

Development of a Strategic Road Safety Plan in the Company Aquaterra S.A.S

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ABSTRACT

In Colombia, all companies, organizations, and entities must comply with the minimum regulatory standards according to current legislation to ensure internal security of the institution and fulfill their mission objectives. This research addresses the structuring and implementation of a Strategic Road Safety Plan (PESV) in the company Aquaterra S.A.S. The goal is to establish preventive measures and best practices among all its employees, promoting the five fundamental pillars of road safety and ensuring the commitment of top management to the staff.

To achieve this, an organizational diagnosis was conducted to assess the actions taken in relation to the development of the Strategic Road Safety Plan (PESV). Strategic measures were implemented following the guidelines provided in the step-by-step guide issued by the Bogotá city government, within the framework of the Business Mobility Network program. As a result of this process, ten (10) essential documents were generated, including policies, procedures, formats, and manuals, all designed for the effective implementation of the PESV. Finally, a work plan was formulated, including seven (7) indicators to continuously monitor the implementation and operation of the plan. The ultimate goal of this initiative is to ensure the accuracy and regulatory compliance of the organization, benefiting both suppliers and customers. This translates into an improvement in the prevention of road incidents, both internally within its vehicle fleet and nationally at each of its locations.

Keywords: Strategic Road Safety Plan, road incidents, pillars, best practices, indicators.

Date of Submission: 08-12-2023

Date of Acceptance: 22-12-2023

I. INTRODUCTION

Road safety focuses on implementing preventive measures to reduce the mortality rate in traffic accidents, considering various factors in the environment. The goal is to promote safe practices on the road and preserve lives. Globally, traffic accidents are a concerning eighth leading cause of death, making them a worldwide public health issue [1].

These issues lead to various negative consequences, with injuries from traffic accidents being one of the main concerns. A study conducted by the World Health Organization (WHO) in 2004 revealed that, during that year, 1.27 million people lost their lives due to road accidents. Surprisingly, the majority of these victims come from low or middle-income countries, even though these countries only account for 48% of the vehicles worldwide. This means that more than 90% of the people affected by traffic accidents belong to these middle and low-income countries [1].

Furthermore, it is important to note that these diverse population groups experience different levels of risk, often related to the region they are in, the income levels of their respective countries, and the type of transportation they use. For example, in Africa, 38% of traffic accident deaths are reported to result from pedestrian accidents. In contrast, in Pacific countries, the situation is different, with 36% of fatalities attributed to traffic accidents involving two or three-wheeled motorized vehicles affecting their occupants. These traffic incidents are often categorized as traffic-related injuries (TRIs) and account for at least a third of all traffic-related injuries worldwide. Such accidents often result in severe injuries and, in tragic cases, loss of human lives [1]. In Latin America, on the other hand, the affected individuals are typically men in the age range of 20 to 45 years, in their productive life stage, and are the primary providers for their families. Their absence has a significant economic impact on their households and communities [2].

The Ministry of Transport, through article 94 of the National Traffic Code (Law 769 of 2002) [3], establishes the obligation for motorcycle drivers and their passengers to use reflective identification vests or jackets. These must be visible during the period between 18:00 and 6:00 the next day, as well as in situations of

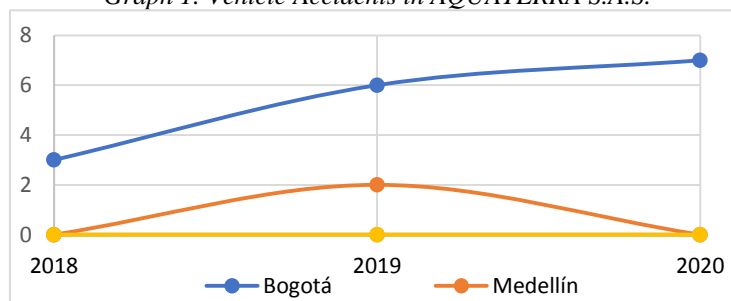
poor visibility. However, it is important to note that a detailed regulation specifying the precise characteristics that these vests designed for motorcycles must meet has not yet been defined [4].

In another context, it is relevant to consider that speed control devices have been subject to regulation by the Ministry of Transport in collaboration with various stakeholders, such as transport associations, equipment manufacturers, and traffic and transportation authorities. This led to the creation of Resolution 1122 of 2005. The main objective of this resolution is to ensure that vehicle passengers, especially those providing collective or school public transportation services, have a device that informs them about the speed at which the vehicle is moving. This allows passengers to exercise control over the driver and, at the same time, contributes to imposing sanctions on organizations operating transportation that lacks these devices or does not keep them in good working condition [5].

