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EXECUTIVE SUMMARY



There is a large number of parking citations caused by the confusing parking information shown on parking signs in the City of Los Angeles. Drivers find it hard to decipher the messages in short time and have a higher chance to conduct parking violation. Apart from the financial loss on paying tickets, more trips are generated to avoid the violation, which increase the vehicle emission and traffic congestion. To investigate the reasons and possible improvements of parking sign design in City of LA, the study team conducted a survey to collect information on drivers' expectation on the design and concluded people's preferences on some key design elements. The team has found that people prefer texts than symbols, numbers than texts, larger fonts for key information, standard sign than the calendar-format design, and can accept at most 2 boards.

After analyzing the feedback from the survey, the study team has generated a set of design principles for the city. The team also did research on other methods of delivering parking information, including parking apps and other technologies. Comparison of three representative parking apps Park Me, Best Parking and Parkopedia have clearly showed the top difficulty of building sufficient and comprehensive databases for app users. However, they also provided the efficiency of information delivery which does not require drivers to show up at the destination physically. The team also studies on the other technological and managerial improvements the city is planning, and concludes the report with future development trends of delivering parking information.



INTRODUCTION

The Los Angeles Department of Transportation (LADOT) issued nearly 2.5 million tickets in fiscal year 2015 spreading out over 6,500 miles of streets. The large volume of tickets brought \$148 million in gross parking ticket revenues that year, and over a quarter of the citations come from parking at the wrong time, especially in street sweeping areas. Other common violations include meter violation and preferential permit, of which a significant proportion are caused by confusing parking signs (LA City Controller, 2015).

There is a large number of complaints on the hard-to-decipher parking signs (Barragan, 2016), which are designed to expect drivers to understand the complicated parking information in very few seconds. Confusions include multiple parking messages beyond drivers' immediate determination, unclear expression of parking regulation, and unreasonable layout of parking messages failing to highlight key information (for example, the messages of allowed parking time or permit acquisition requirement are shown in hidden corners with small fonts). As a result, the violation impacts caused by the confusing parking signs are more than communities' financial loss on paying tickets. The confusion would also lead to an increasing amount of vehicle emission to the environment, as well as the congestion and delay on the road system from the extra VMT for finding parking. It is also estimated to decrease people's trust in public transportation regulations.

Based on the observed confusions of the parking information delivering, the study team conduct the research to understand the public expectation on parking signs, therefore, to explore how the cities can enhance the information delivering. Over 200 people responded to the quick "which do you prefer" questionnaire about parking sign design. Apart from discussing on the public expectation, we also compare the best practices to deliver parking information across the world, including parking sign design and digital delivery innovation such as parking apps. Other leading technologies innovations dedicated to improving the communication system between parking devices and drivers will support the forecast of future developments in the industry of delivering parking information.

Reference:

Barragan, B. (2016, March 24). LA Finally Making a Database of All Its Parking Rules. LA Curbed. Retrieved November 29, 2017, from <https://la.curbed.com/2016/3/24/11299824/los-angeles-parking-sign-database>

LA City Controller. (2017, January 09). Top Violations and Violators. Retrieved November 29, 2017, from <http://parking.controlpanel.la/top-violations-and-violators/>



BACKGROUND

Few technological innovations have done more to spur economic growth, grow infrastructure, and improve the American way of life than the invention of the automobile, which also sparked the rise of many secondary industries. One such secondary industry which evolved alongside the traffic and road systems in the 20th century was parking sign manufacturing. Parking signs started as simple products and most remain simple today. But over time, the message on parking signs have become increasingly specific and sometime lead to confusion. As our lives become more complex and fraught with more new laws and regulations, our parking signs also become more complex, in accordance with these same laws and regulations.

The mass-production of automobiles in the United States began at the turn of the 20th century, and so did sign production. Early parking signs were often sponsored by Automobile Clubs. Federal Highway Administration (FHWA) records indicate that in 1905, the Buffalo Automobile Club installed one of the first known widespread signpost networks in the state of New York. The Automobile Club of California followed suit just a few years later, posting signs on the main highways within a 250-mile radius of San Francisco (FHWA, 2017).

The American Association of State Highway Officials (AASHO) did not begin to discuss the national implementation of Parking Signs until the 1927 manual was initiated, in which Parking Sign designs started

to be regulated and made uniform across the U.S.A. Street signs were discussed in a manual from the National Conference on Street and Highway Safety (FHWA, 2017).

