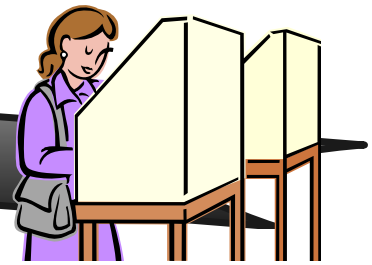
Lean Six Sigma
DMAIC Improvement Story

Black Belt **Project Objective:**

To Reduce Election Day Voting Time

(Lean Approach)

Last Updated: 1-22-14



Team: ***In and Out Voting***

Ray Scher (Team Leader) Michael Johnson Miriam Rivero Robert Vinock
Patricia Prochnicki Patrick Morris Akasha Ramnarine
Carlos Maxwell Lourdes Avalos Amy Horton-Tavera Bill Busutil Mayra Morales

Penny Townsley (Sponsor)

Select Problem

Management evaluated many possible projects using a Project Selection Matrix.

Miami-Dade County - Black Belt Project Selection Matrix

	Area/ Department	Problem/Project	Customer/ Stakeholder	(1-low 5-High) Priority/ Readiness	Selection Criteria A Customer (Accuracy/ Cost /Timeliness)	Selection Criteria B Improve (Performance Gap)	C=A*B Overall
1	**GG/ISD PS/FR**	**Reduce the Cost for Heavy Fleet Repairs**	**Service Delivery Departments**	**4**	**4**	**4**	**16**
2	GG/ISD	Reduce administrative cost per procurement	Service Delivery Departments	3	3	3	9
3	PS/MDFR	Reduce costs of fire inspections	Businesses, Fire Rescue	3	3	3	9
4	**SAO**	**Reduce overall County costs by funding an expedited release program in SAO**	**State Atty Office, County**	**4**	**4**	**3**	**12**
5	Pub Defender	Reduce overall County costs by evaluating an expedited release program in the PDO.	Public Defender's Office, County	3	3	3	9
6	**TP/Transit**	**Reduce Bus Complaints per 100K boardings**	**Bus Riders**	**5**	**4**	**4**	**16**
7	**GG/Elections**	**Reduce the time required to vote on Election Day**	**Voters**	**5**	**4**	**4**	**16**
8	**PS/MDPD**	**UMSA (balance resources)**	**UMSA Residents**	**4**	**5**	**3**	**15**
9	PS/ME	Improve Toxicology case turn-around times	The Public	3	2	3	6
10	**NI/PWWM**	**Increase the Citation Conviction Rate**	**PWWM, Residents**	**5**	**3**	**3**	**9**

Management chose this project because of the importance of voters being able to cast their vote conveniently and timely.

Identify Project Charter

The team developed a team Project Charter.

Project Charter		
Business Case	*Project Name:*	Reduce Election Day Voting Time
	Problem/Impact:	It took some voters an unacceptable time to vote and long lines for voters to cast their ballot as particularly evidenced in the 2012 election.
	Expected Benefits:	Reduce the time it takes for voters to vote.
Objectives	*Outcome Indicator(s)*	Percentage of Voters Voting On-Time
	Proposed Target(s)	95% of Voters Voting in Less than 1 Hour (General/Large Election)
	Time Frame:	August 2013 through December 2013
	Strategic Alignment:	Supports the County's Strategic Plan (General Government Goal #7)
Scope	*In Scope:*	Election Day Voting Process
	Out-of-Scope:	Early Voting
	Authorized by:	Penny Townsley
Team	*Sponsor:*	Penny Townsley, Michael Johnson
	Team Leader:	Ray Scher
	Team Members:	Mike Johnson, Miriam Rivero, Robert Vinock, Paticia Prochnicki, Patrick Morris Akasha Ramnarine, OMB MPPA Staff
	Process Owner(s):	Michael Johnson
	Mgmt Review Team:	Alina Hudak, Penny Townsley
Schedule	*Completion Date:*	13-Dec-13
	Review Dates:	13-Dec-13

Lean Six Sigma Problem Solving Process

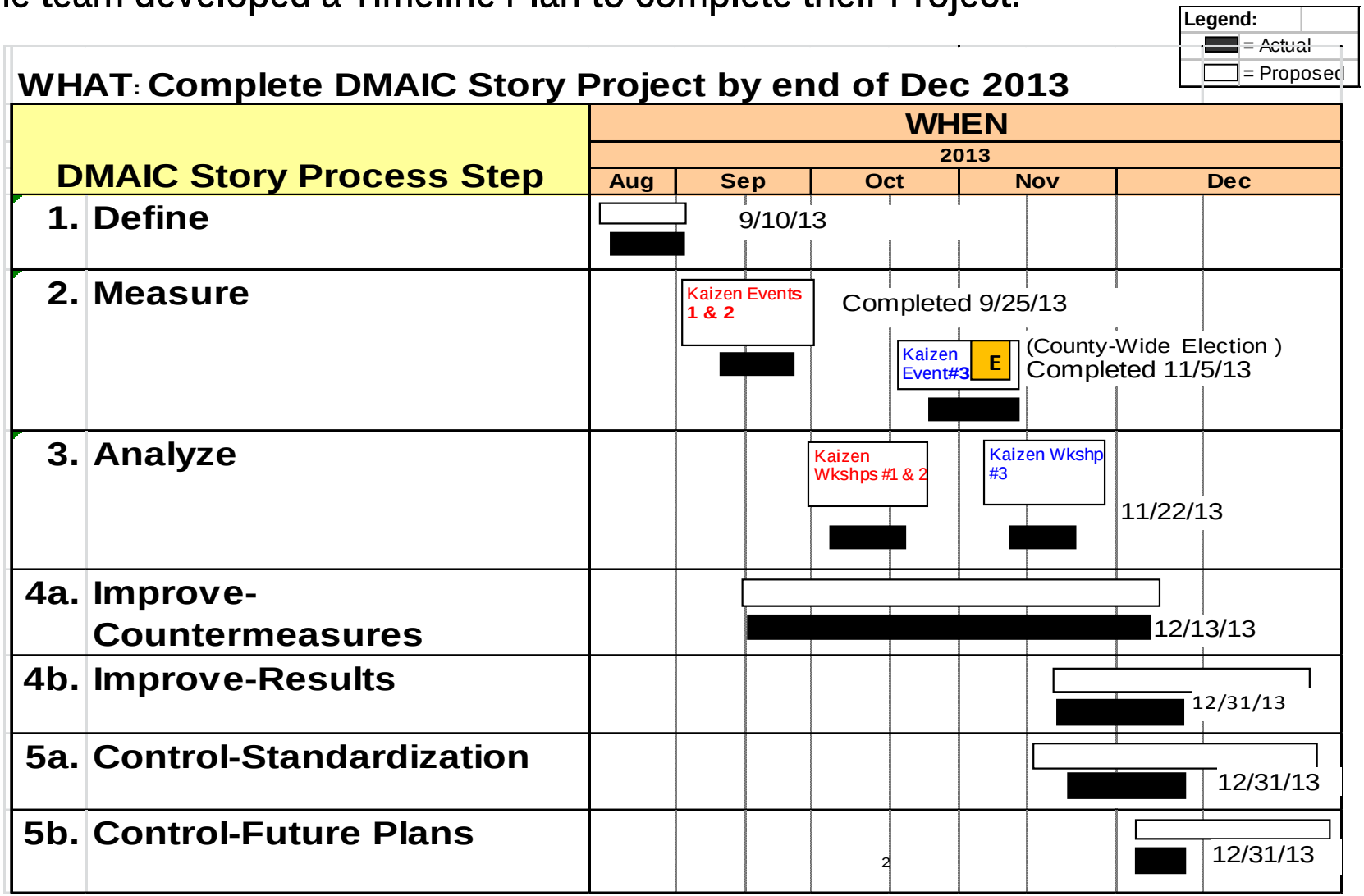
The team utilized the 5-Step DMAIC problem solving process.

Lean Performance Improvement Process

Process Step		Description of Team Activities
Number	**Name**	
1	DEFINE	• Select Problem • Identify Project Charter • Develop Project Timeline • Construct Value Stream Map • Display Indicator Performance "Gap"
2	MEASURE	• Develop Lean Process Data Collection Plan • Collect Lean Process Performance Data • Identify Waste and Low-Value Added Areas
3	ANALYZE	• Analyze Waste and Low Value Added Areas • Identify Cause(s) of Waste and Low value Added Areas
4	IMPROVE	• Conduct Kaizen Improvement Workshop • Identify and Select Improvement(s) • Develop and Implement Improvement Plan • Confirm Improvement Results
5	CONTROL	• Standardize Improvements within Operations • Implement Process Control System (PCS) • Document Lessons Learned • Identify Future Plans

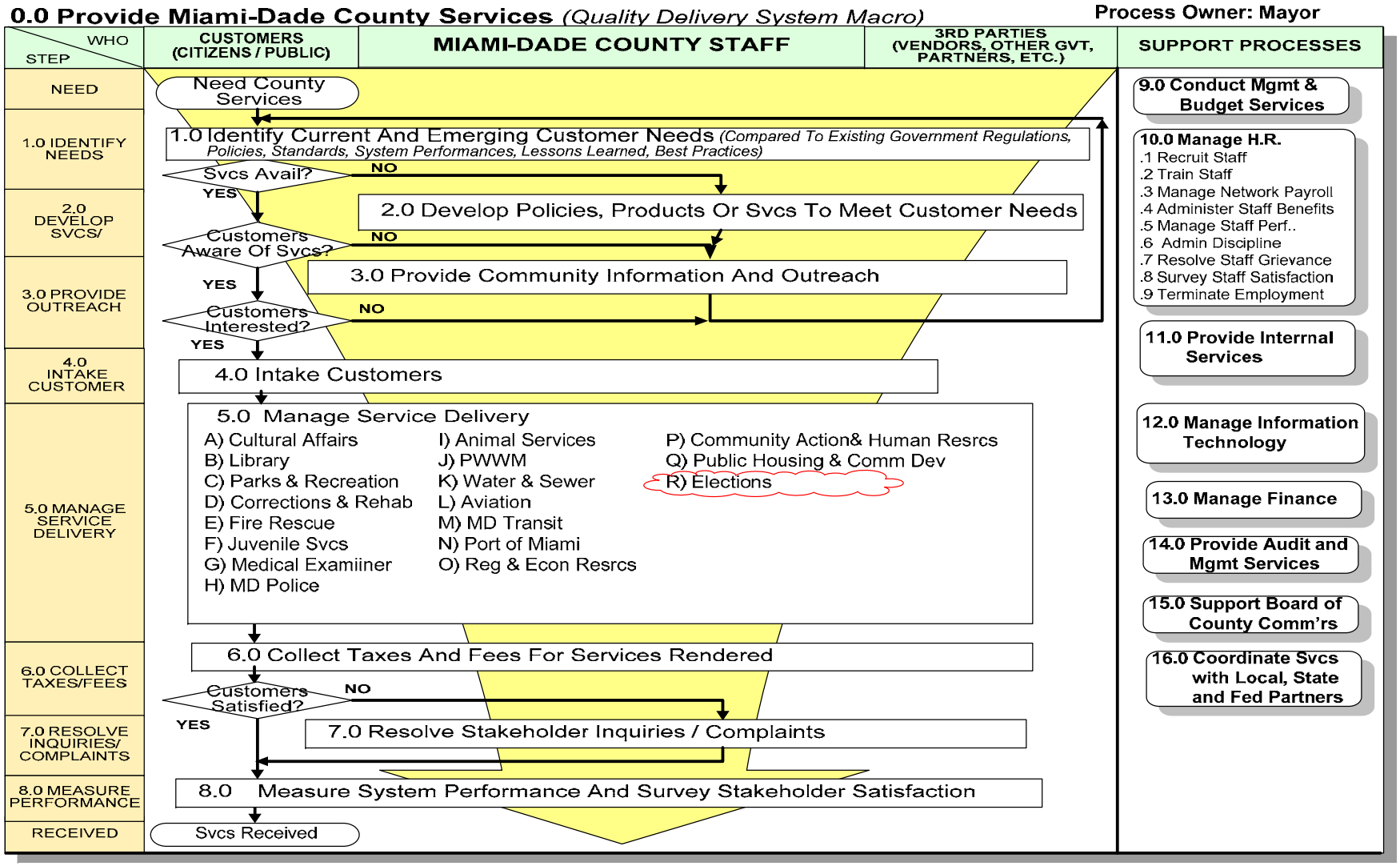
Develop Project Timeline Plan

The team developed a Timeline Plan to complete their Project.



