AAMVA
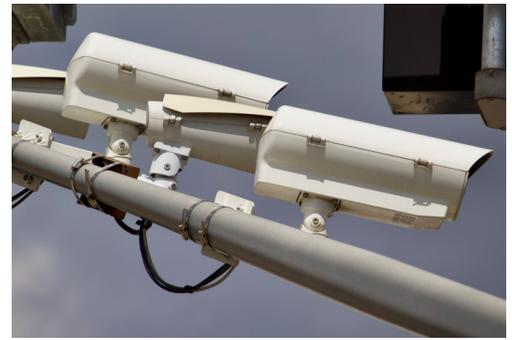American Association of
Motor Vehicle Administrators

technology
POLICY security
Safety training
REVENUE Data
ACCURACY

License Plate Reader Program
Best Practices Guide

October 2021

LAW ENFORCEMENT STANDING COMMITTEE
VEHICLE STANDING COMMITTEE

Contents

Executive Summary

Since their inception more than a century ago, license plates have primarily been used to display information for fast and accurate identification of motor vehicles and to demonstrate compliance with motor vehicle registration laws.

In support of their highway and public safety missions, License Plate Readers (LPRs) provide law enforcement with the ability to check license plates against various databases. Tolling and parking enforcement authorities also rely on LPR technology for the collection of tolls and enforcing parking regulations.

Law enforcement agencies can build meaningful LPR system policies that respect individuals' privacy rights while providing authorized users with the information necessary to ensure the public's safety.

More than a decade ago, it was recognized that inconsistent business rules used by license plate issuing authorities were resulting in alarmingly high "misreads," diminishing law enforcement's ability to identify and apprehend suspected criminals and terrorists, recover stolen vehicles, and assist people in need of assistance. Similarly, tolling and parking authorities are hampered in their revenue collection mandates that are critical to maintaining infrastructure and ensuring parking regulations are not flouted. In addition, license plate misreads hamper Customs and Border Protection's ability to correctly identify vehicles crossing international borders.

In response to this issue, in 2012, AAMVA published a *Best Practices Guide for Improving Automated License Plate Reader Effectiveness Through Uniform License Plate Design & Manufacture*. At the time, AAMVA did not have a License Plate Standard. Since that time, AAMVA has published a License Plate Standard (2016) and a License Plate Standard, Edition 2 (2020).

In 2020, the AAMVA Law Enforcement and Vehicle Standing Committees determined the 2012 LPR document should be retained but with content now covered in the License Plate Standard removed and the remaining material updated and added to as appropriate. This guide has been renamed *License Plate Reader Program Best Practices Guide* and has been refocused on best practices in the administration of LPR Programs for state and provincial law enforcement, although much of the content is applicable to tolling and parking enforcement authorities alike.

Chapter 1   Introduction

License Plate Readers (LPRs) are an effective law enforcement and traffic safety tool and are critical to government entities—such as tolling and parking enforcement authorities—who use the technology to enforce the law and collect revenue. LPRs enhance public safety and security by providing law enforcement the ability to check license plates against databases such as the National Crime Information Center. The databases searched are at the discretion of each law enforcement agency using LPR technology.

Federal, state, local, and tribal public safety agencies rely on accurate and timely license plate information to effectively and efficiently perform the multiple tasks required in the performance of their duties. Information is available in multiple formats, including hot lists (e.g., stolen vehicle), Be On the Look Out (BOLO), Attempt to Locate (ATL), officer safety information, AMBER Alerts for at-risk children, SILVER Alerts for at-risk adults, and more. Much of this information can be, and often is, associated with a vehicle's license plate. The ability of LPRs to quickly and accurately scan thousands of license plates is critical to the men and women of law enforcement who contact hundreds of thousands of people throughout the U.S. and Canada every day, as well as to Customs and Border Protection officers and agents monitoring international ports of entry. When LPRs misread license plates, law enforcement is hampered in its mission to protect and to serve, and government entities lose revenue from uncollected tolls.

The International Association of Chiefs of Police conducted a 2021 survey of police agencies across the U.S. about their use of LPR systems. More than 1,200 agencies responded to the survey measuring LPR use,

policy considerations, data retention and management, and more.[1]

Among all respondents:

- **40%** reported currently using LPR systems in their departments.

- Cost was the biggest barrier to LPR use.

- Larger agencies were more likely to use LPR systems than smaller agencies were.

- Mobile units were the most common form of LPR system used.

Among agencies using LPR:

- **75%** owned their own LPR system. Others contracted use of their LPR system or leveraged another agency's LPR system.

- **63%** shared their system with another agency, and **84%** shared their LPR data with other agencies.

- **64%** reported full control of the data in their LPR system.

- **44%** of the agencies using LPR stored their data on the cloud, and **43%** stored their data on agency servers or other government resources.

A study conducted by the Police Executive Research Forum[2] concluded that LPRs increased license plate reads by a factor of more than eight. What the study did not, and could not reveal, is the number of hits "missed" because of license plate misreads. Regardless of the misread rate in a particular jurisdiction, there

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1 As of this printing, these represent preliminary estimates only.

2 Combating Auto Theft in Arizona: A Randomized Experiment with License Plate Recognition Technology: Police Executive Research Forum, December 2011.

is no refuting that misreads occur. And when they do, the potential exists to miss opportunities to arrest a suspected criminal or terrorist, to recover a stolen vehicle, or to collect toll revenue.

A completely effective "ecosystem" is needed to ensure as close to 100% as possible accurate license plate read rate is achieved by LPRs. Multiple stakeholders share the responsibility for maintenance of the ecosystem. Motor vehicle agencies having license plate design and manufacture administration oversight responsibility should ensure their issued license plates align with the AAMVA License Plate Standard (see Appendix B). LPR manufacturers have a responsibility to develop and implement state of the art technology to accurately read the multi-variant license plates that exist. Law enforcement and other government entities using LPR are responsible for ensuring they have policies and training that align with the most current best practices available.

AAMVA published a *Best Practices Guide for Improving Automated License Plate Reader Effectiveness Through Uniform License Plate Design & Manufacture*. At the time, AAMVA did not have a License Plate Standard. Since that time, AAMVA has published a License Plate

Standard (2016) and a License Plate Standard, Edition 2 (2020) (see Appendix B).

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AAMVA also has four policy statements addressing license plates (see Appendix B).

In 2020, AAMVA launched the License Plate Verification Program (LPVP). The LPVP allows jurisdictions to submit up to four license plates per fiscal year for examination and comparison with the AAMVA License Plate Standard, at no cost to the jurisdiction. The examination is conducted by an independent third-party laboratory under contract with AAMVA. A written report is provided to the submitting jurisdiction outlining areas where their license plate(s) do, and do not, align with the License Plate Standard. The report identifies for jurisdictions areas for potential improvement in the readability of their license plates.

This LPR Program Best Practices document, combined with the AAMVA License Plate Standard, Edition 2; License Plate Policy Statements; and License Plate Verification Program all serve to assist jurisdictions in shaping of jurisdiction laws and regulations and operational policies ensuring license plate readability and integrity.

Chapter 2 License Plate History

Introduction

Since their inception more than a century ago, license plates have primarily been used to display information for fast and accurate identification of motor vehicles and to demonstrate compliance with motor vehicle registration laws. The advancement of manufacturing technology has resulted in more colorful and detailed graphics on plates, which can be used to promote a jurisdiction or organization but at times have created an identification challenge for law enforcement and a readability challenge for camera technology. Most jurisdictions now have numerous plate types and designs available to the public.

Hand-Made, Horse-Drawn

The first record of a registration plate in the U.S. was in Philadelphia, Pennsylvania, in the 1850s. Even then, legibility of plates was a concern, and horse-drawn vehicles required registration to be identified with numbers "not less than four inches high." Among other things, these numbers provided a means of identification when reporting an incident involving inappropriate or reckless driving. Today, only the state of Indiana still requires a license plate on a horse-drawn carriage.

The construction of these early registration plates was left to the innovation of the vehicle owner; wood, brass, or other metals affixed to leather backings were common materials used. During the next 50 years, many cities required registration, and they frequently required payment of a modest registration fee.

Plate Production and Issuance

In the early 1900s with the advent of motorized vehicles, jurisdictions took responsibility for registration and standardization of plate issuance.

In 1901, New York became the first state to require license numbers on motor vehicles. In 1903, Massachusetts was the first state to issue a standard statewide plate. Others soon followed, but issuance of plates remained inconsistent.

California also began requiring plates in 1903 but did not produce them; the Automobile Club of Southern California (an early AAA organization) issued license plates—called mouse ears—to members for $1.00. The state assumed this responsibility in 1910.

On March 22, 1905, the Maine senate debated House Document 552, which required automobiles to be registered and plates to be issued. A senator argued in favor of the plate by stating: "The point upon this bill comes is upon the matter of registration. What does it mean? The matter of registration does not prevent the violation of the law, but the matter of registration, and the law compelling the carrying in a conspicuous position, of a certain number, which leads to the registration and which may lead to the detection or recognition of a violation of the law, is all that registration can amount to as to guarding the safety of the public against accidents from automobiles."

As the debate continued, another senator voiced his support for the display of a number on automobiles so that the operator could be identified when it frightened a horse. In part he stated, "I do not own

an automobile, and do not ever expect to. I do own a cheap horse and have a wife and three girls that drive it. What is the result now? They do not dare to go out. I have a safe horse, but when one of those reckless fellows comes along (*in an automobile*), they are likely to get tipped out, as many have in the State of Maine."

The debate continued, the bill passed and became public law Chapter 147. It required the Secretary of State to license operators, to register automobiles and motorcycles, and to issue plates. The law also required the Secretary of State to "furnish the applicant two enameled iron plates containing the word 'Maine' and the number of the registration in Arabic numerals not less than four inches in height. The number plates must be attached to the front and back of the automobile and one number plate must be attached to the back of motorcycles."

Maine plate, 1905 to 1911. The width changed based on the number of characters on the plate.

Starting in 1903, "mouse ear" plates were sold for $1 by the Automobile Club of Southern California.

By 1915, nearly all jurisdictions issued license plates on an annual basis and charged a registration fee that allowed a vehicle to be driven on public roads. Government officials recognized early on that a registration system provided for vehicle identification and a source of transportation revenue. However, license plate design continued down an inconsistent path. It wasn't until 1956 that a standard plate size (12" x 6") was introduced at the request of automobile manufacturers to make it easier to incorporate license plates.

Integrating Safety Concepts

With the rapid increase in the motor vehicle population in the 1920s and 1930s, traffic crashes increased dramatically, leading to the need to improve not only vehicle identification but also vehicle safety. License plates became one means to improve safety by providing a device that improved the night visibility of motor vehicles. The first retro-reflective license plates in the U.S. were issued by New Mexico in 1936.

As retro-reflective technology advanced, fully retro-reflective plates became possible and the first was issued by Connecticut in 1947 followed by Maine in 1949. Delaware followed suit in 1950 followed by Rhode Island and Oregon in 1951.

During the 1950s, relatively new sheeting gave retro-reflective plates their biggest boost. Minnesota had the distinction of being the first state to use the sheeting on automobile license plates.

The effect that retro-reflective plates had on nighttime motor vehicle crashes was dramatic, and it did not go unnoticed. In 1956, the first year of use in Minnesota, deaths caused by automobile crashes in rural areas dropped from 24% to 9%. Urban area fatalities involving parked vehicles decreased from 28% to 7%.

Standards Materialize

Tiny San Marino—the smallest republic in Europe, with an area of only 24 square miles—had the distinction of being the first country on that continent to make reflective license plates mandatory on all 2,500 of its automobiles. In the other hemisphere, the South and Central American countries of Peru and Costa Rica also became pioneers in retro-reflective license plates. In Canada, the provinces of Newfoundland and Alberta led the way. Today, all 50 U.S. states and most other countries in the world use retro-reflective plates.

With the advent of retro-reflective license plates, law enforcement realized a benefit in improved legibility.

Although one of the original intents of a vehicle registration number was to aid law enforcement, the reality was that non-reflective plates could only be easily read during daylight hours. Retro-reflection provided greatly improved legibility at night, and even today fully retro-reflective plates continue to have strong endorsement from U.S. law enforcement officials, who advocate fully retro-reflective plates on both the front and rear of vehicles for improved safety and law enforcement efficiency.

Although early license plates were often homemade or devised of porcelain, steel became the predominant base material for plates during the first half of the 20th century. Today, aluminum dominates as the material used in license plate manufacture.