AQUATERRA S.A.S. was founded in 2001 with the aim of meeting the raw material needs, specifically in the chemical and construction sectors, [6] in such a way that a quality product is ensured and, likewise, it manages to position itself in a leading market, given that there are four nationwide product distribution centers, the need to establish the implementation of regulations within the strategic road safety plan has been identified. This is done not only as a social commitment to its employees but also to its customers, due to the absence of standardization in the current regulations [4].

Therefore, it can be noted that the Strategic Road Safety Plan (PESV) is fundamental in the organization because the increase in personnel over time is evident, which means that risks will be higher, especially for drivers who should undergo an induction and training process. It is worth noting that before starting work, the worker must have all affiliations to the comprehensive social security system in place. Consequently, the increase in occupational accidents over the years in the company, from 2018 to 2020, in cities such as Bogotá and Medellín, is evident in (Graph 1).

Graph 1. Vehicle Accidents in AQUATERRA S.A.S.



Source: The authors, 2021

II. OBJECTIVE:

Develop a strategic road safety plan at AQUATERRA S.A.S, which enables the efficiency of the established routing system within the organization.

PROBLEM: Currently, Aquaterra S.A.S faces a significant challenge related to the absence of a strategic road safety plan, a requirement as per Article 110 of Law 2106 of 2019. [7] This section establishes that any entity, whether public or private, with a fleet of motorized or non-motorized vehicles exceeding ten (10) units, or that employs or manages drivers, must design and implement a Strategic Road Safety Plan tailored to its mission and size. This plan should follow the guidelines provided by the Ministry of Transport and must be integrated into its Occupational Health and Safety Management System (SGSST) [7]. Throughout several years, the company has faced this issue without managing to establish a complete and adequate process to meet the requirements set by the road safety business network. This network focuses on various aspects, including institutional strengthening, individual behavior, vehicle safety, secure infrastructure, and victim support. Therefore, it is essential to prevent any risk that could lead to traffic accidents by promoting road safety education and encouraging safe behaviors both on the roads and in the organization's workplace.

III. METODOLOGY

This article presents research on decision-making oriented towards the employees of the company AQUATERRA S.A.S, located nationwide in major cities such as Bogotá, Medellín, Bucaramanga, and Cali, with a total of seventy-seven (77) workers, including administrative and operational staff. The research aims to adapt spaces to prevent road and workplace accidents.

This study was conducted in three stages, which are:

1. Diagnosis: The collection of information in the field of Occupational Health and Safety (OHS) was carried out as a fundamental part of assessing the organization's state concerning the parameters required by the

strategic road safety plan. This assessment was conducted in comparison with other entities that are effectively implementing this process. Additionally, five initial documents were analyzed as an integral part of the project. As part of the methodology, a DOFA matrix was developed to identify the company's needs. This matrix served as a guiding tool that provides a clear vision.

The main focus is to seek maximum benefit for all stakeholders while addressing the real problems to which the organization is exposed, as well as the potential causes of these issues. Within the research process, a comprehensive analysis of risks in various categories, such as physical, chemical, biological, biomechanical, psychosocial, electrical, and locative, among others, was conducted. This analysis culminated in the development of a risk matrix intended for internal use within the organization. The matrix includes information on the level of exposure, the level of consequence, and associated risks, among other relevant data.

2. Elaboration: Once all deficiencies and risks in the organization were identified, the corresponding documentation was created and updated. This documentation covers aspects such as manuals, procedures, policies, instructions, and formats, among others, and is directly related to the five (5) fundamental pillars: institutional strengthening, human behavior, safe vehicles, secure infrastructure, and victim support [9]. The purpose of this initiative is to establish a solid documentary foundation that allows for the recording of all incidents that may occur, while simultaneously working on their prevention.

3. Formulation: A comprehensive evaluation of all the required characteristics was conducted using a matrix that allowed for a comparison between the state of the company before and after the implementation of the plan. Additionally, performance indicators were created with the purpose of enabling the organization to conduct periodic validation of each of the processes.

