ASSESSMENT OF JEEPNEY IN TERMS OF ERGONOMICS, SAFETY AND ENVIRONMENTAL FACTORS FOR THE DEVELOPMENT OF SPECIFICATIONS AND STANDARDS

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ABSTRACT: This research assessed the jeepney vehicle in terms of ergonomics, safety and environmental factors. It established database of manufacturers and their design specification, determined the condition and design of the vehicle based on the perception and preference of jeepney drivers and passengers, and compared the parts of the jeepney vehicle using Philippine National Standards and international standards. The study revealed that most jeepney manufacturing firms have varied specifications with regard to the capacity, dimensions and weight of the vehicle and similar specification on the parts and equipment of the jeepney vehicle. Most of the jeepeney drivers and passengers want to improve, change and standardize the parts of the jeepney vehicle. In addition, the parts of jeepney vehicles have parallel specifications compared to the 4 out of 5 mandatory PNS and 22 out 32 UNECE Regulations applicable for jeepney vehicle. Finally, the jeepeny vehicle can be standardized in terms of design, safety and environmental concerns.

Key Word: Jeepney, Ergonomics, Safety, Environmental Factors

1. INTRODUCTION

The most popular means of transportation in the Philippines is the jeepney. In fact, jeeps are one of the insignias of Philippine culture. They were originally built from US military jeeps left over from World War II and famous for their colorful decoration and crowded seating. They are commonly used for public transportation.

The popularity of this mode is attributed to the following: (1) local availability – manufacturing technology is locally available and parts such as second-hand engines and imported chassis are readily available; (2) intermediate size or capacity – compatible to most Metro Manila road network and configuration, enabling it to easily move, stop, load and unload passengers as well as penetrate even the smallest interior areas; and (3) accessibility – providing a door-to-door service at practically any time and place (Bayan, 1995:29 and Ebata, et al., 1996).

Other attributes of jeeps are its ability to provide relatively efficient and high levels of service, being able to cultivate stable riding habits due to their extensive network and route choice, high frequency, and seat availability, among others. (Iwata, 1995)

Figure 1-1 shows the percentage of 1996 transportation demand by mode in Metro Manila. Trips made by public utility jeepney comprise 39 % of the daily person trips. It was estimated by MMUTIS that the share of public transport trips was around 70%.

Table 1-1 shows the total number of jeepneys in the National Capital Region and nationwide in 2007. Also, it shows the type of fuel used by jeepneys.
In 2007, the jeepneys were first officially classified as utility vehicle under customized local road vehicle (CLRV). Class CLRV is defined as motor vehicles manufactured, assembled or rebuilt using new or remanufactured parts or a combination of both, driven or used upon highways for the purpose of transporting people and/or goods. This classification (PNS 2060:2007) in the Philippine National Standard was promulgated by Sub-Committee 28 under TC 44 of the Bureau of Product Standards (BPS) of the Department of Trade and Industry (DTI).

The DTI through the BPS is mandated as per Republic Act No. 4109 to undertake standardization activities for consumer safety and for environmental protection as per Republic Act No. 8749 (Clean Air Act) to improve air quality through abatement and mitigation of air pollution from mobile sources.

1.1 Statement of the Research Problem

The jeepney has remained uncomfortable with high level of emissions, and severely lacking in safety features. When a new jeepney vehicle is manufactured/ assembled and registered, it follows the Land Transportation Office (LTO) registration guidelines for rebuilt-locally assembled vehicles as well as it follows prescribed emission standards. It is generally classified and chunked into new utility vehicle.

At present, there are no national standards for assembly of customized local road vehicles (CLRV), particularly the jeepney to comply with environment and safety regulations. Because of the lack of such standard, local manufacturers or assemblers produce vehicles using sub-standard materials and backyard manufacturers proliferate whose products might be unsafe for users.

1.2 Objectives

Table 1-1. Number of Jeepneys and by Fuel Type

<table>
<thead>
<tr>
<th>Source of Data</th>
<th>NCR</th>
<th>Nationwide</th>
</tr>
</thead>
<tbody>
<tr>
<td>LTO (2007)</td>
<td>54,868</td>
<td>201,636</td>
</tr>
<tr>
<td>LTFRB (2007)</td>
<td>48,832</td>
<td>213,707</td>
</tr>
<tr>
<td>By Fuel, LTO (2007)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gasoline</td>
<td>221</td>
<td>22,575</td>
</tr>
<tr>
<td>Diesel</td>
<td>54,647</td>
<td>179,061</td>
</tr>
</tbody>
</table>

Figure 1-1. Transportation Demand by Mode in Metro Manila, 1996

Source: MMUTIS Final Report (JICA, 1999)
This study aims to characterize and evaluate the jeepney vehicle based on ergonomics, safety and environmental factors. Specifically, the study attempts to:

1. Establish database of manufacturers or assemblers and their design specifications in constructing jeepney vehicle;
2. Determine the condition and design of the vehicle based on the perception and preference of jeepney drivers and passengers; and,
3. Assess the parts of the jeepney vehicle using Philippine National Standards (PNS) and selected international standards.