Review Quality Delivery System

The team reviewed the Miami-Dade Quality Delivery System.



The team will focus on a "core" delivery process in the Elections area.

Hidden Costs of Lengthy Voting Time

The team identified hidden costs of lengthy voting times

Polls Closing Late

		Equivalent Event Cost
Equivalent Value/cost of Poll Workers		
a.	38% open beyond 1 hour voting standard (after 8pm)	$ 23,926
b.	15% open additional 1 hour (beyond a.)	$ 9,445
c.	9% open additional 1 hour (beyond b.)	$ 5,667
d.	3% open additional 1 hour (beyond c.)	$ 1,889
e.	1% open additional 1 hour (beyond d.)	$ 630
		$ 41,557 *

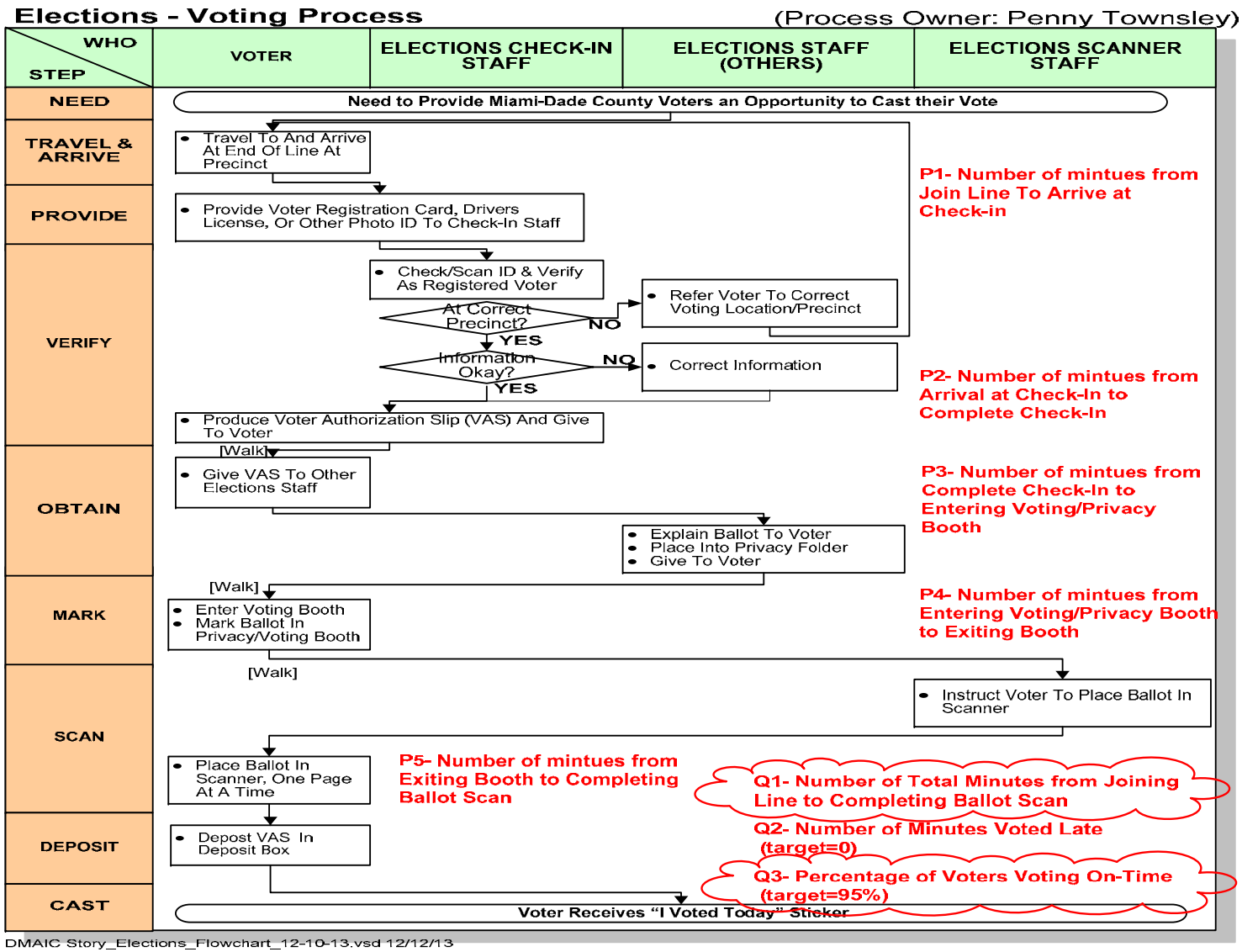
*** If 2 major elections for a given year, then annual cost would be 2 x $41,557 = $83,114**
See Appendix for Detailed Calculations

Other Qualitative Impacts:

- Increased Dissatisfaction of flat-rate employees (increased risk of not being able to secure good flat-rate employees in the future)
- Decreased Voter Satisfaction (waiting times to vote are too long)
- Bad Press & Overall Increased Dissatisfaction with Government (increased resident dissatisfaction)
- Increased risk of voters not casting their ballots

Review Elections Process

The team developed a Process flowchart

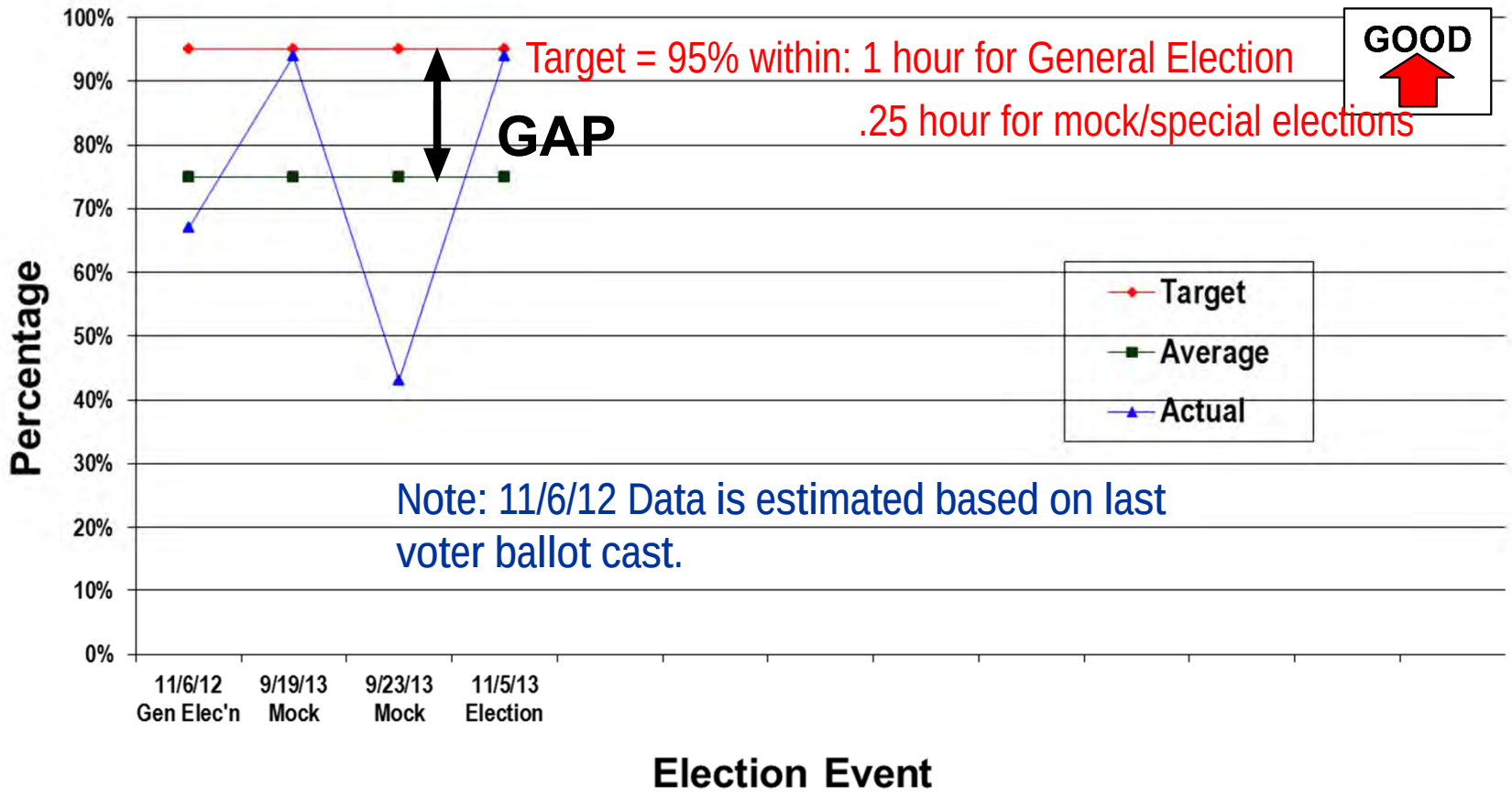


The team will especially focus on the Q1 and Q3 indicators.

Review Indicator Performance

The team reviewed Q3 indicator

Q3 – Percentage of Voters Voting On-Time



Next, the team looked closer at the Mock Voter Times for this step.