The first half of the 20th century was an era of simplicity for parking sign producers. Few businesses needed to customize parking signs for their specific needs, and for many regions, there were not enough cars on the road to justify even making parking signs. As highway systems expanded and car-ownership became more common, businesses and professional offices began to require parking signs for their private lots. As car ownership rates rose and the automobile became increasingly affordable and accessible for the American consumer, parking signs and parking sign messages became more diverse (Hawkins, 1992).

The rise of the American civil rights movement in middle of the century coincided with the introduction of new parking sign materials and artwork: newer, durable materials like aluminum were used to create longer-lasting signs, while designs were streamlined to send clear messages, consistent across different states (My Parking Sign, 2017).

There are plenty of old parking signs from eras past that have remained in production to this day, but new regulations, fresh industries, and innovative technologies have also created a hyper-specialized market for unique, niche parking signs.

As population density in urban areas rises and more and more car ownership floods the city streets, the demand for specific, detailed parking signs continues to evolve. Nowadays, parking signs include text specifying the permitted duration of parking, permit information, tow-away regulations, and other specific information. Valet parking signs and permit parking signs restrict parking during certain hours and warn would-be violators that they will be towed at their own expense (Urban Remains, 2000).

Parking signs have become, literally, symbolic representations of a new, complicated world overrun with rules and regulations. So how do we keep signs user-friendly, easy to understand and obey amidst all this complexity? Standardized color schemes nicely codify the different types of parking signs— red for prohibition, green for permission, and blue for informational. Clear fonts increase the legibility of signs, and symbols like the car-tow graphic on the sign below ensure that even drivers who can't read will understand the ramifications of parking illegally. For communities with large non-English speaking populations, there are even bilingual parking signs, like this No Parking Sign featuring the same message written in Spanish and English. This is evidence of how social forces like immigration can greatly influence the growth of the parking sign industry.

Reference:

Federal Highway Administration (FHWA). (2017). The Evolution of MUTCD. Retrieved November 22, 2017, from <https://mutcd.fhwa.dot.gov/kno-history.htm>

Hawkins, H. G. (1992). Evolution of the MUTCD: The MUTCD Since World War II.

My Parking Sign. (2017). The Progression of Parking Signs: A History of Parking Signs in America. Retrieved November 28, 2017, from <https://www.myparkingsign.com/history-of-parking-signs-in-america>

Urban Remains. (2000). Original c. 1930's double-sided freestanding no parking by police order street sign. Retrieved November 22, 2017, from <https://www.urbanremainschicago.com/original-c-1930-s-double-sided-freestanding-no-parking-by-police-order-street-sign.html>



Figure 1: Parking Signs in the 1930s
Source: My Parking Sign, 2017.



CURRENT POLICY



The Manual on Uniform Traffic Control Devices for Streets and Highways, or MUTCD defines the standards used by road managers nationwide to install and maintain traffic control devices on all public streets, highways, bikeways, and private roads open to public travel. The MUTCD ensures uniformity of traffic control devices across the nation by setting minimum standards and providing guidance. It is updated periodically to accommodate the nation's changing transportation needs.

The current edition of MUTCD (2015) provides general guidance and standard about parking signs, design of parking signs, and the placement of parking signs. For example, one of the standard for the design of parking signs is "The legend on parking signs shall state applicable regulations. Parking signs shall comply with the standards of shape, color, and location." (MUTCD 2009 Section 2B.47) One guidance of the placement of parking sign is "When signs with arrows are used to indicate the extent of the restricted zones, the signs should be set at an angle of not less than 30 degrees or more than 45 degrees with the line of traffic flow in order to be visible to approaching traffic." (MUTCD 2009 Section 2B.48)

In the city of Los Angeles, Los Angeles Department of Transportation (LADOT) enforces regulatory parking signs indicating prohibitions or restrictions on parking. There are five types of parking signs. Five types of parking signs are shown in figure 2.

According to LADOT, any parking sign without time or day restrictions specified is in effect 24 hours a day, 7 days a week. In addition, parking meters and time limits parking sign are usually coming together. They are used to encourage turnover, allowing more people access to high-demand parking spaces. Although the parking meters is not the part of parking sign, it still can reflect the time limits which labeled on the parking sign. Once users paid for parking space, the light on the parking meter will turn from red to green to show users the effective rights and time to use the parking space.