After 1945, most states returned to the pre-war practice of requiring two plates per vehicle. Since then some states have moved from two plates to one or vice versa. States typically move to one plate with the intent to save on the cost of the second plate. During the late 1980s, Connecticut was the last state to move from one plate to two plates. Law enforcement effectiveness was cited as the primary reason for the change. The U.S. and Canada are two of a small number of countries that allow one plate. The following chart identifies the North American jurisdictions that require either one or two license plates.

Within the U.S. and Canada, each jurisdiction is responsible for issuing license plates for vehicles registered in their jurisdiction. To create a plate unique and easily recognizable to that jurisdiction, combinations of colors were originally used. Plate background color and colors of the alphanumeric were varied, along with the characters, to create the necessary combinations needed for vehicle classifications and to differentiate plates among the jurisdictions. With increases in vehicle populations and registration classifications, color alone was not enough. Graphic technology became available in the early 1970s that allowed another level of differentiation of license plates. In 1973, Illinois was the first state to

One vs. Two License Plates

- ◼ Two plates required
- ◼ One plate required

Three Canadian jurisdictions require two plates and 10 require one plate. Thirty U.S. States and the District of Columbia require two plates and 20 states require one plate. NOTE: The five U.S. Territories are not included.

use graphics preprinted on the reflective sheeting, for a special plate for disabled veterans. South Dakota quickly followed with the first general issue graphic of Mount Rushmore National Monument. Today all jurisdictions use graphic plate design. When first introduced, graphic design plates were viewed as attractive and as a mechanism to enhance the image of the jurisdiction.

However, since the proliferation of graphic plate designs, law enforcement is no longer able to easily recognize the issuing jurisdiction. The widespread use of graphics and colors frequently makes legibility of the plate characters a challenge for law enforcement.

Modern Features, Security, and Function

Until the 1990s, all the U.S. and Canada and most of the rest of the world produced license plates with raised (embossed) alphanumeric characters. In the late

1990s, digital printing technology was introduced, resulting in flat, digitally printed license plates. Today, many states are issuing flat plates. Some jurisdictions issue a combination of embossed and flat plates.

As a result of increasing concern with the use of counterfeit license plates used to perpetrate crimes, security features were added to license plate. These security features allow for easy recognition of fraudulent plates and provides one more obstacle for criminals to overcome.

The following functions of a license plate have been, and continue to be, the most important over the past century:

- Display of information necessary for fast and accurate identification of a motor vehicle and compliance with motor vehicle registration laws

- A validation sticker is issued in most jurisdictions, often rotating the color, to indicate a current and valid registration

- Provide an added margin of visibility and safety by making vehicles more visible

More recently, additional functions of license plates have emerged to

- Provide revenue for highway funds and sponsoring organizations (specialty and vanity plates)

- Use images of plates to improve and increase toll collection, parking fees, and fines

- Provide a way for individuals to express their pride or to promote various causes

- Provide access control to parking, facilities, and gated communities.

Alternative Vehicle License Plates

Two nontraditional license plate technologies have recently emerged: digital license plates and front license plate wraps. These alternative vehicle license plates are intended to replace traditional aluminum or metal license plates.

Digital license plates are reflective but not retro-reflective, creating challenges for law enforcement, tolling authorities, and others that read license plates in all light conditions and rely on License Plate Reader (LPR) technology, which is currently programmed to read retro-reflective license plates.

A license plate wrap is an adhesive license plate applied to a vehicle's bumper. Wraps, where currently authorized for purchase, are only allowed to be applied to the front of a vehicle.

A curved, indented, or otherwise non-flat surface could render the wrap unreadable to LPRs or the human eye.

For a fuller explanation of both the benefits and challenges associated with nontraditional license plates, see the AAMVA License Plate Standard, Edition Two, Chapter 5 – Alternative Vehicle License Plate Displays.

Chapter 3 License Plate Reader Fundamentals

Introduction

This section provides an overview of License Plate Readers (LPRs), the license plate reading process, and key challenges faced by LPR systems.

Typical applications for LPR technology by law enforcement, motor vehicle administrations, and other entities include but are not limited to:

- Law enforcement stolen vehicle and other "hot list" files

- AMBER, BLUE (violent criminal who has killed or injured a law enforcement officer), and SILVER Alerts

- Open road tolling (pay by plate)

- Congestion pricing

- Parking enforcement

- Access control

- Traffic studies

- Automated speed enforcement

- On-street parking enforcement

- Travel or journey time calculations

As the demand for LPR systems expands in both law enforcement and commercial applications, LPR technology continues to evolve. LPR provides cost-efficient approaches in varied environments that include both environmental challenges (e.g., mobile-based platforms, high-speed traffic) and license plate challenges (e.g., introduction of new designs, fonts, and so on across multiple jurisdictions).

The reads from LPR systems, namely the license plate number and in some applications the license plate jurisdiction, are primarily used as input into downstream systems to support the intended application. For example, whereas in open road tolling systems, the license plate number and jurisdiction are used to support the collection of toll revenues, in federal and state law enforcement systems, the license plate number and jurisdiction are used to support law enforcement queries against both large-scale (e.g., National Crime Information Center) and local data sources.

In some applications, manual verification or certification of LPR results is required at some point in the process. To the extent LPR systems can improve and retain a high degree of accuracy, operational costs can be reduced. In some applications, LPR system service-level objectives call for a 95% accuracy rate in correctly identifying both the license plate number and jurisdiction when the license plate is completely visible in the license plate image. The most significant challenge to maximizing license plate read rate accuracy is the ability of LPR system vendors to quickly adapt to the introduction of jurisdictional license plate designs with varying fonts, graphical designs, stacked letters, and so on.

License Plate Reader Systems

LPR systems include deployment of fixed, portable, mobile, and mobile application platforms.

Fixed Platforms

Fixed LPR platforms are permanently mounted on fixed infrastructure such as overhead gantries or roadside bollards. LPR fixed platforms are commonly used in open road tolling, commercial vehicle weigh station operations, and some federal and local law enforcement applications.

Fixed LPR in weigh station operations.

Fixed LPR in Customs and Border Protection inbound.

Portable Platforms

Portable LPR systems can be transported between locations, assembled, operated, and then disassembled. Once deployed, they operate as a fixed

Portable department of transportation trailer with LPR.

Speed trailer with LPR.

platform. Examples include portable trailers, traffic barrels, and other platforms configured with or containing LPR equipment.

Mobile Platforms

Mobile LPR systems are defined as any LPR system that is mounted on a vehicle, whether a police car, tow truck, street sweeper, parking enforcement vehicle, and so on. These systems can include one to four camera configurations and are typically mounted on the roof or trunk, or they are custom manufactured.

Typical components of mobile systems include cameras that obtain images of the plate and vehicle, which in turn are passed to a processor mounted in the trunk. The processor locates the license plate in the image and extracts the license plate number. It then compares the textual license plate read against selected data sources and sends the output in the form of an alert to a mobile data terminal (screen) and an operator in the cab. The alert typically contains the name of the data source to which the image was compared such as an expired license or registration system, an infrared (IR) image of the license plate, and a color overview image of the vehicle in question. Data generated from mobile LPR systems can also be stored or transmitted via a back-office software application.

Patrol vehicle roof-mounted LPR.

Parking enforcement roof-mounted LPR.

Mobile LPR Applications (Apps)

Mobile LPR applications are defined as LPR systems that are held and operated by individuals using devices such as barcode readers, ruggedized PDAs, and smart phones that provide other capabilities (e.g., communications, internet access). These technologies provide mobile LPR capabilities and rely on the user to point the imager toward the location of the license plate.
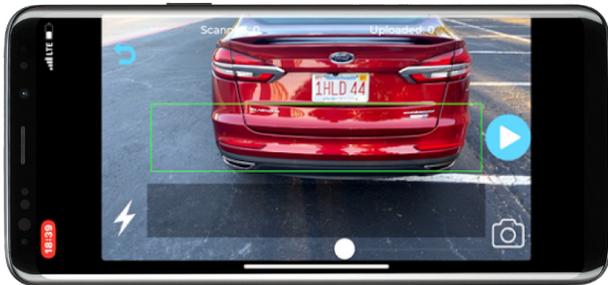
LPR application on a mobile device.

Use of these devices is limited to speed applications typically less than 45 mph and are subject to unique challenges such as shadows, low ambient light, distance or angle to the license plate surface, and non-reflective surfaces. These limits can be overcome using techniques to light or IR illuminators resident in the device. Because IR imagers are not typically available on commercial general-purpose handheld devices, overcoming readability of non-reflective surfaces using a color imager generally requires special Optical Character Recognition (OCR) techniques. The accuracy of these OCR devices is dependent on the specific device and environment in which it is being used.

Handheld platforms are useful because they are easily deployed and can be used in parking enforcement, covert applications, portable checkpoints, and more. Benefits include portability, relatively low cost, and tactical use. The biggest drawback is that when the LPR application is used, it drains the device battery much faster than normal usage.

LPR Camera Technology

Two primary approaches are used to capture images from which the license plate information can be extracted. One approach is to capture a single still image of the license plate at an "optimal" distance from the camera, where the illumination, lens settings, and field of view can all be controlled to yield the best possible images under any ambient lighting and weather conditions. Another approach is to capture multiple images as the vehicle travels through the field of view of the camera. In this approach, near-instantaneous adjustments to the flash, shutter, and gain settings are performed to optimize the license plate image for different environmental conditions.

Monochrome (black and white), color, and IR cameras are used in various solutions. Monochrome cameras tend to yield the best resolution, can work with most types of visible light illumination, and are generally less costly. Color cameras are useful when the color information can be used to improve

the separation between characters and background and for identification of the jurisdiction. Color cameras require white light to produce accurate color information and are of very limited value at night without the use of additional illumination.

IR cameras are tuned to respond to IR illumination. IR cameras tend to be most sensitive at night and tend to be fitted with a band-pass filter designed to block visible light (to limit the effect of headlights and sunlight). This tuned IR illumination is effective at reflecting off the reflective background finish of the plate and not reflecting off the non-reflective characters (or vice versa).

Additional cameras are often used as part of the solution so that both a plate image and a vehicle image can be simultaneously captured to provide context and for investigative purposes. Multiple cameras are also useful when multiple bandwidths of light are used. For example, the fusing of white light and NIR (near-IR) light imagery adds significant information during the OCR and jurisdiction determination.

License Plate Recognition Process

The license plate recognition process begins when a vehicle is detected by an LPR system and ends when an LPR system information has been collected, analyzed, and handed off to backend systems for further processing.

The key steps of the LPR process are to

- Detect the vehicle and/or license plate.

- Locate the license plate in the image(s).

- Extract license plate characters from the background.

- Identify the license plate number.

- Determine the license plate jurisdiction *(optional)*.

- Hand off LPR results to backend systems.

The following paragraphs describe each of the LPR steps in detail.

Detecting the Vehicle and/or License Plate

External triggers such as through-beam IR sensors, retro-reflective license plate sensors, ground-based induction loops, laser range sensors, and so on can be used to detect the presence of a vehicle in the field of view of the ALPR system. These types of triggers are primarily used in fixed-platform ALPR systems. Alternatively, the ALPR system detects the presence of a license plate by analyzing the camera's video signal (which may capture up to 60 images per second) and looking for potential license plate candidates. This type of detection is primarily used in mobile platform ALPR systems and can support vehicle speeds up to 140 mph. When the vehicle is detected, the ALPR captures one or more images containing the license plate that will be used to support the subsequent license plate number and jurisdiction determination.

Locating the License Plate in the Image

After one or more images containing a license plate are captured, a "license plate finder" algorithm is used to determine the exact location of the license plate in the image. This may be accomplished by searching for license plate characteristics (e.g., high-contrast objects) or character strings in the image that indicate the presence of a license plate. This process is one of the most difficult steps of the LPR process because the license plate must be located in potentially conflicting images that contain other information that may appear as license plates (e.g., bumper stickers, other writing, contrasting graphic designs). In addition, the type and condition of the license plate (e.g., retro-reflective, non-reflective, license plate frames and covers, license plate orientation) may require the use of special lighting and camera technologies to both locate and present the optimal license plate image to the character recognition algorithms.

As shown in the picture below, LPR cameras can vary flash, shutter, and gain settings to capture multiple images per vehicle over a wide range of ambient and environmental conditions.

