

Study on Whether Full-Color Special License Plates Should Continue to be Authorized or Phased Out

Session Law 2011-392, Section 11

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Joint Legislative Transportation Oversight Committee
NC Department of Transportation, Division of Motor Vehicles
NC Department of Public Safety, State Highway Patrol



Session Law 2011-392 required the departments of Transportation and Public Safety to “study whether, for purposes of effective law enforcement, full-color special license plates should continue to be authorized or be phased out, with all special license plates being on the First in Flight background,” and report to the Joint Legislative Transportation Oversight Committee. As a part of this study, the departments considered the readability of these plates by both law enforcement officers and automatic camera readers used by law enforcement agencies. This report also includes input from law enforcement and stakeholder groups who have full-background special plates.

DOT STUDY OF AUTOMATIC LICENSE PLATE READERS

The Department of Transportation sponsored a study of automatic license plate recognition systems. Two types of systems read various types of license plates in a controlled environment. The study found that standard license plates were much more readable than specialty plates on a standard background, and significantly more readable than specialty plates on alternate backgrounds. The complete report of this study is attached as Appendix A.

STATE HIGHWAY PATROL SURVEY OF LAW ENFORCEMENT AGENCIES

The State Highway Patrol contacted select law enforcement agencies within North Carolina and several other state patrol/state police agencies requesting information regarding the legibility of multi-colored registration plates. The responses comprised a wide variety of results. Some agencies reported no knowledge of complaints regarding readability, while others reported some general concerns. Survey questions are included in Appendix B, and the response compilation is in Appendix C.

RECOMMENDATION

The Department of Transportation and the Department of Public Safety recommend that the State of North Carolina continue to issue full-color background special license plates in the new standardized format developed as required by S.L. 2011-392. The NC State Highway Patrol, the NC Sheriffs Association, and the Raleigh Police Department have expressed support for a standardized format such as the “white block” that serves as the background for the plate number and the standard font used for the state name.

Effects of License Plate Attributes on Automatic License Plate Recognition

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FINAL REPORT

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Effects of License Plate Attributes on Automatic License Plate Recognition

EXECUTIVE SUMMARY

This technical assistance project report describes the methodology of an experiment designed to develop a comprehensive and thorough understanding of the readability of North Carolina's license plates with an Automatic License Plate Recognition system. This research focused on law enforcement applications and utilized two infrared camera systems for data collection in a controlled environment. Age, reflectivity, and condition will be considered during the analysis of the readability of over 900 license plates. The following list summarizes the settings and conditions of the effort:

- 25 mph test vehicle
- Nighttime evaluation
- Test track
- 40' spacing of license plates
- 9' lateral offset between license plates and camera
- Standard-issue and specialty plate types
- Standard syntax and personalized plates
- Varying license plate age and condition

The key finding of this research project is that the current, standard issue, blue ink license plate has the highest capture and read rates of all the plates tested in this study. Factors which decreased the capture and read rates were personalized syntax, specialty license plates, and the presence of stacked characters on a specialty license plate.

Effects of License Plate Attributes on Automatic License Plate Recognition

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Effects of License Plate Attributes on Automatic License Plate Recognition

INTRODUCTION

Automatic license plate recognition (ALPR) – also known as automatic number plate recognition, automatic vehicle identification, car plate recognition, and license-plate recognition - is a valuable tool for law enforcement agencies to identify vehicles. A typical, contemporary ALPR system uses cameras and infrared lighting to capture images of license plates and optical character recognition to translate the images into text. This automation allows a law enforcement agency to automatically scan thousands of license plates a day and compare the plates to agency databases with minimal effort for officers. For ALPR systems to be effective and efficient, license plates must be readable by this technology. However, due to variations of license plates across jurisdictions and the variety of possible designs within a jurisdiction, law enforcement agencies face some difficulties with complete and accurate matches of license plates.

In North Carolina, the standard issue plate includes three letters and four numbers embossed on the plate, separated by a dash mark with “First in Flight” along the top border and “NORTH CAROLINA” along the bottom border. The current design, featuring blue ink, has been in use since 1983, except for a period of time between early 2007 and late 2009, in which red ink was applied to the embossed characters (Exhibit 1). In addition to personalized standard issue plates, many specialty plates are also available, which may also be customized by the vehicle’s owner. The standard issue license plates have consistent, expected syntax (three letters and four numbers), while personalized plates introduce tremendous variability from a vehicle owner’s choice of letters, numbers, and symbols. Additionally, the full backgrounds available on some specialty plates decrease the contrast between the background and characters, further exacerbating the task of character recognition on license plates.



Exhibit 1. Standard Issue NC License Plates [Current Issue (left) and 2007 to 2009 Issue (right)]

RESEARCH OBJECTIVE AND SCOPE

The primary objective of this research was to develop a comprehensive and thorough understanding of the readability of North Carolina’s license plates with an ALPR system. This research focused on law enforcement applications and utilized the City of Raleigh Police Department’s infrared ALPR system and a Federal Signal / PIPS Research and Development’s ALPR system for data collection in a controlled environment. Age, reflectivity, contrast ratio, and condition of the license plates were considered during the analysis of the readability of the license plates.

LITERATURE REVIEW

The deployment of an ALPR system for identifying, reading, and comparing to relevant databases numerous vehicles in the vicinity of the equipment offers promising efficiencies and effectiveness for law enforcement agencies. This literature review summarizes the technology and techniques employed by ALPR systems, as well as, applications of ALPR systems.

AUTOMATIC DETECTION AND RECOGNITION

The development of image processing tools and algorithms for recognizing and reading license plates has been critical for the refinement and improvement of ALPR systems. In broad terms, there are three essential steps in the process of identifying a specific license plate alphanumeric sequence: 1) identifying the license plate (as opposed to other parts of the vehicle or road signs), 2) identifying and separating license plate characters, and 3) recognizing each character. Kim et al. (1996), Chang et al. (2004), Duan et al (2005), Ozbay and Ercelebi (2005), and Daramola et al. (2011) each developed methods that address one or more of the fundamental steps of identifying license plate characters.

In experimental testing, systems designed to automatically detect license plates and recognize characters have produced reliable results in the majority of the test samples. Kim et al. (1996) applied a genetic algorithm to 70 license plates in Korea with a 93% extraction rate. Chang et al. (2004) obtained a 94% success rate applying ALPR algorithms to over 1,000 license plates in Taiwan. Ozbay and Ercelebi (2005) achieved a 93% recognition rate on a sample of 340 license plates in Turkey. Duan et al. (2005) evaluated an automated system with 805 license plates in Vietnam and found a system accuracy of 93%. Daramola et al. (2011) tested 100 license plate images from 50 vehicles with a resulting 98% recognition rate.

The syntax, or the expected order of letters and numbers, of the characters on the license plate is a critical aspect influencing the readability of a license plate. Errors in the predicted characters can arise due to the similarities of some characters, particularly between numbers and letters. These errors are most prevalent in the case of personalized license plates or when syntax rules allow for letters and numbers in the same position on a license plate. Previous research from Chang et al. (2004) and Ozbay and Ercelebi (2005) support this conclusion with the most likely errors occurring between the following characters: B and 8, E and F, D and O, D and 0, O and 0, 1 and 7, S and 5, Z and 2 (Ozbay and Ercelebi 2005). Five of the eight combinations are matches between letters and numbers, supporting a need for syntax to read plates consistently.