1.3 Significance of the Study

This study will generate baseline information that will help government agencies such as DOTC, LTO, DTI-BPS in their standardization activities on CLRVs. Primarily, this study will provide data on jeepney manufacturers’ specifications, design preference of jeepney drivers and passengers regarding the vehicle and determine if jeepney vehicle could comply with the mandatory and voluntary PNS standards and international standards particularly the UNECE regulations. The result of the study will be utilized for the development of jeepney specifications and standards.

1.4 Scope and Limitations

This study focused on the jeepney, defined under category M2 and M3 (PNS 2060:2007) that are manufactured, assemble or rebuilt by the local manufacturing firms in Metro Manila and adjacent provinces. Also, the study is limited on perception and preference of the jeepney drivers and passengers only. The ergonomics, safety and environmental aspects of the vehicle will be considered in this study. Existing standards such PNS and UNECE will be used for the assessment of vehicle systems/components and separate technical units.

1.5 Conceptual Framework

The assessment of jeepney vehicle is based on ergonomics, safety and environmental factors through the jeepney manufacturing firms survey, driver and passengers survey and comparison of design specifications with PNS and UNECE regulations. After the evaluation and analysis, the outcome will be used for the development of jeepney specifications and standards as indicated in Figure 1-2.

Figure 1-2. Framework of the Study

2. REVIEW OF RELATED LITERATURE
2.1 Introduction

As any world traveler knows, each Asian country offers its own unique brand of public transport. Passengers in Japan, for example, rocket down the tracks aboard sleek 170-mph Bullet Trains. In Vietnam, however, passengers move at a sedate five mph while sitting in cyclo pedicabs. Passengers in Thailand buzz about in three-wheeled tuk-tuks, while in Hong Kong they steam across the harbor on green-and-white Star Ferries. And perhaps, most famously of all, the Filipinos cruise along in style aboard chrome-plated jeepneys that literally dazzle the eye.

Jeepneys embody the history of the Philippines in the 21st century. They also stand as a testament to Filipino mechanical genius. The “jeepneys” is the Filipino version of the “jitney,” the taxi/minibus that travels along a fixed route, found in many countries. Jeepneys are commonly used in the Philippines for public and private transportation. They were originally built by modifying leftover army surplus Willys and Ford military jeeps after WWII.

Over the years, the WWII military Willys MB and Ford GPW jeep were rebuilt and modified, again and again, until they finally wore out all the original parts. Drivers began painting their olive-drab jeeps in a bright rainbow of peacetime colors designed to grab the attention of potential passengers. Drivers added metal roofs to ward off the sun and rain; they extended the rear of their vehicles in order to crowd more people aboard. An entire range of accessories followed chrome-hood ornaments, ear-shattering airhorns, religious icons and flashing multicolored lights. Manileños suddenly realized that an entirely new sort of vehicle had been born in their war-ravaged city.

The original jeepneys were modifications of old military vehicles. However, since the U.S. military has long since run out of surplus jeeps to give away, today’s jeepneys are quite literally manufactured from scratch. Instead, independently owned factories within the Philippines now produce modern jeepneys.

The jeepney had been the predominant mode of public transport in Metropolitan Manila, accounting for 55% of the daily person trips, followed by buses at 15% (Ebata, et al., 1996:1). Based on the Databook on Philippine Transportation prepared by the University of the Philippines, National Center for Transportation Studies, the highest mode share of total person trips per day belongs to jeepneys, estimated at 46% in 1974, 59% in 1980, 56% in 1985 and 50% in 1989. However, the trend is decreasing due to the introduction of the other modes. In 1994, the Jeepney industry accounted for 40% of the total vehicles registered in the National Capital Region (NCR) and there were about 350,000 units plying the major and minor routes in the metropolis (Sevilla, 1994).

2.2 Jeepney Profile

In 1981, R. B. Ocampo described how the Philippine jeepney was locally remodeled to have larger capacities from six to fourteen passengers during those days. The report also showed the route characteristics, gross income, operating cost, and net income per driver. Also, Barwell, et al. (1985) provided a detailed description of the jeepneys, its ordinary routine and the average revenue and operating expense based on the interviews with six jeepney operators.

