



VIDEO TOLL COLLECTION IN NORTH AMERICA

Video Toll Business Practices and Technology
and How They Translate to Europe and the Middle East

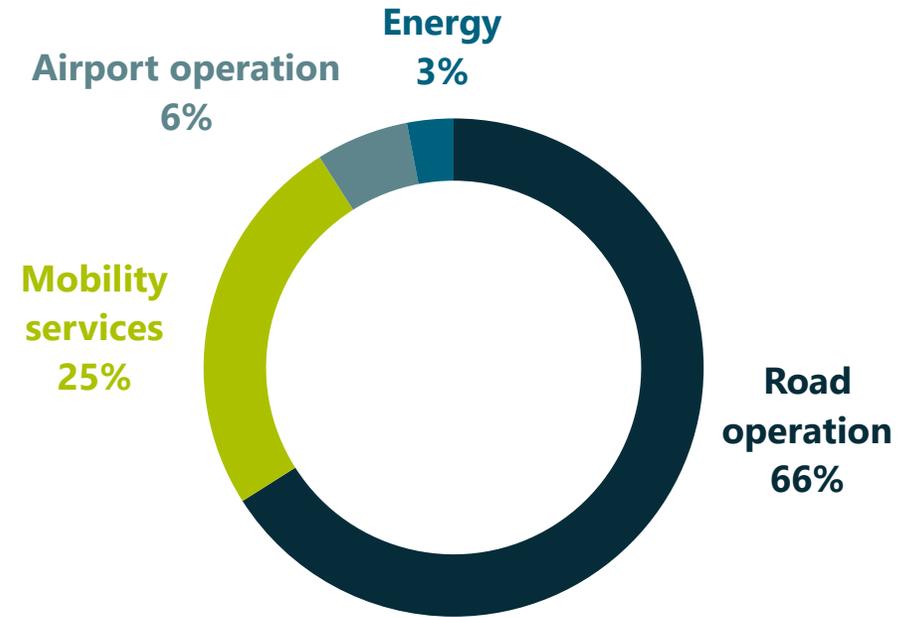
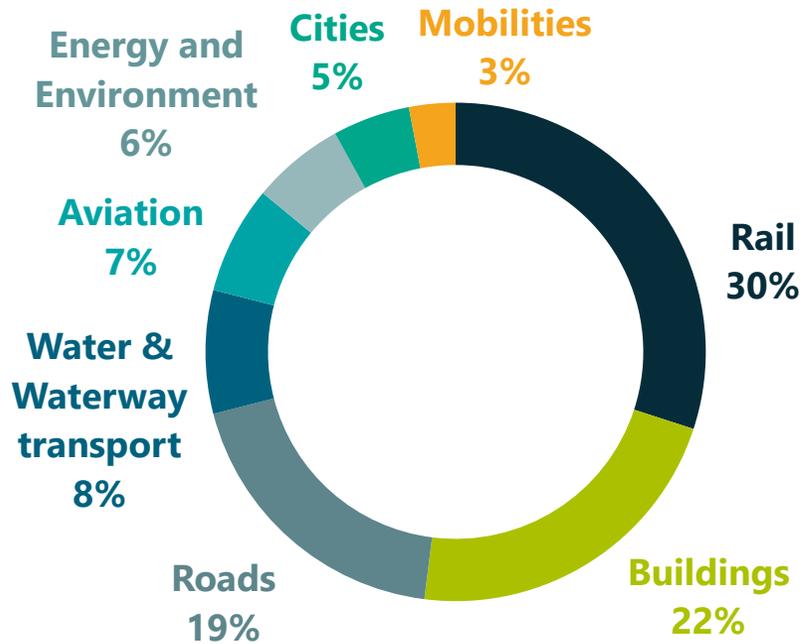