IV. DEVELOPMENT AND RESULTS

4.1 Diagnosis:

From the analysis of the initial information gathering, five initial documents were identified, which were:

PowerPoint Presentation: The mission, vision, and values of the company, as well as the company's location in Colombia, are highlighted. The company, with 77 employees distributed in Bogotá, Medellín, Cali, and Bucaramanga, introduces the benefits of implementing the strategic road safety plan and emphasizes its importance. Additionally, they share the previous research conducted regarding the regulatory framework.

Subsequently, it was analyzed that based on the previous information, the company has a need and importance in implementing the strategic road safety plan because some factors are present but not in the appropriate form and order. For this reason, the company takes into account Law 1503 of 2011[8] and Law 2050 of 2020 [10].

Occupational Health and Safety (OHS) and Road Safety Policies: These safety policies highlight document DG-SS-11 in its version 03, consisting of 3 structured pages. The importance of occupational health and safety is evident, aiming to promote a preventive culture and self-care. The policies emphasize the timely identification, assessment, and intervention of hazards that may cause accidents or occupational diseases.

It is important to mention that basic information regarding safety policies was considered. Additionally, plans of action are proposed, although examples of these are not evident within the document. For this reason, it is analyzed that a commitment is established by the company towards its workers on behalf of the legal representative. This commitment emphasizes the importance of the occupational health and safety system and the Strategic Road Safety Plan (PESV), aiming to comply with established regulations and promote a preventive culture. The company also encourages employees to be part of the continuous development of all internal processes to achieve a common goal.

Regulation Policies: A 3-page document, currently in the drafting process, without a code. It demonstrates the purpose of supporting the PESV. Eight (8) regulation policies are evident:

- Policy on regulation of driving hours and rest
- Speed Regulation Policy
- Seat Belt Use Policy
- Policy on the Use of Mobile Communication Devices While Driving
- Personal Protective Equipment Policy
- Signage and Marking Policy
- Alcohol and Drug Control Policy
- Hiring Policy

Likewise, in this document, all policies related to the human behavior factor are established, aiming to define the characteristics and conditions of driving personnel, whether internal or outsourced, to regulate how they carry out their activities and conduct safe transfers.

Driver Tracking Matrix: A document in which all basic information about drivers and the vehicle is identified, ensuring to have:

- General Information: Provides basic information about the worker, such as their name, number, position, etc., and, on the other hand, verifies everything related to the type of vehicle, plate, identification, among other factors
 - Insurance and Technical-Mechanical Inspection: Procedure in which the goal is to ensure the vehicle's condition through a mechanical check and also the mandatory established policies
 - Traffic Fine Check: The vehicle's history is reviewed, and new infractions are recorded
- Based on this matrix, the basic information of each driver and the vehicle they operate can be identified, ensuring the tracking of regular maintenance as well as fines for misconduct by the drivers.

PESV Work Plan: A document outlining the individuals supporting the PESV process and their tasks or functions, along with their progress. The document established tasks assigned to each person involved in the process to monitor the status of activities, start and end dates, progress, and any observations if issues arose. A DOFA analysis was conducted to identify the company's requirements. This method was employed as a guide to gain a clearer understanding of the environment in which the project would be developed. The ultimate goal was always to achieve the greatest benefit for all stakeholders and address the actual challenges affecting the organization. Additionally, the possible sources of each identified problem in the analysis were identified (Figure 1).

Figure 1. DOFA

		INTERNAL FACTORS	
		STRENGTHS	WEAKNESSES
EXTERNAL FACTORS	OPPORTUNITIES	1. Top management committed to the implementation of the PESV 2. Good reputation and positive corporate image 3. Committed and adequately skilled human talent 4. Legally established company	1. There is no road safety policy 2. The organization does not identify the impact that the company has in terms of road safety 3. There is a lack of establishing a program for preventive maintenance for drivers 4. There is no road safety proposal for internal drivers to ensure their safety
	THREATS	SO1. Implementation of a Road Safety Management System (PESV in Spanish) SO2. Training drivers and leveraging their knowledge and experience for the execution of the Road Safety Management System SO3. Expansion of the company to other municipalities or cities, taking advantage of its legally established status to address other markets	WO1. Develop, adopt, and present a strategic road safety plan to keep the company up-to-date with compliance with road safety regulations WO2. Implement a culture of continuous improvement to strengthen process performance and enhance employees' sense of belonging to the organization WO3. Documentation of all internal processes related to road safety
		STRATEGIES (SO)	STRATEGIES (WO)
		STRATEGIES (ST)	STRATEGIES (WT)

Source: The authors, 2023

Based on the DOFA matrix, it can be inferred that it is crucial to implement a Strategic Road Safety Plan (PESV). This aims to improve the internal procedures of the organization and, at the same time, establish control over regulatory provisions in road safety. The proposal includes preventive strategies to anticipate any eventuality in the road environment, thus ensuring the safety of both employees and the company.