Collect Performance Data and Analyze Wastes

The team designed a spreadsheet to collect process data for the Kaizen events:

Election Day Process Summary

(Each row is a Voter on Election Day)

Active Strategy is A Voter on elecion d

AS OF: 11/20/13

MIAMI-DADE COUNTY

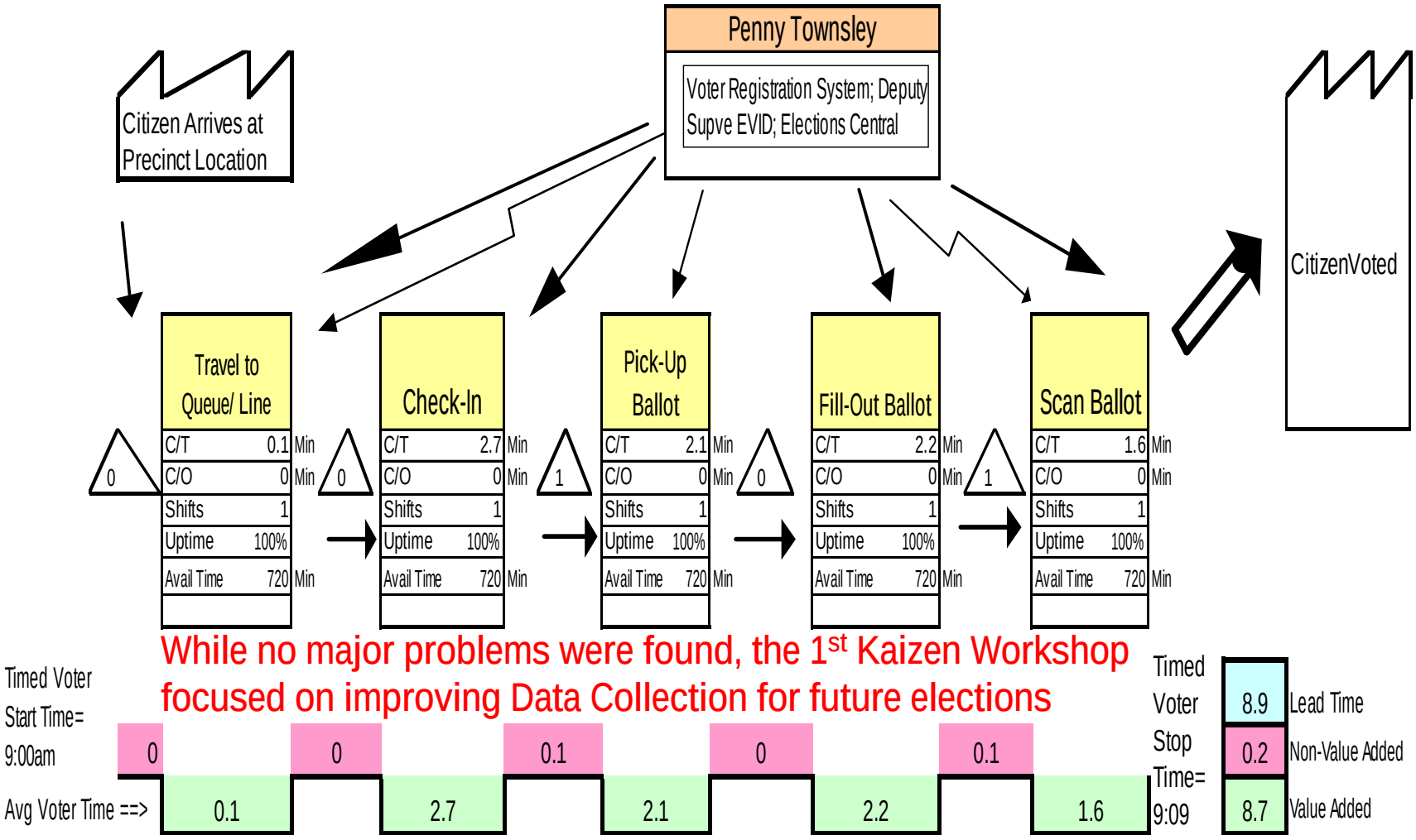
DEMOGRAPHICS							MILESTONE DATES						DURATION						OUTCOMES	
Election Information		Voter Information					PWWM Construction Dept												End-of-Process	
B	C	J	K	L	M	N	Q	R	U	V	W	X	AE= S-Q	AF= U-S	AG= W-U	AH= Y-W	AJ= AC-Y	AK= AC-Q	AR	AS= AK-AR	AU= 'Y' if AS<=0
Precinct	Type Election	Gender	Apparent Age	Cand Races	Ballot Questions	Voting Location	1-Voter Joins Line Time	Mil Hour	3-Voter Completes Check in Date	Mil Hour	4- Voter Enters Voting Booth Time	Mil Hour	Join Line TO Arrive at Chk-in	Arrive at Chk-in TO Complete Chk-in	Complete Chk-in TO Enter Booth	Enter Booth TO Exit Booth	Exit Booth TO Scan Ballot	Join Line TO Scan Ballot	Time Standard to Vote	# of Minutes Voted late	Vcoting on-Time?
			Total										Average							Avg	%Y
			52.3										0.2	2.2	0.8	5.1	1.2	9.4		-5.6	93.9
													P1	P2	P3	P4	P5	Q1		Q2	Q3
30	Special ED	M	40	4	7	MB Botani	9:47 AM	9	9:48 AM	9	9:48 AM	9	0.0	0.4	0.0	7.0	0.7	8	15	-7	Y
35	Special ED	M	55	4	7	MB Sr High	1:58 PM	13	1:59 PM	13	1:59 PM	13	0.0	0.4	0.8	62.3	0.7	64	15	49	N
27	Special ED	M	65	4	7	MB Rgn Li	8:48 AM	8	8:49 AM	8	8:49 AM	8	0.0	0.6	0.4	6.0	0.7	8	15	-7	Y
30	Special-Early	F	55	4	7	MB City Ha	1:15 PM	13	1:16 PM	13	1:18 PM	13	0.1	0.7	1.7	2.3	1.1	6	15	-9	Y
35	Special ED	M	65	4	7	MB Sr High	2:14 PM	14	2:15 PM	14	2:15 PM	14	0.0	0.8	0.2	2.9	0.5	4	15	-11	Y
30	Special-Early	F	35	4	7	MB City Ha	1:29 PM	13	1:30 PM	13	1:31 PM	13	0.1	0.8	1.0	5.2	1.6	9	15	-6	Y
32	Special ED	M	40	4	7	MB Rgn Li	8:24 AM	8	8:25 AM	8	8:26 AM	8	0.0	1.0	0.3	4.0	1.0	6	15	-9	Y
35	Special ED	M	60	4	7	MB Sr High	2:13 PM	14	2:14 PM	14	2:14 PM	14	0.0	1.0	0.2	4.2	1.0	6	15	-9	Y

After analyzing the data from the 1st mock election, the team found…

Define | Measure | Analyze | Improve | Control

Develop Process Value Stream Map (Kaizen #1)

The team developed Value Stream Map for the **Mock Early Voting Process** (as is, Sept 19, 2013 – 1 page, double-sided ballot)



Travel to Queue/ Line	Check-In	Pick-Up Ballot	Fill-Out Ballot	Scan Ballot
C/T 0.1 Min	C/T 2.7 Min	C/T 2.1 Min	C/T 2.2 Min	C/T 1.6 Min
C/O 0 Min	C/O 0 Min	C/O 0 Min	C/O 0 Min	C/O 0 Min
Shifts 1	Shifts 1	Shifts 1	Shifts 1	Shifts 1
Uptime 100%	Uptime 100%	Uptime 100%	Uptime 100%	Uptime 100%
Avail Time 720 Min	Avail Time 720 Min	Avail Time 720 Min	Avail Time 720 Min	Avail Time 720 Min
0	0	1	0	1
0	0	0.1	0	0.1
0.1	2.7	2.1	2.2	1.6

8.9	Lead Time
0.2	Non-Value Added
8.7	Value Added

Define | Measure | Analyze | Improve | Control

ActiveStrategy

Identify and Select Countermeasures

The team identified Voting Documentation issues and countermeasures to improve documentaiton

Countermeasures Matrix (Kaizen #1)

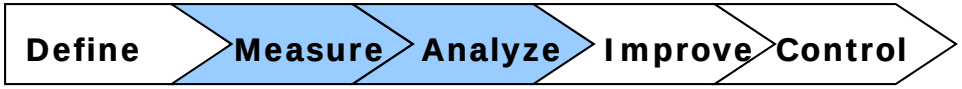
Lean Objective	Lean Process Analysis	Countermeasures	Effectiveness	Feasibility	Overall	Take Action? Yes/No
			Legend: 5=Extremely 4=Very 3=Moderately 2=Somewhat 1=Little or None		Ratings	
To Reduce Time required for a voter to cast a ballot on Election Day	A - Tracking and collecting data for more than one voter at a time was extremely difficult. B - When issues arose with check-in, bottlenecks and overall process delays were likely. C - All ballots for this event were short; the data collected for filling-in the ballot is not representative of longer ballots.	A1 - For future events, have data collection staff track no more than two voters at one time.	3	5	15	Y
		B1 - Collect sufficient data for the electronic check-in process to ensure check-in staff is fully trained and capable of handling voter check-in process accurately and expeditiously.	4	4	16	Y
		C1 - Collect more data for voters marking a longer ballot so that a model can be developed that would help predict average time to vote.	4	4	16	Y

The team selected these countermeasures for implementation.

Document Lessons Learned (Kaizen #1)

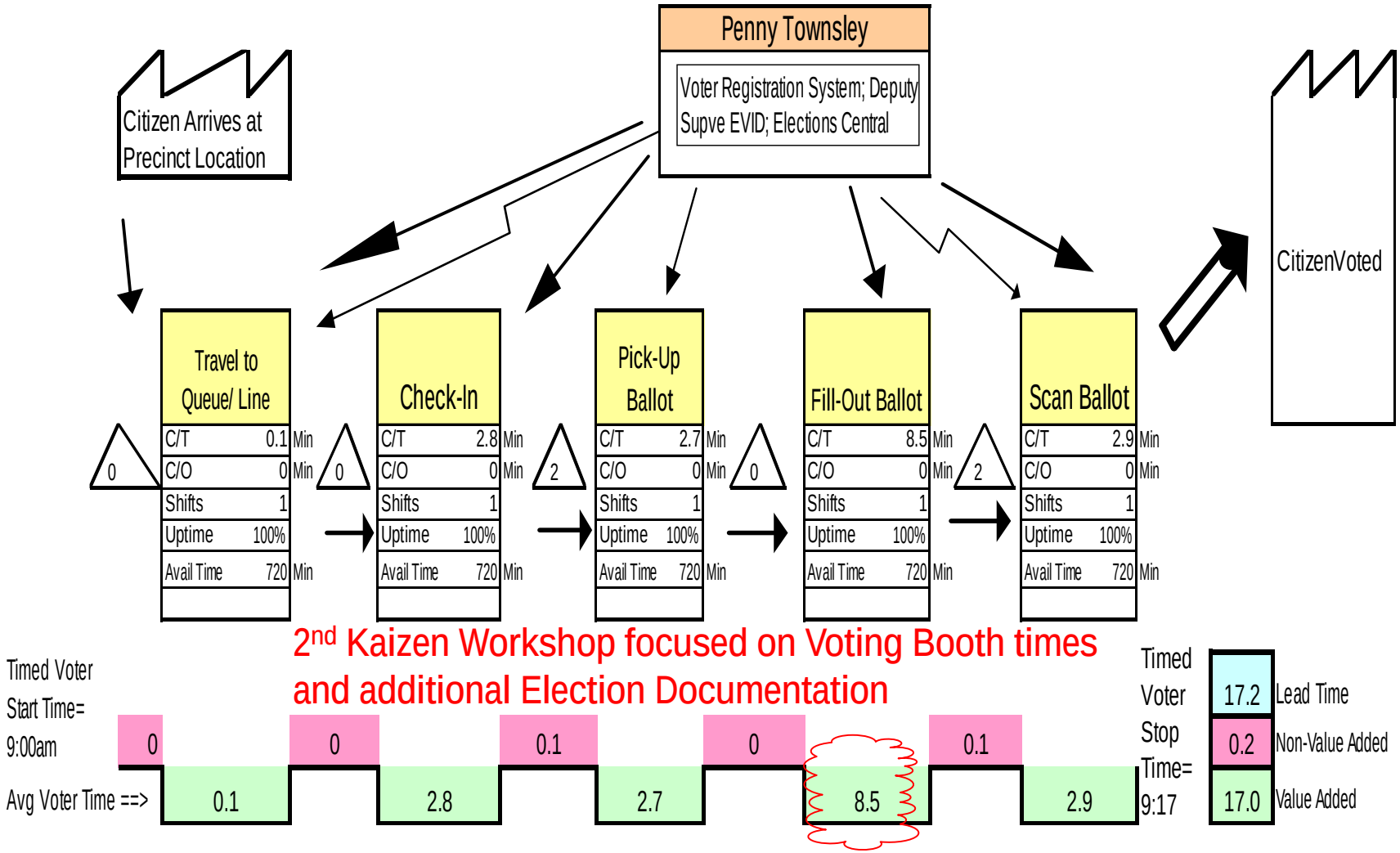
The team documented the Lessons Learned from the Mock Early Voting on Sept. 19, 2013:

- When observing voting process, it's not easy to track more than 2 voters at a time.
- There were no significant bottlenecks with the short ballot
- The expertise and knowledge of the check-in staff is crucial to ensuring minimal bottlenecks at check-in
- When EVID check-in was flawless, it took less than one minute for a voter to check-in
- Mock Elections are primarily training events so data may not be representative of an actual election



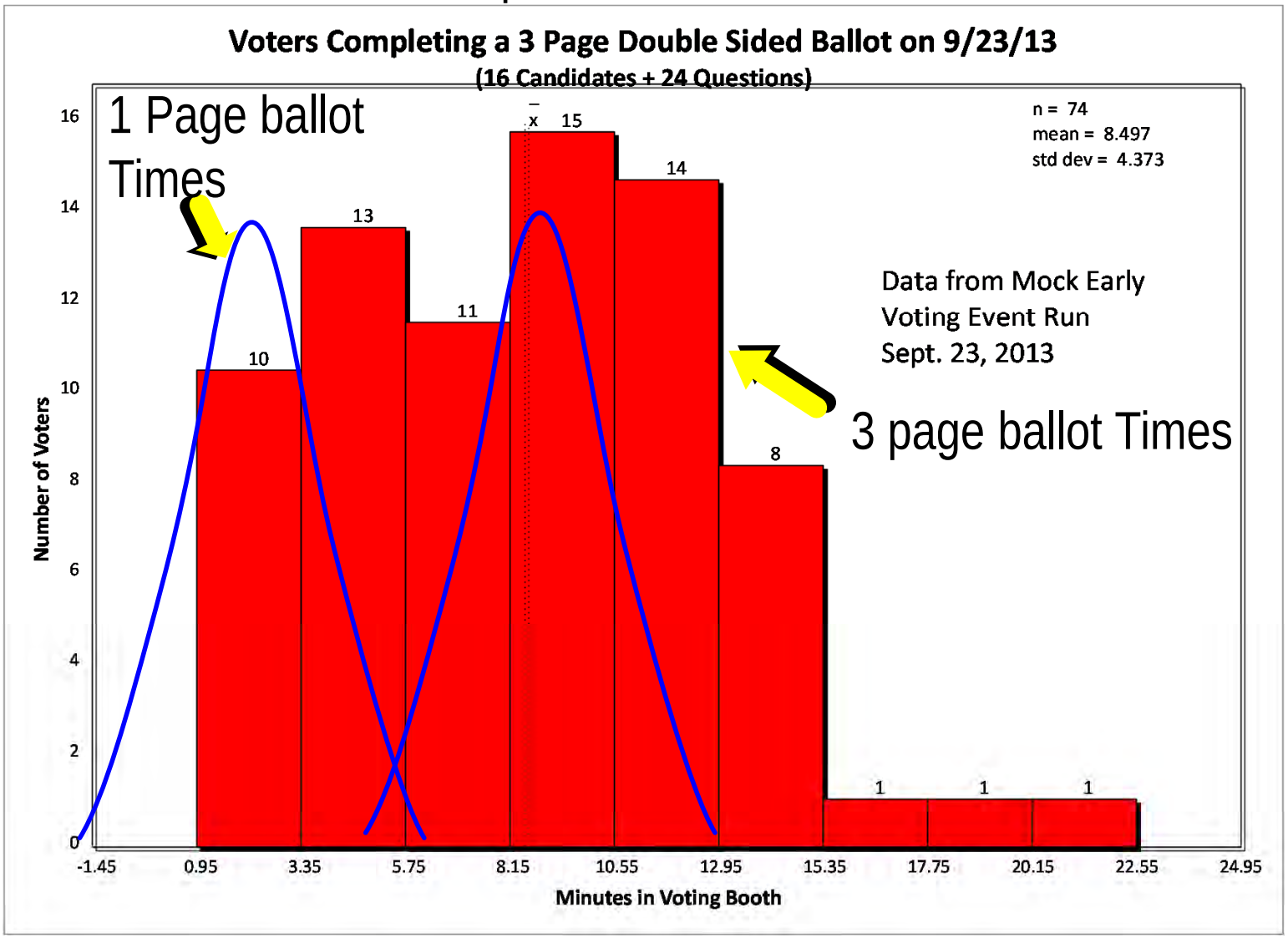
Develop Process Value Stream Map (Kaizen #2)

The team developed Value Stream Map For the **Mock Early Voting Process** (as is, Sept 23, 2013 – 3 page, double-sided ballot)



Collect Performance Data and Analyze Wastes (Kaizen #2)

The team collected process data and analyzed using the Value Stream Map and the data collection spreadsheet:



Define | Measure | Analyze | Improve | Control

Collect Performance Data and Analyze Wastes (Kaizen #1, #2)

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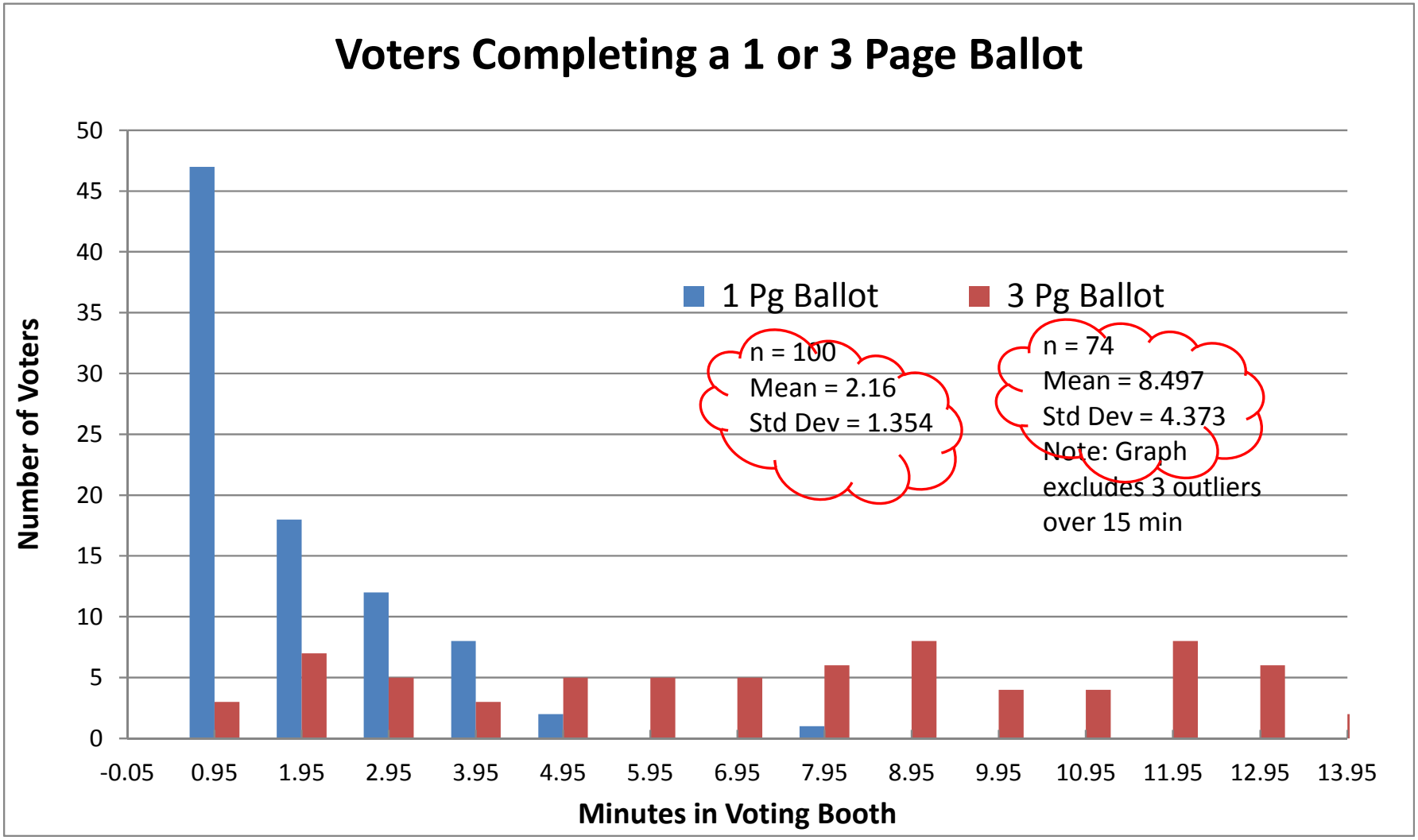

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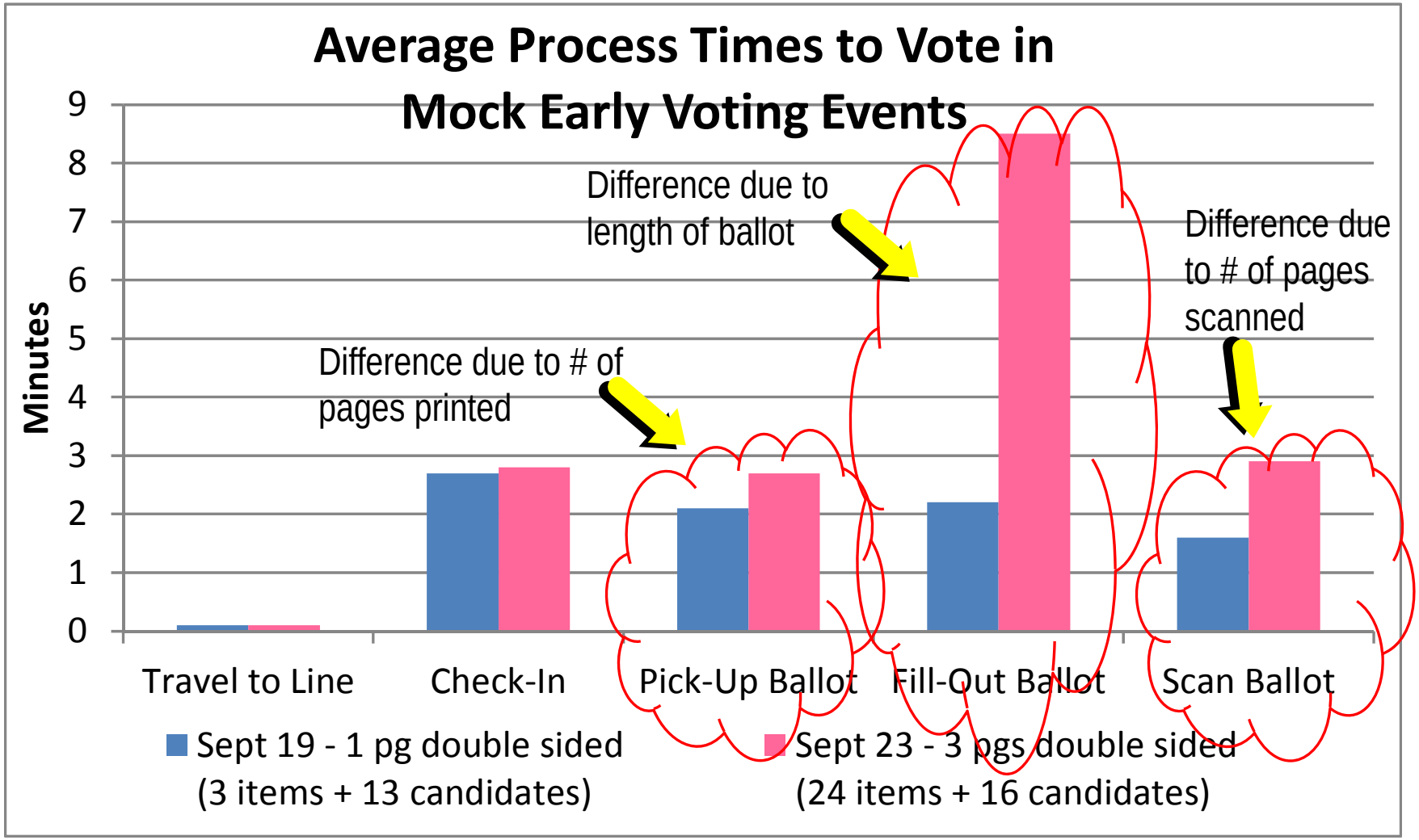