On the other hand, D.B. Bautista (1995) identified several components that contributed to the increasing number of serious accidents in the City of Manila as well as the locations where such transpired. One of his findings was that jeepneys ranked second in terms of proportions of accident by vehicle while trucks and buses ranked first and third, respectively.
Edata, et al. (1996) studied the jeepney supply system and structure in order to address the problems related to the goals of achieving a sustainable and stable jeepney business in Metro Manila in their paper entitled “Jeepney business in Metro Manila: What are the conditions for its sustainability?”.

2.3 Public Transport Operation

In 1997, A Bus and Jeepney Operators Interview Surveys were undertaken as part of the Metro Manila Urban Transportation Integration Study (MMUTIS). One of its main objectives was to establish an updated transportation database system similar to the one built in JUMSUT which is intended to contribute to transportation planning, research and education in the Philippines. A total of 49 jeepney operations and 18 jeepney cooperatives participated in the survey. Included in the survey are jeepney operators with a minimum fleet size of 5 units.

For public transport modes, the jeepney has a significant share of total demand. This mode comprised 51% of the total demand or 77% of public transport demand alone. However, a distinct 40% of “business” trips were notably made by cars (JUMSUT I).

Jeepney is dominating the trips in Metro Manila accounting for 39% of the trips. The work-trip commuting demand was significant enough to encourage jeepney services to serve the affluent commuter moving from the suburb to the urban or vice versa. Jeepneys are used not only by the very poor but by middle and upper income groups. Jeepneys are privately owned and operated, with the fleet mostly owned by individual operators who lease them to drivers. In addition, the vehicles are assembled locally. The dominance of jeepneys have resulted from generally dispersed travel demand pattern in Metro Manila. According to JICA (1995), Other factors leading to dominance of jeepneys include:

- Abundant low-cost labor that contributes to low operating costs.
- The self-management system of the industry including the support of jeepney association.
- The availability of local technology for vehicle supply.
- Fare levels about equal to those for buses whose service level is generally lower than that provided by jeepney.

Based on study, the total Metro Manila trips length covered by PUJ is 609.5 kilometers and the estimated forecast growth rates from 1997 to 2016 for PUJ will be 2.11 for number of trips and 2.37 vehicles per kilometer.

Regidor and Sigua (1995) conducted study on the Development of Simulation Program for the Evaluation of Jeepney Stop Configurations with Focus on a Single Lane Roadways. The study found that: (1) there is a significant increase in the total delay of vehicles as the traffic volume is increased; (2) there is significant increase in the total delay of vehicles as jeepney stop are spaced at closer intervals; and, (3) there is an increase in the total delay of vehicles as the demand for jeepneys are increased.

The development of cheap passenger transport such as the public utility jeepney (PUJ) and Asian Utility Vehicle (AUV) have done more than anything else to facilitate the expansion of Metro Manila while at the same time affording access to work and to other amenities which one comes to expect in daily life (Chiu, 2006).

2.4 Emission standard
In the Philippines, motorization is strongly pushed by the use of over aged vehicles with particularly low environment. Jeepney manufacturing companies use second-hand Japanese engines, reconditioned or overhauled and fitted to the newly assembled PUJ body. The common perception that a jeepney is old, inefficient and notorious smoke belchers and older vehicles burn more fuel, which carries the risk of increasing air pollution due to exhaust gas (Kirby, Tagell and Ogden 1986a; Kirby, Sayeg and Fehon 1986b). Emission is also a major issue raised by environmental NGO on the removal of jeepneys such as non-compliance on removal of thermostat and emission gas recycling (EGR) in late model engines (Diaz 2002; Susan, 2003).

2.4 Characterization of the Jeepney Vehicle

The Characterization of Jeepney Vehicle in Metro Manila study aimed to define the important aspects of the construction of jeepneys to be able to establish standards in its assembly methods. These aspects include the specifications of the jeepneys used, frame materials and construction methods, and the overall dimension of the jeepneys vehicle. In Metro Manila, jeepney factories were all over the place, making their own standards in the construction of jeepney (Colos, 2005).

Braganza, et al. (2007) conducted study entitled “Comparison of Local Jeepney Specifications and Selected Philippine National Standards for Road Vehicles”. The study aimed to develop basic standards for jeepney vehicles based on safety, materials used in construction and ergonomics. With these standards, jeepney will be able to improve the quality and comfort of jeepney and be more competitive with other means of transportation. Based on the data gathered from the two leading manufacturers, most of the safety regulations practiced by the manufacturers matched up with the Philippine National Standard.