€1.050 Billion

MANAGED TURNOVER IN 2017

Engineering **76%**

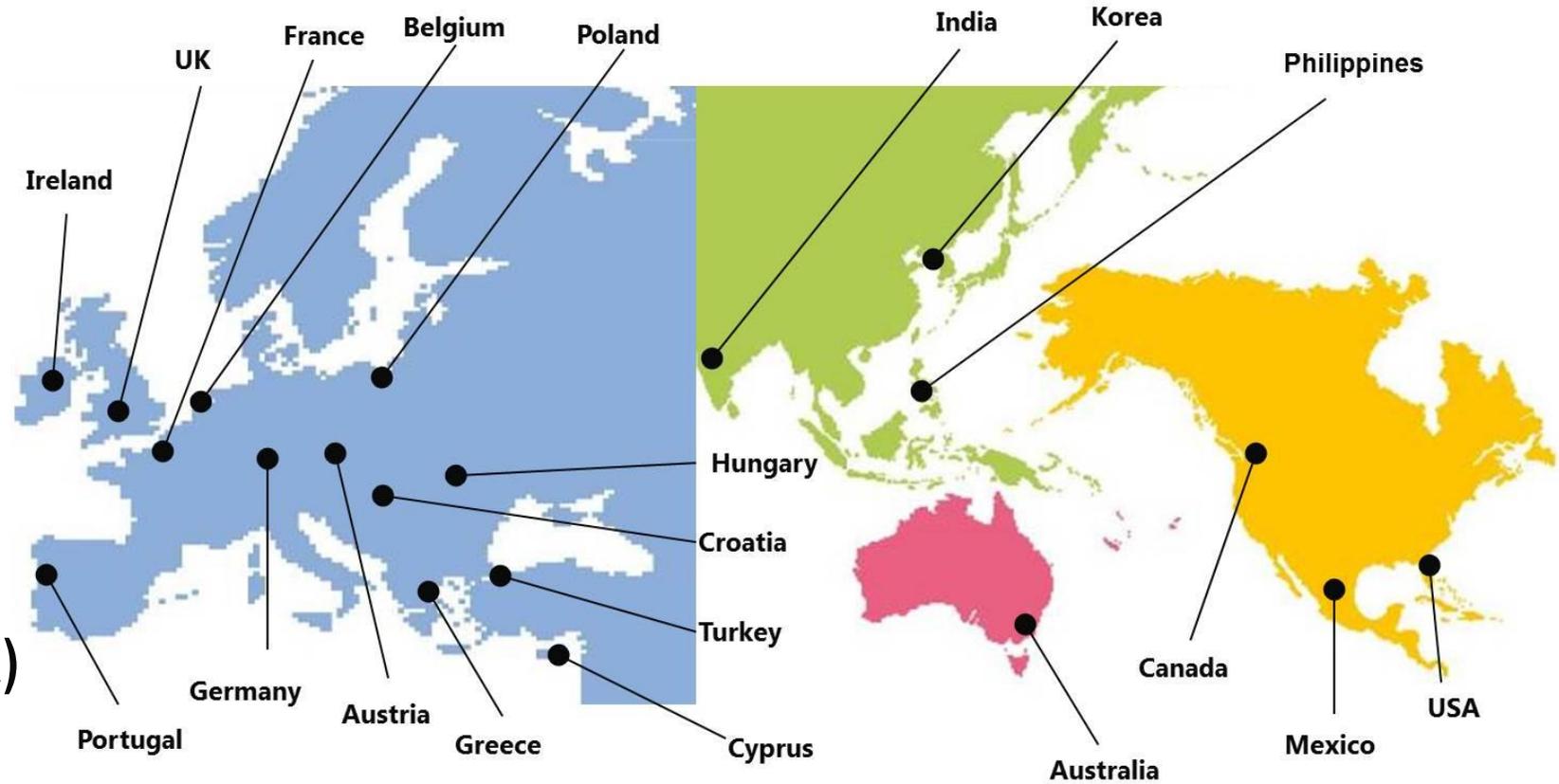
24% Operation and mobility services



14.000 STAFF

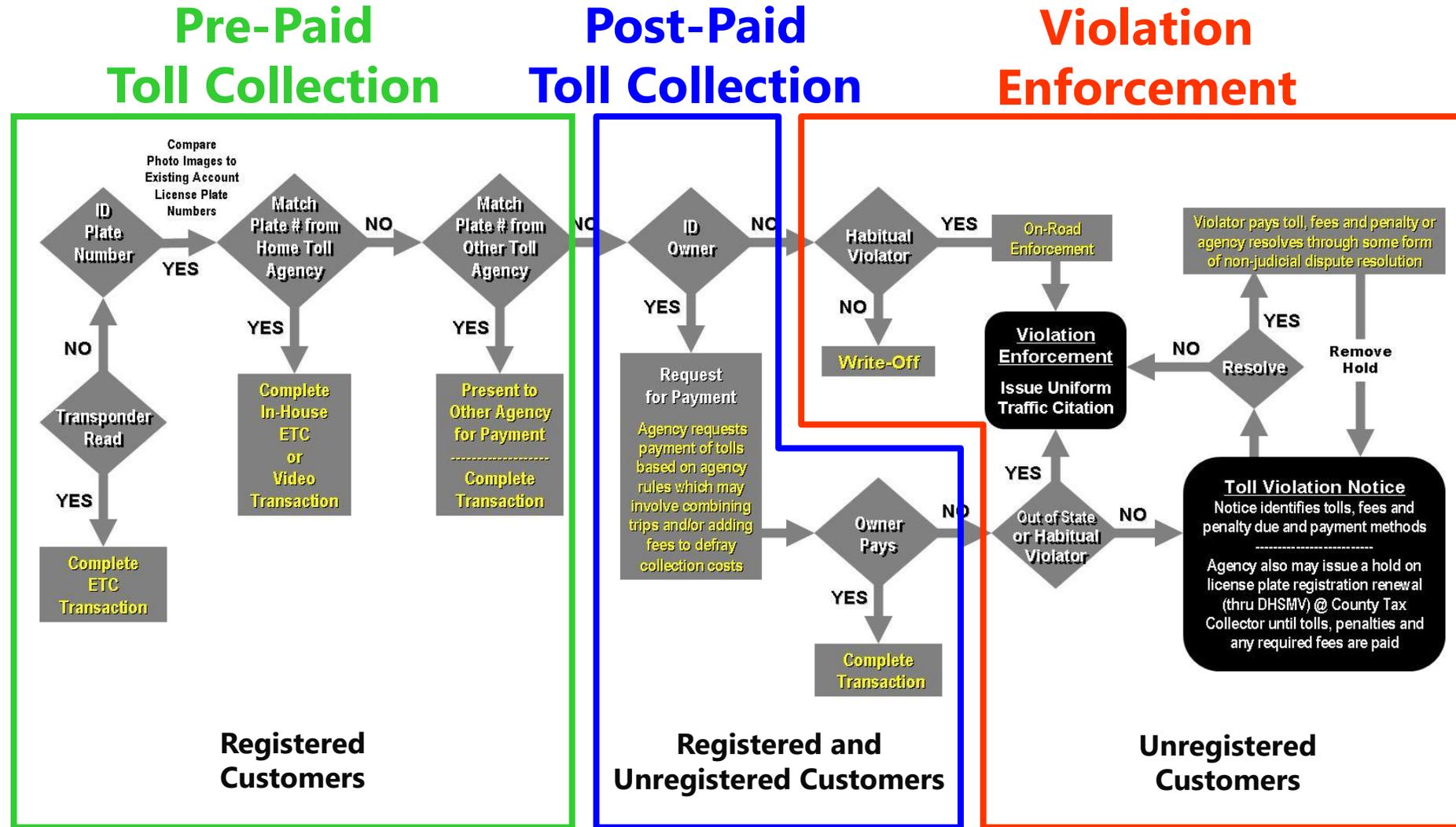
50 PROJECTS IN 20 COUNTRIES

- ❖ 50 Toll & Road O&M Projects with >7,000 Employees
- ❖ >3 Million Daily Tolls with >\$2.5 Billion Annual Tolls
- ❖ >3 Million ETC Subscribers
- ❖ >1,400 Miles of Multi-Lane ETC and Traditional Tolls
- ❖ Worldwide Leader in All-Electronic Tolling (AET)
- ❖ 1,100+ Staff (North America)
- ❖ 300+ Staff (USA)