ALPR IMPLEMENTATION AND APPLICATIONS

Plotnikov and Shuldiner (2002) identified three key factors influencing an ALPR's ability to accurately read a license plate: ambient light, video recording settings, and ALPR settings. Data were collected by using video of moving vehicles with variations of lighting and exposure settings of the video recording. The analysis settings of the ALPR system were structured to achieve the highest accuracy possible, with particular focus on the syntax of the license plates. The study found that the highest read rates in various lighting conditions occurred when the sun was in front of the vehicle such that the license plate was completely shaded. Video recording settings and ALPR settings each influenced the read rate, indicating the importance of proficient operators.

Oliveira-Neto et al. (2009) studied the applicability of an ALPR system with two units for large-truck speed monitoring and enforcement in Knoxville, Tennessee. The output from the ALPR systems were compared to the raw images of the license plates which resulted in an accuracy of 61% and 63% from the units. The initial results were then constrained by a travel time criteria and a text-mining technique which significantly improved the resulting license plate matches. After refining the data, the authors were able to achieve a 97% positive detection rate between two ALPR units with only 2% false positive matches.

A variety of uses of ALPR system data exist outside of law enforcement applications. License plate identification through automated means can provide transportation agencies and highway users with valuable information about travel times along a route (Shuldiner, et al. 1996, French et al. 1998, Clark et al. 2002, Buisson 2006, Findley 2010a). Matched license plate data can also supply necessary information for transportation planning processes, including origin-destination studies and cordon studies (Shuldiner, et al. 1996, French et al. 1998, Gupta et al. 2002, Foyle 2010). Other transportation engineering studies including parking studies (Findley 2010b) and path-based traffic volume studies (Schroeder 2010) can benefit from matched license plate data.

SUMMARY

Previous literature focuses on technology to read license plates, techniques for data cleaning and reduction, or uses for the data captured by ALPR systems. However, the authors of this research found no previous studies which have focused on the impact of the license plate attributes on the readability by an ALPR. This study will focus on license plate attributes as a means to improve readability.

METHODOLOGY

The purpose of this research effort was to test the readability of North Carolina license plates through automated, infrared camera systems. Therefore, only the physical features of the license plate were of interest during the experiment, other conditions that could influence the accuracy of the ALPR were controlled to the fullest extent possible. Recently returned license plates were tested in this study to evaluate the readability of plates that are currently displayed on vehicles across the state. This data provides a baseline assessment to compare future changes in license plate design. The license plates included in the study were collected from the manufacturer of North Carolina licenses plates, Correction Enterprises, a division of the North Carolina Department of Correction. The licenses plates were selected from the existing stock of returned license plates. Critical features collected on each license plate included the production year, retroreflectivity, and condition (rating of physical condition). A total of 905 license plates were collected for testing with the quantities by license plate type shown in Exhibit 2. Among the types of plates were:

- Standard issue plates
 - Standard issue plates (pre-2007 and current) with blue characters (Exhibit 1)
 - Standard issue plates (2007 to 2009) with red characters (Exhibit 1)
- Specialized and personalized plates
 - Specialized plates in the standard issue format with special artwork on the left and a stacked suffix (Exhibit 3)

- Existing specialty plates with the previous full-background design (Exhibit 4)
- New specialty plates with the new full-background standard template format (Exhibit 4)

Exhibit 2. License Plates Tested by Plate Type

Plate Type	Number of Plates
Standard Issue – Blue Ink	240
Standard Issue – Red Ink	274
Specialty – No Stacked Character	47
Specialty – Stacked Character	95
Specialty – Full Background (With White Box)	240
Specialty – Full Background (Without White Box)	6



Exhibit 3. Example Specialized Plate in Standard Issue Format with Artwork and Stacked Suffix



Exhibit 4. Example Full Background Plate without White Block (left) and with White Block (Right)

LICENSE PLATE ATTRIBUTE CHARACTERIZATION

Each license plate was cataloged and characterized to compare to the output of the field testing. The license plates were cataloged in a spreadsheet and characterized by their age (by production date), contrast ratio between the license plate background and alphanumeric values, retroreflectivity value, and condition assessment rating. The contrast ratio is a measure of the difference in contrast between the background and characters of a license plate. The contrast ratio is calculated by dividing the background grayscale value by the character grayscale value and was generated automatically by the ALPR system.

The retroreflectivity of each license plate was measured with a retroreflectometer. The retroreflectivity of each plate was measured in a consistent location that could be easily replicated across all similar plate types.

The following condition assessments were used by Correction Enterprises in evaluating each license plate:

- Functional (functioning as designed in terms of overall condition – does not include any of the following damage conditions)
- Faded
- Bent
- Cracked surface
- Peeling sheeting

FIELD TESTING

The North Carolina State Highway Patrol Training Academy in Raleigh was utilized for the experiment. This limited-access facility features several road courses for officer training, including an oval with straight segments of approximately one quarter of a mile which were used for this study (Exhibit 5). These facilities are surrounded by natural areas which offer little background lighting and reflectivity interference with the ALPR system. The experiments were conducted during nighttime conditions to minimize the impact of lighting on the tests. The experiment was conducted on March 7, 2012.



Exhibit 5. Field Testing Location

Two ALPR systems were utilized for the testing: the City of Raleigh Police Department's infrared ALPR system and a Federal Signal / PIPS Research and Development's ALPR system. Both systems were Federal Signal / PIPS Technology infrared camera systems and were mounted under the vehicle's light bar. Immediately prior to field testing, a PIPS technician ensured that the equipment was properly calibrated for the field conditions.



Exhibit 6. ALPR Cameras Turned Off (top) and in Operation (bottom)

Many environmental issues can affect the readability of license plates, including: sunshine, darkness, direction of sun / shadows, presence of clouds, precipitation, fog, etc. Additionally, vehicle mounting factors can impact readability, including: occlusions created by trailer hitches, poorly designed frames, bike racks, trailers, height of the license plate off the ground, etc. The field testing scenario was developed to control for the potential environmental and vehicle mounting factors through specifications of the environmental conditions, ALPR operation, and license plate placement. This test scenario mimics the reading of parked car's license plates as shown in Exhibit 7. The testing began at 7:00 PM, which was 45 minutes after sunset (with sunset time defined by United States Naval Observatory (USNO 2012)).

Multiple runs on the test course were required to test the full sample of license plates. During each run, thirty license plates were placed perpendicular to the ALPR-equipped vehicle's direction of travel and spaced at an interval of forty feet. Among the 30 license plates examined during each run, 25 were replaced for successive runs and 5 remained constant throughout the testing to serve as a calibration of the ALPR systems. The lateral offset, or perpendicular distance from the test vehicle to the license plates, was set as 9 feet to imitate parked vehicles alongside the roadway. During the testing, the license plates were stationary. The license plates were supported by wooden posts and mounted onto a piece of black poster board with a matte finish at a height of 24" above the ground (Exhibit 7). The test vehicle

equipped with the ALPR was moving at a consistent speed of 25 mph while passing each plate. The license plates were placed in a pre-specified order for comparison to the ALPR system data.



Exhibit 7. Field Testing Layout

MEASURES OF EFFECTIVENESS

The following measures of effectiveness serve as the basis for evaluating the readability of NCDMV's current license plates. These measures facilitate the evaluation of license plates based on the type of plate, age, contrast (between lettering and background), retroreflectivity, and condition.

- **Capture Rate** – The capture rate quantifies the percentage of license plates that are correctly identified as license plates to be analyzed by the ALPR system and is defined by the following equation:
 - $\text{Capture Rate} = \text{Number of License Plates Recognized As License Plates} / \text{Total Number of License Plates Studied}$
- **Read Rate** – The read rate quantifies the percentage of license plates that are accurately read among the plates that were captured by the ALPR system and is defined by the following equation:
 - $\text{Read Rate} = \text{Number of License Plates Accurately Read} / \text{Number of License Plates Recognized As License Plates}$
- **Character Read Rate** – The character read rate quantifies the percentage of a specific letter, number, or symbol that is accurately read by the ALPR system.

