# Ergonomic Evaluation of Vehicle License Plates used in Saudi Arabia

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## Overview

Vehicle license plates are essential for identification and are closely associated with road safety and security. This paper highlights a few studies that involve the evaluation of license plates for vehicles used in Saudi Arabia. There currently exists two types of license plates for cars (normal and long) and one type for motorcycles. The authors examine various readability design aspects of the license plates. Based on the results, an enhanced design for each type of plate is suggested. Results from a pilot survey also support the preference of the proposed design for each type of plate.

## Keywords
License plates, Saudi Arabia, Cars, Motorcycles

## 1. Introduction

There currently exists an estimated 18 million registered vehicles in Saudi Arabia [**1**]. There are three major types of vehicle license plates that are currently used in Saudi Arabia. Both normal series (with dimensions of 32 cm by 16 cm) and long series (52 cm by 11 cm) are used for cars, while the motorcycle series comes in one standard size of 18 cm by 9 cm [**2**]. To our knowledge, no study has yet been performed to evaluate the readability of vehicle license plates. Therefore, in the studies presented here, we focus on several ergonomic design parameters for such an important identification tool, including contents of plate, font type, number arrangement, languages, logos used, etc. These aspects are discussed below for each of the three license plate types, with the overall goal of finding the means to enhance the speed of reading each of these plates.

## 2. Car License Plates – Normal Series

Variations of the current version of the normal Saudi license plate are shown in Figure 1, including sample private car plate (left top), sample import/export plate (right top), sample commercial plate (middle left), sample public car plate (middle right), and a sample diplomatic car (C.D.) plate, with some signs/numbers blurred out for confidentiality purposes (bottom). The normal plate is the most commonly used vehicle plate in Saudi Arabia. Previous research on this specific type of plates was conducted by a group of senior design project students back in 2011 [**2, 3, 4**]. This is actually the sixth version of normal license plates, whereby for each preceding version (starting from the 1950's) the design was modified by adding more numbers and letters in order to accommodate for the increasing demand throughout the years. The current version consists of up to four numbers and three letters, thereby -according to basic forecasting techniques- having a capacity of 49.3 million unique plates, which is expected to suffice until approximately the year 2052 A.D. [**2**].
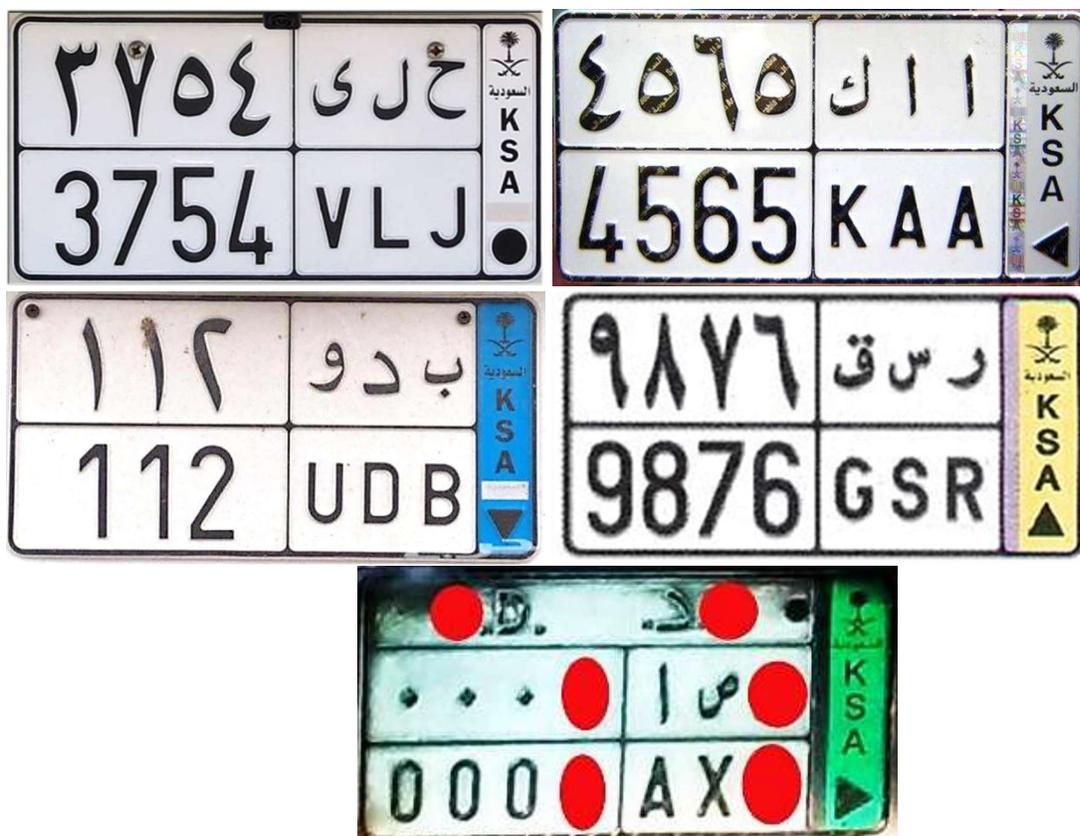
Figure 1 Variations of the current version of the normal Saudi license plate (2007 series).