Identify & Select Countermeasures (Kaizen #1, #2)

The team identified Voting Documentation issues and countermeasures to improve documentaton

Countermeasures Matrix (Kaizen #1, #2)

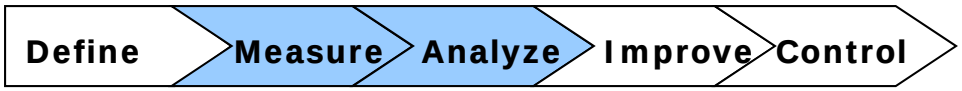
Lean Objective	Lean Process Analysis	Countermeasures	Effectiveness	Feasibility	Overall	Take Action: Yes/No
		Legend: 5=Extremely, 4=Very, 3=Moderately, 2=Somewhat, 1=Little or None	**Ratings**			
To Reduce Time required for a voter to cast a ballot on Election Day	A - Electronic Check-In times collected in mock/training events do not likely reflect actuals B - Arrival times of voters for mock/training elections cannot be used C- All ballots for this event were long; the data collected for filling-in the ballot is not representative of ballots for upcoming Elections	A1 - Collect true electronic and manual check-in data on Election day so that better estimates of time savings can be documented for using electronic check-in. Deploy election day observers in both EVID & manual voting locations.	3	4	12	Y
		B1 - Collect true voter arrival times on Election day. Design & use customized form to ensure collecting this data accurately.	3	4	12	Y
		C1 - Collect more data for voters marking various sized ballots so that a model can be developed that would help predict average time to vote; ensure sufficient election day observers to collect data at Miami Beach precincts where the ballot will be longer and voter turnout is expected to be heavier.	4	4	16	Y

The team selected these countermeasures for implementation.

Lessons Learned (Kaizen #2)

The team documented the lessons learned from the Mock Early Voting on Sept. 23, 2013:

- There were more bottlenecks with the longer ballot
- Because printing the 3 page ballot took longer, lines were more likely to form, taking voters longer to pick-up their ballot
- Because the ballot was longer, it took longer for voters to fill-out the ballot
- Because scanning the 3 page ballot took longer, lines were more likely to form at the scanner and it took voters longer to scan their ballot



Develop Process Value Stream Map (Kaizen #3)

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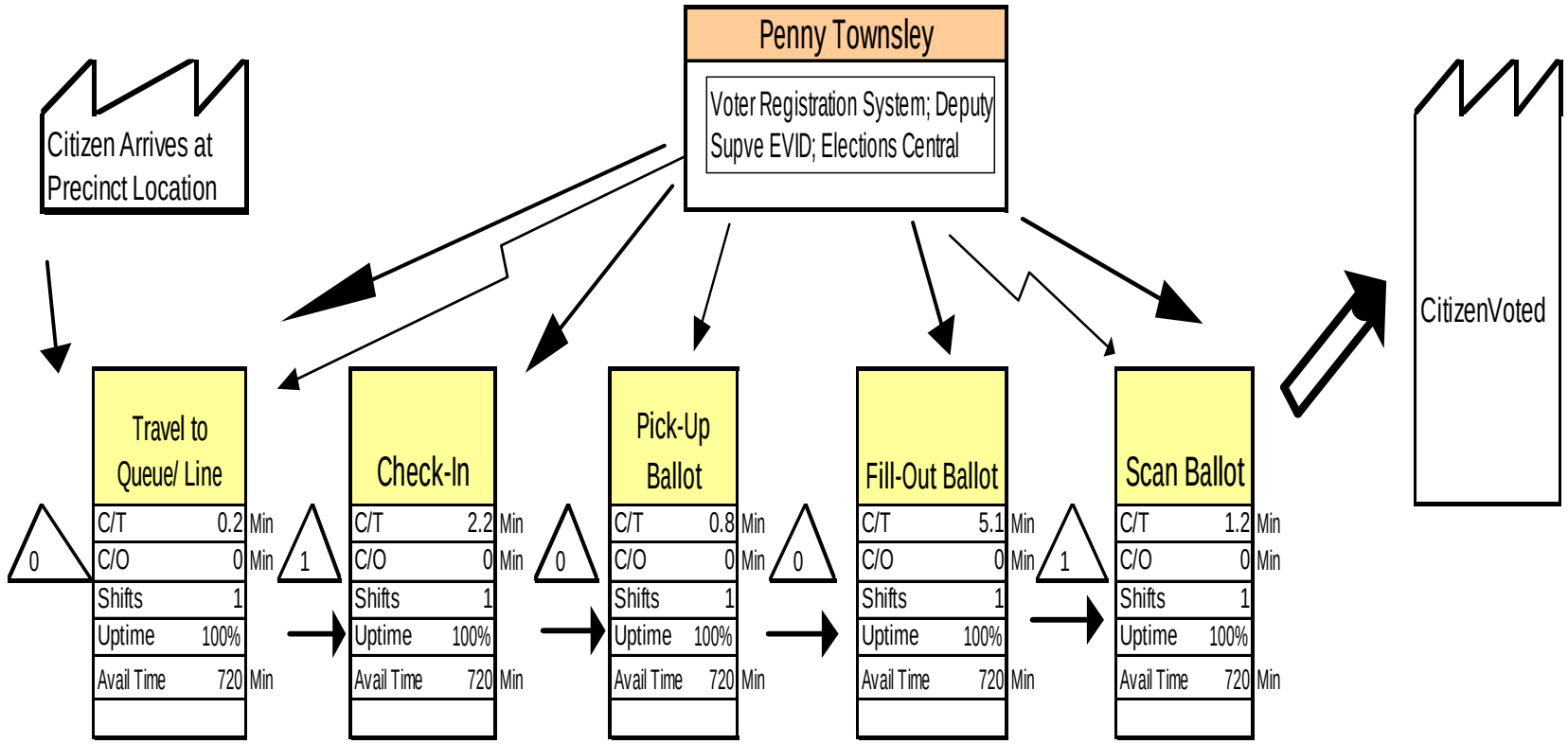
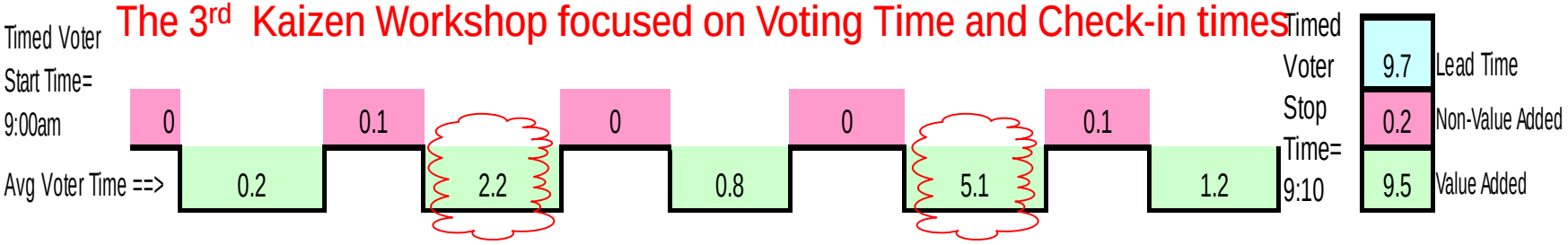
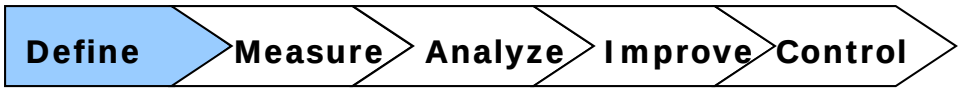


The 3rd Kaizen Workshop focused on Voting Time and Check-in times





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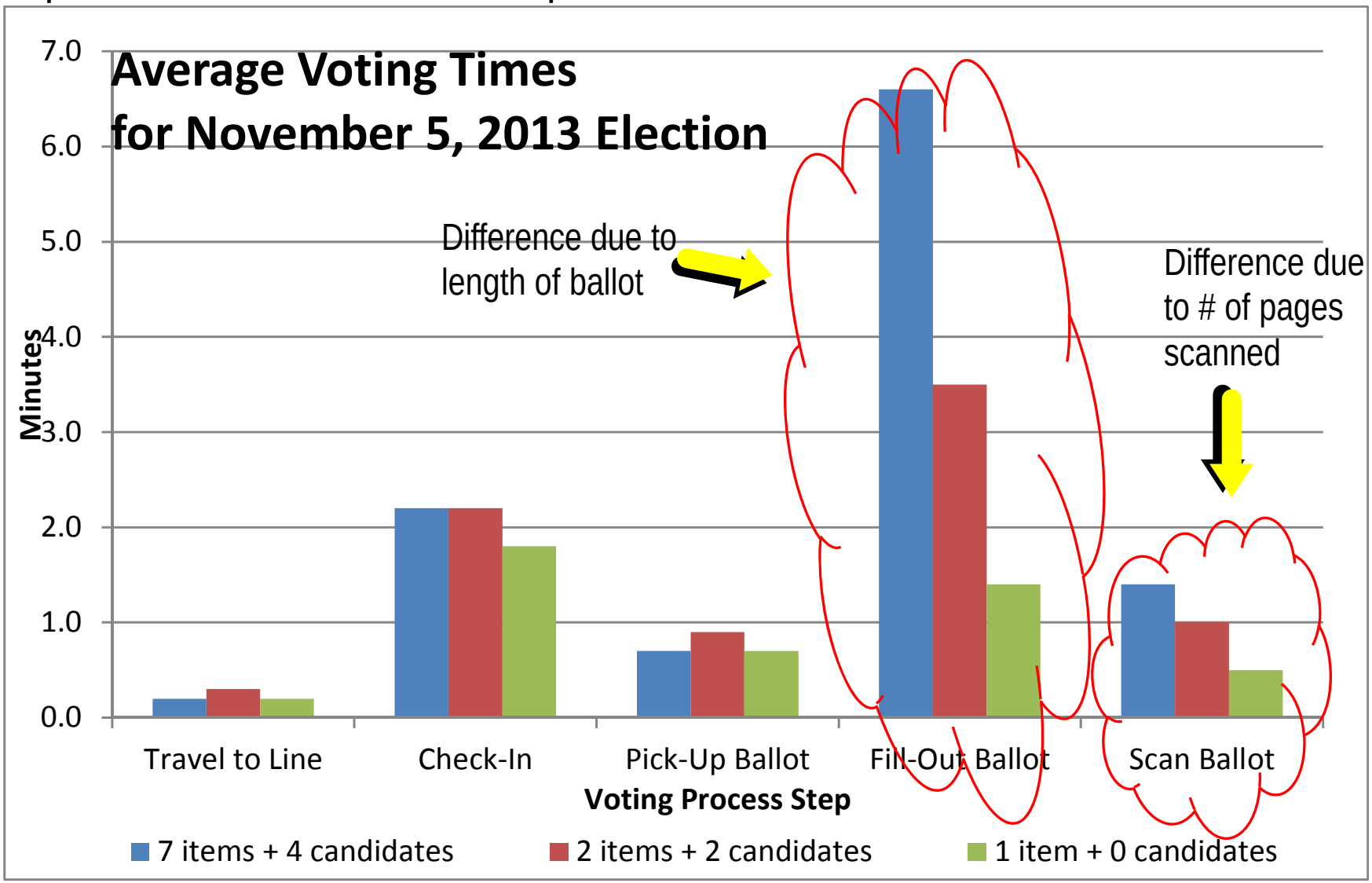
Collect Performance Data and Analyze Wastes (Kaizen #3)