RESULTS

The 902 license plates included in this study were evaluated with two ALPR systems: the City of Raleigh Police Department's infrared ALPR system (Raleigh PD) and a Federal Signal / PIPS Research and Development's ALPR system (PIPS R&D). Both systems were Federal Signal / PIPS Technology infrared camera systems and were mounted under the vehicle's light bar. The PIPS R&D system most likely represents the ideal testing equipment with a new camera and optimized algorithms for finding and evaluating the license plates included in the study, while the Raleigh PD system represents a system currently in operation in the field. A license plate is referred to as captured if that plate is correctly identified as a license plate to be analyzed by the ALPR system, while a license plate is referred to as accurately read if all of the characters on the license plate have been correctly reported and matched to the actual characters. Exhibit 8 presents the license plate matching outcomes for the Raleigh PD system and PIPS R&D system. The PIPS R&D system captured and accurately read 367 license plates (shown in the bottom row) and the Raleigh PD system captured and accurately read 293 license plates (shown in the far right column). Among the license plates studied, 77% resulted in the same outcome for each of the systems: 271 were correctly identified as a license plate by both ALPR systems and accurately read; 297 license plates were correctly identified as license plates, but not accurately read; and 123 license plates were not captured by both systems.

Exhibit 8. License Plate Match Outcome Raleigh PD & PIPS R&D

		PIPS R&D ALPR Match Type and Quantity			<i>Raleigh PD ALPR Total</i>
		Capture and Read	Capture Only	No Capture	
Raleigh PD ALPR Match Type and Quantity	Capture and Read	271	16	6	293
	Capture Only	81	297	23	401
	No Capture	15	70	123	208
<i>PIPS R&D ALPR Total</i>		367	383	152	902

Exhibit 9 displays the capture and read rate of the Raleigh PD system and the PIPS R&D system. As an example of the information provided in the exhibit, Exhibit 9 shows that 154 standard issue, blue ink license plates were included in the study. Among the 154 license plates, 148 (96%) were appropriately identified as license plates by the Raleigh PD system. Among the set of 148 plates captured by the Raleigh PD ALPR system, 142 (96%) plates were accurately read by the system. Exhibit 10 and Exhibit 11 present the read rate and number of correctly read characters for each of the 36 alphanumeric characters, for the Raleigh PD system and PIPS R&D system, respectively. As an example of the information provided in the exhibits, Exhibit 10 shows that the letter "B" was accurately read 14 times on personalized standard issue, blue ink license plates, for a read rate of the letter of 78%.

Similar to the alphanumeric read rate exhibits, Exhibit 12 shows the read rate for stacked characters, as well as the capture rate. A total of 341 stacked characters appeared on the 902 plates included in the study. The Raleigh PD and PIPS R&D systems were able to capture 75% and 84% of those plates, respectively. The Raleigh PD and PIPS R&D systems were able to accurately read 60% and 65% of the captured plates, respectively.

Exhibit 9. License Plate Capture and Read Rate – Raleigh PD & PIPS R&D

Plate Type	Syntax Type	Number of Plates	Raleigh PD		PIPS R&D	
			Capture Rate % (Number)	Read Rate % (Number)	Capture Rate % (Number)	Read Rate % (Number)
Standard Issue - Blue Ink	Std	154	96% (148)	96% (142)	95% (147)	95% (140)
	Person	86	84% (72)	40% (29)	83% (71)	48% (34)
Standard Issue - Red Ink	Std	249	66% (164)	45% (74)	75% (186)	60% (111)
	Person	25	56% (14)	7% (1)	72% (18)	11% (2)
Specialty FIF - No Stacked Character	Std	43	86% (37)	57% (21)	88% (38)	68% (26)
	Person	4	50% (2)	50% (1)	50% (2)	50% (1)
Specialty FIF - Stacked Character	Std	83	80% (66)	20% (13)	87% (72)	28% (20)
	Person	12	33% (4)	0% (0)	50% (6)	0% (0)
Specialty Non-FIF - New Style	Std	213	80% (171)	7% (12)	89% (189)	17% (33)
	Person	27	52% (14)	0% (0)	67% (18)	0% (0)
Specialty Non-FIF - Old Style	Std	5	20% (1)	0% (0)	40% (2)	0% (0)
	Person	1	100% (1)	0% (0)	100% (1)	0% (0)
Total		902	77% (694)	42% (293)	83% (750)	49% (367)

Note: Std = Standard, Person = Personalized

Exhibit 10. Alphanumeric License Plate Character Appearances and Read Rate – Raleigh PD

Values	Read Rate % (Number of Correct Readings)								
	Blue Ink		Red Ink		Specialty Plates		All Plate Types		All Plates
	Personalized	Standard	Personalized	Standard	Personalized	Standard	Personalized	Standard	
A	100% (35)	100% (43)	100% (7)	100% (2)	100% (6)	29% (2)	100% (48)	90% (47)	95% (95)
B	78% (14)	100% (9)	100% (4)	50% (1)	100% (2)	13% (1)	83% (20)	58% (11)	72% (31)
C	100% (18)	100% (21)	90% (9)	100% (13)	100% (6)	38% (3)	97% (33)	88% (37)	92% (70)
D	80% (12)	93% (13)	50% (1)	67% (6)	100% (1)	44% (4)	78% (14)	72% (23)	74% (37)
E	100% (33)	100% (20)	100% (10)	N/A (0)	100% (4)	50% (3)	100% (47)	88% (23)	96% (70)
F	100% (11)	100% (17)	100% (1)	100% (1)	50% (2)	44% (4)	88% (14)	81% (22)	84% (36)
G	100% (7)	N/A (0)	50% (1)	N/A (0)	50% (2)	0% 0	77% (10)	N/A (0)	77% (10)
H	78% (7)	100% (7)	100% (5)	90% (18)	100% (5)	60% (3)	89% (17)	88% (28)	88% (45)
I	100% (28)	N/A (0)	100% (6)	N/A (0)	100% (4)	0% 0	100% (38)	N/A (0)	100% (38)
J	100% (11)	100% (5)	100% (5)	100% (21)	67% (2)	50% (4)	95% (18)	88% (30)	91% (48)
K	100% (9)	100% (4)	N/A (0)	80% (4)	100% (3)	0% (0)	100% (12)	50% (8)	71% (20)
L	97% (34)	100% (5)	100% (5)	100% (4)	100% (1)	0% (0)	98% (40)	50% (9)	83% (49)
M	92% (24)	100% (1)	100% (2)	50% (2)	100% (6)	40% (4)	94% (32)	47% (7)	80% (39)
N	96% (22)	100% (26)	N/A (0)	78% (21)	50% (1)	43% (3)	92% (23)	83% (50)	86% (73)
O	93% (25)	N/A (0)	75% (3)	N/A (0)	80% (4)	100% (1)	89% (32)	100% (1)	89% (33)
P	94% (16)	100% (33)	100% (3)	97% (30)	100% (3)	0% (0)	96% (22)	91% (63)	92% (85)
Q	N/A (0)	N/A (0)	N/A (0)	N/A (0)	0% 0	0% 0	N/A (0)	N/A (0)	N/A (0)
R	100% (35)	93% (28)	100% (7)	100% (15)	100% (2)	25% (2)	100% (44)	85% (45)	92% (89)
S	97% (32)	100% (27)	80% (4)	100% (11)	80% (4)	50% (7)	93% (40)	87% (45)	89% (85)
T	92% (22)	100% (27)	80% (4)	95% (40)	80% (4)	0% (0)	88% (30)	88% (67)	88% (97)
U	100% (14)	N/A (0)	100% (2)	N/A (0)	100% (1)	45% (5)	100% (17)	45% (5)	79% (22)
V	100% (4)	100% (33)	100% (2)	93% (27)	100% (1)	0% (0)	100% (7)	90% (60)	91% (67)
W	100% (9)	100% (28)	N/A (0)	65% (15)	100% (2)	14% (1)	100% (11)	76% (44)	80% (55)
X	100% (6)	100% (15)	N/A (0)	97% (95)	0% 0	14% (1)	100% (6)	93% (111)	93% (117)
Y	100% (12)	100% (30)	50% (2)	92% (85)	0% (0)	0% (0)	82% (14)	91% (115)	90% (129)
Z	100% (5)	100% (52)	100% (1)	95% (41)	0% 0	0% (0)	100% (6)	92% (93)	93% (99)
0	100% (3)	96% (49)	N/A (0)	78% (39)	100% (1)	95% (103)	100% (4)	91% (191)	92% (195)
1	79% (11)	100% (70)	N/A (0)	94% (66)	100% (1)	97% (94)	80% (12)	97% (230)	96% (242)
2	100% (3)	100% (57)	100% (2)	97% (62)	100% (2)	100% (127)	100% (7)	99% (246)	99% (253)
3	75% (3)	100% (60)	N/A (0)	97% (72)	100% (2)	96% (95)	83% (5)	97% (227)	97% (232)
4	83% (5)	98% (63)	100% (1)	93% (74)	0% 0	93% (101)	86% (6)	94% (238)	94% (244)
5	100% (3)	100% (57)	N/A (0)	90% (53)	0% (0)	98% (111)	75% (3)	97% (221)	96% (224)
6	100% (3)	100% (60)	N/A (0)	87% (67)	0% 0	100% (94)	100% (3)	96% (221)	96% (224)
7	N/A (0)	100% (60)	N/A (0)	100% (70)	100% (1)	97% (69)	100% (1)	99% (199)	99% (200)
8	33% (1)	100% (58)	100% (2)	89% (54)	0% 0	94% (92)	60% (3)	94% (204)	93% (207)
9	100% (1)	98% (58)	N/A (0)	88% (45)	100% (1)	99% (77)	100% (2)	96% (180)	96% (182)
Total	95% (504)	99% (1,043)	92% (97)	92% (1,148)	87% (85)	87% (1,163)	93% (686)	92% (3,354)	93% (4,040)