Characters in the normal plate (as shown in Figure 1) are presented in both Arabic (Traditional Arabic font) and English (Arial font), all having black characters on a white background. Note that the English letters have only been introduced in the current series in order to accommodate for the millions of expatriated, non-Arabic speaking foreigners currently working and living in Saudi Arabia. This group amounts to around 5.5 million people, representing approximately 16% of the total population of around 34 million people [**5**]. The sidebar consists of the KSA logo and letters as well as both a unique geometric shape (circle or pointed triangle) and associated color (white, grey, blue, yellow, or green) to distinguish the type of vehicle, respectively representing private, import/export, commercial, public, or diplomatic cars, the latter of which is also further discriminated by the letters C.D. (short for the French words *corps diplomatique*, meaning diplomatic corps) on the top row of the plate as shown.

Research conducted on this type of plate [**2**, **3**] has focused on investigating the possibility of changing such aspects as the English and/or the Arabic font types due to increasing reported complaints regarding difficulties in reading the plate, resulting from the presence of two languages [**4**, **6**]. Additional, equal-sized characters (14 in total) have inevitably added a smaller size readability burden. A suggested replacement font for English characters is the FE-font (derived from the German words *Fälschung*, meaning falsification, and *Erschweren*, meaning to hinder). This font has a clearer, larger stroke width than its Arial counterpart (both of which are Sans Serif fonts) for increased legibility.

The authors of the research also propose making the Arabic characters smaller than the English letters, thereby giving dominance to the widely appreciated English characters used nationwide (by both Saudis and expatriates), while retaining overall contents and design aspects of the existing normal plate. Also, the enhanced plate integrates a suggested additional plate expiration date and a logo to signify drivers who have special needs (such as a handicap or hearing disability). The suggested plate is shown in Figure 2 [**2**, **3**], which incorporates the Saudi logo and "KSA" letters, special needs symbol (if applicable), geometric symbol for plate type, plate expiration date, English letters with Arabic numerals, and corresponding Arabic letters and Indian numerals.

Figure 2 Proposed normal Saudi license plate.

A pilot survey was conducted on 29 male volunteers, with ages ranging between 17 and 38. Participants were given a paper survey and asked to compare various readability aspects of the current versus proposed designs. The results are shown in Table 1 below. The majority of participants favored the proposed design with such features as clarity of the letters and numbers, logo, special needs symbol, and overall plate design. The current design was favored only when it comes to the Arabic letters, apparently due to its smaller size in the proposed design.

Table 1 Participant feedback regarding current vs proposed normal Saudi license plate.

| Question: the following feature applies more to which plate design? | Number of Responses | Current Design | | Proposed Design | |
|---|---|---|---|---|---|
| | | # | % | # | % |
| Design is clear | 22 | 2 | 7% | 20 | 66% |
| Design is unclear | 22 | 21 | 72% | 1 | 3% |
| Letters and numbers are crowded | 8 | 8 | 28% | 0 | 0% |
| Saudi logo is clear | 14 | 1 | 3% | 13 | 45% |
| Special needs logo is clear | 9 | 0 | 0% | 9 | 31% |
| Arabic letters are unclear | 8 | 0 | 0% | 8 | 28% |
| Bad design | 4 | 4 | 14% | 0 | 0% |
| Beautiful design | 9 | 0 | 0% | 9 | 28% |
| Better overall design | 22 | 1 | 3% | 21 | 69% |