To continue, a risk analysis was conducted to prevent possible events and assess the magnitude of their consequences. This involved collecting information through emails to the safety departments of each of the branches (Bogotá, Bucaramanga, Cali, and Medellín), where the matrix was sent for proper recording (matrix created by AQUATERRA S.A.S). Subsequently, a virtual meeting was organized to review and refine the information, identifying a total of 68 risks, including physical, chemical, biological, biomechanical, psychosocial, electrical, locative, mechanical, etc.

Based on the information provided by AQUATERRA S.A.S, a new matrix was created, which is structured as follows:

- Identification and risk assessment: Branch, risk, class, description, location, cause, impact value, impact level, possible impact effects, impact probabilities
- Risk control: Inherent risk level, value and area, management options, source, medium, individual, supporting documents, evaluation of control measures, effectiveness of control, acceptance, control measures, actions, responsible, execution date, resources, monitoring frequency, evidence
- Corrective actions: Number of corrective actions, start date, review date and monitoring/control

Likewise, a risk matrix was proposed adapting various processes requested by the company and complementing it with columns that can generate value when evaluating this process, which was structured as follows:

- Identification: This section has 6 columns (process, area/place/headquarters, activity, task, position, routine) in order to carry out a survey of the information that is being evaluated in order to obtain a clearer vision
- Danger: This section has 3 columns (description, risk category, classification) with the purpose of identifying one of the 16 existing risks and one of the 114 risk classifications found
- Possible effects: The consequences of this danger in the short, medium or long term
- Existing controls: This section has 4 columns (engineering controls, medium, individual, supporting document). In the case of engineering controls, automated control systems, automatic locking systems, alarm systems, ventilation systems are taken into account. /extraction, isolation of the source of danger, in the middle column is how it will be carried out, in individual check that the worker has the necessary knowledge and in the supporting documentation all the information will be taken into account
- Risk assessment: This section has 7 columns which measure different levels such as: deficiency (table 1), exposure (table 2), probability (table 3), consequence (table 4), level of risk and intervention and finally, there is a column for interpreting the risk level (Table 5)

Table 1. Deficiency level

DEFICIENCY LEVEL	ND VALUE	MEANING
Very high (MA)	10	A threat has been identified with the probability of a significant incident, or the effectiveness of the set of preventive measures against this risk is null or non-existent, or both
High (A)	6	Threats have been identified that may have serious consequences or make existing preventive measures less effective, or both
Half (M)	2	Hazards have been identified that may cause minor or low-impact consequences, or measures are moderately effective
Low (B)	No Assigned Value	No effects have been identified, or the measures are effective These risks are classified directly into risk intervention level four (IV)

Source: The authors, 2023

These levels aim to identify the value of ND (Deficiency Level), which is the relationship between the set of identified hazards and their direct causal connection to a potential event.

Tabla 2. Exposure level

EXPOSURE LEVEL	ND VALUE	MEANING
Keep going (EC)	4	Exposure occurs continuously or multiple times over a longer period of time during the work day
Frequent (EF)	3	This exposure occurs several times in a short period of time during the workday
Occasional (EO)	2	The exposure occurred during a certain work day and lasted a short time
Sporadic (EE)	1	The exhibition is presented circumstantially

Source: The authors, 2023

These exposure levels help identify whether it is continuous, frequent, occasional or sporadic for a hazardous event that occurs in a given period during work hours.

Table 3. Probability level

LEVEL OF PROBABILITY	ND VALUE	MEANING
Very high (MA)	Between 40 and 24	Continuous exposure is bad or frequent exposure is very bad. In general, risk materialization occurs regularly
High (A)	Between 20 and 10	Serious situations with frequent or occasional exposure. Risk materialization can occur several times during a person's working life
Half (M)	Between 8 and 6	Sporadic exposure is worse, or frequent, prolonged exposure may improve. Sometimes damage can occur
Low (B)	Between 4 and 2	Conditions that may improve with occasional or sporadic exposure or in the absence of obvious abnormalities from any exposure. Although this risk is conceivable, it is not expected

Source: The authors, 2023

These probability levels are understood as the product of the level of impairment and the level of exposure that reflects the risk, that is, the probability of the worst outcome occurring.