Camera Arrangement			Resulting Image with Unchanged Ambient Conditions
Flash Duration	=	130 μs	KUF 593
Shutter Duration:	=	200 μs	
Gain	=	2	
Flash Duration	=	390 μs	KUF 593
Shutter Duration:	=	500 μs	
Gain	=	2	
Flash Duration	=	780 μs	KUF 593
Shutter Duration:	=	1000 μs	
Gain	=	2	

By varying camera settings and controlling illumination, the ability to locate a license plate within an image can be greatly improved. In addition, the 'best' image can also be used to improve the accuracy of the subsequent character extraction and license plate number determination.

License plate that has been located in the larger vehicle image captured by an LPR camera.

Extracting the Characters from the Background (Segmentation)

After the license plate is identified in the images(s), the region around the license plate may be further analyzed to extract the characters from the background. In the following example, pixels making up the candidate region are separated into foreground and background pixels to provide a more suitable candidate image used by the OCR algorithms to translate a character string image into an alphanumeric value that constitutes the license plate number. This is made more difficult when there is little contrast between the license plate number and the plate background. The segmented or pre-processed license plate image is then passed off to OCR software, where the images are converted to individual alphanumeric characters.

Determining the License Plate Number

Challenge: Poorly designed fonts and variations in fonts themselves, additional symbols, half-height characters, location of registration stickers, license plate frames and covers, and holograms on characters all increase the complexity of OCR algorithms used to determine the alphanumeric characters of a license plate.
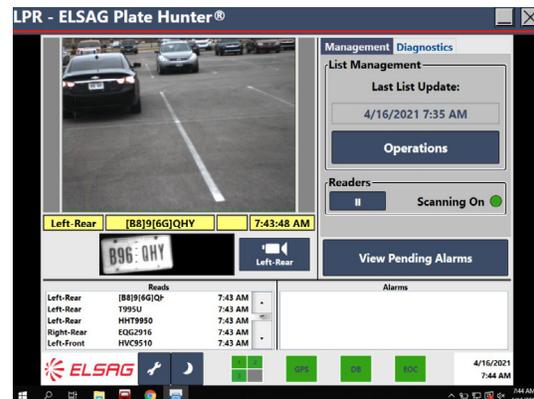
In the following example, you can see the software cannot discern whether the first character is a "B" or and "8" and whether the third character is a "6" or a "G."

In the following license plate examples, the ascender and descender of the letter 'Q' takes on different characteristics that may require specifically tuned or trained OCR engines depending on the region or jurisdiction in which the LPR system is deployed. The number '4' in the first license plate compared with the '4' in the second photo below provides another example of inconsistent fonts used between jurisdictions, making the same number look different. Note that the image processing and segmentation steps described must discern the actual license plate number from other alphanumeric information such as vehicle registration tabs and jurisdiction names and logos.

Determining the License Plate Types and Jurisdiction

Some LPR systems can identify the license plate type and the jurisdiction of origin by recognizing key features on the plate such as the jurisdiction logo, background graphics, special symbols, unique character font features, and so on. Other techniques include applying syntax rules and other regionalization rules to provide additional clues to determine the license plate jurisdiction. Use of white light for this process significantly improves the accuracy of jurisdiction identification. Many of the jurisdiction specific features are lost when imaging the license plate in the NIR light spectrum.

Handing Off LPR Results to Backend System

After the license plate number and, in some cases, the jurisdiction, are determined, the information is handed off to backend systems in support of the intended LPR system application. These systems may compare the license plates with watch lists or other

law enforcement systems to allow interdiction or other actions to occur in near real time. Sometimes these actions are not for interdiction purposes but merely to allow vehicles to gain access to secure locations, parking garages, and so on.

In some cases, the LPR data—along with supplemental data such as scene and driver images, vehicle location, and date and time stamps—are stored in highly scalable and searchable data sources to support intelligence analysis, bill generation, or other processes that may occur at a later date.

LPR systems are often configured to automatically communicate or transmit all the collected data to a backend data archive or server. Communication methods can include any conventional networking protocols, including cellular, Wi-Fi, hardwire, and thumb drives, all with a variety of security protocols. In many cases, this communication process occurs in the background without any effort from the system user.

After the data have been inserted into the backend data management software, they are immediately available for review and search. These systems are generally web based and can support numerous workstations simultaneously. Often the software solutions used to manage data sources allows information to be queried in a multitude of ways, by location, time, plate number, and so on.

In addition, the image captured and the results generated by the ALPR system can be digitally signed and encrypted to enable a third party to verify that the data was collected at a specific time and location and that no one has tampered with it. This approach also provides for a chain of custody for legal evidence purposes.

Challenges Associated with License Plate Reading

Certain steps of the LPR process present unique challenges that require continuous innovations in hardware and software technologies. A key challenge is the constant introduction of new and varied license plate designs that greatly expands the types of license plates

that LPR systems are required to process. Some of those challenges and the current techniques being applied to address these challenges include the following.

## Detecting the Vehicle and/or License Plate

Challenge: LPR systems operate in outdoor environments subject to constantly changing conditions, including lighting, weather, varying vehicle speed and acquisition angles, and varying distances from cameras.

Techniques: LPR camera locations, focal points, illumination controls, and vehicle detection sensors are carefully controlled to help ensure the capture of optimal images used for subsequent license plate location and OCR. Often ALPR cameras are sequencing illumination levels or acquisition parameters to counteract the constantly changing conditions in which they are operating.

Locating the License Plate in the Image(s)

Challenge: Low-contrast license plates, license plate frames and covers, and other noise in the image (e.g., bumper stickers) all impact the ability of license plate detection algorithms to locate the license plate in the larger image captured by the LPR system.

Techniques: Commercial LPR systems typically use a narrow band of IR illumination to light the plate for detection purposes in nearly all weather and lighting conditions. This band ranges from 750 nanometers (nm), which has a visible bright red glow, to 810, 850, 940, and 950 nm. A 950-nm IR illumination is completely invisible to the naked eye.
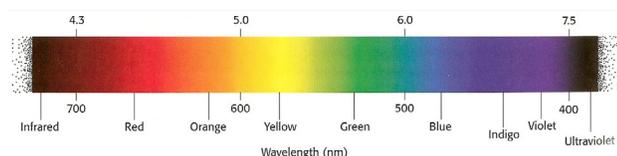
The purposes in using several bands of IR light are to filter out the effects of background graphics and to highlight the alphanumeric characters for OCR software systems. To help overcome graphic-heavy backgrounds, a spectral analysis can be performed

automatically on a plate-by-plate basis to determine which IR illumination is best suited for each plate at the time it is read by the LPR. In general, lower IR bands such as 750 nm handle heavier graphics, and higher IR bands of light are more effective with lower density graphic backgrounds.

Extracting License Plate Characters

Challenge: License plates with conflicting backgrounds or graphics that encroach on the character fields present conditions that make it difficult to recognize specific license plate characters.

Technique: To address these challenges, LPR systems can use different illumination techniques to improve the contrast between characters and background. Also, specialized segmentation algorithms are used to segment the characters from the background. Many LPR systems use neural networks that are trained to find characters correctly in cases of low contrast between characters and background.

In this example, the R could be read as an A and the Q as an O.

The first photo shows a plate with three stacked characters (the AAMVA License Plate Standard calls for no more than two characters to be stacked). The second photo shows appropriate half-height stacked characters. In some jurisdictions, the stacked characters are considered part of the plate number, but in other cases, they are not.

When characters are located too close to the plate's edge, license plate frames can easily prevent the plate number from being read by an LPR.

Chapter 4 License Plate Reader Benefits

Introduction

Prior to the introduction of License Plate Reader (LPR) technology, a law enforcement officer could run a minimal number of plates per shift. LPR technology allows an officer to "read" more than eight times the license plates than officers conducting only manual checks. LPR systems may be used in targeted areas such as crime hot spots, assisting law enforcement in obtaining valuable information of vehicles that may be involved in criminal activity. Moreover, by eliminating the manual check process, not only is officer efficiency increased, but it allows officers to focus more on their surroundings, which improves both officer and public safety.

In studies supported by the National Institute of Justice, research was conducted as to the effectiveness of LPR use for law enforcement patrol and investigations. The first study was conducted in a large suburban jurisdiction in designated hot spots for a period of four months. Officers who used LPR were found to be much more likely to recover stolen vehicles than officers who did not use LPR. The second study examined how LPR could be used for investigations and was focused on a large city with nearly 100 LPRs in fixed locations. After two years, researchers noted 4,000 incidents were documented, including auto theft, missing persons, and homicide cases. LPRs were found to provide information that contributed somewhat to resolving roughly one in five incidents.[1]

Misreads of license plates by LPRs or illegible license plates causing no reads by LPRs do occur.

Research conducted by one major toll authority from December 2020 indicated that 9% of toll revenue was lost because of unbillable revenue from misread or illegible license plates.

Gantry mounted LPR technology commonly used for automated toll collection.

When they do occur, the potential for arresting the wrong person, missing an opportunity to arrest a suspected criminal or terrorist, recover a stolen vehicle, or miss toll revenue exists. Research conducted by one major toll authority from December 2020 indicated that 9% of toll revenue was lost because of unbillable revenue from misread or illegible license plates.[2]

Challenges to Law Enforcement

In the past, a law enforcement officer could be familiar with all 50 states' license plates. Today with the proliferation of license plate designs, specialty, and vanity plates—in some cases into the hundreds in a single jurisdiction—it is virtually impossible for instant visual recognition for today's police officer. The issue

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1 Christopher S. Koper and Cynthia Lum, "Effectiveness of License Plate Readers for Patrol and Investigations," Research in Brief, Police Chief 85, no. 9 (2018): 14–15.

2 E470 Public Highway Authority Quarterly Dashboard Report December 31, 2020.

is exacerbated by the introduction of additional new license plate designs each year. Moreover, novelty plates that closely resemble official license plates have added to the difficulty law enforcement contends with in determining plate validity.

A sampling of eight states illustrates the significant growth in the number of license plate designs in circulation in the U.S.

This table represents a sample of the growth in license plate designs:

Jurisdiction	2009	2012	2021
Arizona	52	64	75
California	106	117	167
Maryland	800	935	1,365
Missouri	172	200	269
Montana	152	177	350
Pennsylvania	245	310	582
South Carolina	385	417	429
Texas	225	376	499
8 state totals	2,137	2,596	3,736
% Increase from 2009 to 2021			57%

Officer Safety Benefits

Safety is of paramount concern for any law enforcement officer initiating a "routine" traffic stop. Officers in patrol vehicles that are not equipped with LPR technology may not be as informed about the vehicle and its occupants as those who have the technology.

LPR technology provides the ability to check the vehicle plate number automatically and rapidly against selected databases. License plates are often "flagged" when the owner is associated with certain information (e.g., wanted, attempt to locate, be on the lookout for, stolen car). With LPR technology, officers stopping drivers for sometimes minor traffic offenses can be

made aware of this type of information, which allows them to use the appropriate officer safety tactics given the information they have instead of unknowingly walking into a dangerous encounter.

Traffic Safety Benefits

One significant example of a traffic safety benefit involves suspended, *revoked, or otherwise ineligible* drivers. *Across North America, at any given time, approximately 7% of all drivers are suspended, and it is estimated as many as 75% of these people continue to drive.*[1] Moreover, 19% of all fatal crashes involve an unlicensed or suspended driver. These drivers pose a significant threat to highway safety. LPR technology has the capability to quickly identify vehicles whose registered owners have suspended or revoked licenses or registrations, making it much faster and easier for law enforcement officers to detect and apprehend suspended drivers.

Benefits to Law Enforcement: Beyond Traffic Safety

LPR's are at the forefront of discussions about the impact of technology on improving traffic and public safety. In the field of auto theft recovery and investigation, the LPR is a force multiplier for officers in the field. The technology enables reading and checking the status of thousands of license plates in a single shift, all while the investigator can watch his or her surroundings for activity, malevolent or benign. The LPR is a tireless partner, constantly on the watch

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1 The National Cooperative Highway Research Program, Report 500, Volume 2.

for stolen vehicles and wanted subjects, AMBER Alerts, missing persons, and more. This technology is even more effective when there is a front and rear license plate for the LPR to read.

Many police agencies use LPR-equipped vehicles to collect plate information as they respond to bank robberies and other major crimes to capture plate numbers of vehicles leaving the area as police respond to the scene of the crime. There have been many instances when these reads have led to the identification of suspect vehicles and suspect arrests.