Exhibit 11. Alphanumeric License Plate Character Appearances and Read Rate – PIPS R&D

Values	Number of Character Appearances (Read Rate, %)								
	Blue Ink		Red Ink		Specialty Plates		All Plate Types		All Plates
	Personalized	Standard	Personalized	Standard	Personalized	Standard	Personalized	Standard	
A	100% (35)	98% (44)	90% (9)	100% (2)	100% (8)	29% (2)	98% (52)	89% (48)	93% (100)
B	89% (16)	100% (10)	100% (4)	100% (2)	100% (5)	40% (4)	93% (25)	73% (16)	84% (41)
C	100% (18)	100% (20)	100% (10)	100% (15)	80% (4)	56% (5)	97% (32)	91% (40)	94% (72)
D	100% (15)	100% (14)	83% (5)	89% (8)	0% (0)	63% (5)	95% (20)	87% (27)	90% (47)
E	100% (32)	100% (19)	100% (13)	100% (1)	100% (5)	33% (2)	100% (50)	85% (22)	95% (72)
F	100% (11)	100% (14)	100% (1)	100% (1)	100% (3)	70% (7)	100% (15)	88% (22)	93% (37)
G	100% (7)	N/A (0)	75% (3)	N/A (0)	100% (4)	0% (0)	93% (14)	N/A (0)	93% (14)
H	78% (7)	100% (7)	100% (4)	90% (26)	75% (3)	50% (3)	82% (14)	86% (36)	85% (50)
I	100% (28)	N/A (0)	86% (6)	N/A (0)	100% (3)	0% (0)	97% (37)	N/A (0)	97% (37)
J	91% (10)	100% (5)	100% (4)	100% (19)	67% (4)	18% (2)	86% (18)	74% (26)	79% (44)
K	100% (9)	100% (4)	0% (0)	80% (4)	83% (5)	14% (1)	88% (14)	56% (9)	72% (23)
L	100% (35)	100% (5)	100% (6)	67% (2)	100% (3)	0% (0)	100% (44)	44% (7)	85% (51)
M	96% (25)	100% (1)	60% (3)	80% (4)	100% (7)	60% (6)	92% (35)	69% (11)	85% (46)
N	87% (20)	100% (26)	67% (2)	79% (26)	67% (2)	43% (3)	83% (24)	83% (55)	83% (79)
O	88% (23)	N/A (0)	75% (3)	N/A (0)	80% (4)	100% (1)	86% (30)	100% (1)	86% (31)
P	94% (15)	97% (32)	100% (4)	97% (33)	100% (4)	0% (0)	96% (23)	90% (65)	92% (88)
Q	N/A (0)	N/A (0)	N/A (0)	N/A (0)	0% (0)	0% (0)	N/A (0)	N/A (0)	N/A (0)
R	100% (35)	97% (29)	90% (9)	100% (17)	100% (4)	18% (2)	98% (48)	83% (48)	90% (96)
S	100% (33)	100% (24)	75% (3)	100% (12)	71% (5)	47% (7)	93% (41)	84% (43)	88% (84)
T	96% (22)	100% (27)	80% (4)	98% (44)	100% (5)	25% (2)	94% (31)	91% (73)	92% (104)
U	100% (14)	N/A (0)	67% (2)	N/A (0)	100% (1)	73% (8)	94% (17)	73% (8)	86% (25)
V	100% (4)	100% (33)	75% (3)	100% (31)	100% (2)	20% (1)	90% (9)	94% (65)	94% (74)
W	100% (9)	96% (27)	50% (1)	57% (16)	100% (2)	17% (1)	92% (12)	71% (44)	75% (56)
X	100% (6)	100% (14)	N/A (0)	97% (112)	100% (2)	33% (2)	100% (8)	94% (128)	94% (136)
Y	100% (12)	100% (30)	60% (3)	95% (97)	100% (1)	0% (0)	89% (16)	93% (127)	93% (143)
Z	100% (5)	100% (52)	100% (1)	98% (48)	0% (0)	0% (0)	100% (6)	93% (100)	94% (106)
0	100% (3)	98% (51)	N/A (0)	78% (40)	100% (1)	91% (113)	100% (4)	90% (204)	90% (208)
1	69% (9)	100% (68)	0% (0)	97% (70)	100% (3)	98% (103)	71% (12)	98% (241)	97% (253)
2	100% (3)	100% (56)	100% (2)	100% (75)	100% (3)	99% (136)	100% (8)	100% (267)	100% (275)
3	100% (4)	100% (60)	100% (1)	99% (79)	100% (2)	97% (112)	100% (7)	98% (251)	98% (258)
4	100% (5)	95% (57)	33% (1)	89% (77)	0% (0)	94% (113)	75% (6)	93% (247)	92% (253)
5	67% (2)	100% (57)	N/A (0)	88% (68)	0% (0)	96% (111)	50% (2)	94% (236)	94% (238)
6	100% (2)	100% (60)	N/A (0)	90% (83)	0% (0)	99% (100)	100% (2)	96% (243)	96% (245)
7	N/A (0)	100% (59)	N/A (0)	99% (80)	100% (1)	100% (78)	100% (1)	100% (217)	100% (218)
8	67% (2)	100% (58)	100% (2)	93% (62)	0% (0)	95% (104)	80% (4)	96% (224)	95% (228)
9	N/A (0)	100% (58)	N/A (0)	85% (53)	100% (1)	98% (84)	100% (1)	95% (195)	95% (196)
Total	96% (496)	99% (1,029)	84% (129)	93% (1,302)	91% (107)	88% (1,268)	93% (732)	93% (3,599)	93% (4,331)