The team collected process data and analyzed using the Value Stream Map and the data collection spreadsheet:



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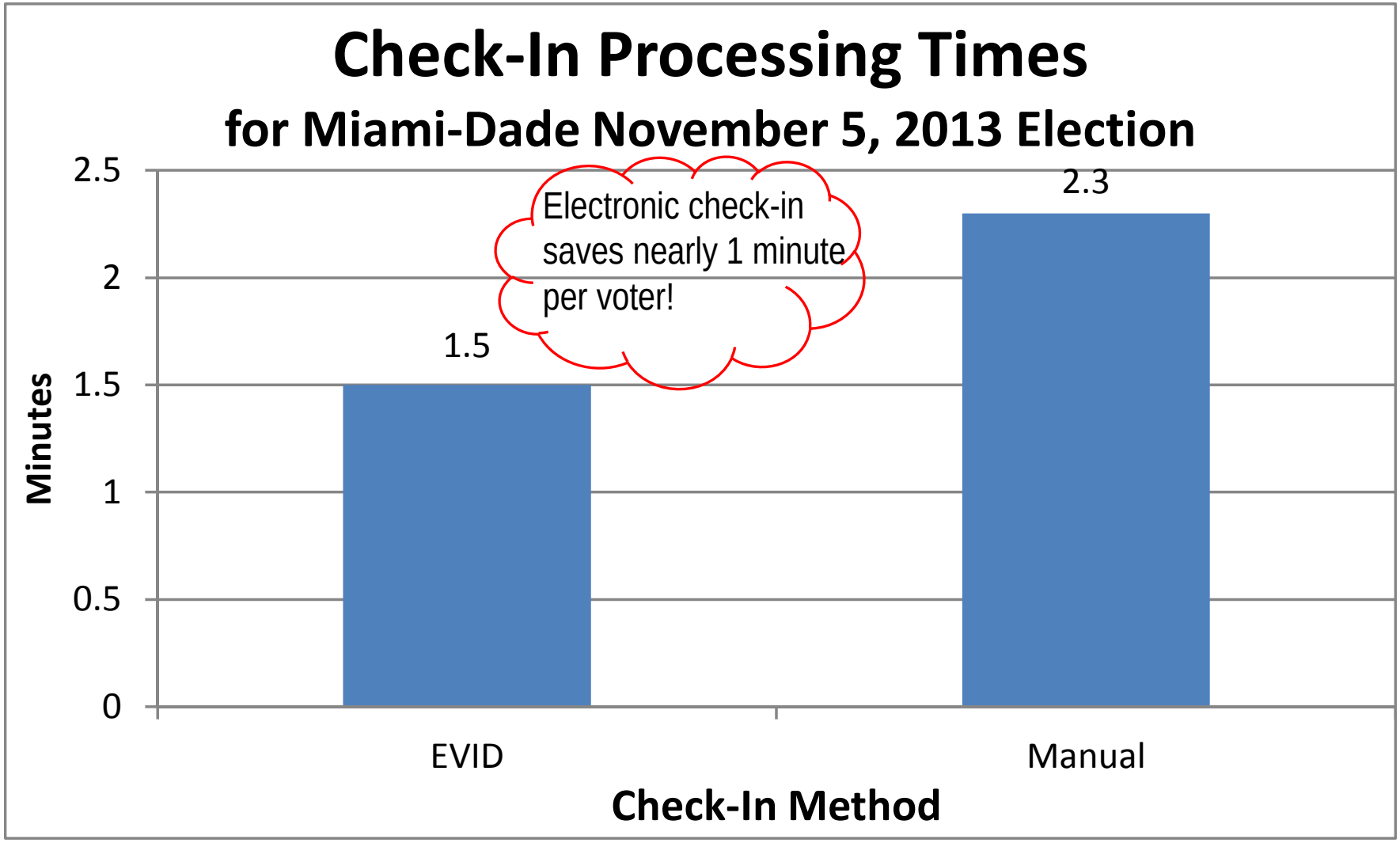


Analyze Waste and Identify Improvements (Kaizen #3)

The team conducted "Brainstorming Sessions" and identified wastes & countermeasures associated with each process step, narrowing them down to 8 for implementation.

Productivity Analysis for Process: *In and Out Voting*

Process Step	Wastes Found: H=Handling too much; O=Over Production; W=Wait Time; R=Rework; U=Unnecesary Processing; I=Inventory/WIP; M=Motion							Possible Action(s) to Implement	Improvement Selection Matrix: A Effective-ness	B Ease to Implement	C= A X B Overall	Implement? Y/N
	H	O	W	R	U	I	M					
1 A- Voter arrives at Check-in Location			X					A1- Develop simple sign showing the 4 basic steps to voting (see appendix); place at voting locations and at each station in the precinct	3.0	4.5	13.50	Y
2 B- Voter provides Idetification to worker							X	B1- Sign or person announcing to be ready with ID (Picture or Signature)	3.5	4.5	15.75	Y
3 C- Worker checks Voter ID and authorizes Voter to vote	X		X	X			X	C1- Develop standard for deployment of existing EVIDs	4.0	5.0	20.00	Y
								C2-Install EVIDs at key locations	3.5	4.5	15.75	Y
4 Worker gives the voter a blank ballot							X		-	-	-	-
5 D- Voter enters booth, reads and marks ballot				X	X			D1- Provide a sample ballot while voter in line	4.0	3.5	14.00	Y
								D2 - Develop standard for deployment of voting booths	4.0	5.0	20.00	Y
								D3- Provide a single language ballot in the language of the choice of the voter	4.0	2.5	10.00	N
6 E- Voter scans ballot, deposits receipt in box, and departs precinct			X				X	E1- Discontinue/Standardize having the voter deposit the receipt in box	3.0	5.0	15.00	Y
								E2- Develop model to help predict average voting time	4.0	4.0	16.00	Y

Eight (8) countermeasures were selected for implementation.

Analyze Waste and Identify Improvements

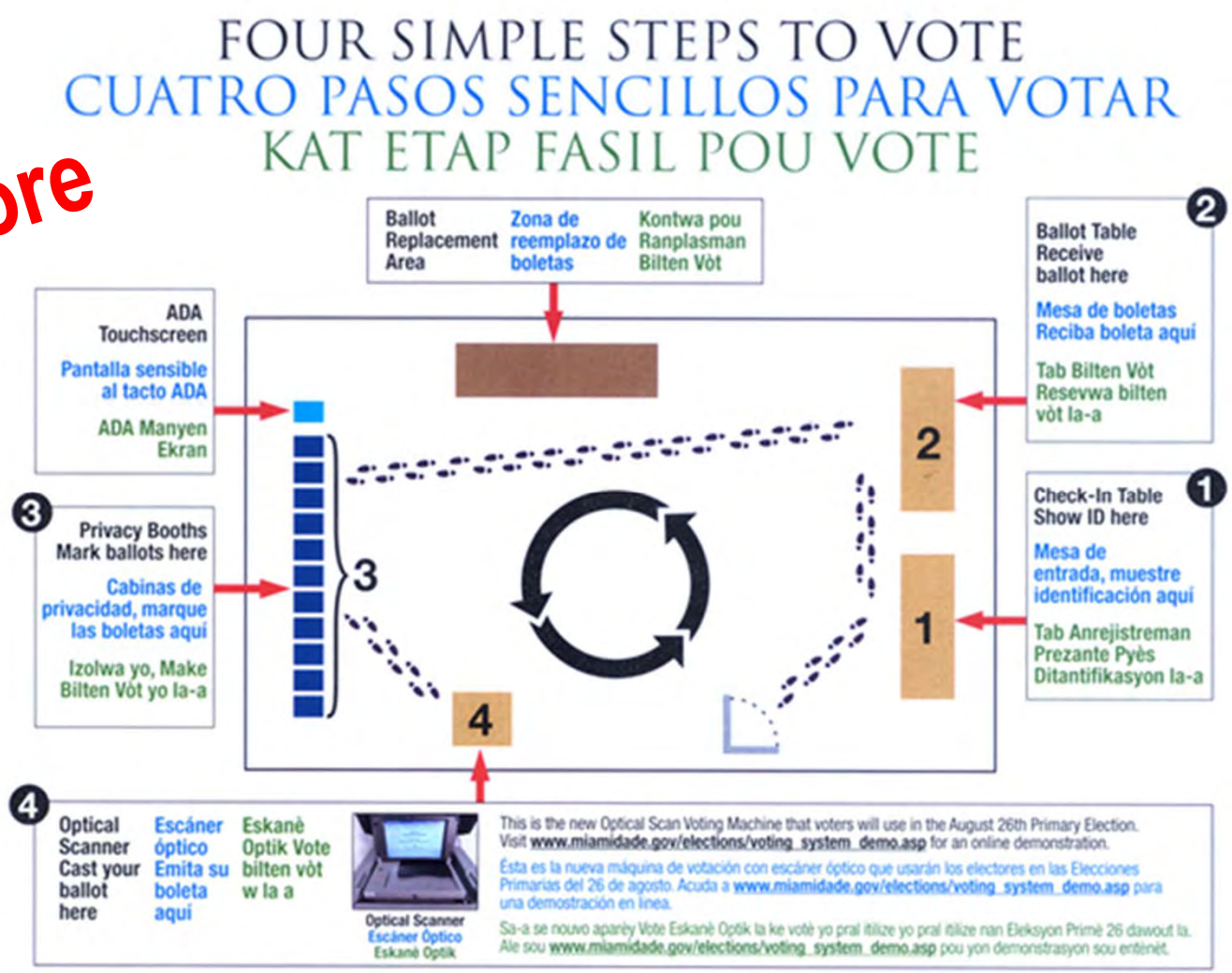
The team developed an Action Plan to implement the 8 selected countermeasures.