GLOBAL RESOURCES WITH A LOCAL FOCUS

Video Tolling Business Rules: Based on Plate Images



Video Tolling Technologies: Based on Plate Images

- Video Toll Collection & Violation Enforcement Systems
 - License Plate Photography



Plate Image Theory

Color



B/W (grayscale)



Near Infrared



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CHALLENGES

Plate Image Reality



Color



B/W (grayscale)



Near Infrared



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■ Video Toll Collection & Violation Enforcement Systems

CHALLENGES

■ License Plate Photography



■ Plate Elements

- Plate Number
- Plate Type
- State/Jurisdiction

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CHALLENGES

X 50 STATES



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CHALLENGES



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Video Toll Collection & Violation Enforcement Systems

CHALLENGES



www.worldlicenseplates.com

11/2014



www.worldlicenseplates.com

5/2014



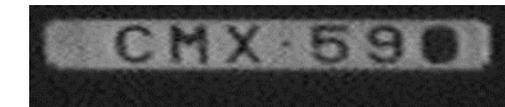
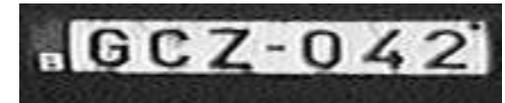
Video Tolling Technologies: Based on Plate Images