2.5 Customized Local Road Vehicles

CLRV is defined as motor vehicles manufactured, assembled or rebuilt using new or remanufactured parts or a combination of both, driven or used upon highways for the purpose of transporting people and/or goods (PNS 2060:2007). The classifications of these vehicles are:

1. Utility Vehicle (UV) – Jeepney, Owner type Jeepney, Local Utility Vehicle (LUV), Filcab, Jumbo Jeepney
2. Motorcycle engine powered vehicle – Motorcycle with carrier, tricycle, Motorela
3. Mini bus

2.6 Philippine Laws Governing Motor Vehicles Standards and Regulations

The Philippines have existing laws governing motor vehicles standards and regulations. Republic Act No. 4136 (1964) is the Land Transportation and Traffic Code of the Philippines. Commonwealth Act No. 146 (1936) is the Public Service Act. Seatbelt Law is Republic Act No. 8750 (1999). Presidential Decree No. 96 (1973), declared unlawful the use or attachment of sirens, polls, horns whistles or similar gadgets that emit exceptionally loud or startling sound. Republic Act No. 8506 (1998) banned the registration and operation of vehicles with right hand steering wheel in any private or public street, road or highway.

Pursuant to Section 21 of the Republic Act No. 8749 (1998), Philippine Clean Air Act of 1999, and Rule XXXIII, Section I and Section 3, Part VIII of DAO 2000-81, the DENR hereby promulgates the following exhaust emission standards for new, in use, rebuilt and imported second hand motor vehicles.
The Republic Act 4109 is the Standardization Law of the Philippines (CIRCA 1964), stipulated that the BPS as the National Standards Body of the Philippines was mandated to develop, promulgate, implement and coordinate standardization activities in the Philippines.

Executive Order No. 628 (2007), created a Committee on Harmonization of Vehicle Standards and Regulations (CHVSR).

2.7 UNECE Regulations

The 1958 Agreement provides procedures for establishing uniform prescriptions regarding new motor vehicles and motor vehicle equipment and parts for reciprocal acceptance of approvals issued under regulations. There are currently 125 regulations for motor vehicles.

Currently, the reciprocal recognition under the agreement is only for vehicle systems, parts and equipment, not for the entire vehicle. Regulations adapted by the contracting parties pursuant to the agreement govern the approval of motor vehicles and motor vehicle equipment for sale in those countries. The agreement was originally intended to address only safety requirements, but had been amended to encompass environment (air and noise pollution), energy and anti-theft prescription (WP. 29, 2007).

3. JEEPNEY INDUSTRY, DRIVERS AND PASSENGER SURVEY METHOD

3.1 Sampling Design

Popular jeepney manufacturers either large or small-scale companies in Metro Manila and adjacent provinces were selected as key informants in the jeepney industry survey. The Jeepney Industry Survey covered 12 jeepney manufacturing companies located in Rizal, Las Piñas City, Valenzuela City, Antipolo City, Imus Cavite and San Pablo City, Laguna.

For the jeepney drivers and passengers’ survey, the respondents were interviewed in jeepney terminals. The selection of jeepney terminals were based on the length of the jeepney route.

3.2 Research Instrument

There are 3 sets of survey questionnaires used in the study. These are jeepney manufacturing company’s questionnaire, jeepney driver survey questionnaire and passenger survey questionnaire.

The jeepney manufacturing company’s questionnaire is composed of the profile of the company and the technical description of the jeepney vehicle. The jeepney driver survey questionnaire is composed of the driver’s profile, jeepney operation, perception and preference with regards to the existing design of jeepney. The passenger survey questionnaire shown in Annex 3 is composed of the passenger’s profile, trip characteristics, and perception with respect to the comfort, safety and design of the jeepney vehicle.

3.3 Data Gathering Procedure

Surveys from questionnaires and interviews were administered to jeepney manufacturers to determine and establish database of company’s profile and technical input or design specifications in constructing jeepneys. The dimensions of the frame, length, height and width were measured directly from the jeepney sample. Photographs were taken and compiled to determine and show the existing condition of the vehicle.
The drivers and passengers were interviewed about their perception and preferences with the jeepney’s configuration, operational requirements and existing design of the jeepney vehicle.

3.4 Standards and Regulations Checklist

The 5 Philippine National Standards for road vehicles particularly the mandatory standards such as pneumatic tires, rubber inner tubes, safety glass, seat belt and restraint systems and lead acid starter batteries were used as a checklist in the study.

The international standards specifically the 32 UNECE regulations applicable on jeepney vehicle such as regulations on light and light signalling devices, door, seat, braking system, audible warning devices, noise emission, pneumatic tires, fuel system, speedometer equipment, mirrors and safety glazing materials, steering equipment and general construction were also used as checklist to compare and evaluate the parts of jeepney vehicle.

The UNECE regulations were used in the study because the Philippine government is planning to participate to WP 29 and accession to 1958 agreement with the issuance of Executive Order 628 on June 20, 2007 which created the committee on harmonization of vehicle standards and regulations.