Table 4. Consequence level

LEVEL OF CONSEQUENCES	NC	MEANING
		PERSONAL INJURY
Deadly or catastrophic (M)	100	Death
Very serious (MG)	60	Severe and irreparable injury or illness (permanent, partial disability or invalidity)
Serious (G)	25	Injuries or illnesses with temporary work disability (ILT)
Mild (L)	10	Injuries or illnesses that do not require disability

Source: The authors, 2023

The levels aim to reveal the degrees of consequence, with fatal or catastrophic being the most serious, and slight being a subtle event. Finally, the meaning of the risks and their level of criticality is disclosed to have a clearer understanding of the control measures that must be implemented.

Tabla 6. Meaning of risk

RISK LEVEL	ND VALUE	MEANING
I	4000 – 600	Suspend operations until the risks are under control. Immediate intervention
II	500 – 150	Correct and take control measures immediately. However, if the risk level is equal to or greater than 360, the operation is suspended
III	120 – 40	Improve it if possible. Interventions and their cost-effectiveness can be easily justified
IV	20	Maintain existing controls but consider solutions or improvements and review them periodically to ensure that risks are acceptable

Source: The authors, 2023

Then, the health impact is analyzed through a definition table to validate the information provided by each branch and identify it. Additionally, a probability of frequency is considered in the materialization of the risk at the annual criticality level (Table 7).

Table 7. Health Criticality Level

HEALTH IMPACT LEVEL		
CRITICAL LEVEL	DESCRIPTION	VALUE
Low	Illnesses that do not cause occupational disability or that cause temporary occupational disability for up to 2 days. Discomfort and irritation (e.g., headaches), temporary illness that causes discomfort (e.g., diarrhea), superficial injuries, shallow wounds, bruises, mild irritations in the eyes or skin	1
Half	Illness causing temporary disability. For example: partial hearing loss, asthma, dermatitis, upper limb impairments. Lacerations, deep wounds, first-degree burns; concussion, severe sprains, fractures of short bones	2
High	An acute or chronic illness that causes permanent disability, invalidity, or death. Injuries resulting in amputations, fractures of long bones, traumatic brain injuries, second and third-degree burns, severe hand injuries, spinal cord diseases affecting the spinal cord, eye diseases affecting vision, damages causing a decrease in hearing capacity	3

Source: AQUATERRA S.A.S, 2022

4.2 Elaboration:

An information gathering process was carried out to verify what records were available and on what basis work could be done. From this assessment, the guide established by the municipality was taken as a reference, and the creation of the necessary documents began, considering Decree 2851 of 2013 [11]

- **RE-GH-24 Job Profile:** A job profile matrix was established to determine the characteristics and requirements that a company driver operating an authorized vehicle (forklift, van) must have. This aims to specify the experience, training, and minimum competencies required to occupy a position as an employee of the company
- **RE-LG-13 Vehicle Life Sheet:** All vehicles must have the appropriate documentation for their maintenance. Therefore, a third party is responsible for controlling and verifying the mechanical conditions of the vehicles
- **MT-SS-68 Indicators of the Occupational Health and Safety System:** Proposed management indicators to outline action plans for evaluating each of the achievements, ensuring periodic verification of their fulfillment
- **RE-LG-14 Preoperational Inspection of Vehicles:** Checklist matrix designed to ensure the overall good condition of the vehicle, detect any issues, and take immediate corrective action

- **RE-SS-82 Investigation of Incidents and Accidents at Work:** In the event of an accident or incident, the investigation matrix must be followed to inquire into the case using the 5W+1H method, providing a detailed description of the event and attaching photographic evidence. This is done to document and have information on such cases and prevent similar events in the future
- **PR-GH-10 Personnel Selection:** Document formalizing the personnel selection process based on the company's needs, outlining all filters in place, and specifying the responsibilities of the process leader
- **PR-SS-85 Work Incidents and Accidents:** Establish procedures for notifying, reporting, and investigating accidents and incidents that occur during work activities within or outside the company, in order to establish and analyze the facts and determine various direct or indirect intervention causes, in addition to complying with the duties and requirements currently established. Furthermore, prioritize and implement corrective and improvement measures to prevent or reduce risk situations, improve the quality of life of employees, enhance company productivity, and avoid issues with Colombian labor laws
- **IN-SS-93 Roadside Protocol:** Plan of what to do in case of a breakdown on the road, how to act, and whom to contact
- **DG-SS-90 Road Safety Strategic Plan:** Management document that contains the consolidation of all tools, methodologies, and mechanisms to be used in the company, aiming to comply with the regulations of Article 110 of Decree Law 2106 of 2019 [12], based on the principles of best practices to prevent road accidents and incidents [13].