Public Safety Benefit

As mentioned in the previous Benefits subsections, LPR-equipped law enforcement vehicles can scan thousands of plates an hour, thus increasing the chances of finding a particular vehicle quickly, enhancing highway and public safety. One example was provided by the Utah Department of Motor Vehicles Enforcement Division, which prior to installing LPRs on their police vehicles, averaged

One example was provided by the Utah Department of Motor Vehicles Enforcement Division, which prior to installing LPRs on their police vehicles, averaged 400 stolen vehicle recoveries annually. After LPR deployment, they now scan 45,000 plates monthly and are now recovering more than 1,000 stolen vehicles annually. See Chapter 7 – License Plate Reader Success Stories for many more examples.

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It should be noted that there are circumstances when the lack of a front license plate limits the effectiveness of LPR on front-facing traffic. This is also an issue for school bus drivers who report drivers who fail to stop for the buses while loading or unloading students. These drivers often rely on the presence of a front license plate to be able to report these violations. Some tolling authorities also rely on the front plate for both revenue collection and enforcement.

Homeland Security Enhancements

LPR technology has also become an important national security tool. LPR technology is used to query the license plate numbers of vehicles entering and departing the U.S. to identify potential threats to national security. LPR units are also set up in locations in proximity to critical infrastructure to identify potential threats.

Chapter 5 License Plate Readers as a Tool to Improve Toll, Commercial Motor Vehicle, and Border Operations

Introduction

This chapter discusses how License Plate Reader (LPR) systems benefit public mobility but also have become core to the way many electronic toll systems collect tolls and enforcing payment. LPR has made it possible for the toll industry to move increasingly toward all-electronic cashless toll operations, which are permitting free-flow traffic to pay tolls at highway speeds, improving roadway efficiency, improving the customer experience, and mitigating adverse environmental impacts. Road and bridge toll collection helps provide revenue assurance for highway lane management, maintenance, and improvement.

LPR systems are also effective in commercial vehicle enforcement, which results in efficiencies in safety and traffic flow near weigh station and inspection facilities. These systems help officers identify and focus resources on the vehicles and drivers that are most likely to present safety risks.

LPR systems are also deployed by Customs and Border Protection along the U.S. borders with Canada and Mexico to improve and enhance traveler mobility across these borders.

The introduction of electronic toll collection (ETC) has reduced the dependence on toll collection personnel and manual cash transactions at toll points. Although ETC has improved traffic flow and efficiency, it has also introduced a new challenge—toll evasion and revenue loss.

Mobility and Toll Collection

Collection of user fees on roads, bridges, and tunnels—or tolls—has served as an important means of financing key transportation projects and funding ongoing operations and maintenance for as long as roads have existed. Tolls provide a direct approach to funding highways, bridges, and tunnels without increasing local or state taxes, and they ensure that those who use and benefit the most from these projects pay for them directly.

For toll facilities to be effective, however, tolls must be collected. Historically, toll collection involved staff at a gate or in a toll booth collecting cash directly from motorists and making change at strategic points along the roadway. This process required each vehicle to stop in the tolling zone for a brief period to tender a cash toll payment. When the collection site becomes a choke point – risks of rear impact and chain reaction crashes increase. Toll chokepoints also reduce the efficiency of the corridor where collection takes place. Additionally, when toll collection slows traffic, the reduced efficiency adds emissions into the environment and increases the time required to move people and commercial goods.

Over the past three decades, most toll operators modernized their toll collection systems with technology that allows for prepaid toll accounts using in-vehicle transponders to identify valid toll account holders. The introduction of electronic toll collection (ETC) has reduced the dependence on toll collection personnel and manual cash transactions at toll points. Although ETC has improved traffic flow and efficiency, it has also introduced a new challenge—toll evasion and revenue loss. Toll violators

include motorists who travel through an ETC-only lane without a transponder or unfunded toll account, creating unpaid toll transactions. This not only reduces the funding available for roadway operations and maintenance but also adversely affects fairness to those who pay their tolls, potentially eroding public support for tolling. In an ETC environment, there is a cash payment option for motorists without a transponder and prepaid toll account. LPR technology is used to capture license plate images of vehicles without toll transponders in ETC toll lanes to enforce the toll payment from the registered vehicle owner.

In recent years, toll operators are increasingly adopting all-electronic tolling (AET) operations, in which the cash payment option is eliminated entirely. Cashless AET operations offer the benefit of allowing free-flow tolling, often permitting all vehicles to move through the tolling point at the posted speed limit without stopping or slowing. AET operations are reducing the need to separate cash payment and ETC vehicles and the associated roadside infrastructure required to do so. Instead, AET operations often use overhead gantries with electronic toll equipment (e.g., antennas, transponder readers, and LPR cameras) to process the toll transaction with all vehicles.

This not only reduces the funding available for roadway operations and maintenance but also adversely affects fairness to those who pay their tolls, potentially eroding public support for tolling.

Vehicles with in-vehicle transponders pay their tolls through their toll accounts, just as they do in an ETC environment. Vehicles without toll transponders in an AET environment have their license plate images captured, and toll bills are sent to the registered owners of the vehicles to arrange payment of the toll due. In an AET tolling environment, more transactions are being processed based on LPR technology. For commercial motor vehicles, the Federal Motor Carrier

Today as motor vehicle transportation solutions orient their designs toward improved mobility, reduced congestion, and more reliable levels of service, the use of LPR technologies has increased substantially. The conundrum in this development is that as LPR technologies improve, license plates continue to take on increasingly complex designs, making accurate license plate reading problematic.

Safety Administration estimates a truck will save approximately $10 per facility each time a truck is able to legally bypass a weight station or inspection facility.

According to the Federal Highway Administration (FHWA), jurisdictions throughout the U.S. are installing managed lanes (e.g., high occupancy/toll [HOT] lanes) in response to increased congestion. Managed lanes are intended to lessen congestion and provide greater mobility than the adjacent general-purpose lanes of state highways or interstate highways located in urban areas. In some cases, it is also used to enforce High Occupancy Vehicle (HOV) violations automatically, without the need of a law enforcement officer to visually detect violations. LPR also assists transportation officials to understand and influence traffic patterns and set flexible pricing based on traffic levels to reduce congestion, resulting in fewer roadway incidents and increased mobility.

Today as motor vehicle transportation solutions orient their designs toward improved mobility, reduced congestion, and more reliable levels of service, the use of LPR technologies has increased substantially. The conundrum in this development is that as LPR technologies improve, license plates continue to take on increasingly complex designs, making accurate license plate reading problematic.

Another feature of the move to LPR-related open road tolling is the use of enforcement-intended data access for revenue collection that is not law enforcement related. In jurisdictions where overhead tolling is

introduced, the department of motor vehicles should be consulted in the means by which vehicle and vehicle operator data may be obtained.

Revenue Loss

License plate designs, license plate obstruction, and purposeful avoidance to register and title vehicles are the most significant contributors to revenue losses for authorities using LPR systems. License plates that align with the AAMVA License Plate Standard will improve the effectiveness of LPRs and subsequently increase toll collections.

One toll agency with years of experience in operating a cashless AET operation that depends on license plate images to collect tolls from motorists without toll transponders indicates the following experience:

	2017		2018		2019	
Total Image Transactions	**36.930M**		**39.092M**		**41.143M**	
Reject Reason	**Total**	**%**	**Total**	**%**	**Total**	**%**
Unreadable Plate	2.058M	5.6%	2.139M	5.5%	1.901M	4.6%
Temporary Plate	1.063M	2.9%	723K	1.8%	667K	1.6%
No DMV Record	1.116M	3.0%	801K	2.0%	780K	1.9%
Other	784K	2.1%	1.061M	2.7%	978K	2.4%
Unenforceable Totals	**5.021M**	**13.6%**	**4.724M**	**12.1%**	**4.326M**	**10.5%**
Lost Revenue	**$23.1 Million**		**$25.8 Million**		**$25.3 Million**	

Although the unrecoverable revenue is significant, it should also be noted that even through a 12.1% growth in image-based transactions over three years, there was a 13.8% decline in unenforceable images. This is indicative of what the industry has experienced in terms of improvements in hardware, software, and business practices improving overall outcomes. That said, easily identifiable license plates can further mitigate lost revenue in the transportation industry as well as other businesses and enforcement models that use imagery and license plate information as the core of their revenue enforcement efforts.

Lost toll revenues amounted to $23.1 million in 2017, $25.8 million in 2018, and $25.3 million in 2019.

Mobility at U.S. Borders with Canada and Mexico

Currently, Customs and Border Protection (CBP) has three programs that use LPR to expedite entry to the U.S.—NEXUS, Secure Electronic Network for Travelers Rapid Inspection (SENTRI), and Free And Secure Trade (FAST). NEXUS is used at the Canadian border and SENTRI, is used at the Mexican border. FAST is a commercial clearance program for low-risk shipments entering the U.S. from Canada and Mexico. Each of these programs has dedicated lanes, and users are vetted.

All vehicles and persons entering the U.S. are subject to inspection. Every vehicle and every person entering at a land border port must be queried through various law enforcement databases before they can enter the U.S. Although the inspection process encompasses more than just queries, each query takes time to perform, and time is a factor in vehicle wait times. CBP, through the Western Hemisphere Travel Initiative (WHTI), has installed technology at most ports of entry that automates many functions previously done manually. This automation has resulted in reduced vehicle inspection times while maintaining the integrity of the inspection process.

Other LPR Applications That Benefit Mobility

Commercial Vehicle Enforcement

Commercial Vehicle Enforcement entities use LPR. Several specialized companies have emerged that use LPRs to read license plates and compare the plate number to federal safety data sources to ensure trucks are in compliance with federal and state motor carrier safety programs. Some systems also verify various state and federal credentials required to operate in the jurisdiction, check for out-of-service violations, and check for wants or warrants associated with vehicles. Municipal Parking Enforcement

LPR camera in use at a roadside truck scale.

Municipal Parking Enforcement

On-street parking enforcement efficiencies have been gained by using LPR technology. With these systems, parking scofflaws who fail to pay their parking citations or fines are placed in a data source that is downloaded to an LPR-equipped vehicle. The LPR quickly identifies those who have failed to pay, which allow municipalities to boot vehicles, ensuring parking revenues are recaptured.

In a 30-day trial conducted during 2020 using one LPR-equipped vehicle, the Long Beach Police Department in southern California identified nearly 300 scofflaws who had five or more unpaid parking citations, capturing nearly $200,000 in unpaid fines. In addition, seven arrests not associated with a parking citation were made.

Mobile LPR camera mounted on parking enforcement vehicle.

Chapter 6 License Plate Reader Program Best Practices for Law Enforcement

Introduction

A properly organized and managed license plate reader (LPR) program can greatly enhance the effectiveness of patrol operations and criminal investigations. The best LPR programs are built on a foundation of good policy and training.

The measurement of success for an LPR program is subjective. Recovering stolen vehicles; arresting subjects with active warrants; and recovering AMBER, SILVER, and BLUE Alert subjects are some measures of success. However, in an era of transparency and civilian oversight, a true measure of success should include an agency's ability to collect, store, and delete millions of LPR reads in an efficient and secure manner. It should also be noted that LPR systems are only as good as the data they rely on. Ensuring that the hot lists they access are kept current is critical to limiting the possibility that users will act on erroneous information.

Policy

Law enforcement agencies can build meaningful LPR system policies that respect individuals' privacy rights while providing authorized users with the information necessary to ensure the public's safety. Policies should include LPR program goals and objectives and should not be too restrictive as to limit 'operators' ability to perform law enforcement functions yet still be protective of the massive amounts of data an LPR system collects.

Because LPR equipment and accounts can have broad permissions, policies should contain language defining what functions an operator can and cannot perform with an assigned LPR account or LPR equipment. Having operators sign an acceptable use statement is a method of tracking and ensuring each user has been made aware of the policies set forth. In addition to the policies already explained, the following specific topics and their relationship to the use of LPRs should also be reflected in policy:

- **Data retention and dissemination** – Data usage policies should conform with jurisdiction laws governing the agencies legal authority to collect, retain, disseminate, and dispose of LPR data. Agencies should have a data retention period in policy (whether it is included in jurisdiction law or not) with justification for the data retention period they choose.

- **Freedom of Information Act (FOIA)** – An agency's FOIA policy should be examined to reflect the legal standards of FOIA.