■ Video Toll Collection & Violation Enforcement Systems

CHALLENGES



Graphics courtesy of Q-Free



Video Tolling Technologies: Based on Plate Images

■ Video Toll Collection & Violation Enforcement Systems

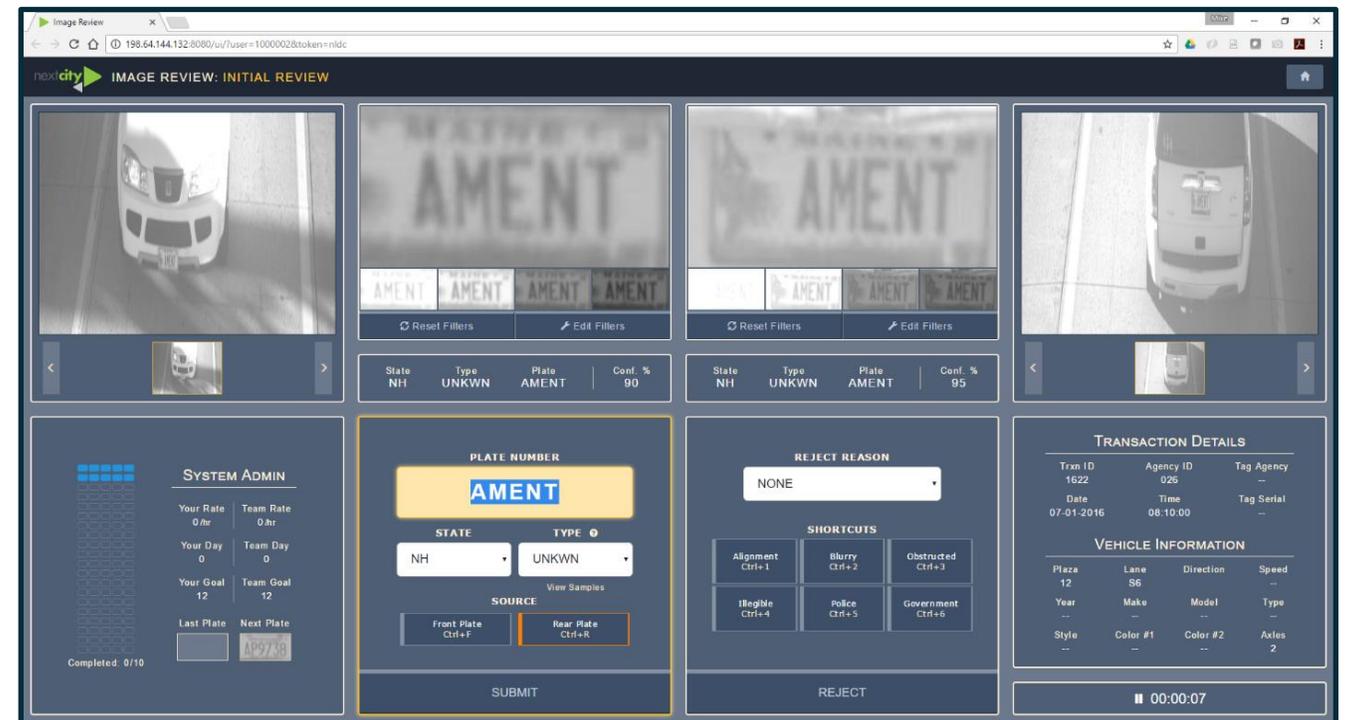
SOLUTIONS

- License Plate Photography
- Automated and Manual Image Review

Modern Image Review Systems combine **humans, hardware and software** to take advantage of the best capabilities that each brings to plate reading.

Machines can read certain plate styles and characters **faster and more accurately if given high quality images to process** (maximize cost effectiveness)

Humans can read **all possible plate styles even with poor images or plate quality** (minimize leakage)



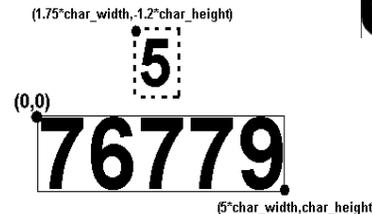
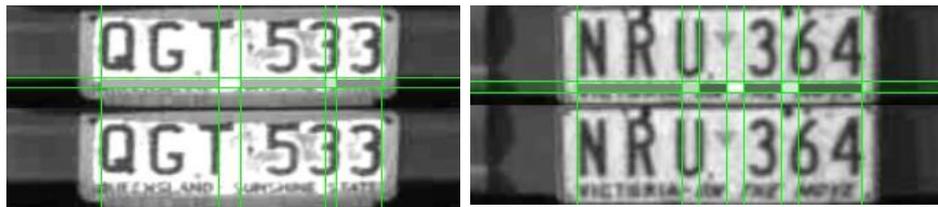
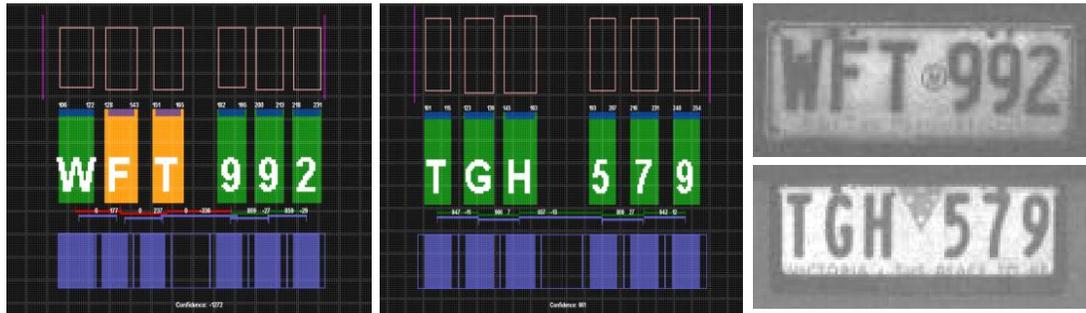
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Video Toll Collection & Violation Enforcement Systems

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SOLUTIONS

Optical Character Recognition (OCR)



KSA	
KSA (5 plate styles)	
	Car_private_1 Standard private car plate dddd III
	Truck_private_1 Standard private truck plate dddd III
	Truck_public_1 Standard public truck plate dddd III
	Export_1 Standard export plate ddd III
	Car_private_thin_1 Thin private car plate ddd III