Starting from each of the pillars, different reports and methodologies were generated to complete the road safety strategic plan, which are presented as follows:

Institutional Strengthening: First and foremost, the focus was on defining the objectives, both the general and specific goals of the project. Guidelines were established by top management, who will play a crucial role throughout the process, overseeing the planning, design, implementation, measurement, monitoring, and feedback of the road safety strategic plan.

Furthermore, the scope of the plan was defined, and the road safety committee was formed. This committee agreed on aspects such as the minutes, the committee's objective, the identification of its members and their respective roles and functions, including the president and the secretary. Subsequently, the road safety policy was addressed and efforts were made for its dissemination. A characterization was conducted, evaluating the company's mission and vision, its national location, all transportation activities it manages, the distribution of goods, and both cargo and passenger transportation.

Finally, the diagnosis of road risks was carried out through surveys and subsequent analysis. The objective was to define road risks, classify them, and evaluate them using a heat map matrix. Special emphasis was placed on proposing action plans to address risks that can directly impact human factors, vehicles, and infrastructure. These action plans were designed to ensure compliance through performance indicators and the implementation of periodic audits.

Human behavior: A comprehensive analysis was conducted on all human factors involved in the process, encompassing the necessary selection procedures during recruitment. These procedures included specific requirements for hiring qualified personnel, detailing exams and tests to verify the driver's fitness.

Continuing with the selection process, once the candidates were chosen, all their physical and mental capabilities were evaluated. This involved conducting psychosensory and medical exams, as well as theoretical and practical tests. The selected candidates underwent training, covering all aspects related to road users, traffic regulations, defensive driving, and knowledge of the type of vehicle they would be operating. For this reason, the training was carried out according to a schedule established by the organization, with a designated person in charge of the training sessions and continuous assessment of the skills of the hired workers.

Additionally, a rigorous control of documentation for all workers was implemented. A tracking matrix was maintained to ensure that the data was up-to-date, providing control and traceability in case unforeseen situations arose. The matrix was also used to record traffic ticket reports, thus documenting all infractions committed due to driver recklessness. However, action plans were developed to explore alternatives and payment solutions for each worker facing infractions, aiming to raise awareness and sensitize personnel, preventing the recurrence of such incidents.

Vehicles Safety: In this context, it is crucial to conduct analyses in three key parameters: preventive maintenance, corrective maintenance, and pre-operational check. To achieve effective preventive maintenance, five essential pillars have been considered. One of these pillars is the vehicle's life record, which is used as a crucial tool to manage proper equipment maintenance, through the RE-LG-13 format.

- I. **Technical Recommendations for Maintenance Operations:** These go hand in hand with the vehicle's life sheet where general information, dates, or mileages are related
- II. **Preventive Maintenance Schedule:** Used for maintenance at appropriate dates according to the factory or maintenance provider recommendations

III. Verification of Maintenance for Outsourced Vehicles: These vehicles can be either individuals or companies. For individuals, a report on the vehicle's condition must be generated, and maintenance records must be documented. For companies, the Road Safety Strategic Plan (PESV) must be requested to ensure the safety and health of the drivers

IV. Suitability of Workshops for Performing Preventive Maintenance: It must be ensured that the workshops where maintenance is carried out have both the appropriate personnel and equipment

For corrective maintenance, 3 items were taken into account:

- Record of Corrective Maintenance: Planned through the RE-LG-13 format, where the vehicle's condition is documented

- Roadside Protocol: This is carried out through document IN-SS-93 with the aim of providing basic instructions to the personnel or third parties

- Suitability of Workshops for Carrying Out Corrective Maintenance: It must be ensured that where maintenance is performed, there is both qualified personnel and appropriate equipment

For the pre-operational check, the pre-operational inspection must be taken into account by completing the RE-LG-14 format along with warehouse assistants, ensuring the correct completion of forms, and obtaining their signatures to verify proper documentation.