WHAT: Implement 8 Lean Countermeasures

HOW	WHO	WHEN
		Week Ending: 15-Nov, 22-Nov, 29-Nov; Month: Dec, Jan, Feb
1. Develop Countermeasures (and decide on GO/NO GO):		
A1, B1 - Develop signs explaining voter steps and advising voter to be ready with voter card or driver's license	Team	
C1, C2, D2, E2 - Develop standards for deployment of EVIDs and ballot booths for upcoming elections and develop model for predicting average voting time	Team	1/10/14
D1, E1 - Provide sample ballots for voters in line and standardize procedure for depositing receipt after voting	Team	
2. Inform Management and secure Approval of Countermeasures	Team	1/10/14
3. Communicate/Train Elections Staff in Countermeasures and related policies/procedures (share Voter benefits and Clarification of responsibilities)	Team and Elections Staff	1/28/14
4. Implement Countermeasures	Team and Elections Staff	1/28/14
5. Review results and adjust as necessary and present results to management	Team	2/28/14
6. Establish On-going responsibilities and standardize countermeasures into operations	Team and Elections Staff	On-going

Countermeasure A1- Develop Simple Sign for Voters

Before



The team will develop a Process Value Stream Map …

Countermeasure A1- Develop Simple Sign for Voters

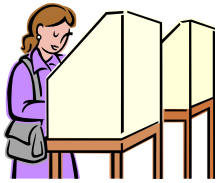
Four (4) Simple Steps to Vote

After

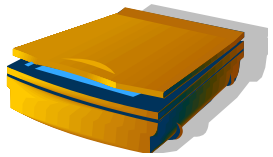
1. Check-In

2. Obtain Ballot

3. Fill In Ballot



4. Scan Ballot



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Countermeasure D2- Develop Model to Deploy Voting/Privacy Booths

The team developed a model to assist the department in determining the minimum number of voting/privacy booths required on an Election Day:

(Lead Time / TAKT Time) = (# min/ballot) / [(12*60) / (# voters)] *(rounded-up)*

Note: See appendix for more info

Estimated Number of Voting/Privacy Booths Required per Election Day Event

Precinct(s) Size	Election Day Turnout	Projected # Voters	Ballot Size (number of equivalent single sided pages)					
			1	2	3	4	5	6
		Projected Minutes in Booth =	*2.5*	*5*	*7.5*	*10*	*12.5*	*15*
800	10%	80	1	1	1	2	2	2
800	20%	160	1	2	2	3	3	4
800	35%	280	1	2	3	4	5	6
1200	10%	120	1	1	2	2	3	3
1200	20%	240	1	2	3	4	5	5
1200	35%	420	2	3	5	6	8	9
1600	10%	160	1	2	2	3	3	4
1600	20%	320	2	3	4	5	6	7
1600	35%	560	2	4	6	8	10	12
2000	10%	200	1	2	3	3	4	5
2000	20%	400	2	3	5	6	7	9
2000	35%	700	3	5	8	10	13	15
2400	10%	240	1	2	3	4	5	5
2400	20%	480	2	4	5	7	9	10
2400	35%	840	3	6	9	12	15	18
2800	10%	280	1	2	3	4	5	6
2800	20%	560	2	4	6	8	10	12
2800	35%	980	4	7	11	14	18	21

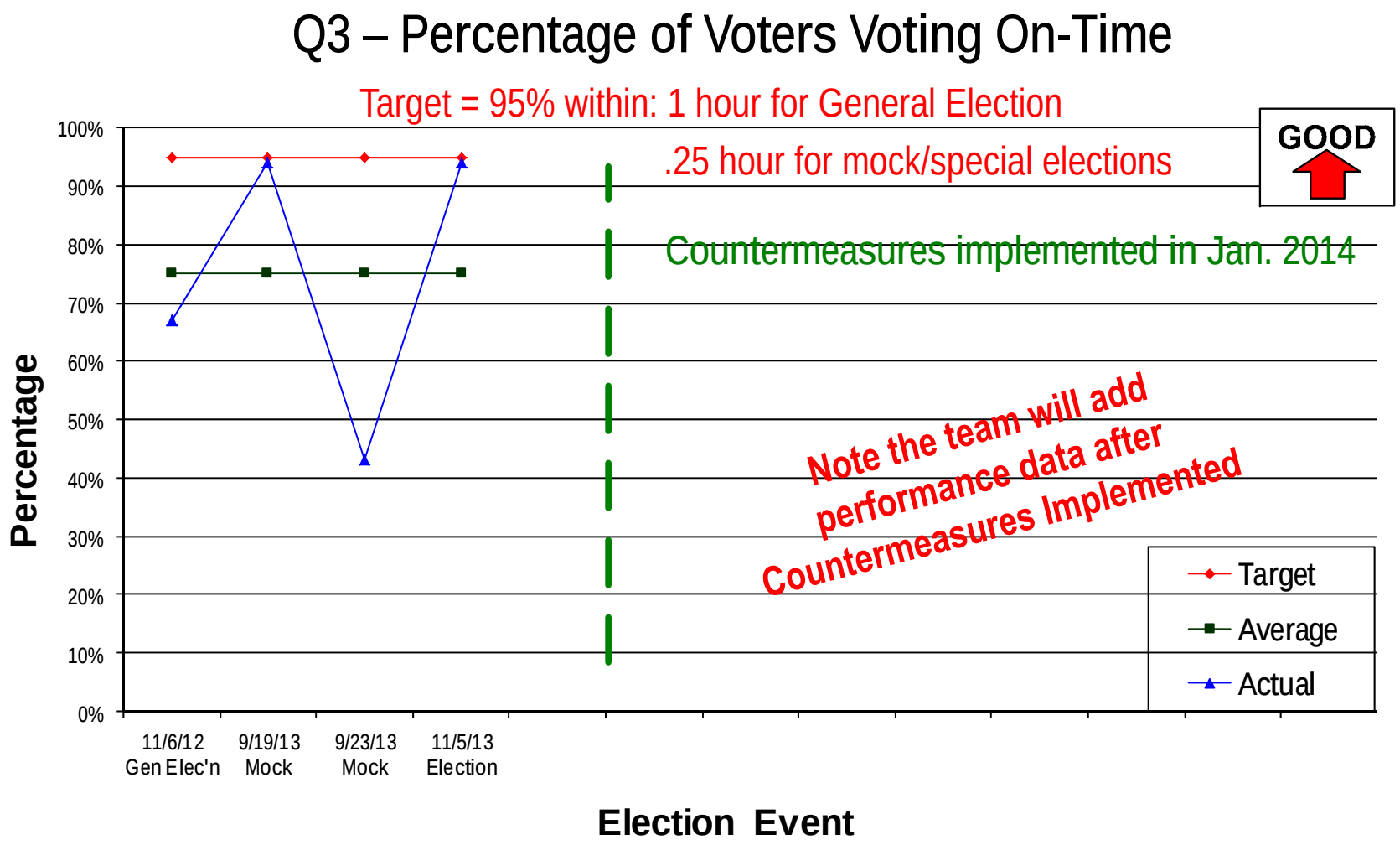
Estimated Number of Voting/Privacy Booths Required

Note: May require adjusting to account for peak voter arrival times

Review Results

17.,18.,19.,20.

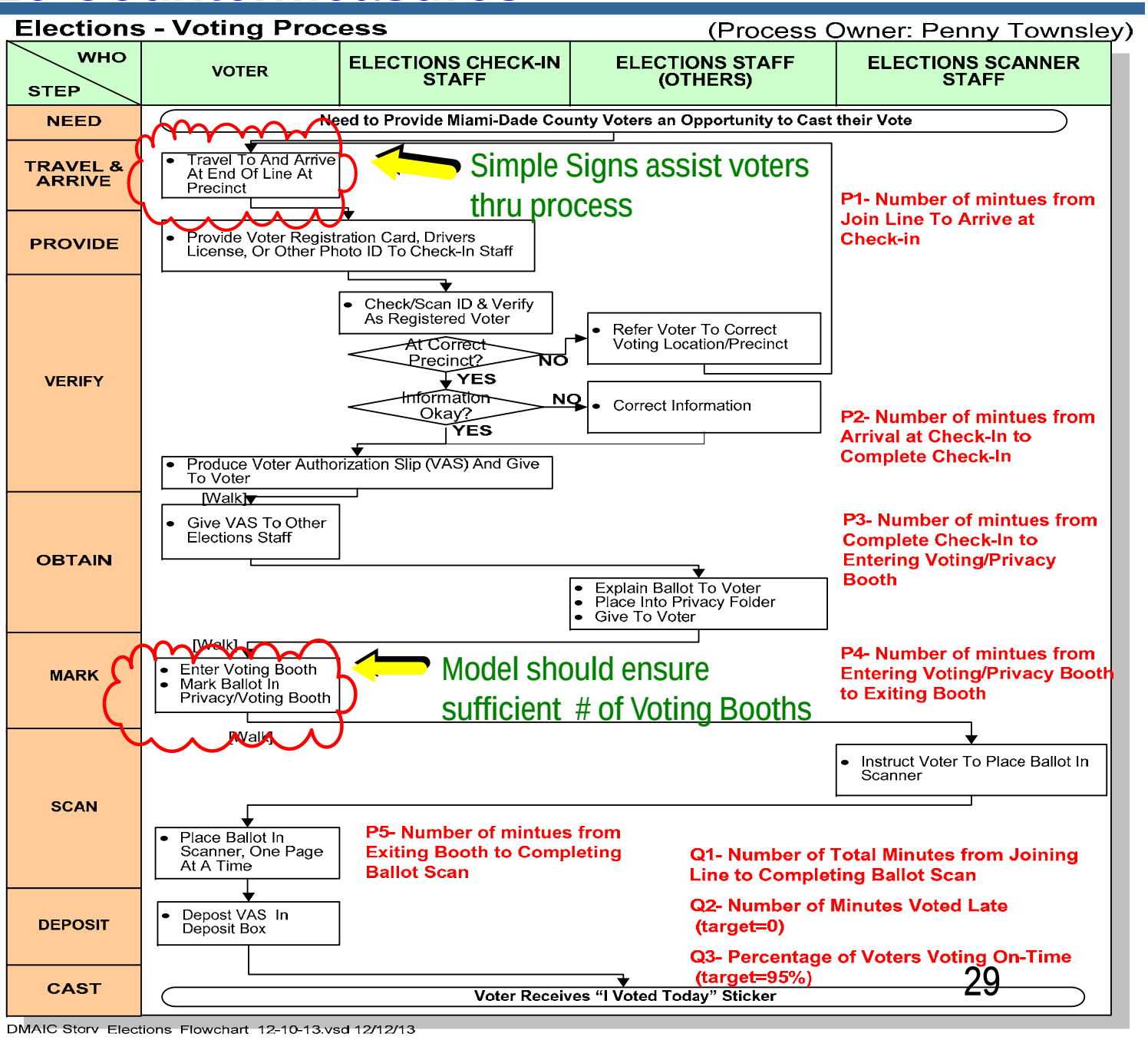
The team will continue to collect indicator data in 2014.



Standardize Countermeasures

21.,22.,23.

The team incorporated the improvements into the Process flowchart.



ActiveStrategy

Standardize Countermeasures

21.,22.,23.

The team Developed a Process Control System (PCS) to monitor the process on-going.