- **Data security** – Operator passwords, system lockouts, system audits, and user audits should all be addressed in policy. Many of these are already established within an agency or by an overarching governing body. Assurances should be made to maintain compliance with these existing policies.

- **Memorandums of understanding (MOU)** – Many agencies and jurisdictions may decide to work together to establish one large LPR network. This reduces the cost per agency, and the burden of responsibility is shared. An established MOU identifies the roles and responsibilities between the agencies.

See Appendix (C) for Sample LPR Policies from Ohio, Utah, and Virginia.

Training

In addition to having sound policy, formalized training should be in place that conveys the policy content to LPR system operators. Training is a fundamental component of an LPR system. Without properly documented training, operators have no direction for which to properly set up, use, and troubleshoot LPR equipment. Training should emphasize policy (and case law) surrounding data retention. This can serve to assure the public that data are being collected, stored, used, and deleted in a manner consistent with established legal guidelines and policy.

LPR training can be divided into three sections: operations, data analysis, and technical support. All sections of training should be recurring and culminate in a test. This ensures new material is presented and operators remain vigilant in the use of the LPR system.

Operations training should focus on the daily operator of an LPR-equipped vehicle. Like speed-measuring devices, the operator of an LPR-equipped

vehicle should be able to set up, operate, and troubleshoot a vehicle-mounted LPR system.

Data analytics could be considered the second most important function of an LPR system.(the most important function being data collection). Having the training necessary to analyze a target vehicle across a network of LPR cameras relies on consistent and thorough training.

The last section of training which that be included in an LPR program is technical support. This section of training encompasses the logistical support staff most agencies will use to up-fit LPR patrol vehicles, monitor fixed sites, perform server maintenance, and perform system upgrades.

LPR Program Staffing

An LPR program should be adequately staffed to provide proper program support, oversight, and planning. Prior to determining staffing levels, a decision should be made if the LPR program will fall under the management and leadership of an existing police hierarchy (such as Operations or Investigations) or if it will be autonomous (specialty unit).

If an agency has fixed LPR equipment in its program, the program should be staffed sufficiently to maintain 24-hour operations to respond to any received alert, such as AMBER Alerts.

An LPR program needs enough employees to install and fix the equipment and employees who can manage both the system and equipment. If agency staffing is limited, employees can effectively multitask and meet the needs of multiple positions at once. If an agency does not have the number of employees or expertise to complete all the required aspects of running an efficient program, contractors can be employed to conduct one or more critical functions of the LPR program.

Equipment

Like staffing, LPR equipment needs to encompass all aspects of the program. A comprehensive, but non-inclusive list of equipment needed for an effective LPR program follows (mobile, fixed, and portable platforms):

MOBILE LPR	FIXED-SITE LPR	PORTABLE PLATFORM
Vehicle-mounted readers	Overhead or pole-mounted readers	Platform: commonly a trailer
Connecting wires from readers to trunk box	Continuous power supply	Continuous power supply (solar combined with battery)
Trunk box	Cellular or fiberoptic network	Cellular network
Mobile systems software	Systems software	Systems software
Mobile computer capable of operating mobile systems software		
GPS-capable antenna		

Vehicle-mounted reader.

Pole-mounted reader.

Trailer-mounted reader.

Roof-mounted LPR.

Trunk-mounted LPR.

There are many LPR manufacturers that produce reliable and durable LPR equipment. Purchasing agents need to consider the proprietary nature of LPR equipment and be aware that some products are not interoperable with others. It is critical for LPR data to properly communicate from the point of collection

(reader) to a central computer (server). LPR data must be securely protected and accessible by operators, most commonly from a desktop- or vehicle-based computer system. Legal considerations need to be addressed before purchasing equipment. For example, a cloud-based data storage system may not be compliant with a jurisdiction's data storage laws.

The specific type of LPR equipment chosen should be driven by agency mission and priorities. Whereas some agencies may prefer only mobile LPR, others may also use fixed-site LPR's, covert equipment, or portable platforms to create a robust LPR program.

When selecting LPR equipment, anticipate and plan for program expansions and logistical support needs. Items such as spare parts, storage facilities, and ancillary equipment should be considered as well.

Summary

A well-thought-out and well-executed LPR program provides law enforcement an additional tool in providing essential public safety services. Establishing an LPR program is a task that should be completed with careful consideration, planning, and organization.

Chapter 7 License Plate Reader Success Stories

Introduction

What follows are documented examples of how License Plate Reader (LPR) technology has benefited law enforcement in the performance of their public safety mission.

On **January 7, 2021**, Kristin Walker from Alabama was putting fuel into her vehicle with her two children in the backseat when a subject jumped into the driver seat to steal the vehicle. Walker was able to remove her children from the vehicle before it was highjacked. With the use of LPR technology, the Rankin County, Mississippi, Sheriff's Office was able to spot the vehicle a short time later and arrest the two subjects involved.

In **December 2020**, a North Carolina DMV License & Theft Bureau Law Enforcement Agent observed a Volkswagen traveling in a toll lane at a high rate of speed and attempted to stop the vehicle. The vehicle operator failed to stop, and with speeds near 130 mph, the pursuit was called off. LPR information was obtained from the North Carolina Turnpike Authority that included photographs of the driver, vehicle, and license plate information. The violator was located, apprehended, and charged with several serious traffic violations.

On **December 19, 2019**, A Delaware guidance counselor allegedly sexually assaulted a minor teenage boy while in Ocean City, Maryland. The victim alleged Allen Reese drove him from Delaware into Ocean City, where he sexually assaulted him. Using Ocean City's LPR, detectives were able to confirm

that Reese's vehicle crossed the Route 90 bridge as well as entry and exit times consistent with the dates and times of the assault provided by the victim. Based on the evidence from the victim corroborated by the LPR system, detectives scheduled an interview with the suspect to execute a warrant and collect DNA samples. However, detectives were notified by Homeland Security that a flight to Casablanca, Morocco, had been booked for Mr. Reese. Because it appeared that he was preparing to flee the country to avoid the sexual assault charges, a warrant was immediately issued for Mr. Reese. He was quickly located and held without bond on charges of sexual abusing a minor and third-degree sexual offense.

In **August 2019**, police with Duck, North Carolina, Police Department (an Outer Banks Island community) deployed their LPR systems to find residents who stayed on the island during a mandatory evacuation during Hurricane Dorian. LPR cameras recorded the plate numbers of vehicles exiting the island to determine which registered vehicles did not leave. The homes associated with those vehicles were visited by police to warn those residents of the risks of remaining on the island.

On **July 24, 2019**, a woman put her dog Happy into her car in Baltimore's Guilford neighborhood. She was just getting into the driver's seat when she was forcibly pulled her from her car and several suspects got into her car and sped off. Happy was still in the car when the suspects fled. The woman notified police, and the Baltimore Police Department immediately placed the license plate on an LPR hotlist as a carjacked vehicle. Soon after a patrol officer passed by the vehicle, which

was parked and unoccupied, and received an alarm on the LPR system he was operating. He approached the car and saw that Happy was still inside with the windows closed and doors locked. Because it was a hot July day, the officer smashed a window and rescued Happy before he was overcome from the heat. The woman and Happy were soon reunited.

On **July 15, 2020**, a man shot and killed his ex-girlfriend in the parking lot of her workplace in Springfield, Tennessee. Two days later, the suspect drove through Mt. Juliet, where a Mt. Juliet Police Department (MJPD) vehicle equipped with an LPR system detected the suspect vehicle license plate, alerting the officers who arrested the suspect.

According to MJPD Chief James Hambrick, "It's amazing the stuff that you wouldn't know travels through your city … is actually traveling through your city." That's one of many success stories to come out of the MJPD's use of LPR, Chief Hambrick said.

On **June 30, 2018**, a subject in Sacramento, California, was attempting to cross a street in his wheelchair and was hit and killed by a passing motorist who failed to stop and render aid. The license plate belonging to the vehicle that left the scene was detected by LPR, and the driver was arrested for felony hit and run.

On **March 15, 2018**, James Allen Hayes plead guilty in federal court to committing multiple bank robberies over the course of five months throughout California. Hayes was apprehended as a result of LPR detecting his vehicle traveling between robbery locations.

Robert Sheets was accused of shooting a man on **August 13, 2017**, in Manor Township, Pennsylvania. Sheets returned to the suspect the next day and discovered him still alive. He then shot the victim again, leaving him for dead and fleeing the area.

Miraculously, the victim survived and was able to identify the man who tried to kill him as Sheets. The vehicle driven by Sheets was immediately filed in National Crime Information Center as a felony vehicle, which resulted in a hotlist entry on LPR systems across the U.S.

A few days later, in Fairfax County, Virginia, an LPR alerted officers that Sheets was connected to a 2007 Ford Edge heading west on I-66. Fairfax police cruisers pulled in behind Sheets, and after a 38-mile pursuit, Sheets was apprehended.

On **August 26, 2015**, a gunman shot and killed a news anchor and cameraman from a local news station (Alison Parker and Adam Ward) while they were doing a report in Roanoke, Virginia. The license plate number of the shooter was broadcast statewide. Several Virginia State Police patrol vehicles were equipped with LPR. Five hours later and approximately 200 miles away from the shooting scene, Virginia State Police Trooper Pam Neff entered the license plate number into her LPR and discovered the LPR had just read the suspect license plate three minutes prior. Trooper Neff was able to catch up to the suspect vehicle and when back-up was in position proceeded with the apprehension. Trooper Neff was recognized by AAMVA during the AAMVA Annual International Conference in Williamsburg, Virginia, in August 2016.

For more news stories about law enforcement LPR successes from September 2017 to September, 2018, go to https://www.theiacp.org/sites/default/files/ALPR%20Success%20News%20Stories%202018.pdf

Appendix A Significant License Plate Reader Court Cases and Applicable Federal Statutes

United States Court of Appeals for the Ninth Circuit
United States v. Jay Yang,
958 F.3d 851 (9th Cir. 2020).
May 4, 2020
https://law.justia.com/cases/federal/appellate-courts/ca9/18-10341/18-10341-2020-05-04.html

Jay Yang was observed stealing mail from U.S. mail collection boxes on surveillance cameras driving a rented GMC vehicle beyond the rental contract due date. The license plate number was observed and searched in a License Plate Reader (LPR) database, which helped lead investigators to his home. Yang claimed because his rental agreement was past due and the contract was no longer valid when the plate was observed by LPR, the LPR data were invalid, and anything obtained from the search of his residence was not admissible. The court ruled there is no expectation of privacy of a license plate regardless if rental contract was expired. The LPR database did not reveal all the defendant's movements and therefore did not infringe on reasonable expectation of privacy.

United States Court of Appeals for the Eleventh Circuit
United States v. Larry Lamar Wilcox,
415 F. App'x 990 (11th Cir. 2011).
February 28, 2011
https://law.justia.com/cases/federal/appellate-courts/ca11/10-13031/201013031-2011-02-28.html

Larry Wilcox argued the use of LPR technology amounted to unconstitutional surveillance violating his reasonable expectation of privacy. The defendant said the district court erred in denying a motion to suppress, stating an Atlanta police officer's use of LPR

technology violated his Fourth Amendment right to be free from an unreasonable search.

The Court of Appeals ruled that the Supreme Court had concluded in similar contexts visual surveillance of vehicles in plain view does not constitute an unreasonable search for Fourth Amendment purposes. Given the Supreme Court's Fourth Amendment precedent, the Court of Appeals ruled the district court did not commit plain error in concluding Wilcox did not have a reasonable expectation of privacy in the plainly visible license plate and the officers' use of LPR did not violate the Fourth Amendment.

United States Supreme Court
United States v. Knotts,
460 U.S. 276, 103 S.Ct. 1081, 75 L.Ed.2d 55 (U.S. 1983).
December 1983
https://supreme.justia.com/cases/federal/us/460/276/

Tristian Armstrong was being investigated for stealing chemicals to manufacture illegal drugs. Agents attached a radio transmitter to a container of chemical sold to Armstrong, which tracked the location of where methamphetamine was being produced by Leroy Knotts. A search warrant was obtained, and an illegal drug manufacturing lab was discovered.

Knotts was convicted in district court, but the U.S. Court of Appeals reversed the conviction, stating Knotts' Fourth Amendment rights were violated by use of the tracking device, and the evidence could be suppressed. The U.S. Supreme Court held the initial conviction, ruling the tracking device did not invade any legitimate expectation of privacy and was neither a "search" nor a

"seizure" by grounds of the Fourth Amendment. The movement of a person traveling on a public highway does not afford an expectation of privacy of the movements. Nothing indicated the tracking device was used to gather information from within the private area.