Safe Infrastructure: In this section, internal routes and their proper functioning were considered with the aim of keeping them in good condition and providing safety for various road users. [14] Additionally, pedestrian access and internal vehicle circulation were taken into account. Evidence was included showing the state before and after the progressive adjustments. These adjustments were made with the purpose of improving the infrastructure and ensuring a safer environment for everyone involved in mobility within the company.

Victim Assistance: Finally, a protocol plan for victim assistance in the event of accidents or incidents was developed, regulated by document IN-SS-03. This protocol establishes the investigation of traffic accidents or incidents through the matrix PR-SS-85, which compiles all the details of the scenario to implement corrective and improvement actions with the aim of minimizing future similar events. Additionally, a lessons learned plan has been created, which includes the dissemination of the protocol and all generated logs. This is done with the purpose of raising awareness and educating all involved parties about the importance of learning from events and continuously improving road safety within the organization.

4.3 Formulation:

Specific parameters have been established for each of the pillars of the Strategic Road Safety Plan (PESV) to diagnose the state of the company both before and after its implementation. The aim of this assessment is to measure the changes and improvements achieved and determine the effectiveness of the plan's execution. In table 8, all the characteristics that were evaluated and the assigned ideal scores can be observed as a reference for the assessment.

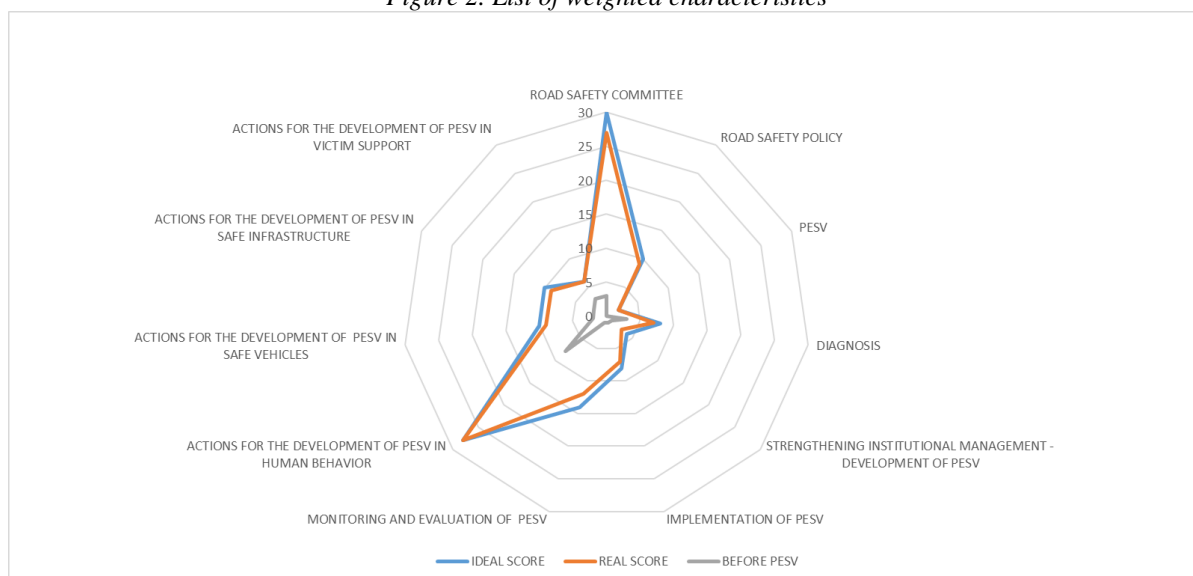
Table 8. PESV implementation characteristics

CHARACTERISTICS	IDEAL SCORE	REAL SCORE	BEFORE PESV	% IMPLEMENTATION	% COMPLIANCE BEFORE PESV
Road safety committee	30	27	3	90%	10%
Road safety policy	10	9	0	90%	0%
PESV	2	2	0	100%	0%
Diagnosis	8	7	3	88%	38%
Strengthening institutional management - preparation of the PESV	4	3	1	75%	25%
PESV implementation	8	7	1	88%	13%
Monitoring and evaluation of the PESV	14	12	1	86%	7%
Actions for the development of the PESV in human behavior	28	28	8	100%	29%
Actions for the development of the PESV in safe vehicles	10	9	2	90%	20%
Actions for the development of the PESV in secure infrastructure	10	9	2	90%	20%
Actions for the development of the PESV in care of victims	6	6	3	100%	50%
TOTAL	130	119	24	91,5%	18,5%

Source: The authors, 2023

The table 8 shows that the actual score obtained by the company is similar to the ideal one, indicating that, following the implementation of the PESV, a 91.5% compliance is achieved, significantly improving each process. Before applying the plan, the organization had an 18.5%.