## 3.  Car License Plates – Long Series

The current version of the Saudi long license plate (shown in Figure 3) was introduced in 2013 and -as with the normal plate- is also used for cars, yet in smaller numbers. This is the third version of the long plate, differing from the second version mostly in the organization of the contents. Also note how the contents of the long plate are identical to those in the normal plate (Figure 1), with the only differences being in the size of the plate and location of the sidebar (here situated as a center bar). Unlike the many variations of the normal plate, there exists only the private

( ⬤ ) and diplomatic ( ▶ ) long plates.



Figure 3 Sample of the current version of the long Saudi license plate (2013 series).

Research on this specific type of plates was conducted by a group of senior design project students in 2015 [7]. As with the normal plate, research has focused on investigating ways to increase the readability of the long plate. The suggested refined long plate is shown in Figure 4, incorporating Saudi logo and "KSA" letters, geometric symbol for

plate type, English letters with Arabic numerals, corresponding Arabic letters and Indian numerals, as well as a digital identification barcode.
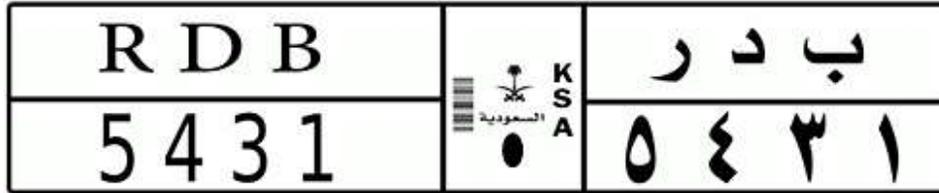


Figure 4 Proposed long Saudi license plate.

The most notable improvement was determined by conducting subjective testing in favor of transposing the orientation of the set of plate characters (letters and numbers) from each language to be on one vertical line, instead of a horizontal line (as shown in Figure 3). Another proposed adjustment is the incorporation of an additional barcode at the center of the plate (as shown in Figure 4), which can be scanned from a long distance with a special digital reader provided to police vehicles to enable tracing back cars to their owners.

A pilot study was conducted on 10 volunteers (8 males and 2 females) between the ages of 21 and 33. As with the paper survey conducted with the normal plate, the participants were asked to compare the readability of various aspects of the current versus proposed designs. The results are shown in Table 2 below. The majority of participants favored the proposed design with such features as clarity of the letters and numbers in both the English and Arabic languages, layout, and overall plate design. Participants were equally divided, however, regarding the preference of the Saudi logo in either plate. Note that participants were also shown three other alternative designs not shown here), and the design with only the best subjective results (Figure 4) has been displayed.

Table 2 Participant feedback regarding current vs proposed long Saudi license plate.

| Question: the following feature applies more to which plate design? | Number of Responses | |
|---|---|---|
| | Current Design | Proposed Design |
| Arabic characters and digits are clear | 1 | 3 |
| English characters and digits are clear | 1 | 3 |
| Saudi logo is clear | 2 | 2 |
| Best layout | 1 | 3 |
| Best overall design | 1 | 2 |
| Total responses | 6 | 13 |

## 4. Motorcycle License Plates

Unlike cars, there is only type of license plate for motorcycles (as shown in Figure 5), and it is the only version of this plate that has ever existed. Note how it contains more subtle contents including only one language (Arabic), the absence of logo or vehicle type, and contains up to only two letters and three numbers (i.e. one letter and one number less than its car counterpart). According to a basic forecasting analysis, this configuration can suffice motorcycles up to the year 2038 A.D. with a total of about 288,000 plates [8].



Figure 5 Sample of the unified motorcycle Saudi license plate.