4. JEEPNEY INDUSTRY, DRIVERS AND PASSENGER SURVEY RESULTS

4.1 Jeepney Manufacturing Company

In terms of years of operation, 5 companies are 30 years and above, 4 companies are 15 years and above and 3 companies are less than 15 years in existence and service. In terms of production, at present, most companies produce 2 jeepney units per month. There are 18 jeepney sample models from 12 jeepney manufacturing firms having a 20, 22, 24 and 26 passenger capacities excluding driver.

The company practices with regards to mode of payment for sales are usually on cash and instalment basis. The usual number of terms is 1 to 5 years. The retail price ranges from PhP 400, 000.00 to PhP 745, 000.00 for conventional jeepney and PhP 980, 000.00 to PhP 1, 500, 000.00 for jumbo jeepney. Pick up is the most mode of turnover to the customers. The amenities provided are third party liability, registration assistance, and free accessories such as jack, tire wrench, lights, stereo and speaker and spare tire. The share of raw materials of jeepneys ranges from 50 to 80 % brand new and 20 to 50 % surplus.

Most clients of the jeepney companies are OFWs, private individuals, local residents, walk–in clients from Bulacan, Manila, Pangasinan, Visayas and other provinces.

4.2 Jeepney Industries’ Specifications

Based on the survey results, the conventional and jumbo jeepneys comply with the LTO regulations pertaining to the overall length, overall width, overall height and gross vehicle weight. Also, the conventional and jumbo jeepneys conform to maximum mass prescribe in the PNS 1891:2006.

4.2.1 Jeepney’s Body
Most of the jeepney body panels are made up of galvanized iron, stainless steel and aluminum. It is more expensive if the body is made up of more stainless steel and most of the materials used in the construction are sourced and manufactured locally.

Based from the jeepney drivers and passengers’ survey results, most of the height of jeepney drivers and passengers are 1,524 mm – 1,651 mm. This indicates that the height of the service door of conventional jeepneys is much lower than the height of the drivers and passengers while jumbo jeepney door’s height is higher than the height of the drivers and passengers. This means that the height of entrance and exit of conventional jeepney is not sufficient for the drivers and passengers.

The driver perceived that the floor – ceiling height and ground – floor height is adequate for them while passengers experienced of head bump during entrance/exit and during the ride of passengers. This indicates that the height of the service doors and floor – ceiling height is not sufficient for the passengers. In addition, passengers experienced difficulty in getting in and out of the jeepney vehicle. This shows that the height and width of the service door of the conventional jeepney is not adequate for the passengers.

4.2.3 Jeepney’s Seating Configurations

The seating configuration of the conventional jeepney is car seat in the front seat and bench type at the back while the jumbo jeepney is bus type either in front and at the back. The frame of materials is made of steel and padding materials are made of foam and leatherette with complete upholstery.

If a hip breath of 357 mm will be considered as a seat space, only 5 jeepney models including jumbo jeepney passed the seat space requirement and 13 jeepney models failed on the seat space requirement. Based from LTO regulations on seat space, 8 jeepney models passed the seat space regulations including the jumbo jeepney and 10 jeepney models failed on the said regulations.

The heights of the seat from the floor either front or rear of all the jeepney models are lower to the popliteal height or the knee height of average Filipino which is 406 mm. For the back seat- front length and back seat – back seat length, all the jeepney models passed considering the buttock – popliteal length of 477 mm.

On LTO back seat to knee proportion of passenger requirement of 600 mm, all jeepeny samples passed for the back seat- front length and all failed on the back seat – back seat length except jumbo jeepney considering the horizontal distance and legroom of the passengers.

For the door latches and door retention components regulations (UNECE 11), jumbo and conventional jeepney’s specifications are similar with regards to the design, construction and fittings of the door latches and retention components requirements.

On the seat, anchorages and head restraints regulations (UNECE 17), jumbo and conventional jeepney have similar specifications pertaining to the requirements of the construction and position of the seat and head restraints but are not similar with other requirements particularly on the height and width of head restraint.

4.2.4 Jeepney’s Engine
Most of the jeepney companies use surplus or reconditioned/overhauled second-hand Japanese engine. Surplus or reconditioned/overhauled second-hand engine failed on the emission standard set by Clean Air Act.

4.2.5 Jeepney’s Clutch, Steering, Fuel and Electrical System

For the steering equipment (UNECE 79), both jumbo and conventional jeepneys have similar specifications with regards to the requirement pertaining to the steering system, steering control, design and energy supply of steering equipment.

For the prevention of fire risk (UNECE 34), the specifications of jumbo and conventional jeepneys are similar with the requirements of the fuel tanks and its location, filler hole, and tank cap requirements.