Exhibit 12. License Plate Stacked Character Read Rate – Raleigh PD & PIPS R&D

Stacked Character	Number of Plates	Raleigh PD		PIPS R&D	
		Capture Rate % (Number)	Read Rate % (Number)	Capture Rate % (Number)	Read Rate % (Number)
AA	1	100% (1)	100% (1)	100% (1)	100% (1)
AI	6	50% (3)	33% (1)	50% (3)	0% (0)
AT	23	52% (12)	67% (8)	78% (18)	78% (14)
BC	3	100% (3)	67% (2)	100% (3)	100% (3)
BP	97	86% (83)	58% (48)	93% (90)	72% (65)
CF	22	73% (16)	31% (5)	91% (20)	45% (9)
CH	2	0% (0)	N/A (0)	50% (1)	0% (0)
CP	3	100% (3)	33% (1)	100% (3)	100% (3)
CV	3	100% (3)	100% (3)	100% (3)	100% (3)
DI	1	100% (1)	100% (1)	100% (1)	100% (1)
DU	11	45% (5)	60% (3)	45% (5)	100% (5)
DV	2	50% (1)	0% (0)	100% (2)	50% (1)
EF	10	40% (4)	100% (4)	90% (9)	89% (8)
FF	2	50% (1)	0% (0)	50% (1)	100% (1)
GT	1	0% (0)	N/A (0)	100% (1)	0% (0)
HD	28	93% (26)	23% (6)	96% (27)	7% (2)
HG	1	100% (1)	100% (1)	100% (1)	100% (1)
IC	5	100% (5)	100% (5)	100% (5)	100% (5)
KA	1	100% (1)	100% (1)	100% (1)	100% (1)
KF	4	75% (3)	67% (2)	100% (4)	50% (2)
KV	1	100% (1)	100% (1)	100% (1)	100% (1)
LP	1	0% (0)	N/A (0)	0% (0)	N/A (0)
NG	3	0% (0)	N/A (0)	0% (0)	N/A (0)
PH	1	100% (1)	0% (0)	100% (1)	0% (0)
RE	1	0% (0)	N/A (0)	0% (0)	N/A (0)
RF	2	0% (0)	N/A (0)	50% (1)	0% (0)
SA	1	0% (0)	N/A (0)	100% (1)	0% (0)
SF	3	100% (3)	0% (0)	100% (3)	0% (0)
SM	66	83% (55)	87% (48)	83% (55)	84% (46)
SP	9	89% (8)	25% (2)	78% (7)	0% (0)
SR	6	67% (4)	75% (3)	50% (3)	100% (3)
ST	6	50% (3)	67% (2)	83% (5)	80% (4)
TF	4	0% (0)	N/A (0)	25% (1)	0% (0)
TH	2	100% (2)	0% (0)	50% (1)	100% (1)
VV	4	100% (4)	25% (1)	100% (4)	50% (2)
WC	4	75% (3)	100% (3)	100% (4)	100% (4)
WM	1	100% (1)	100% (1)	100% (1)	100% (1)
Total	341	75% (257)	60% (154)	84% (287)	65% (187)

FINDINGS

The key findings of this research project include the following observations about North Carolina license plate readability by an ALPR system:

- The current, standard issue, blue ink license plate has the highest capture and read rates of all the plates tested in this study. These plates were the type most accurately recognized as license plates

and accurately read by the ALPR system. The personalization of the blue ink license plate resulted in a read rate approximately half of the read rate of the standard issue syntax.

- The red ink which was used on plates from 2007 to 2009 performed significantly worse than blue ink in terms of both capture rate and read rate.
- Among the specialty license plates with the First in Flight background, the plates without the stacked character were more easily captured and read than the plates with the stacked character.
- Among the specialty license plates with the full background, the ALPR system was generally able to appropriately recognize the plates as license plates, but had difficulty accurately reading the plates for both the standard syntax and personalized syntax (none of the 27 personalized plates were read correctly by either system).

POTENTIAL FUTURE TESTS

Future tests could be undertaken in the future to evaluate the effectiveness of:

- High contrast inks
- Digital license plates
- Digital license plates with bar codes
- Real-world conditions (on-street parking, weather, daytime, etc.)
- Additional specialty plates
- Larger sample size for some plates where additional data is needed for decision-making

ACKNOWLEDGEMENTS

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APPENDIX B
SHP Survey Questions

- 1.** Does your state issue registration plates with ONE standard background, OR does your state offer registration plates with different backgrounds? For example, NC has its “standard” registration plate background (white), but NC also offers registration plates having various multi-colored backgrounds (ex: NASCAR racing and special interest plates completely different in both color and design from the standard plate).
- 2.** If your state DOES issue plates with various multi-colored backgrounds, are you aware of any incidents or complaints by law enforcement authorities or the general public concerning the legibility or recognition of these plates?
- 3.** Regarding these plates, are you aware of any incidents or issues about the legibility or recognition thereof by electronic sources (i.e. red/light cameras, toll road cameras, etc.)?

APPENDIX C

Multi-colored Registration Plates Survey of Select NC Agencies and State Patrol/State Police Agencies March 2012

The Research and Planning Unit of the North Carolina State Highway Patrol contacted select law enforcement agencies within North Carolina and several state patrol/state police agencies requesting information regarding the legibility of multi-colored registration plates. The following summarizes responses received to our inquiry.

I. In-state Law Enforcement Agencies

Traffic Unit representatives from the Raleigh Police Department, Greensboro Police Department, and the Charlotte-Mecklenburg Police Department reported no significant concerns have been expressed by officers regarding the legibility of North Carolina multi-colored registration plates. Furthermore, the individuals with whom we contacted did not indicate any known difficulties with the readability of such plates by electronic devices designed to identify registration plate characters.

II. State Patrol/State Police Agencies (Multi-colored plates within their states)

Arizona

Arizona issues a multitude of specialty plates which can be viewed at www.azdot.gov/mvd/vehicle/mvdplate.asp. While some plates have been revised because of readability issues, others continue to be issued.

Delaware

Two main backgrounds are available for Delaware's standard plates. One has a dark blue background with yellow numbers, and the second has a black background with silver/white numbers. Vanity or special plates have the same blue and gold number appearance. Four multi-colored background plates can be problematic; however, the Delaware State Police believes the Farmland Preservation plate (pink background) has been discontinued. The qualification process for multi-colored plates is quite difficult which impacts the number of plates issued. There are no reported incidents concerning the detection or recognition thereof by electronic sources (i.e. red light cameras, toll road cameras, etc.).

Illinois

Illinois offers registration plates with different backgrounds. There have been no incidents or complaints by law enforcement authorities or the general public about the legibility or recognition of these plates.

Louisiana

Louisiana has multi-colored backgrounds on license plates. Several State Police officers complained about the legibility of one particular plate – the Louisiana State University Fighting Tigers license plate (LSU Tigers). As a result, this plate is no longer available. There have not been any particular incidents about the legibility or recognition thereof by electronic sources (i.e. red light cameras, toll road cameras, etc.).