Research on this specific type of plates was recently conducted by a group of senior design project students in 2018 [**7**]. As with car plates, research has focused on investigating ways to increase the readability of the plate. The suggested refined motorcycle plate is shown in Figure 6, incorporating Saudi logo and "KSA" letters, a fixed location for bolts, English and corresponding Arabic letters, and common Arabic numerals.
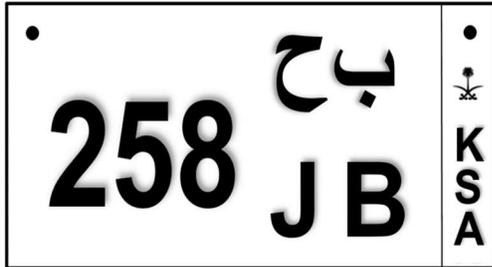


Figure 6 Proposed motorcycle Saudi license plate.

In view of the previously mentioned, well-established importance of incorporating English letters into the plates, students presented three alternatives aimed at reducing the identification time for this particular plate, while keeping character content at a minimum for such a small plate area. An additional objective was to unify the location of the bolts at a specific corner of the plate, as not to interfere with the character content of the plate, which can result in misleading readings (whether done intentionally or unintentionally).

A pilot study was conducted on 227 volunteers (49% male, 51% female), mostly between the ages of 18 and 35. The majority of volunteers were Arabic-only speaking (70%), while 3% were English-only speaking, and the rest (27%) were bilingual. The students conducted the survey electronically. The participants were simply asked to determine which of the motorcycle plate designs they preferred. Note that participants were also shown two other alternative designs (not shown here) and the design with only the best subjective results (see in Figure 6) has been displayed. The responses were scaled down to a score (or scaled preference factor) out of a maximum of 4.0. The results are summarized in Table 3, whereby the proposed design was clearly preferable for both Arabic-only and bilingual speakers (more than double the preference in both cases).

Table 3 Participant feedback regarding current vs proposed motorcycle Saudi license plate.

| Target Participants | Number of Participants | Scaled Preference Factor (/4.0) | |
|---|---|---|---|
| | | Current Design | Proposed Design |
| Arab-Speaking participants | 159 | 1.5 | 3.6 |
| All participants | 227 | 1.6 | 3.6 |

## 5.  Final Remarks and Recommendations

This paper summarizes findings from a few studies that have analyzed and evaluated existing normal and long car plates, as well as motorcycle plates used in Saudi Arabia. Our studies have shown that the readability of each plate was affected by such factors as language content, character orientation issues, and plate fixation problems. The findings of our studies serve as evidence of the inevitable need to improve vehicle plate design as language, technological, and security demands change over the years. Future research entails incorporating advanced objective means of evaluation of such and other design improvements in addition to some of the subjective results presented in this paper, which will be the subject of forthcoming publications.

## References

1. Arab News (Oct 23, 2014), 18m Vehicles Likely on Saudi Roads by Year-End, Available: www.arabnews.com/saudi-arabia/news/648791, June 15, 2019.
2. Al Suhaibani, A. S., Al Suhaibani, H. M., Al Suhaibani, A. A., *Redesign of Saudi Arabian License Plate*, Senior Design Project, King Saud University, Riyadh, June 2011.

3. El-Sherbeeny, A. M., Al Suhaibani, H. M., Al Suhaibani, A. S., Al Suhaibani, A. A., Evaluating the Design of the Current Saudi Arabian License Plate, *Proceedings of the 41st International Conference on Computers & Industrial Engineering*, Los Angeles, California, USA, 23-26 October, 2011, pp. 223-228.

4. Public Security, Traffic Department, Kingdom of Saudi Arabia. *System of Traffic in Saudi Arabia*. Traffic Manual. 2011.

5. Global Media Insight – GMI (June 10, 2019), Saudi Arabia's Population Statistics of 2019, Available: https://www.globalmediainsight.com/blog/saudi-arabia-population-statistics/, June 18, 2019.

6. Suliman, F. M., *Comparison between Old and New Designed Car Number Plate*, Senior Design Project, King Saud University, Riyadh, December 2008.

7. Alzahrani, H., Alotibi, M., Alqahtani, A., *Redesign of Long Saudi Arabian License Plate*, Senior Design Project, King Saud University, Riyadh, June 2015.

8. Al-Dhobaie, S. I., Atamimi, W. A., Almawash, M. F., *Evaluation and Redesign of Saudi Arabian Motorcycle License Plates*, Senior Design Project, King Saud University, Riyadh, December 2018.

## Biography

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