On the lead acid starter batteries (PNS 06: 2002), the jumbo and conventional jeepney have similar specifications particularly on the size and dimension of the batteries.

4.2.6 Jeepney’s Braking, Ventillation System and Audible Warning Devices

For braking (UNECE 13), the specifications of jumbo and conventional jeepneys are similar with the requirements on the design, brake linings, service braking system, parking braking system, control and power supply pertaining to the braking system as well as on the replacement brake lining assemblies and drum – brake linings (UNECE 90).

For audible warning device (UNECE 28), the jumbo jeepney has equivalent specifications to the continuous and uniform sound regulations while the specifications of the conventional jeepney are not similar with this regulation. On the regulation for noise emissions (UNECE 51), both jumbo and conventional jeepneys do not have noise reduction system.

4.1.2.7 Jeepney’s Wheels and Tires

For the rubber inner tubes pneumatic tires - specifications (PNS 34: 2006), most of the specifications of jumbo and conventional jeepney are similar to the requirements of the standards particularly on the type, dimension, appearance and serviceability. Also, the jumbo and conventional jeepneys have similar specifications with regards to the requirement of the pneumatic tires - specifications (PNS 25: 1994).

The tires of jumbo and conventional jeepney have equivalent specifications with respect to the sizes and dimensions of the regulation concerning pneumatic tires (UNECE 30).

4.2.8 Jeepney’s Light and Light Signaling Devices

For the regulations concerning retro-reflecting devices (UNECE 3) and head lamp cleaner (UNECE 45), both jumbo and conventional jeepneys do not have retro-reflecting device as well as headlamp cleaner.

On the devices for the illumination of rear registration plates (UNECE 4), the specifications of jumbo and conventional jeepneys are match with respect to the construction and design of light module.

The specifications also match with regards to the regulation concerning the direction indicators (UNECE 6); front and rear lamps, stop lamps and end-outerline marker lamps
(UNECE 7); front fog lamps (UNECE 19); reversing lamps (UNECE 23); rear fog lamps (UNECE 38); parking lamps (UNECE 77); and side marker lamps (UNECE 91).

For the regulation concerning the filament lamps for in use approved lamp units (UNECE 37), jumbo and conventional jeepney’s specifications are similar to the design, bulbs and caps standards.

For the regulation pertaining to the vehicles with regards to the installation of light and light signaling devices (UNECE 48), the specifications of jumbo and conventional jeepney are similar with requirement pertaining to the installation and fitting of lamps, visibility and colors emitted by the lamps.

4.2.9 Jeepney’s Safety, Exterior and Convenience Items

With regards to safety, exterior and convenience items, both conventional and jumbo jeepneys have the following items: driver’ seat belt, passenger grab rail, front and rear step board and mirrors. Also, they have front bumper, front grille/bumper guard, front and rear grab rail and plastic window cover.

On the safety glass for road vehicles- specifications (PNS 130: 2004), the dimensions, shapes and type of glass and windscreen of jumbo and conventional jeepneys differ from the general specifications of safety glass standards.

For the approval of safety glazing materials and their installation (UNECE 43), the jumbo jeepney glazing materials and windscreen have similar specification with the regulation pertaining to the resistance to incidents while conventional jeepney’s specifications are not similar with the regulations. On the devices concerning indirect vision (UNECE 46), the mirrors of jumbo and conventional jeepney are adjustable and have protective housing similar to the regulation but most the specifications are not similar with the general requirements of the regulations.

For the road vehicles – safety belts and restraint systems (PNS 130: 2004), jumbo and conventional jeepneys have parallel configuration with respect to the installation, type of seat belt, rigid parts of seat belt, buckles, adjusting device and strap of seat belts of this regulation. The seat belt provided in the jeepney is on the driver’s seat only.

For the regulation pertaining to the speedometer equipment including its installation (UNECE 39), the jumbo and conventional jeepney’s configurations are similar with the regulation particularly on the location and graduation of the speedometer equipment.

4.2.10 Jeepney’s Chassis

For the chassis of jeepney, chassis material is made up of black iron. Nine jeepney companies out-sourced their chassis while three companies have in-house fabrication based on the survey of jeepney manufacturing firms.

For the regulation with respect to the general construction (UNECE 52), the jumbo and conventional jeepneys have similar specifications with regards to the protection against fire risk, engine compartment, fuel holes, fuel tanks, electrical and wiring, batteries, and material used. For the exit and doors requirements, both jumbo and conventional jeepney’s configurations are parallel with the requirements. However, conventional jeepney does not have similar specifications particularly on the dimension of the service door. With respect to seat, both jumbo and conventional jeeps have similar requirement with the seat cushions and seat spacing regulations. But on the seat dimensions, only jumbo jeepney is similar to the
requirement. For the handrails and handholds, both jumbo and conventional jeepney’s specifications are similar to the requirements of the regulation.