Privacy and Fourth Amendment

Authority for Police to Check License Plates
United States Court of Appeals for Ninth Circuit
United States v. Ismael Diaz-Castaneda,
494 F.3d 1146 (9th Cir. 2007).
July 18, 2007
https://caselaw.findlaw.com/us-9th-circuit/1468527.html

An officer ran the license plate on a pickup traveling in front of him in traffic. The plate information response indicated that the driver's license of the registered vehicle owner, Solia Diaz, was suspended. The officer, believing the operator fit the description of Diaz, stopped the vehicle. Diaz was arrested for driving while under suspension. The vehicle passenger, Ismael Diaz-Castaneda, was found to have an immigration detainer on him and was arrested.

Diaz-Castaneda argued the stop violated his Fourth Amendment rights, and any subsequent evidence should be withheld. The court held a license plate check does not constitute a Fourth Amendment search, and evidence should not be suppressed.

U.S. Court of Appeals for Sixth Circuit
United States v. Curtis Ellison,
462 F. 557 (6th Cir. 2006).
September 5, 2006
https://caselaw.findlaw.com/us-6th-circuit/1031532.html

A Farmington Hills, Michigan, police officer ran a license plate of a parked vehicle through a police telecommunication system belonging on a vehicle operated by Curtis Ellison. Information returned revealed the registered owner was a "wanted person." Ellison was determined to be a passenger in the vehicle and was

arrested. District court originally ruled the officer did not have probable cause to run the plate because the van was not parked illegally, and therefore Ellison Fourth Amendment Rights were violated. The court determined what a person exposes publicly is not subject to Fourth Amendment protection, and observing a license plate displayed in plain view does not constitute a search.

Validity of License Plate Reader Technology

United States Court of Appeals for the Third District
United States v. Marcus White,
504 F. App'x 168 (3d Cir. 2012).
November 15, 2012
https://law.justia.com/cases/federal/appellate-courts/ca3/11-4035/11-4035-2015-04-29.html

Marcus White was convicted in Pennsylvania for his involvement in robberies of a post office and convenience stores. White's vehicle had been reported stolen and was detected by a Maryland state police trooper by an alert from an LPR while on patrol. During the suppression hearing, the District Court noted "the technology used by the license [plate] reader is verifiable and acceptable technology." White did not challenge this conclusion.

Use of License Plate Reader Data

Supreme Court of Virginia
Opinion of Justice Stephen R. McCullough
Harrison Neal v. Fairfax County Police Department, ET AL,
299 Va. 253, 849 S.E.2d 123 (Va. 2020).
October 22, 2020
https://law.justia.com/cases/virginia/supreme-court/2020/191127.html

In a prior ruling, the Virginia Court of Appeals ruled the "passive use" of LPR data by Fairfax County, Virginia, police violated the Virginia Data Act. Neal

argued the police department could not collect and store passively obtained LPR data without suspicion of criminal activity. Neal claimed the Virginia Data Act prohibited the gathering of personal information unless justified by law. The court initially ruled the LPR data provided a link to identify the vehicle owner and therefore LPR data was subject to the Virginia Data Act.

In a later ruling from the Virginia Supreme Court, the court stated the LPR system did not qualify as an information system because it did not contain name, personal number, or other identifying particulars of data for a subject. The court further stated the plate, vehicle photo, date, time, and GPS location did not bring the Data Act into play because the LPR system did not contain all the components and operations of a record keeping process. The court found the police department's passive use of the LPR system was legal.

Massachusetts Supreme Court
Commonwealth of Massachusetts v. McCarthy,
484 Mass. 493, 142 N.E.3d 1090 (Mass. April 16, 2020).
https://law.justia.com/cases/massachusetts/supreme-court/2020/sjc-12750.html

Law enforcement officers were investigating Jason McCarthy's suspected illegal drug activity and deployed LPRs on bridges to track his activity. Police used data from the LPRs and received real-time alerts, which led to the arrest of McCarthy. McCarthy filed motion to suppress the LPR data because it violated his constitutional right to privacy of his public movements. The court ruled the defendant's privacy was not violated because of the limited extent and use of the LPR data.

Reasonable Suspicion for Vehicle Stop Based on License Plate Reader Information

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United States Court of Appeals for the Ninth Circuit
Denise Green v. City and County of San Francisco,
751 F.3d 1039 (9th Cir. 2014).
May 12, 2014
https://caselaw.findlaw.com/us-9th-circuit/1666208.html

An LPR operated by a San Francisco Police officer indicated a license plate displayed on Denise Green's vehicle was on a stolen vehicle. A high-risk felony stop occurred, and Green was held at gunpoint, handcuffed, and detained. Eventually, officers ran the actual plate to confirm stolen and determined the LPR misread the plate, and the vehicle was not stolen; Green was released.

San Francisco Police Department officers are trained that an LPR hit does not automatically justify a vehicle stop. Officers are directed to verify validity of the identified hit before executing a stop. Officers are instructed to verify the plate being read by the LPR is truly the plate on the vehicle and to confirm the stol-en "hit" with their police telecommunications system. **The court ruled an unconfirmed LPR "hit" does not form a reasonable suspicion to support an investigatory detention of subject.**

Georgia Court of Appeals
Hernandez-Lopez v. The State of Georgia,
319 Ga. App. 662, 738 S.E.2d 116 (Ga. Ct. App. 2013).
February 5, 2013
https://caselaw.findlaw.com/ga-court-of-appeals/1622591.html

An LPR in use by an officer with the Gwinnett County, Georgia, Police Department indicated a plate belonged to a "wanted person" by the name of Eloy

Hernandez-Lopez. The officer noted a warrant was for an adult male, which matched the warrant identifying information. The vehicle was stopped and the subject operating the vehicle was determined to be Salomon Hernandez-Lopez, and he was arrested for operating without a license.

Hernandez-Lopez claimed the officer lacked reasonable suspicion to conduct a traffic stop based on the LPR information. The court held the officer did in fact have reasonable suspicion based on the LPR information indicating the license plate belonged to a "wanted person." This would be the same as if an officer ran the license plate through the Georgia police telecommunications system directly. **The court ruled an LPR "hit" provides an officer with reasonable suspicion to justify an investigatory stop.**

New York Supreme Court
People of the State of New York v. Luis Davila, Jr., **27 Misc.3d 921, 901 N.Y.S.2d 787 (N.Y. Sup. Ct. 2010),** *aff'd,* **137 A.D.3d 655, 26 N.Y.S.3d 862 (N.Y. App. Div. 2016).**
April 1, 2010
https://law.justia.com/cases/new-york/other-courts/2010/2010-20111.html

A New York Police Department LPR mounted on a police vehicle alerted officers to a suspended plate, and the vehicle was stopped. An officer observed what appeared to be a weapon in possession of a vehicle occupant and subsequently arrested the subject for possession of a firearm. Davila contested the arrest, arguing the officer failed to follow department policy by first verifying the LPR data had been updated in the past 24 hours and did not verify the information against the department database. The court ruled the department policies are guidelines and not required by law; therefore, use of LPR to detect the vehicles registration as suspended was lawful.

Related Federal Statutes

28CFR Part 23 Criminal Intelligence Systems Operating Policies
28 CFR Part 23 contains policy standards for law enforcement agencies operating federally funded multijurisdictional criminal intelligence systems. The standards specifically provide guidance for the submission, entry, security, inquiry, dissemination, review, and purge of criminal intelligence information.

2 CFR § 200.79 Personally Identifiable Information (PII).
LPR information is NOT PII
PII is information considered capable of identifying an individual either by itself or with other identifying information. LPR systems contain information consisting of vehicle license plates, vehicle photos, dates, times, and GPS locations—information generally not considered PII. Therefore, LPR information may not be restricted by statutes concerning maintaining PII but can become PII if additional information is included that is defined as PII. Case-by-case assessment is recommended when developing LPR system data maintenance and use.

Driver's Privacy Protection Act (DPPA) of 1994, 18 U.S.C. 2721
The Driver's Privacy Protection Act (DPPA), 18 U.S.C.A. §§ 2721-25 also supports the premise that a license plate number alone is not PII. Enacted in 1994, the DPPA is a federal law that regulates how state motor vehicle departments release information contained in their records. DPPA addresses the prohibition on release and use of certain personal information from state motor vehicle records. Collected LPR information contains no PII that may be used to connect a license plate detection to an individual. It is only with permissible purpose law enforcement may make this connection (using motor vehicle records).

Appendix B Additional License Plate Reader Resources

American Association of Motor Vehicles (AAMVA)

AAMVA – Best Practices and Model Legislation

- License Plate Standard, Edition 2 (2020)

AAMVA – AAMVA Policy Positions

- Alternative License Plates Policy Statement (Adopted 2020)

- License Plates Policy Statement (Amended 2020)

- License Plates Should Not Be Obscured Policy Statement (Amended 2020)

- Temporary License Plates Policy Statement (Amended 2020)

International Association of Chiefs of Police (IACP)

You must be an IACP member with log-in credentials to access these resources:

https://www.theiacp.org/resources/policy-center-resource/license-plate-readers

- IACP License Plate Reader Model Policy (2010)

- IACP License Plate Reader Concepts and Issues Paper (2010)

These IACP resources are publicly accessible:

https://www.theiacp.org/projects/automated-license-plate-recognition

- IACP License Plate Reader Privacy Impact Assessment (2009)

- IACP License Plate Reader Policy & Operational Guidance (2012)

- IACP Resolution: Retro-Reflective Front and Rear Plates (2018)

- IACP Resolution: Digital License Plates (2020)

- IACP Technology Policy Framework (2014)

Police Executive Research Forum

Free Online Documents (policeforum.org)

- Combating Auto Theft in Arizona: A Randomized Experiment with License Plate Recognition Technology: Police Executive Research Forum, December 2011

RAND Corporation

https://www.rand.org/pubs/research_reports/RR467.html

- License Plate Readers for Law Enforcement – Opportunities and Obstacles (2014)

Introduction

The core business values that License Plate Reader (LPR) promises can only be achieved through proper planning, implementation, training, deployment, use, and management of the technology and the information it provides. Like all tools and technologies available to law enforcement, LPR must also be carefully managed. Agencies must clearly articulate their strategic goals and tactical objectives for the technology, and this strategy should be tightly aligned with the broader strategic plans of the agency. Thorough and ongoing training is required to ensure that the technology performs effectively and that users are well versed in the operational policies and procedures defined and enforced by the agency.

Policies must be developed and strictly enforced to ensure the quality of the data, the security of the system, compliance with applicable laws and regulations, and the privacy of information gathered. Building robust auditing requirements into agency policies will help enforce proper use of the system and reassure the public that their privacy interests are recognized and respected.[1]

Three agency sample policies follow:

Ohio State Highway Patrol

Utah Tax Commission, Motor Vehicle Enforcement Division

Virginia State Police

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1   IACP ALPR Policy & Operational Guidance (see Appendix B).

OHIO STATE HIGHWAY PATROL POLICY

Purpose

To provide guidelines for the implementation, installation, and use of mobile and stationary Automatic Plate Reader (APR) technology and equipment at selected locations to scan, detect, and identify license plate numbers appears on selected "Hot Lists."

Policy

A. **STATEMENT OF POLICY –** The Ohio State Highway Patrol will utilize APR technology in patrol cars and at stationary locations to accurately identify license plates *linked to criminal activity and/or commercial motor vehicle administrative violations.*

B. **FUNCTIONALITY AND OPERATION <41.3.9a>**

1. **Installation –** Stationary and mobile scanners will be installed at selected locations and on selected marked and unmarked vehicles. *GHQ electronic technicians are responsible for maintaining a list of all locations and vehicles equipped with APR technology.*

2. *Data Sources for "hits" – All APRs have the ability to match a captured image to two categories of databases: criminal violations and commercial motor vehicle violations. Officers and MCEIs have the ability to match images with one or both types of databases simultaneously.*

   a. *Criminal Databases: Both mobile and stationary APRs can match captured images with LEADS and NCIC entries with an associated license plate (e.g., stolen motor vehicles, felony warrants, missing persons, protection orders, etc.)*

   b. *Commercial Motor Vehicles – Both mobile and stationary APRs can match captured images with the Federal Motor Carrier Safety Administration PRISM database for commercial motor vehicles placed out of service and ones with an "Inspect" or "Possible" score in the Inspection Selection System (ISS).*

3. *General Operation – The Division's automatic plate readers capture images of numbers and letters resembling license plates and match those captured images to the current "hot list." The "hot list" is the master index of license plates entered in both data sources listed above. The criminal database "hot list" is updated twice daily and the commercial motor vehicle database "hot list" is updated once daily.*

4. Units assigned to enforcement vehicles equipped with mobile APR systems shall *verify the receipt of* the most recent "Hot List" from the applicable databases at the beginning of each shift.

