality
- Number

Product Features / Customer needs	Local output	Transport	Store	Fund	Data	Equipment	Quality	Number
Information	9	9			9	9		
Water	1	9	9					9
Food	1	9					9	9
Fuel	1	9	5					
Energy	1	9			5	9		
Telecom	9	9			9	9	1	
Material	1	5	1	9			5	1

Process Features

- Flow Chart
- Manufacturing and Design
- Budgeting
- Survey
- Inspections
- Controlling
- Communication

Process Feature / Product Features	Flow Chart	Manufacturing and Design	Budgeting	Surveys	Inspections	Contorling	Communication
Local output			9	1		5	
Transport	5	1			5		9
Store		5				9	
Fund			9	3		9	
Data		1		9			5
Equipment		9	5	1	5		
Quality	9	5				5	
Number		1	9				

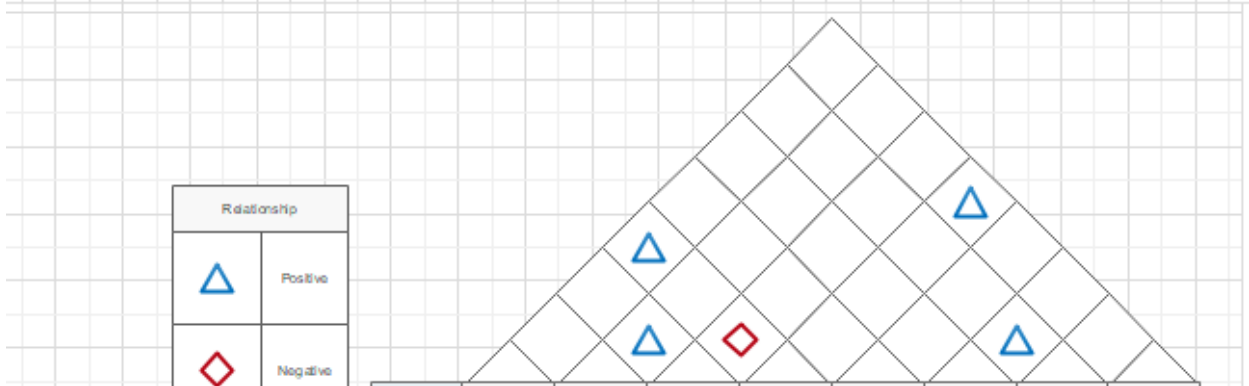
Process Control Features

- Flow Chart
- Manufacturing and Design
- Budgeting
- Survey
- Inspections
- Controlling
- Communication

Process Control Features / Process Features	Real time Monitoring	Data Analysis	Timeline	System engineering	Process Analysis	Quality function deployment
Flow chart			9		5	
Manufacturing and Design	1			9		9
Budgeting		9				
Surveys	5	9				
Inspections	9		1		5	5
Contorling	5	1		1	9	5
Communication			5		5	

House of Quality

- Transport
- Number
- Store
- Quality



Relationship	
△	Positive
◇	Negative
Priority	
9	Strong
5	Mid
1	Weak

Customer Requirements	Customer Importance	Local Output	Transport	Store	Fund	Data	Equipment	Quality	Number
Information	1	9	9			9	9		
Water	3	1	9	9					9
Food	3	1	9					9	9
Fuel	2	1	9	5					
Energy	1	1	9			5	9		
Telecom	1	9	9			9	9	1	
Material	1	1	5	1	9			5	1
Priority Score		28	104	38	9	14	18	33	55