Reference:

Manual on Uniform Traffic Control Devices for Streets and Highways (2015 edition)

Parking Signs. (n.d.). Retrieved November 22, 2017, from <http://ladot.lacity.org/node/476>

Parking Sign Type	Regulation
Time Limit Parking	Installed in areas where there is a need for parking turnover to ensure customer access to retail and commercial buildings. Time limit areas also may have parking meters.
No Parking	Prohibit parking of unattended vehicles during the posted days and times. However, active loading or unloading is allowed.
Street Cleaning	It comes with a no parking sign that only applies to certain times and days.
No Stopping	Prohibits any stopping, including commercial and passenger loading. May only apply to certain times and/or days.
Permit Parking	Districts Created by City Council to limit or restrict parking in designated areas unless a vehicle displays the proper permit.
Disabled Parking	Signs Reserved for constituents displaying a valid disabled parking placard or license plate issued by the California Department of Motor Vehicles

Figure 2: LADOT Parking Regulations



PROBLEM STATEMENT

With the growth of traffic, more and more parking signs were installed on the street to regulate parking time, location, and other restrictions. Although those parking signs try to deliver information to users in a more direct way, too much information still cost people more time to understand what they would like to convey. In the Downtown, West Hollywood, and Koreatown, lots of parking signs with three or more than three plates were found for the on-street parking. Parking signs with too much information require people to spend more time to read and response, which also slow down the traffic on that lane. Therefore, the effectiveness of conveying parking sign information could also lead to traffic problem.

The purpose of this study is to evaluate whether the city delivers parking information effectively, and develop some recommendations such as better parking sign design principles or phone application to solve problems which found during the





METHODOLOGY

Assumption

On-street parking signs aim to inform the drivers about the parking restrictions on the street. Although the signs are designed in a straightforward manner, it could create conflict thoughts in which the driver can or cannot park. A gap between what the sign is shown and what the driver is understanding. This case represents when a driver receives a parking citation, or in Another, the car gets towed due to a parking violation. This issue is always related to two major parts which are the city and the driver. There are two situations when it comes to the driver. The driver might not be aware of the parking restrictions, or the driver cannot perceive the parking restrictions. The first case is related to the driver's behavior, so it's driver liability. The second case is associated with the sign which is endorsed by the city. The city is usually responsible for regulating on-street parking and designs the signs to clarify these restrictions. Although the city uses a standard configuration to design these sign, it seems inefficient sometimes. To resolve the misconception, and a field survey is required. Assuming that the city follows specific standards in designing, and the drivers have the same level of knowledge and background. A survey could be applied to understand the ambiguous situation in a parking area. The situation could be understood just by identifying the factors that create the confusion.

Data Collection Approach

This study seeks to collect public feedback on parking sign design. To identify the common expectation on the clear and easy-to-decipher sign design, the study team designed a survey, which controls the parameters to test one variable at a time. This approach tests the driver's grasp to two or three signs that have the same information. This means it can determine the parameters that make the sign simple and clear to comprehend. Also, it helps to mark the spot where a sign fails to convey its message. The study team designed the questionnaire on BuzzFeed website, and carried a tablet to show people and asked them to simply click on which one they preferred.

The survey was designed to compare signs that show the same information. The signs have same instruction, but it interprets in several ways. People were asked five questions where they had to choose only one sign that they think it easier to comprehend. People were not informed about the differences between the options to eliminate unrelated measurement. In other words, people had to

1. Words Versus Symbols

In this comparison, both signs show the same message, but they are delivered in two different ways. First sign uses symbols and the second sign uses only written words as shown in figures 3.



Figure 3: Words Versus Symbols

2. Words Versus Numbers

In this comparison, both signs show the same message. The first sign tends to use numbers, when it's possible, instead of written words. The second sign uses only written words. Figures 4 illustrates the comparison.



Figure 4: Words Versus Numbers

3. Font Size Versus Sign Size

In this comparison, both signs show the same message. In the first sign, the most significant information, which is the (8 AM - 11 AM). The restriction period has the most significant size compared to other messages. The second sign is an existing sign with a different font ratio. It presents restriction period and other words barely in the same font size. Figures 5 demonstrates the comparison.



Figure 5: Font Size Versus Sign Size

4. Standard Sign Versus DIY Schedule

In this comparison, both signs show multi-messages. The first way is the typical way that most of the cities are using. Each sign has a separate message, and they are placed in a vertical alignment which figures 7 shows. The second sign is a new initiative to show more than one message by using DIY parking schedule, which figures 6 illustrates.