5. **Probable Cause** – An APR "hit" from the criminal databases shall not be used as probable cause for a traffic stop or enforcement contact. Contact with the vehicle and occupants shall only be made after the "hit" is confirmed through LEADS/NCIC.

6. **Manual Entry by User into "Hot List" Database** – *The system does not obtain real*

time information from LEADS/NCIC; therefore, there may be situations which require an officer or dispatcher to manually enter a vehicle registration into the database. These situations include, but are not limited to: active Amber Alerts, Ohio Blue Alerts, endangered missing child alerts, endangered missing adult alerts, BOLOs, and other emergency messages/alerts. Manual entry of a plate into the "Hot List" shall only be done with supervisor approval. See User Manual for entry procedures.

A "hit" on a BOLO that is manually-entered into the system shall not be used as probable cause for a traffic stop or enforcement contact.

7. **'O' vs. Zero** – Because of standardized NCIC formats, a letter 'O' and a zero in a license plate number are synonymous in NCIC records. Therefore, the "hot list," NCIC, and the APR read the letter 'O' as a zero. Any plate entry, including any manually entered by an officer or a dispatcher with an 'O' is automatically converted to a zero.

8. **Fixed Point and APR Notification** – When a license plate entered in the "Hot List" is detected by a stationary APR, a notification is automatically sent by the APR system to an OSP dispatch facility equipped to receive the notifications. When a mobile APR detects a "Hot List" entry, the officer receives an audible and visual notification on the in-car MCT.

9. **Case Documentation** – A record of the APR "hit" shall be included in the case/incident report. All "hits" captured by the APR system shall be stored for 30 days and will then be automatically purged. All "hits" will be stored electronically in the ELSAG system. Access to the ELSAG system is limited to authorized personnel only. <41.3.9b,d>

10. **Storage of "Non-Hits"** – All "non-hit" APR captures shall be automatically purged from the system within a 24-hour period. APR captures shall not be collected, stored, or shared with the intent of data mining. Dispatchers assigned to Cleveland and the Statehouse shall query the system for plates older than 24-hours on a quarterly basis to ensure "non-hit" captures are being deleted in accordance with this policy. Troopers assigned APR equipped enforcement vehicles shall perform the same query as part of the semi-annual vehicle inspection. <41.3.9d>

11. **Training –** Dispatchers, sworn officers, electronic technicians, motor carrier enforcement inspectors, and network administrators shall receive appropriate training from qualified OSP staff or vendor representatives prior to using or maintaining the APR equipment. <41.3.9c>

C. **USER MANUALS –** The manufacturer's user manuals, which provide operational procedures for both the Mobile Auto-Detector User and Operations Center Personnel are attached to this policy.

D. **GUIDELINES FOR USE <41.3.9a>**

1. **Stationary APRs**

   a. **Notification** – After receiving a "hit" through LEADS/NCIC, the dispatcher will verify the APR "hit" on the plate matches the image and follow established procedures to check NCIC/LEADS. The dispatcher will then dispatch an officer to intercept the vehicle. Two officers will be dispatched to verify "hits" at the Statehouse Garage. The officer(s) will be notified of the reason for the "hit," that the dispatch is a result of the APR and that the "hit" has been verified through NCIC.

   b. **Verification of Hit** – If, for any reason, the APR "hit" cannot be verified through LEADS/NCIC, the vehicle is not to be stopped based solely on the APR. If the

dispatcher cannot read the digital image sufficiently to verify the license plate number and state, an officer may be dispatched to intercept the vehicle, however the intercepting officer <u>must first verify the "hit" through NCIC</u> prior to stopping the vehicle.

c. **Turnpike Gate Personnel** – If an officer is unavailable to immediately intercept a valid "hit," the dispatcher may notify additional personnel to be on the lookout for the suspect vehicle. Ability to identify the vehicle, reason for the "hit," and known direction of travel should all be used to determine whether additional personnel should be notified. If the vehicle is observed, they should be instructed to notify the dispatch facility of the route and direction of travel.

d. Officers and dispatchers should use their discretion based on hazards, proximity of assisting officers, type of "hit," etc.

e. **Cleveland Dispatch Center / Capitol Square Parking Facility**

i. The APR system will be checked by the dispatcher at the beginning of the shift and the information will be logged on the OTIS HP-53 using File 1 – Sub Category "APR."

ii. The Statistical Analysis function will determine if the APR is functioning correctly. The system should indicate a number of plates that have been checked. If there are no plates indicated, the system is not functioning. If the system shows that plates are being scanned, the system is working correctly.

iii. The Statistical Analysis section is found in section 6 of the User's Guide.

2. *Mobile APRs*

a. *Mobile APRs are operational as long as the officer is logged in to the MCT in the vehicle.*

b. *Officers have the ability to toggle between the Criminal and Commercial databases or they can activate both. If both databases are active, the mobile APR will indicate a "hit" on a violation in either system.*

c. *Officers must verify the "hit" through LEADS/NCIC prior to stopping the vehicle. If, for any reason, the APR "hit" cannot be verified, the vehicle is not to be stopped based solely on the APR. Officers only need to verify that the plate matches the "hit" in the FMCSA database.*

d. *Officers and MCEIs should use their discretion based on hazards, proximity of assisting officers, type of "hit," etc.*

e. *Motor Carrier Enforcement Inspectors may not stop a commercial motor vehicle for the sole purpose of a LEADS/NCIC "hit".*

3. **Infrastructure Specialist and Electronic Technicians are responsible for:**
   <41.3.9b>

a. Equipment and software deployment and installation

b. Coordinating maintenance and repair

c. Coordinating the establishment of parameters for download of NCIC and LEADS

data, pick-up radius restrictions, misdemeanor and/or felony warrants.

    d.   Ensure all captures on stationary and mobile APRs follow the appropriate retention schedule.

4. **Public Affairs -** All media contacts will be coordinated through the Public Affairs Unit, which shall be consulted prior to releasing any information to the news media.

5. **Licensing and Commercial Standards**

    a. LCS units may stop commercial motor vehicles for the purpose of inspection based on hits received from the PRISM file "Hot List."

    b. The reason code LPRI (License Plate Reader Inspection) will be used in ASPEN for all inspections conducted based on a PRISM hit.

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410</td><td>Utah Motor Vehicle Enforcement Division
Policy Manual</td></tr>
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Automated License Plate Readers (ALPRs)

410.1   PURPOSE AND SCOPE

ALPR is a computer-based system that utilizes special cameras to capture a color image, as well as an infrared image, of the license plate of a passing vehicle. The infrared image is converted into a text file utilizing Optical Character Recognition (OCR) technology. The text file is automatically compared against an "informational data file" containing information on stolen or wanted vehicles as well as vehicles associated with AMBER alerts, warrant subjects or other criteria. If a match is found, the user is notified of the vehicle "hit" by an audible alert and an associated notation on the user's computer screen.

ALPR cameras can be mobile (mounted on vehicles) or on fixed positions such as freeway overpasses or traffic signals. ALPR systems mounted on vehicles have all the necessary equipment to scan plates, notify the user of a vehicle hit, and store the plate scan data for uploading into the ALPR server at a later time. ALPR fixed positions transmit plate scan data to the ALPR server as they are scanned and notify a central dispatch, such as a station desk, of any vehicle hit.

ALPR cameras can photograph thousands of plates in a shift. All plate scan data collected from the ALPR cameras are transmitted to an ALPR server. The ALPR server resides within the State of Utah Data Network Center. In addition to software applications that are used to run the ALPR server, the ALPR server also houses the "informational data file" containing wanted, stolen, or vehicles of interest, as well as all the plate scans captured by the ALPR cameras.

The informational data file is comprised of information from the Stolen Vehicle File (SVF), "HOT FILE" (HF), Wanted Persons File (WPF), Stolen Plate File (SPF), Revoked Registration File (RRF), Cancelled Registration File (CRF), Expired Registration File (ERF), Out of Service (OS), and user defined "hot lists." The Informational data file is updated throughout the day with different data sources being "refreshed" at different intervals. SVF/WPF/SPF/RRF/ERF/OS data is refreshed from the state database daily, HF data is refreshed from the Bureau of Criminal Investigation hourly, CRF data is refreshed weekly, and hot list data is refreshed upon input into the ALPR server. It is important that ALPR users take into account the amount of lag time between receiving an ALPR hit notification and the last updating of the informational data file within the mobile ALPR unit database. When possible, confirm that the mobile ALPR unit hit information is still valid, either through your Communication Center (CC) or via your laptop computer (LC) prior to taking police action. Confirmation can be deferred in rare circumstances (i.e. special investigative units) when compelling circumstances may exist that, if CC is contacted, it could jeopardize the investigation and/or officer safety.

Fixed ALPR cameras have a continuous connection to the ALPR server. They are capable of uploading plate scan data to the ALPR server as the scans occur. ALPR scans can be compared against the informational data file immediately when the data sources are updated. Mobile ALPR units do not have a continuous connection to the ALPR server. In order to facilitate the exchange of data, air cards are used which will allow connectivity to the ALPR server via wireless transmission.

Automated License Plate Readers (ALPRs) - 1

Utah Motor Vehicle Enforcement Division
Policy Manual

Automated License Plate Readers (ALPRs)

If the air card in the vehicle is connected to a service, the ALPR will continually "sync" which will upload plate scan information from the vehicle to the ALPR server and/or download the latest informational data file from the ALPR server to the vehicle. It is imperative that mobile ALPR users sync their mobile units at least once at the beginning of their shift to ensure they have the latest informational data available.

410.2 POLICY AND PROCEDURES

Mobile ALPR unit users receiving an alert shall confirm the status of the vehicle by running the license plate either manually via the LC or over the radio via CC, unless compelling circumstances are present or officer safety issues make it unsafe to do so.In such cases, Officers shall confirm the status of the alert as soon as possible. When requesting CC to confirm the status of an ALPR alert, the officer shall advise CC the request is for an ALPR alert.

In the case of a stolen vehicle alert, personnel may regard the vehicle as a known stolen vehicle, while awaiting a secondary confirmation. If the decision is made to initiate a "felony stop" due to an ALPR alert on a stolen vehicle, officers shall advise CC they are following a vehicle due to an ALPR stolen vehicle alert prior to receiving a secondary confirmation by LC/CC.

Officers shall adhere to the Department's pursuit policy as described in the Manual of Policy and Procedures. CC shall immediately provide secondary confirmation or advise the unit that the vehicle is not reported as stolen.

When Desk Personnel receive an alert from a fixed ALPR system, which is the result of an image taken from a fixed camera, they shall confirm the current status of the vehicle via their CAD terminal or via CC. While waiting for confirmation, desk personnel will advise field patrol units of the ALPR alert, the location, the vehicle description, request aero bureau, and coordinate responding field units.

410.2.1 HOT LISTS
Hot lists are comprised of user defined data that is manually input into the informational data file so that ALPR users will be alerted whenever a "vehicle of interest" is located.Hot lists can be loaded into a specific station area vehicle or to ALPR all vehicles countywide.

Hot lists can be input into the ALPR server informational data file only by ALPR administrators. Unit commanders, or their designees, must approve hot list information that is intended for use solely in their area cars. With the exception of AMBER alert information, hot list information intended for Department-wide use must have the approval of the Division Director, or his designee.Mobile ALPR users can input individual license plates into their patrol vehicle's ALPR system for use during their shift, however, the information will be deleted from that mobile ALPR unit once user performs an "end shift" and the vehicle syncs with the ALPR server. An ALPR vehicle alert identified via hot list information does not automatically provide ALPR users with sufficient justification to pullover or detain vehicle occupants. Often times, these hotlists will identify a "vehicle of interest" which is not necessarily wanted for a crime (ex: sex offender vehicle).

Utah Motor Vehicle Enforcement Division
Policy Manual

Automated License Plate Readers (ALPRs)

Personnel must use discretion and in some cases have independent information justifying a traffic stop.