Maryland

Maryland has multicolored background vehicle license plates. One is yellow at top and fades into red. Another is blue at top and fades white down the plate. However, there have been no known problems reported from Maryland law enforcement agencies regarding legibility or recognition of these plates.

Minnesota

Nearly all law enforcement officers in Minnesota would prefer one style of license plate, as opposed to the countless styles offered by the state. The multitude of plates makes it difficult to discern which state issued the plate, especially when the vehicle is traveling at a high speed at night).

The color issue with Minnesota's plates began after 9-11 when the MN Driver and Vehicle Services (DVS) came up with the red/white/blue "Support our Troops" plate. The Governor favored the plate, and it went into production very quickly without law enforcement's involvement in the approval process. The plates are both attractive and popular but difficult to read at several car lengths and virtually impossible to read at night. The situation worsened as the plates aged.

The law enforcement advisory committee along with other law enforcement officials had discussions with DVS about law enforcement concerns. By then, of course, tens of thousands of these plates had already been printed. After a number of meetings, DVS agreed to alter the rectangular area in the center of the plate (i.e. the area where the letters/numbers appear) whereby the rectangular area would be white and the characters black. This contrast provided the greatest visibility. Recent "Support Our Troops" plates reflect this change.

When DVS pursued flat license plates (absent raised letters/numbers), the law enforcement advisory committee insisted on the white rectangular background with black characters. As a result, the new plates being issued are easy for officers to read even at night.

Shortly after the flat plate came into existence, the MN Department of Natural Resources wanted habitat plates (in support of the loon, deer, fish, etc.). The proposed plates had the same issue as the original "Support Our Troops" plate. These plates would have been very attractive but difficult to read – especially at night. The law enforcement advisory committee insisted these plates have the white rectangular background in the center with black letters/numbers. DNR opposed this design because they felt it would ruin the plate's appearance and thereby diminish sought after revenue – the very purpose of the plate. Nevertheless, the plates do contain the white rectangle with black characters. DNR tried to push the idea of having some of the coloring partially inside the white background, but the law enforcement advisory committee stated that any color other than white touching the black characters would be unacceptable. Law enforcement has not had any more problems with plate designs for the last 10 years.

Nebraska

Nebraska has a standard white background for many plates but also issues special plates with different coloring schemes; however, there have been no reported incidents by law enforcement concerning legibility. In 2012, however, the Nebraska State Patrol started issuing a special plate for troopers that is mostly black with white characters representing badge numbers. There have been complaints that the white characters are not easily distinguishable. Nebraska does not have any red light or toll road cameras; therefore, readability is not an issue.

New Jersey

New Jersey has never offered multi-colored background plates. At one time, however, the State offered various solid colored background plates. Due, in part, to law enforcement's difficulty in reading various color plates, the State moved to a single color scheme. Presently, New Jersey offers a canary yellow fading to a light cream color background with black letters for all dedicated and specialty plates. NJ plates can be viewed at <http://www.state.nj.us/mvc/Vehicle/DedicatedPlates.htm>.

Although the Motor Vehicle Commission moved to a standardized background color, New Jersey has never done a plate recall and so there are still plates in use with previously issued color backgrounds; however, when these plates are returned, they are removed from use.

New Jersey is moving towards cost efficient flat plate technology; however, the current canary yellow fading to a light cream color background with black letters color scheme will remain. New Jersey is not planning a plate recall when the flat plate technology is implemented so other existing color plates will remain in use for a while longer.

New York

New York State currently offers two different backgrounds as they transition from one to the other. There have been no complaints from the public or the law enforcement community regarding legibility.

North Dakota

North Dakota offers several different backgrounds containing unique colors including the ND standard plate, the "Lewis & Clark" plate, and others such as the ND National Guard plate. The state authorizes the standard plate with a variety of colored logos such as military emblems, state university logos, and firefighter emblems to cite a few. While there have been no widespread complaints about legibility, officers in other states may experience difficulty when entering registration information. For example, the Lewis & Clark plates have a small "L" sitting above a small letter "C" on the left side of the plate, and officers must include "LC" in front of the other full-size plate numbers in order to receive registration information. The small "LC" is not readily visible unless the officer is in close proximity to the plate such as would be the case during a traffic stop when the law enforcement vehicle is positioned directly behind the suspect vehicle. There are jurisdictions within North Dakota that utilize electronic sources (i.e. red light cameras, toll road cameras, etc.), but there have been no widespread issues regarding recognition of North Dakota plates.

South Carolina

South Carolina has approximately 400 different license plates. While there have been no official complaints or inquiries, there have been several law enforcement officers around the state who have expressed difficulty reading the standard issued plate because of the dark background.

Tennessee

Tennessee issues plates with different color backgrounds. Unofficially, there have been complaints from troopers concerning their legibility. There have been no recorded instances about recognition by electronic sources (i.e. red light cameras, toll road cameras, etc.).

Virginia

The Commonwealth has a standard blue on white background with many other specialized/vanity plates. There have not been any significant issues regarding their legibility by officers or any incidents concerning recognition by electronic sources (i.e. red light cameras, toll road cameras, etc.). Each

session of the General Assembly has added new plates and no issues have been cited. Like most states, the purpose of special plates is to produce revenue, and it is unlikely the Commonwealth will discontinue these plates for that reason. The internet website for viewing the various types of plates offered by the Commonwealth to its citizens is https://www.dmv.virginia.gov/dmvnet/plate_purchase/select_plate.asp?PLT=&PLTNO=

Washington

Washington State issues many different kinds of license plates but no reported issues related to their legibility were identified. The link to the Washington State Department of Licensing's website is <http://www.dol.wa.gov/vehicleregistration/specialdesign.html>.

APPENDIX D

Cost of Replacement of All Full-Color Background Special License Plates

Number of full-color background plates currently active – 91,311

Assumption of 1% annual growth in number of full-color background plates by July 1, 2015 – 94,078

Per plate production cost – \$1.75

Estimated cost of replacement – \$164,600

RECOMMENDATION FOR FUNDING

The special plate program is receipt funded, with the cost of operating the program deducted from the Special Registration Plate Account before disbursement to other programs. Funds are available to replace the full-background plates as part of program operation for the FY 2016 year without any additional legislative authority or appropriation. This would mean the following amounts less would go to other programs during the same fiscal year:

- \$82,300 less to highway beautification;
- \$54,318 less to the Dept. of Commerce for out-of-state tourism and industrial development promotion;
- \$27,982 less to the Dept. of Health and Human Services to promote travel accessibility for disabled persons.

APPENDIX E

Comments by Interested Parties

J. Lee Warren, Jr.
North Carolina Ducks Unlimited
Public Policy Chairman
PO Box 68
Fayetteville, NC 28302-0068

April 17, 2012

Johanna H. Reese
Deputy Commissioner
NC Division of Motor Vehicles
3101 Mail Service Center
Raleigh, NC 27699-3101

Dear Ms. Reese,

On behalf of the State Chairman for North Carolina Ducks Unlimited Jim Cerza, Ducks Unlimited National Board member Lloyd Goode of Raleigh and the over 26,000 volunteers and members of Ducks Unlimited in North Carolina, let me thank you for the opportunity to make comments on the NC full background license plate program. There are almost 70,000 North Carolinians that have purchased full color plates to provide more than \$9.5 million to assist in improving and promoting North Carolina's natural resources and its tourism industry. The funding that NCDU has received from this program has assisted us in preserving over 35,000 acres of waterfowl and wetland habitat that benefit a large variety of wildlife species in North Carolina.