Graphics courtesy of Q-Free



Video Tolling Technologies: Based on Plate Images

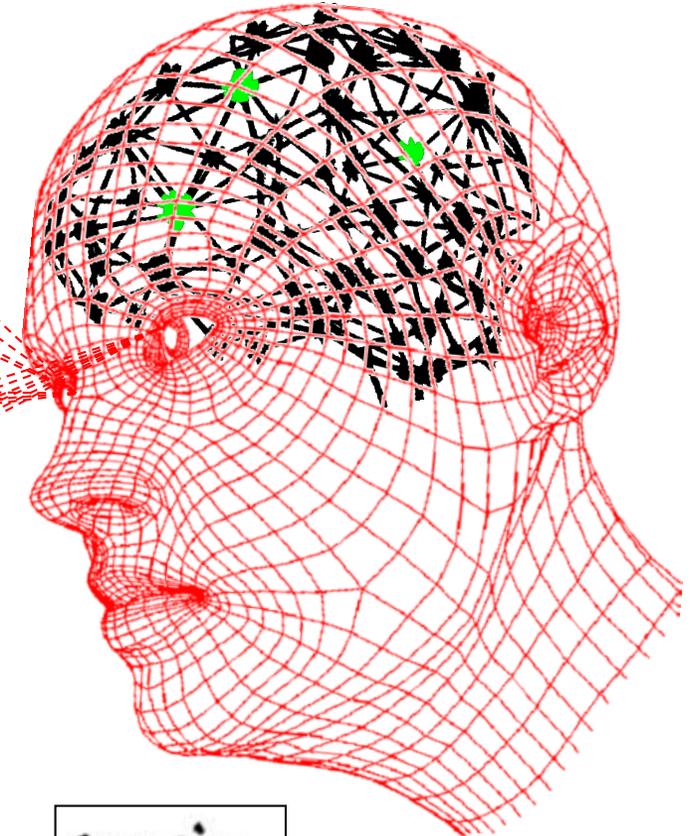
■ Video Toll Collection & Violation Enforcement Systems

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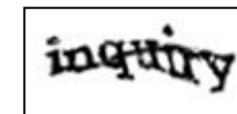
- ▶ Human vision can perceive details that are not explicitly present in digital data
- ▶ For humans, a video image is a trigger that sets off a highly complex perceptual experience that is not well understood computationally
- ▶ With very high accuracy



SOLUTIONS



CAPTCHA
Completely Automated Public Test
to Tell Computers and Humans Apart



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SOLUTIONS

Vehicle Signature Recognition (VSR)

VSR “fingerprinting” creates a digital “match” of the full image – it can confirm the OCR read.

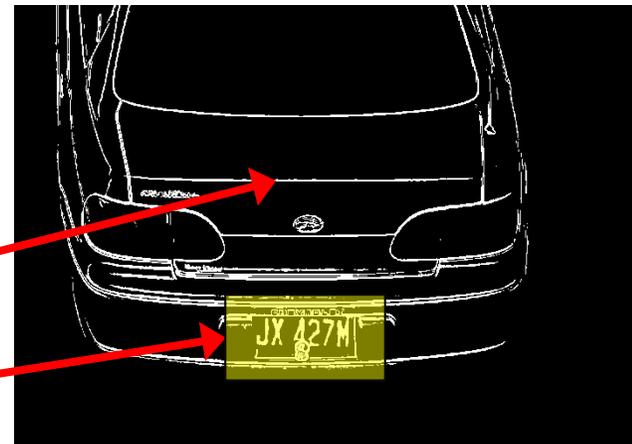


Graphics courtesy of Q-Free



Information utilized by OCR

OCR Result



Vehicle Pattern

Plate-Area Pattern (includes non-Plate info)