410.3   ALPR OPERATION

Use of an ALPR is restricted to the purposes outlined below. Department personnel shall not use or allow others to use, the equipment or database records for any unauthorized purpose.

(a)   An ALPR shall only be used for official and legitimate law enforcement business (Utah Code 41-6a-2003).

(b)   An ALPR may be used in conjunction with any routine patrol operation or official investigation. Reasonable suspicion or probable cause is not required before using an ALPR.

(c)   While an ALPR may be used to canvass license plates around any crime scene, particular consideration should be given to using ALPR-equipped cars to canvass areas around homicides, shootings and other major incidents. Partial license plates reported during major crimes should be entered into the ALPR system in an attempt to identify suspect vehicles.

(d)   No member of this department shall operate ALPR equipment or access ALPR data without first completing department-approved training.

(e)   If practicable, the investigator should verify an ALPR response through the Utah Department of Public Safety (DPS) law enforcement information system or other appropriate database before taking enforcement action that is based solely upon an ALPR alert.

(f)   No ALPR operator may access the DPS database or other system unless otherwise authorized to do so.

410.4   ALPR DATA COLLECTION AND RETENTION

All data and images gathered by an ALPR are for the official use of the Utah Motor Vehicle Enforcement Division and because such data may contain confidential information, it is not open to public review. ALPR information gathered and retained by this department may be used and shared with prosecutors or others only as permitted by law (Utah Code 41-6a-2004).

The Administration Lieutenant is responsible to ensure proper collection and retention of ALPR data, and for transferring ALPR data stored in department vehicles to the department server on a regular basis, not to exceed 30 days between transfers.

All ALPR data downloaded to the server should be stored for the minimum period established by department records retention guidelines and thereafter should be purged unless it has become, or it is reasonable to believe it will become, evidence in a criminal or civil action. In no event shall data be maintained longer than nine months unless it is subject to a warrant, preservation request or disclosure order (Utah Code 41-6a-2004). Data that will not be purged should be downloaded from the server onto portable media and booked into evidence.

Automated License Plate Readers (ALPRs) - 3

Utah Motor Vehicle Enforcement Division
Policy Manual

Automated License Plate Readers (ALPRs)

410.4.1   NON-GOVERNMENTAL AGENCY ALPR
ALPR data captured by a non-governmental agency device may only be obtained pursuant to a warrant or a court order (Utah Code 41-6a-2005).

410.5   ACCOUNTABILITY AND SAFEGUARDS
All saved data will be closely safeguarded and protected by both procedural and technological means. The Utah Motor Vehicle Enforcement Division will observe the following safeguards regarding access to and use of stored data:

(a)   All non-law enforcement requests for access to stored ALPR data shall be referred to the Office Manager and processed in accordance with applicable law.

(b)   All ALPR data downloaded to the mobile workstation and server shall be accessible only through a login/password-protected system capable of documenting all access of information by name, date and time.

(c)   Persons approved to access ALPR data under these guidelines are permitted to access the data for legitimate law enforcement purposes only, such as when the data relate to a specific criminal investigation or department-related civil or administrative action.

(d)   Such ALPR data may be released to other authorized and verified law enforcement officials and agencies at any time for legitimate law enforcement purposes.

(e)   ALPR system audits should be conducted on a regular basis.

Automated License Plate Readers (ALPRs) - 4

Virginia Department of State Police

General Order OPR 1.20   **License Plate Reader Operating Procedures**

Purpose: To establish uniform guidelines for License Plate Reader operations by Department personnel.

1.   The License Plate Reader (LPR) program is intended to enhance law enforcement operations related to homeland security and terrorist watch lists, stolen vehicles and license plates, sex offender violators, wanted and missing persons, and other vehicle-related crimes that impact the safety of citizens.

2.   The Director of the Bureau of Field Operations (BFO) shall appoint a Statewide LPR Program Coordinator who shall be responsible for the daily operations of the LPR Program.

Guidelines for Use

3.   The Department's LPR system shall be used for official law enforcement purposes only. No employee may use, or authorize the use of, the equipment or database records for any other reason. Misuse of equipment or database records may result in disciplinary action.

4.   LPR units will be installed in Department vehicles as determined by the Director of BFO or his/her designee. The Director of BFO must pre-approve the transfer of an LPR unit to another Area. Otherwise, if a sworn employee assigned a vehicle equipped with an LPR unit is transferred, promoted or resigns, the vehicle will be reassigned to another sworn employee and retained in the original Area.

5.   LPR-equipped vehicles may be used for routine patrol or during special events. In all instances, LPR-equipped vehicles shall be operated in accordance with Department policies regarding vehicle operations.

6.   Each employee assigned an LPR unit is responsible for ensuring they are operating with the most current "Hotlist" at the beginning of each shift. The Statewide LPR Program Coordinator should be contacted immediately if problems are encountered with the updating of the LPR units.

7.   Upon receiving an alarm or hit, the sworn employee shall verify the accuracy of the information by contacting the Communications Center per established Department policy.

1

Effective Date – 10/1/2018   Review Date – 7/1/2022
                                               BFO

General Order OPR 1.20

a. An LPR alarm alone is NOT sufficient probable cause to warrant a stop or arrest.

b. Sworn employees are required to confirm a positive hit <u>prior</u> to any enforcement action being taken.

8. Sworn employees are required to ensure that all positive hits on the Terrorist Watch List are reported to the Terrorist Screening Center (TSC) and Virginia Fusion Center (VFC) immediately. All Terrorist Watch List hits will be handled by MDT or telephone. There will be no radio traffic concerning terrorist hits except in the case of emergencies.

9. Special circumstances, such as AMBER Alerts or critical incidents, may require immediate manual updating of the LPR system "hot list." Sworn employees in possession of license plate information related to such circumstances will immediately enter the data into the LPR system. The Virginia Fusion Center (between 0600 and 2200 hours) and/or Statewide LPR Program Coordinator will ensure that new information is uploaded or relayed to all active LPR units. If a critical situation requires manual entry of license plate data, the Communications Center shall immediately notify all LPR users of the new data in the Division and document this action in the CAD system. LPR users shall manually enter the license plate information associated with the critical incident. The Communications Center shall also contact the Virginia Fusion Center and provide the information so that the data may be entered into the statewide list.

10. Terrorist organizations have openly voiced their desire to attack venues where large crowds gather, such as major sporting events, large festivals, etc. Because of the potential of just such an incident, stationary, mobile, and covert LPR use is permitted for such events. Prior to utilizing LPRs at these venues, the affected Division Commander shall submit a letter, through channels, to the Superintendent describing the event, potential threat, and parameters under which the LPRs will be utilized. The decision to grant the approval rests with the Superintendent's Office.

11. Fixed and/or covert LPR units may be used to support on-going criminal investigations or approved venues. The use of fixed and/or covert LPR units shall be coordinated with the Statewide LPR Program Coordinator.

12. At the end of each month, Monthly Plate Reader Activity Logs will be submitted to the appropriate Area Office and Division LPR Coordinator by personnel using an LPR unit.

2

Effective Date – 10/1/2018   Review Date – 7/1/2022
                                              BFO

General Order OPR 1.20

a. At the Area office, a separate file will be maintained for each LPR unit assigned to the Area. Each file will include all Monthly Plate Reader Activity Logs submitted after LPR system usage. These logs will be handled as Department-governed non-records (DGNRs) and shall be retained for two years after the end of the calendar year.

b. At the Division headquarters, all Monthly Plate Reader Activity Logs will be reviewed by the Division LPR Coordinator and consolidated into one Monthly Plate Reader Activity Report. The report shall be reviewed by the Division Commander and forwarded to the Statewide LPR Program Coordinator by the 5th of each month. The Division is the record holder for the Monthly Plate Reader Activity Reports, and these reports shall be included on the Division's file list. Monthly Plate Reader Activity Reports shall be retained for two years after the end of the calendar year.

Data Security and Access

13. The Statewide LPR Program Coordinator is responsible for overall operations of the program, including:

a. controlling access of sworn personnel to the LPR system and hot file data;

b. ensuring stored data are purged from the LPR system server as required;

c. approving or denying in writing requests to access and/or use LPR data; and,

d. designating personnel who will be authorized to access the server and conduct data queries.

14. The Department's Data Center will house the Department's LPR System Operations Center, which is the central database for all license plates scanned by the Department's LPR units.

a. All collected data will be maintained on an independent server that is not connected to, or shared with, other law enforcement databases.

b. The Data Center will provide an inquiry tool, history tracking, and reporting protocols for the entire LPR program.

c. The Data Center will provide a secure intranet site, allowing only approved personnel password-protected access to collected data. This access shall be restricted to:

3

Effective Date – 10/1/2018

Review Date – 7/1/2022
BFO

General Order OPR 1.20

      (1)   searching for a license plate or partial license plate;

      (2)   viewing the image and location of matches on the "hot list";

      (3)   viewing maps showing the location of alarms or hits;

      (4)   viewing statistical reports on alarms or hits; and,

      (5)   searching for matches for a specific geographical location and/or time frame.

Operator Training

15.   All users must receive standardized training prior to operating the LPR system.

    a.   The Statewide LPR Program Coordinator is responsible for providing initial training of all Department personnel who utilize the LPR system.

    b.   Additional training will be provided as needed and as determined by the Statewide LPR Program Coordinator.

    c.   The Training Division will be responsible for maintaining and updated all training records associated with the LPR program.

Data Storage and Retention

16.   Per the Virginia Attorney General's Opinion #12-073, "License Plate Readers – Use and Storage of Data," the Department may not passively collect and store plate read data for potential use in future investigations.

    a.   The collection and use of stored data to help solve future crime are prohibited under the Opinion and existing Virginia law.

    b.   The Department may continue to use the LPRs to compare active reads to existing lists, such as stolen vehicles or Amber Alerts. Only the reads that are directly related to the intended purpose (i.e., stolen plate) may be retained beyond the use session of the LPR. All other non-relevant, passive reads should be deleted at the end of that day's use.

    c.   The Department may collect, store, and analyze data that relates to a specific, on-going, active investigation. That data shall be made part of the criminal investigative file and may not be used for other purposes.

4

Effective Date – 10/1/2018   Review Date – 7/1/2022
                                                             BFO

General Order OPR 1.20

d. The Department may collect and temporarily store data that relates to special events as enumerated in paragraphs 10 and 11 of this General Order. This data will only be stored during the event and will be disposed of immediately following the event if it has been determined no applicable criminal investigation has been initiated. If an applicable criminal investigation is initiated, the data will be handled in accordance with paragraph 16.c. of this General Order.

5

Effective Date – 10/1/2018   Review Date – 7/1/2022
                                                          BFO

Appendix D AAMVA License Plate Reader Working Group Roster

CHAIR AND LAW ENFORCEMENT REPRESENTATIVE

Captain Matthew Beaudin
Colorado State Patrol

LAW ENFORCEMENT REPRESENTATIVES

First Sergeant Robert Alessi
Virginia State Police

Lieutenant Chris LaPrairie
Nevada Highway Patrol

Captain Joseph Moody
North Carolina Department of Motor Vehicles
License & Theft Bureau

Colonel Allan Shinney
Utah State Tax Commission

Sergeant Jonathan Zarkauskas
Virginia State Police

MVA REPRESENTATIVES

Betty Johnson
Division Administrator
Nebraska Department of Motor Vehicles

Rosa Yaeger
Director
South Dakota Department of Revenue

IACP REPRESENTATIVE (MEMBER)

Major Josh Swindell
Ohio State Highway Patrol

IACP REPRESENTATIVE (STAFF)

Ryan Daugirda
International Association of Chiefs of Police

TECHNICAL ADVISORS

Dennis Bernardo D'Annunzio
Firmware and Software Development Manager
Leonardo

Jeff Hielsberg
Regional Sales Director
Intellectual Technology, Inc.

Kyle Hoertsch
Vice President of Public Safety Client Relations
Motorola Solutions

Steve Vaughn
Vice President of Field Operations
PrePass Safety Alliance

Mark Muriello
Director, Policy & Government Affairs
International Bridge, Tunnel and Turnpike
   Association

AAMVA STAFF – PROJECT MANAGER

Brian Ursino
Director, Law Enforcement Programs
American Association of Motor Vehicle Administrators

AAMVA STAFF

Paul Steier
Director, Vehicle Programs
American Association of Motor Vehicle Administrators

**American Association of
Motor Vehicle Administrators**