

SR 520 Bridge Tolling

OCR - Lessons Learned

Tyler Patterson
Toll Operations Engineer
Washington State Department of Transportation

Success of SR 520 Tolling

- AET on SR 520 celebrated its first anniversary on Dec 29, 2012
- Project is meeting traffic and revenue projections
 - Reduced congestion on existing bridge
 - Funding construction of new bridge
- First year statistics:
 - 20 million tolled trips
 - > \$50M in revenue



Future of tolling in Washington

Current toll facilities:

- Tacoma Narrows Bridge
- SR 167 HOT Lanes
- SR 520 Bridge

Authorized toll facilities:

- I-405 Express Toll Lanes
- Columbia River Crossing
- SR 99 Alaskan Way Tunnel

Under study:

- I-90 Bridge
- SR 509 Extension
- SR 167 Extension



OCR Lessons Learned

1. Performance requirements
2. Filtered light
3. Specialty plates



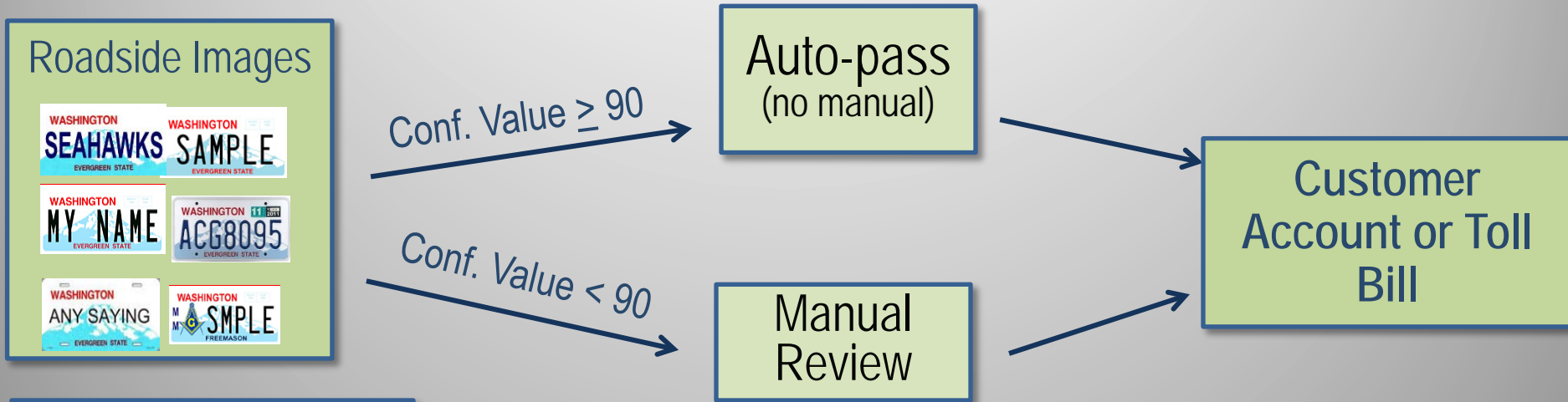
OCR Design Goals

For all vehicles:

- Capture human readable images
- Perform OCR – characters, jurisdiction, and type
 - **Auto-Pass:** Correct OCR results go directly to payment processing
 - **Manual Review:** Questionable OCR results reviewed manually

Goal: Minimize manual review required without impacting performance.

OCR Performance (round 1)



Requirement
90% of all trips have correct OCR value

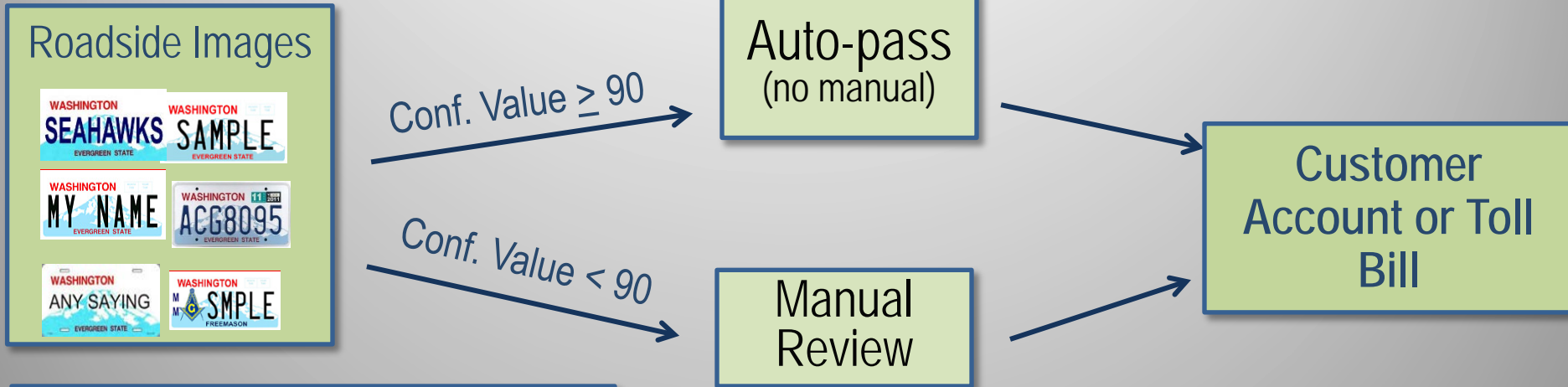
Question
Which trips have correct OCR values?