4.3 Jeepney Driver’s Perception and Preference on the Jeepney Vehicle

With regards to the comfort, more than 50% drivers’ responded that they are comfortable with the seat, access, gauges and ride quality of the existing jeepney vehicle. About 74% of the driver responded that roof of jeepney is not too low for them. In addition, more than 72% do not prefer a low-floor jeepney.

In relation to the alighting practices, when the passenger is getting off, 74.55% of the driver preferred passengers shout and 25.45% preferred of the use buzzer to stop the vehicle. Almost 93% of the drivers are comfortable with the existing fare collection method. And when it rains, 55.91% responded that they stop and roll down the window cover.

For the parts of jeepney to be improved or changed, significant percentages of responses of the jeepney driver are the width and length of the vehicle. These can be done through the manufacturers or assemblers of jeepney. With regards to the issue of standardization of jeepeny, 75% of the drivers are in favored that the jeepney vehicle should be standardized.

4.4 Jeepney Passenger’s Perception and Preference on the Jeepney Vehicle

Most of the passenger (55%) perceived that the seating space design by the manufacturer is not enough for the passengers. With regards to the standing provisions, 84% of the passengers do not want that jeepney has provisions for standing and 56% of the passengers want that jeepenys should have uniform sound of horn.

Based on the interview, most of the passengers are annoyed with the wind, with the noise/sound inside the jeepene and with the smoke comes from the jeepney vehicle. Most of the passengers preferred shout to stop the jeepney vehicle when they are alighting. Sixty five percent (65%) of the passengers observed that the jeepney drivers do not stop and do not roll down the window cover when it rain and only 35% responded that the driver are doing it.

Most of the passengers perceived that driver behavior is the rank 1 in the most serious problem in jeepney. Second is the air pollution, third is vehicle construction and fourth is noise pollution.

For willingness to pay for the adoption of clean technology, 63% of the passengers are not willing to pay any single amount and 35% of the passengers are willing to pay for 50 centavos and 1. 36% are willing to pay for 1 peso.

For the parts of jeepney vehicle to be improved or changed, most of the responses are seat, engine and all parts of the vehicle need to be improved or changed and for standardization of jeepney concern, 58% of the passengers want that the jeepney should be standardized.

7. CONCLUSION

The study provided essential information for the development of jeepney specifications and standards based from jeepney manufacturing survey, jeepney drivers and passengers’ survey and assessment of jeepney parts using PNS and UNECE regulations.

7.1 On Jeepney Manufacturing Firms
At present, most of the jeepney manufacturing firms have an average production of 2 units per month. Jeepney companies have varied specifications with regards to the capacity, dimensions, weight, body area, and seat and fuel system of jeepney vehicle. On the engine, transmission, clutch and steering system, electrical system, braking system, ventilation system and audible warning devices, most of the firms have similar specifications. Also, most of the companies have the same specification with respect to the wheels and tires, light and light signaling devices, safety, exterior and convenience items and chassis. One of the notable results of the study is that most companies use surplus or reconditioned second-hand engine for their jeepney and most of the parts and accessories are sourced and manufactured locally.

Based on the height of jeepney drivers and passengers, the height of service door and exit of jeepney is not adequate for entrance and exit. And based from the anthropometric dimensions of jeepney passengers, only 5 out of 18 jeepney models passed on the seat space requirement.

7.2 On the Perception of Jeepney’s Drivers and Passengers

The study found out that most jeepney drivers are comfortable with the with regards to seat, access, gauges, ride quality and alighting practices but they want improved/changed some parts of the jeepney particularly the width and length. Moreover, majority of the drivers are agreed with the standardization of jeepney.

From the passengers perspective, jeepney is uncomfortable, not enough seating space and difficult to get in and out the vehicle. Most of the passengers are annoyed with the noise and smoke of the jeepney. They perceived that the most problems of jeepney vehicle are driver behavior, air pollution, vehicle construction and noise pollution respectively. In addition, majority of the passengers are not willing to pay for the adoption of clean technology yet they want improved/changed and standardized the jeepney vehicle.

7.3 On the Assessment of Jeepney Parts using PNS and UNECE Regulations.

The jeepneys comply with the LTO regulations pertaining to the dimensions and gross vehicle weight. Also, the conventional and jumbo jeepney conform to maximum mass prescribe in the PNS 1891:2006.

On the LTO seat space requirement, 8 out 18 jeepney models passed on this regulation. And on backseat to knee proportion requirements, all jeepney models passed on the back seat – front length at the front seat but all jeepney models failed on the backseat-backseat length.