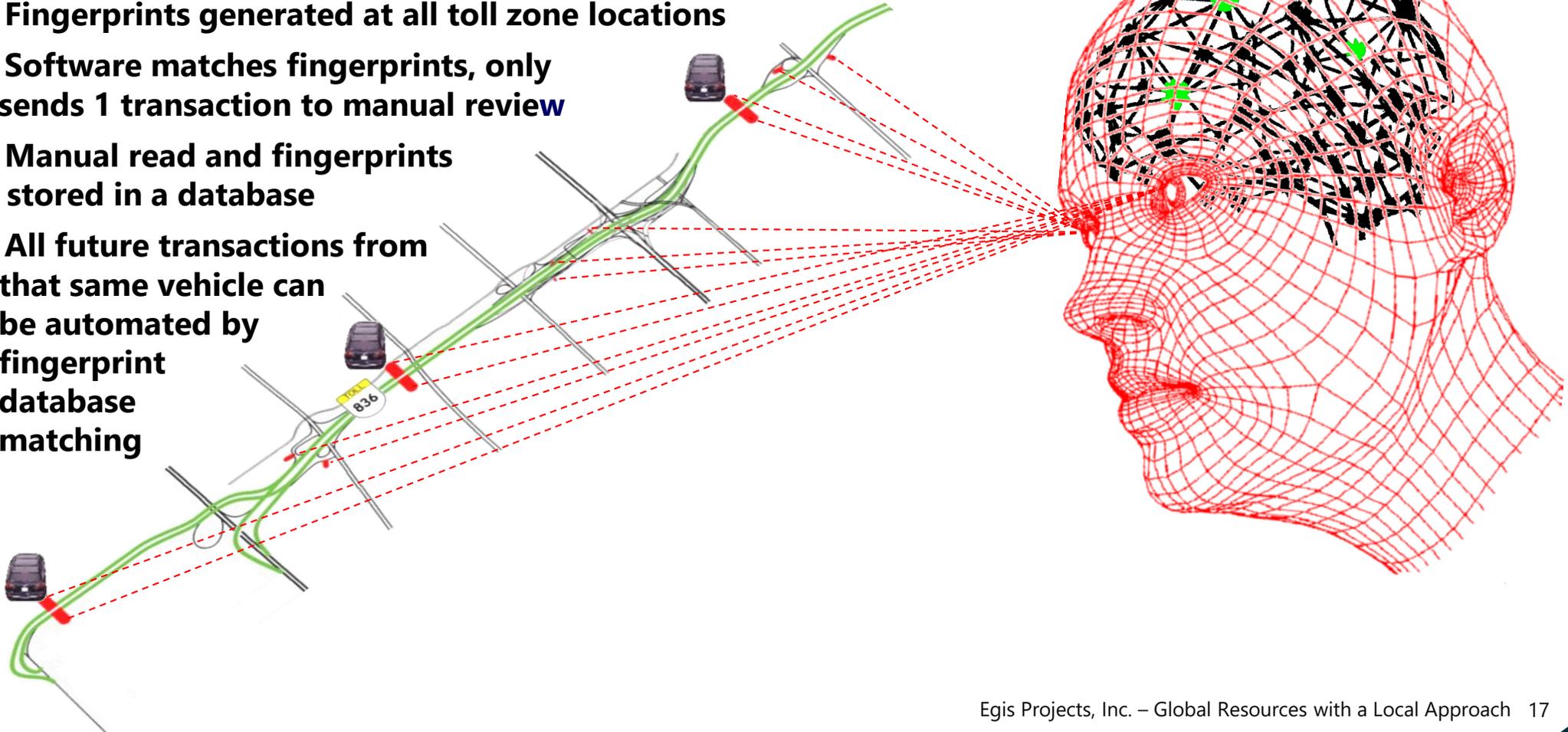
Vehicle Fingerprint & Match Result

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 - ▶ Fingerprints generated at all toll zone locations
 - ▶ Software matches fingerprints, only sends 1 transaction to manual review
 - ▶ Manual read and fingerprints stored in a database
 - ▶ All future transactions from that same vehicle can be automated by fingerprint database matching

SOLUTIONS



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SOLUTIONS

- License Plate Photography
- Automated and Manual Image Review

Combination of:
Modern OCR
VSR/Fingerprinting
Manual Image Review
= >99.9% Accuracy





CONTACT

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