Figure 6: Standard Sign Versus DIY Schedule

5. Number of Signs

This comparison is slightly different than the first four questions. There are three options where the first sign shows two limited periods, the second choice conveys three limited times in two signs, and the third option has three signs with five restricted periods in total (figure 7). This comparison aims to measure when people find it hard to grasp the instructions. Moreover, the survey was conducted September 23 through October 15. On-street parking sign survey provides insights into respondents' opinions.

People were asking in person to participate and answer the five questions in the city of Los Angeles. Also, an online questionnaire was established where people could do the survey using a cellphone or a computer. The online poll helped to reach more people and add diversity to the study.



Figure 7: Number of Signs

Data Analysis

1. Words Versus Symbols

In this comparison, “no parking” and “tow away zone” signs were selected as the sample question. They are the common signs for the street parking to remind people that this place is restricted to park the car. In order to check people’s preference between words and symbols, all the messages on the both of two signs are the same excepting deliver methods. One of them used written word, the other one used symbols. According to the survey, 56% of participants chose the sign with written words as their preference, while 44% of participants chose the sign with symbols. Based on the results from survey, it looks like that more people would like to accept written words rather than symbols. This might because that city usually installs parking sign with written words for street parking. No matter for what kind of parking signs, people has already get used to the written words. The other reason could be that the written words can deliver messages more clearly and directly. Symbols may require people to guess their meaning if those symbols are unfamiliar to people.

2. Words Versus Numbers

In this comparison, the “two-hour parking sign” was selected as the sample question. This kind of sign is used to limit the parking time for street parking. Time can be presented in numbers or words. Therefore, time is the only variable in this question. Same with previous question, other factors such as font size, content, and the amount of information are maintained the same conditions for both of two signs. The only difference is that one sign uses number to show allowable parking time, the other sign uses written words to show the allowable parking time. According to the survey, 82% of participants would like to see the sign with number, while only 18% of participants chose the sign with written words. The reason why we got this result might because people has already gotten used to see time in numbers in daily life. You won’t see a watch which uses written words to show the time. Although some watches use roman numerals to represent time, it’s still numbers rather than written words.

3. Font Size Versus Sign Size

In this comparison, the “no parking” signs with time limit was selected as the sample question. This kind of sign regulates the time periods which prohibit to stop. Generally, It is used to help relieve traffic pressure during peak hours. Most of them regulates that people have to move their car in a specific time period in order to leave a bus lane for the buses and right-turn vehicles. The font in these two signs has different size. Other factors such as font style, content, and the amount of information are maintained the same conditions. According to the survey, 84% of participants chose the sign with larger font size, while only 16% of participants chose the sign with smaller font size. People always would like to see the larger font size since larger font can convey information more clear than small font. Especially for the street parking, large font can be saw from further distance. Then it can give driver more time to make response.

4. Standard Sign Versus DIY Schedule

In this comparison, two different sign design combinations are selected as the sample question. Although they are in different design, both of signs show same content, including “time limit parking sign” and “time limit no parking sign”. The first design is the typical way which is using on the most of streets. It consists of multiple plates which shows one message in each plate. The second design is a new initiative which designed by Los Angeles Department of Transportation (LADOT). The sign uses graphics in green and red to pictorially summarize parking restrictions. It uses one plate to show multiple messages instead of using multiple plates. LADOT tested this new design during a six-month pilot program on Spring and Main Streets between 2nd and 9th Streets in downtown L.A. According to the survey, 69% of participants chose the sign with multiple plates, while 31% of participants chose the sign with new design. Initially, our group believe the new design must be very popular, and it was more understandable to our group members. however, the truth is that people has already get used to what we have now. The new design will take them more time to accommodate and response. That is the reason why more people would like to stay with original design.

5. Number of Signs

The purpose of last question is to check the people’s acceptability of messages. Three signs with different quantity of plates were selected as the sample question. The first sign only contains one plate, which means only one message shows on this sign. The second sign has two plates, which contains two messages in it. The third sign consists of three plates, which require people deal with three messages and do some math in the mind. According to the survey, 39% of participants chose the first sign. 51% of participants chose the second sign. Only 10% of participants chose the third sign. During the survey, we found most of people even didn’t look at the third sign. People was trying to avoid dealing with too many messages in order to make quicker response. As for why the second sign got more support than the first sign, we believe it is a matter of people’s habits. You barely can see the sign with only one plate on the street. Generally, the combination of two plates is the most common sign which were installed on the most of streets. People has already get used to deal with two messages. Therefore, people’s acceptability to parking sign is also consistent with common signs.