Problems

1. Conf. values may be inaccurate
2. Conf. values not required to be accurate

Result
Incorrect OCR values sent to Auto-Pass

OCR Performance (round 2)



Requirements

1. 85% of all trips go to Auto-pass (conf. value > 90)
2. 99% of all Auto-pass trips must be correct

Question

Which trips have correct OCR values?

Lighting Requirements

- Supplemental lighting required (no existing light)
- No negative impacts to driver safety
- No environmental impacts
 - Aquatic Life
 - Ambient light & glare



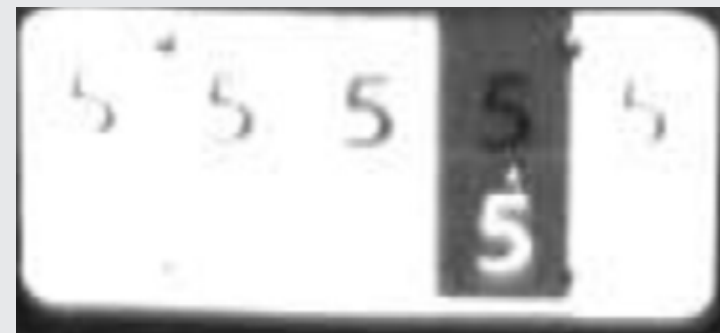
Blue Filter & B/W Cameras

Digital Images	System Images	Issues
		<p>Standard Plate</p> <ul style="list-style-type: none"> Eliminates the background blue – increasing contrast
		<p>Proposed Specialty Plate</p> <ul style="list-style-type: none"> Blue shows up as white
		<p>Specialty Plate</p> <ul style="list-style-type: none"> Red and Orange show up as black

Testing

Digital Images

System Images



Standardizing Specialty Plates

Goals:

- Improve customer service
- Increase net revenue

Strategy: Standardize specialty plate configurations

- Increase automated vehicle identification
- Reduce plate identification errors
- Reduce customer errors when adding vehicle plates to toll accounts on line

Questions?

For more information, please contact:

Tyler Patterson

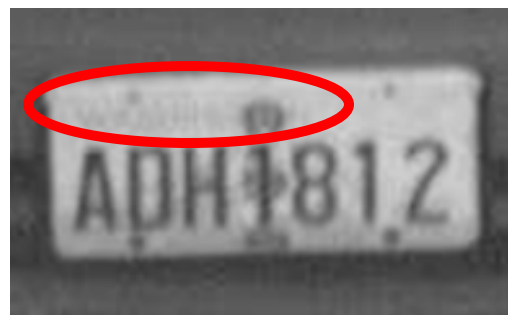
Toll Operations Engineer

(206) 716-1134 or PatterT@wsdot.wa.gov

Filtered Light Required

- Infrared Filters

- Monochromatic B/W cameras can't see RED wavelength











- Blue filters

- Helped improve RED text and reduce BLUE background



Blue Filter Impacts







SYSTEM IMAGE	DIGITAL IMAGE	ISSUE
		<ul style="list-style-type: none"> • Blooming issues • Reduced contrast
		<ul style="list-style-type: none"> • Red and Orange backgrounds show up as black
		<ul style="list-style-type: none"> • Background shading causes incorrect OCR read. System returns "01956"
		<ul style="list-style-type: none"> • Background shading causes incorrect OCR read. System returns "03428"

Current Plate Testing

SYSTEM IMAGE	DIGITAL IMAGE
	
	
	
	

- Working with DOL on creating standards for new specialty plates
- Testing various background / text color combos

Specialty Plates Challenges

Issue		
<ul style="list-style-type: none"> Stacked letters confuse the OCR engine White on red requires special filter Insignia changes location 	 <p>Plate #: "SMPLWSU"</p>	 <p>Plate #: "WSU9999"</p>
<ul style="list-style-type: none"> Insignia changes type Customer confusion 	 <p>Plate #: "W0000A"</p>	 <p>Plate #: "UW00000"</p>
<ul style="list-style-type: none"> Specialty <u>and</u> custom plate cause confusion 	 <p>Plate #: "INE"</p>	 <p>Plate #: "WINE"</p>

Challenges Discovered

- **Results:**
 - High confidence value with incorrect OCR plate result passed through Auto-pass)
- **No contract method available to hold vendor responsible**
 - Vendor was meeting performance requirements
 - WSDOT did not specify a requirement to measure accuracy of sorting tool (auto-pass vs. manual review)
 - Therefore WSDOT assumed risk