Process Control System

Process Name: Provide eligible voters in Miami-Dade County an opportunity to cast an accurate and convenient ballot	**Process Owner:** Penny Townsley
Process Customer: All registered voters in Miami-Dade County	**Critical Customer Requirements:** Timely voting; convenient voting locations; reasonable/low costs
Process Purpose: Accurate and convenient voting for eligible voters	**Current Sigma Level:** TBD
	Outcome Indicators: Q1, Q2, Q3

Process and Quality Indicators			Checking / Indicator Monitoring			
Process Indicators And Quality Indicators		Control Limits Specs/ Targets	Data to Collect What is Checking Item or Indicator Calculation	Timeframe (Frequency) When to Collect Data?	Responsibility Who will Check?	Contingency Plans / Misc. • Actions Required for Exceptions • Procedure References
P1	# of Minutes FROM Join Line TO Arrive at Check-In	TBD	(Time of Arrival at Check-In) – (Time of Joining Line)	By Event	Penny Townsley	TBD
P2	# of Minutes FROM Arrival at Check-In TO Complete Check-In	TBD	(Time of Completing Check-In) – (Time of Arrival at Check-In)	By Event	Penny Townsley	• Times to decrease with full EVID Implementation
P3	# of Minutes FROM Complete Check-In TO Entering Voting Booth	TBD	(Time of Entering Voting Booth) - (Time of Completing Check-In)	By Event	Penny Townsley	TBD
P4	# of Minutes FROM Entering Voting Booth TO Exiting Booth	TBD	(Time of Exiting Voting Booth) - (Time of Entering Voting Booth)	By Event	Penny Townsley	TBD
P5	# of Minutes FROM Exiting Booth TO Completing Ballot Scan	TBD	(Time of Completing Ballot Scan) - (Time of Exiting Voting Booth)	By Event	Penny Townsley	TBD
Q1	# of Minutes FROM Voter Joining Line TO Completing Ballot Scan	15 Min's	(Time of Ballot Scan) - (Time of Voter Entering Line)	By Event	Penny Townsley	• Spec will depend on Event (e.g. ballot length, etc)
Q2	# of Minutes Voted Late	0 Min's	(Acutal # Min's to Vote) - (Target # Min's to Vote)	By Event	Penny Townsley	TBD
Q3	% of Voters Voting On-Time	95%	100*(# of Voters Voting On-Time) / (Total # of Voters)	By Event	Penny Townsley	TBD

The team looked ahead to the future.

Identify Lessons Learned

Lessons Learned

1) Several unique features that made this a challenging project:
   - Many variables impact the time required for a voter to cast his/her ballot
   - Elections are infrequent making data collection a special challenge
   - Each election is often very different (ballot length, voter turnout, etc.)
   - Big challenge is to train voter on the spot as quickly as possible
2) Although many improvements have been made over the past several elections, additional incremental improvements should help streamline the process even further
3) Developing models to help gauge the optimal number of resources (poll workers, EVIDs, voting booths, scanners, etc.) as well as expected voting time for each election, is an important and useful tool for the Elections Department

Next Steps

1) Assess countermeasures and implementation in preparation for the January and Spring Elections
2) Continue to collect data in upcoming elections in order to improve and refine the predictive models

Appendix: Hidden Costs Calculations for Lengthy Voting Time

Polls Closing Late

Equivalent Value/cost of Poll Workers for a Major Election Event (e.g. Countywide Election)

Cost = (Avg # Poll Workers/Election Board) x (# Election Boards) x (% open) x (Avg Hourly rate of Poll Worker)

= (9 Poll Workers/Election Board) x (583 Election Boards) x (% open) x ($12/hr)

a. **38% open beyond 1 hour voting standard (after 8pm)**
   = (9) x (583) x (38%) x ($12/hr) = $ 23,926

b. **15% open additional 1 hour (beyond a.)**
   = (9) x (583) x (15%) x ($12/hr) = $ 9,445

c. **9% open additional 1 hour (beyond b.)**
   = (9) x (583) x (9%) x ($12/hr) = $ 5,667

d. **3% open additional 1 hour (beyond c.)**
   = (9) x (583) x (3%) x ($12/hr) = $ 1,889

e. **1% open additional 1 hour (beyond d.)**
   = (9) x (583) x (1%) x ($12/hr) = $ 630

$ 41,557

Note: % is from 2012 Countywide General Election

Appendix- Countermeasure D2- Develop Model to Deploy Voting Booths

The team developed a model to assist the department in predicting voting times…

Average of Process and Outcome Indicators for Election Day 2013

Ballot Size		Join Line TO Arrive at Chk-in **P1**	Arrive at Chk-in TO Complete Chk-in **P2**	Complete Chk-in TO Enter Booth **P3**	Enter Booth TO Exit Booth **P4**	Exit Booth TO Scan Ballot **P5**	Join Line TO Scan Ballot **Total**	**Q1**	a	b	c
7 items + 4 candidates	95	0.2	2.2	0.7	6.6	1.4	11.1	11	9.4	7.3	7.5
2 items + 2 candidates	52	0.3	2.2	0.9	3.5	1.0	7.9	8	3	2.4	2.7
1 item + 0 candidates	16	0.2	1.8	0.7	1.4	0.5	4.6	5	1.4	1.1	1.1
Totals for All =	163	0.2	2.2	0.8	5.1	1.2	9.5	9.4			

Model for Predicting Time Required to Cast Ballot

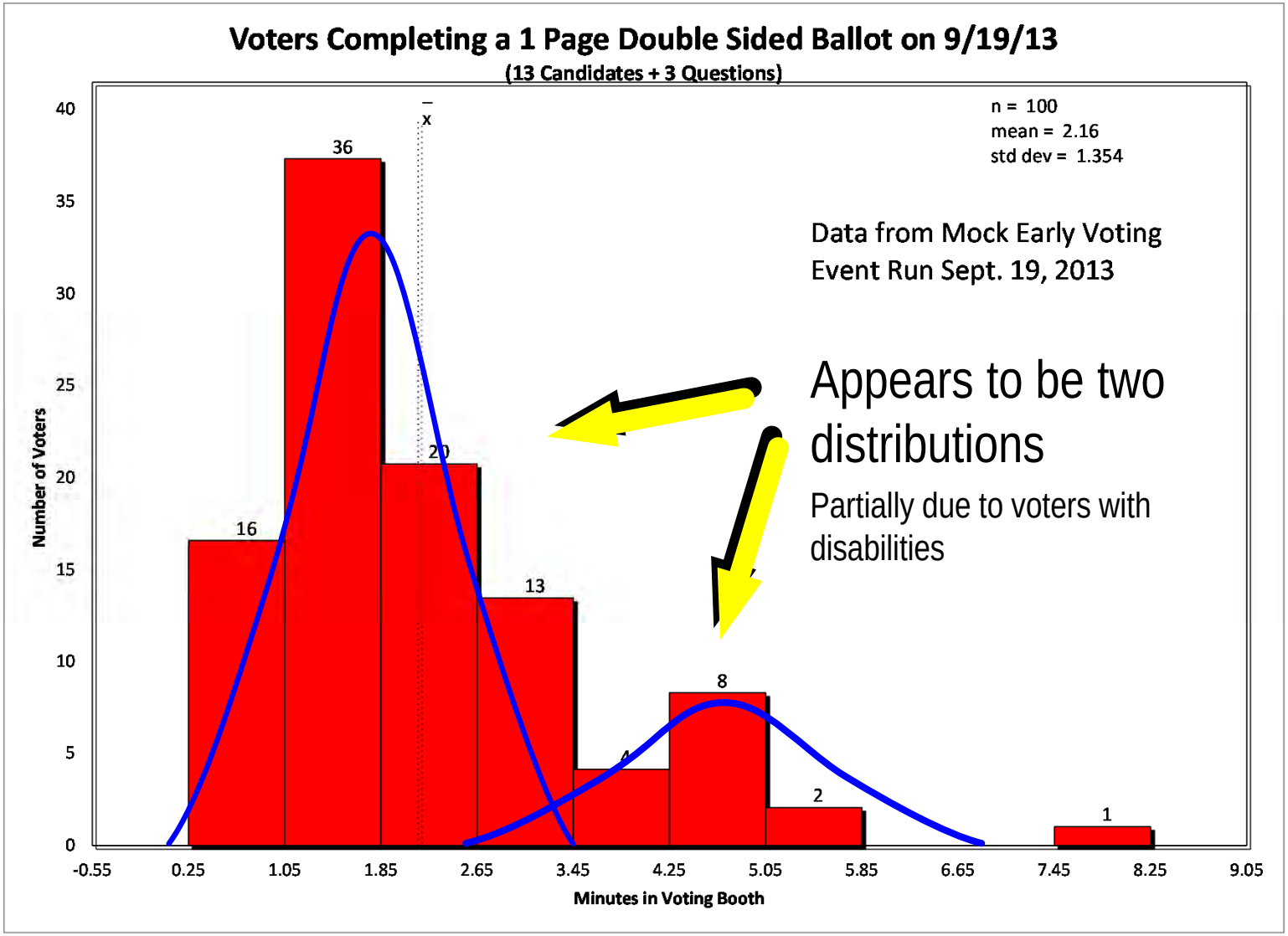
Expected Voting Time = P1' + P2' + P3' + P4' + P5'

a P4' = [.2 + (1.2 x # items) + (.2 x # candidates)]
b P4' = [.2 + (.9 x # items) + (.2 x # candidates)]
c P4' = [.3 + (.8 x # items) + (.4 x # candidates)]

Work in Process

Appendix: Performance Data (Kaizen #1)

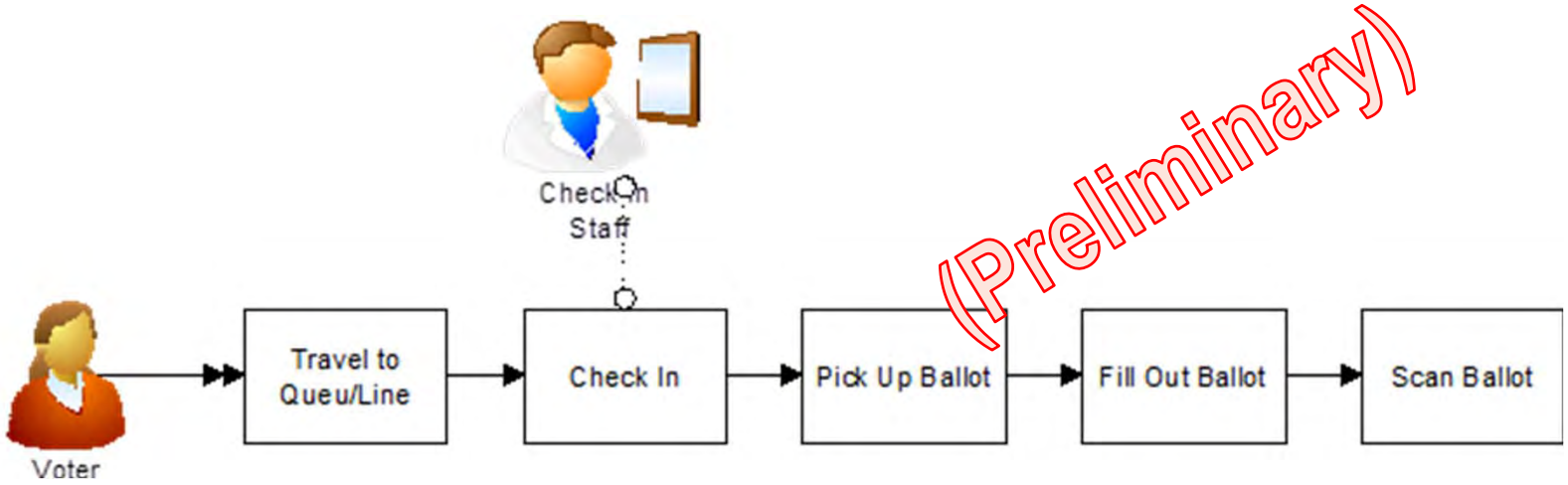
The team collected process data and analyzed using the Value Stream Map and the data collection spreadsheet:



Define | Measure | Analyze | Improve | Control

Appendix - Simulation Model Results

The team collected process data and analyzed using the Value Stream Map and the data collection spreadsheet:



Avg Observed	=	2.3 minutes	2.3 minutes	1 pg: 2.2 minutes 3 pg: 8.7 minutes	1.6 minutes 2.9 minutes
Adjusted Norm	=	.8 minutes	~.25 mins/pg		