NCDU has fully implemented a redesign of our full background plate that far exceeds federal standards of visibility by law enforcement officers. It would be the recommendation of our group for the General Assembly to pass legislation for the 2012 session that would repeal the 2015 sunset on full color license plates.

We thank you for the opportunity to comment on the consideration of the General Assembly's Joint Legislative Transportation Oversight Committee in support of this very important funding source that benefits many North Carolinians. Please feel free to contact me if you have any questions or I can be of any assistance.

Sincerely,

J. Lee Warren, Jr.

Full Color License Plates in North Carolina

Requested Comments for the Inclusion in the Study

Public Safety and Readability

The newly redesigned specialty plates exceed safety and readability standards:

- The recent redesign of all color plates EXCEEDS federal standards, which according to the American Association of Motor Vehicle Administrators (AAMVA) is a 4:1 contrast for visibility by law enforcement officers (Olson and Sivak, 1983). The two colors recommended by the AAMVA as background colors for greatest contrast are white and yellow with black, blue, green, brown or red alpha numerics. The newly redesigned specialty plates that include the white box (and either black or blue alpha numerics) have a contrast at least six times the federally recommended standard. For example, the Blue Ridge Parkway and Friends of the Smokies Specialty Plates have a contrast of 21:1.
- Eliminating full color plates is NOT necessary for the efficient operation of toll roads. Toll cameras do not appear to have an issue reading specialty plates (even the full color ones) as evidenced by a board member who went through the toll booth on a dark, overcast February evening, just as rain was setting in and received the attached bill indicating that indeed the toll booths had no trouble identifying the specialty plate. Barry Mickle, operations director for the N.C. Turnpike Authority recently stated, "What we've seen from our cameras is they are all reading [full color plates] very well" (News and Observer, 2/21/12).
- Full color plates represent approximately 1 percent of North Carolina's 6 million license plates currently registered. From a safety standpoint, any change in the law removing NC full color plates from the road will do nothing to impact the thousands of out-of-state drivers that travel through North Carolina with specialty plates from other states (and the revenue generated from those plates will not benefit NC).

Financial Impacts

Current plate replaces tax dollars and generates revenue:

- Full color license plates provide about \$750,000 annually to the State of North Carolina for important travel and tourism investments including the operating assistance for North Carolina Visitor Centers along NC roadways. Ending the full color license plate program will require the Legislature to either:
 - 1) Use tax dollars to replace the state's share of license plate revenue which now pays for tourism advertising, highway beautification, visitor centers and traveler assistance; or
 - 2) Eliminate or reduce funding for those programs

Changing design will cost the State revenue:

- In addition, a significant financial cost to the State will result if all full-color specialty plates are replaced with a First in Flight design as, according to the language in HB 289,

after July 1, 2015, “the Division must send the owner a replacement special license plate” upon renewal of existing full color plates.

Key Facts

- More than 75,000 North Carolinians purchase full color license plates annually.
- A full color license plate in NC costs \$20 to \$30 - \$10 of which is placed in a special state account to support visitor centers, tourism advertising, highway beautification and assistance for disabled travelers, among other projects.
- Since 1999, NC’s full color license plate program has provided more than \$10 million to improve and promote NC’s natural resources and its tourism economy.
- In Western NC, full color plate revenues for the Blue Ridge Parkway Foundation and Friends of the Great Smoky Mountains alone have pumped more than \$6 million into the promotion and improvements of these destinations – and helped attract countless visitors and their tourist dollars to the region.
- A recent study indicates that in 2010, the Great Smoky Mountains National Park and the Blue Ridge Parkway ranked first and fifth, respectively, among all national parks in the economic investment and jobs created in surrounding counties. According to the study:
 - 9 million visitors spent \$818 million in the gateway communities around Great Smoky Mountains National Park and helped create more than 11,000 jobs.
 - 14,500,000 visitors spent \$299,787 million along the Blue Ridge Parkway and its surrounding communities, supporting more than 4,008 jobs in the area.

Summary

HB 289 was approved by the NC General Assembly in 2011 to make a variety of changes in North Carolina license plates. An end to the state’s full color license plates, beginning in 2015, was included in HB 289 - without public debate - as part of a Senate-House compromise in the last hours of the 2011 General Assembly.

Ending the use of full-color license plates will:

- Remove an important source of revenue from the State of North Carolina for many travel and tourism investments across the state from Visitor Centers to tourism advertising.
- Hurt North Carolina’s tourism economy by ending about \$1.5 million in annual investment in NC tourist attractions and natural resources, including our coast and beaches, the Great Smoky Mountains, the Blue Ridge Parkway and the Appalachian Trail.
- Eliminate funding for Ducks Unlimited, coastal restoration, NC State Parks, Rocky Mountain Elk Foundation and other important charities and conservation efforts.
- Necessitate an expenditure of state funds to replace full-color plates for North Carolina drivers who have purchased them.

Ending the full color plate program is unnecessary:

- The recent redesign of all color plates EXCEEDS federal standards for visibility by law enforcement officers – and addresses ALL of NCDOT and the NC Highway Patrol's concerns about full color plates.
- Neither the NCDOT nor the NC Highway Patrol has requested an end to the full color plate program.
- At its April meeting, the NC General Assembly's Joint Legislative Transportation Oversight Committee approved draft legislation for the 2012 General Assembly to repeal the 2015 sunset in HB289 and preserve the full color license plate program.



Blue Ridge Parkway Foundation
Carolyn Ward, CEO
cward@brpfoundation.org
828-776-4547



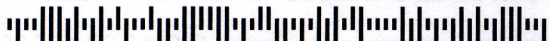
North Carolina Coastal Federation
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252-393-8185
Rob Lamme, Government Relations
roblamme@gmail.com; 919-630-3375



Friends of Great Smoky Mountains National Park
Holly Demuth, North Carolina Director
hollyd@friendsofthesmokies.org
828-452-0720
Rob Lamme, Government Relations
roblamme@gmail.com; 919-630-3375



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0028.01.01
SUZANNE HOBBS
220 GLADE ST
CHAPEL HILL, NC 27516-4436

BILL BY MAIL

Invoice Date: 03/23/2012
Invoice Number: 175688575
Invoice Posting Period: 03/08/12 to 03/22/12

Summary of Activity

Total Amount Due	Due Date
\$1.54	04/22/12

The vehicle(s) registered to you has been utilizing a North Carolina toll facility. Unpaid transactions and license plate images of each vehicle registered to you that utilized a North Carolina toll facility are provided.

Thank you for traveling the Triangle Expressway! Sign up for NC Quick Pass and save 35% on future tolls. If you received a \$0.00 transaction for NC540, tolling begins August 2012.

License Plate Images of Vehicle Registered to You (Please Note: Images may also appear on subsequent pages if necessary.)

Toll Transactions

License Plate/ Transponder	State	Vehicle Class	Transaction Date	Transaction Time	Posting Date	Toll Zone	Location Description	Amount
P202BP	NC	1	02/19/12	16:53:38	03/08/12	NC147	SB TO NC540 SB	\$0.77
P202BP	NC	1	02/19/12	16:58:29	03/09/12	NC540	NB TO NC147 NB	\$0.77
Total Tolls								\$1.54

For additional charges, payment options, dispute procedures, and failure to pay penalties, please see the reverse side of this letter.

Use the www.ncquickpass.com website for the easiest and quickest way to pay your invoice.
Or complete and return this portion with your payment to the NC Quick Pass Customer Service Center.

Please select type of payment below.

Visa ☐ Discover ☐
Master Card ☐ American Express ☐
Check ☐ Money Order ☐

Make checks payable to NC Quick Pass and include the invoice number on the face of the check.