The parts of jeepney vehicles have similar specifications compared to the 4 mandatory PNS particularly on the pneumatic tires(PNS 25: 1994) and rubber inner tubes (PNS 34: 2006), batteries (PNS 06: 2002), and safety belt and restraint system (PNS 130: 2004). The safety belt of jeepeny is provided on the driver’s seat only. On the safety glass specifications (PNS 130: 2004), the jeepney did not have similar specifications on this standards.

For the UNECE regulations, some of the specifications of jeepney vehicle have similar specifications on the 22 UNECE regulations out of 32 regulations applicable for jeepney. These are regulations on the light and light signaling devices, door, seat, braking system, audible warning device, pneumatic tires, fuel system, speedometer equipment, mirrors, safety glazing materials, steering equipment and general construction.
Finally, based on the jeepney manufacturing firms’ specifications, perception and preference of jeepney drivers and passengers and comparison of specifications with PNS and UNECE regulations, the jeepney vehicle can be standardized in terms of design, safety and environmental concerns.

8. RECOMMENDATION

In view of the research results, the following recommendations are suggested by the researcher:

1. Based on the jeepney industry and jeepney drivers and passengers’ survey results, the recommended dimensions for jeepney are shown in Table 7-1.

<table>
<thead>
<tr>
<th>Dimensions and Weight</th>
<th>26-Seater</th>
<th>24-Seater</th>
<th>22-Seater</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Length (mm)</td>
<td>7,100</td>
<td>6,900</td>
<td>6,750</td>
</tr>
<tr>
<td>Overall Height (mm)</td>
<td>2,100</td>
<td>2,100</td>
<td>2,100</td>
</tr>
<tr>
<td>Overall Width (mm)</td>
<td>1,850</td>
<td>1,850</td>
<td>1,850</td>
</tr>
<tr>
<td>Gross Vehicle Weight (kg)</td>
<td>3,600</td>
<td>3,400</td>
<td>3,200</td>
</tr>
<tr>
<td>Floor - Ceiling Height (mm)</td>
<td>1,550</td>
<td>1,550</td>
<td>1,550</td>
</tr>
<tr>
<td>Ground – Floor Height (mm)</td>
<td>850</td>
<td>850</td>
<td>850</td>
</tr>
<tr>
<td>Front Door (mm)</td>
<td>W (mm) 850</td>
<td>850</td>
<td>850</td>
</tr>
<tr>
<td></td>
<td>H (mm) 1,000</td>
<td>1,000</td>
<td>1,000</td>
</tr>
<tr>
<td>Back Door (mm)</td>
<td>W (mm) 850</td>
<td>850</td>
<td>850</td>
</tr>
<tr>
<td></td>
<td>H (mm) 1,350</td>
<td>1,350</td>
<td>1,350</td>
</tr>
<tr>
<td>Seat</td>
<td>Front</td>
<td>W (mm) 400</td>
<td>400</td>
</tr>
<tr>
<td></td>
<td></td>
<td>L (mm) 720</td>
<td>720</td>
</tr>
<tr>
<td></td>
<td>Rear</td>
<td>W (mm) 400</td>
<td>400</td>
</tr>
<tr>
<td></td>
<td></td>
<td>L (mm) 4,320</td>
<td>3,960</td>
</tr>
<tr>
<td>Seat Height from the Floor</td>
<td>Front (mm)</td>
<td>410</td>
<td>410</td>
</tr>
<tr>
<td></td>
<td>Rear (mm)</td>
<td>410</td>
<td>410</td>
</tr>
<tr>
<td>Back Seat- Front Length (mm)</td>
<td>650</td>
<td>650</td>
<td>650</td>
</tr>
<tr>
<td>Back Seat – Back Seat Length (mm)</td>
<td>1,650</td>
<td>1,650</td>
<td>1,650</td>
</tr>
</tbody>
</table>

2. Further awareness of the Philippine National standards and international standards such as UNECE regulations for jeepney manufacturing companies and its stakeholders is greatly recommended to improve and ensure road worthiness and environmentally-friendly jeepney vehicle.

3. It is recommended to explore more research on jeepney vehicle particularly on the type jeepney vehicle used in provincial areas.

4. It is also suggested to undertake survey interview on the general passengers or other mode of transports passengers like bus or MRT passengers to determine their perception and reference about the jeepney vehicle.

5. Actual test/laboratory tests of parts and equipments of the jeepney vehicle are suggested to determine if they meet the minimum requirements prescribed by the local standards or international standards.
6. And finally, study on the impact of the jeepney standardization is recommended. This is to determine whether jeepney companies can sustain and improve their operation or will die naturally with the enforcement of the prescribed standards.

9. REFERENCES