Credit Card Number: _____
Expiration Date: _____
Amount Paid: \$ _____
Cardholder: _____
Date: _____
Signature: _____

SUZANNE HOBBS
220 GLADE ST
CHAPEL HILL, NC 27516-4436

Invoice Number: 175688575

NC Quick Pass Customer Service Center
200 Sorrell Grove Church Road, Suite A
Morrisville, NC 27560

Phone: 1-877-7MY-PASS (1-877-769-7277)

Fax: (919) 388-3279

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License Plate Image(s) of Vehicle(s) Registered to You



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Blue Ridge Parkway Foundation Blue Ridge Parkway Specialty Plate Fact Sheet



Safety and Readability

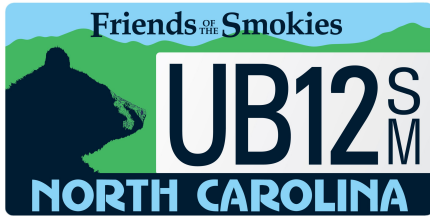
- ☆ The recent redesign design of the Blue Ridge Parkway Specialty Plate, found that the luminosity contrast readings are at a ratio of 21-to-1, which exceeds the nationally recommended minimum of 4-to-1 for license plate readability.
- ☆ The plate design was approved by the North Carolina State Highway Patrol, twice; once for the car specialty plate and second for the motorcycle specialty plate.

Economic Impact

- ☆ There are currently over 27,645 Blue Ridge Parkway Specialty Plates in NC. Revenue generated from specialty plate fees since 2004 for the Foundation and the Parkway is \$3,548,260 and \$1,774,130 for the State of North Carolina.
- ☆ Funds provided from the Foundation to the Parkway in 2011 alone are in excess of \$800,000. In a 2010 study of NC residents, approximately one-third indicated purchasing a specialty plate because of its appearance. If changes are made to the design and appearance of the plate, this could represent an average revenue loss per year of \$166,000 to the Parkway and \$83,000 to the State of NC.
- ☆ The Foundation not only allocates funds directly to the National Park Service/Blue Ridge Parkway but to other organizations for projects that benefit the Parkway, i.e. Buncombe County Greenways Project, Blue Ridge Conservancy, Conservation Trust of North Carolina, Friends of the Mountains-to-Sea Trail, Overmountain Victory National Historic Trail, National Council of Traditional Arts, Altapass Foundation, Southern Highland Craft Guild and multiple communities up and down the Parkway.

Impacts

- ☆ Hundreds of projects and programs have been funded through revenue generated by the Specialty Plate for the Blue Ridge Parkway and other community partners and groups.
- ☆ Examples of funded projects that would not have otherwise been possible without the Specialty Plate program include hiring seasonal rangers to staff visitor centers, putting Blue Ridge Parkway rangers in front of over 40,000 kids annually, providing wildlife cameras for monitoring to assist in protecting park resources, funding for Moses H. Cone Memorial Park, construction of bathrooms and other visitor amenities and facilities, and providing for safety and visitor protection equipment and trainings.
- ☆ Projects enhance the visitor's experiences that collectively represent an estimated \$2.3 billion in economic impact to communities adjacent to the Parkway



Friends of the Smokies

Full-Color Specialty Plate Program

Support Overview

Ending North Carolina's full-color specialty license plate program in 2015, as mandated by H289 passed in the last hours of the 2011 legislative session, will eliminate an important source of funding for one of North Carolina's most-beloved tourist destinations without improving safety.

At its April meeting, the NC General Assembly's Joint Legislative Transportation Oversight Committee approved draft legislation for the 2012 General Assembly to repeal the 2015 sunset in H289 and preserve the full color license plate program.

Great Smoky Mountains National Park is an economic engine for North Carolina. Investments in the Park's preservation from the Friends of the Smokies' full-color North Carolina specialty plate program help ensure that visitors will return time and again. The Friends of the Smokies full-color North Carolina license plate has generated since 1999 more than \$2.6 million to support conservation projects in Great Smoky Mountains National Park.

Signature Projects Supported by Friends of the Smokies' Full-Color Specialty Plate Revenue

- **Museum-quality exhibits** at the **new Oconaluftee Visitors Center**, since the new Visitor Center opened in 2011, visitation has increased 80%
- **Parks as Classrooms**: each year more than **10,000 North Carolina schoolchildren** participate in unforgettable educational experiences
- The **Appalachian Highlands Science Learning Center** at Purchase Knob in the Park, a residential learning laboratory for visiting scientists from around the country and across the globe
- Saving some of the **last stands of old-growth eastern hemlocks in the southern U.S.** from the destructive hemlock woolly adelgid through the most aggressive treatment program in the country
- Returning the **elk** after a more than 200 year hiatus, resulting in a doubling of Park visitation to Cataloochee Valley
- Protecting **Smokies black bears** year after year

For more information about the entire full-color plate program, addressing public safety and state revenue details, see the accompanying "Requested Comments for the Inclusion in the Study" document.

Friends of the Smokies is asking all decision-makers in North Carolina to consider all the negative impacts of ending the full color specialty license plate program and then **act to remove the legislative mandate in H289.**

*For more information contact Holly Demuth, North Carolina Director of Friends of the Smokies, at hollyd@friendsofthesmokies.org or (828) 452-0720.
Thank you for your careful attention to this important matter.*



NORTH CAROLINA SHERIFFS' ASSOCIATION
LAW ENFORCEMENT OFFICERS AND STATE OFFICIALS
OF NORTH CAROLINA



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February 8, 2012

The Honorable Robert Rucho
North Carolina Senate
300 N. Salisbury Street, Room 300-A
Raleigh, North Carolina 27603-5925

Dear Senator Rucho:

We have received your request for input from sheriffs as to whether a threat exists to their deputies concerning the 39 "full color" specialty license plates offered by the Division of Motor Vehicles (DMV). While being able to identify license plates correctly is very important for law enforcement officers, we also understand the wishes of special-interest groups wishing to express themselves.

It is our understanding that sometimes it is difficult to identify the 39 specialty license plates as North Carolina license plates. Due to the different colors and the flat lettering - which is less reflective than raised letters - it could be extremely difficult for a deputy to read a specialty plate. This is particularly true in the event of a heated situation or when a deputy is pursuing a suspect.

We recommend a design template that is readily identifiable by law enforcement officers, reflective lettering and raised block lettering for all specialty plates offered by the DMV. We feel that this recommendation will make it easier for the deputies and other law enforcement officers of this state to identify a North Carolina specialty license plate while maintaining a citizen's right to express themselves on their vehicle.



Post Office Box 20049 • Raleigh, N.C. 27619-0049 • Telephone: (919) SHERIFF (743-7433)

Fax: (919) 783-5272 • E-mail: ncsa@ncsheriffs.net • www.ncsheriffs.org

The North Carolina Sheriffs' Association is a Non-Profit, tax exempt organization recognized by the I.R.S.

The Honorable Robert Rucho
February 8, 2012
Page 2 of 2

Thank you for requesting the sheriffs' input regarding this issue. If you need any additional information, please call me at 919-459-1052.

Sincerely,

Edmond W. Caldwell, Jr.
Executive Vice President and General Counsel
North Carolina Sheriffs' Association

EWC: jt

cc: Senator Phil Berger, President Pro Tempore
North Carolina Senate

Representative Mitch Gillespie
North Carolina House of Representatives

Secretary Reuben F. Young
North Carolina Department of Public Safety

Mike Robertson, Commissioner
Division of Motor Vehicles