Figure 2. List of weighted characteristics



Source: The authors, 2023

As can be seen in figure 2, the actual score is significantly closer to the ideal score compared to the score prior to the implementation of the plan. This indicates a substantial improvement and steady progress toward full compliance with the established objectives. Indeed, a progress of 73% has been achieved in both internal and external processes of the organization.

Furthermore, the validation of the strategic road safety plan was carried out using seven management indicators. This allowed the presentation of action plans aimed at assessing the efficiency and compliance of each proposed objective, ensuring continuous monitoring of the results.

Table 9. Management Indicators

INDICATOR	FORMULA	GOAL	PERIODICITY
Preventive maintenance of internal vehicles	$(\# \text{ Preventive maintenance performed} / \# \text{ Preventive maintenance scheduled}) * 100$	100%	Quarterly
Coverage in road safety training	$(\# \text{ Trained personnel} / \# \text{ scheduled personnel}) * 100$	90%	Quarterly
Economic impact due to road incidents or accidents	$\sum \text{ Costs derived from traffic accidents or incidents}$	0 COP	Quarterly
Occurrence of road accidents	$\# \text{ Number of road accidents}$	0	Quarterly
Monitoring of the PESV work plan	$(\# \text{ Activities executed} / \# \text{ activities scheduled}) * 100$	90%	Quarterly
Compliance with technical standards	$(\text{Last data available} / \text{goal set}) * 100$	90%	Biannual
Impact of incidents on trained personnel	$(\# \text{ Number of road incidents} / \# \text{ Number of trained drivers}) * 100$	0%	Quarterly

Source: The authors, 2022

As can be seen in Table 9, each indicator is specified with a measurement frequency, a formula for evaluation, and a target to validate the periodic compliance. This allows for continuous monitoring of its effectiveness.

V. DISCUSSION

The article "Strategic Road Safety Plan for the company P&R Ingenierías SAS in the city of Arauca, Arauca" [15] is selected, which is in line with the project developed at Aquaterra S.A.S. There are some significant differences in the diagnostic phase and the execution of the plan.

In the case of P&R Ingenierías, a more detailed focus on occupational health and safety is observed, serving as the foundation for the Strategic Road Safety Plan (PESV). They conducted a comprehensive diagnostic evaluation using each of the pillars as a reference and obtained a compliance rate of 32.875% before implementing the plan. This indicates that they were 14.4% above Aquaterra's initial compliance. It is important to note that the organization had a deficient safety system, and no pillar exceeded 50% compliance.

During the plan execution process, P&R gradually implemented actions. Additionally, they had a consolidated set of protocols from the beginning, in contrast to Aquaterra, where documentation was constructed as the plan development progressed.

However, in the P&R article, what needed to be established in the company to improve internal processes was outlined, with a corresponding assessment of the pillars and their performance. This was based on a matrix in the PDCA cycle of proposed activities. In contrast, in Aquaterra, the plan was executed as it progressed, allowing for the evaluation of all necessary characteristics for the organization's development at the end. They achieved a compliance rate of 91.5% from the beginning of the PESV, indicating continuous improvement in processes and the implementation of indicators that must be periodically evaluated and met, along with audits to ensure the accuracy of results.

In summary, although P&R Ingenierías had a solid documentation foundation and higher diagnostic compliance before plan implementation, Aquaterra significantly improved its processes as the plan was executed, resulting in higher overall compliance at the end of the process. Both approaches have their advantages and challenges, and the choice of each will depend on the specific needs and conditions of each company.

VI. CONCLUSIONS

From the evaluation of the characteristics, it was observed that there is a compliance rate of 27% with the established criteria. Therefore, it is necessary to continue reinforcing actions to reach and maintain 100% compliance, using audits as a tracking and assurance tool.

In the pillar of victim support, many drivers lack knowledge about the steps to take in the event of a traffic accident or road incident. In this regard, it is proposed as an improvement action to share lessons learned from traffic incidents among the members of the company. This sharing can complement the dissemination of established procedures to investigate these events, which are part of the overall process of investigating and recording occupational accidents, along with associated indicators.

To achieve a successful implementation of a strategic road safety plan, it is essential to conduct updates at least once a year or when significant changes affecting road safety occur. These updates should reflect the current road safety situation of the organization. From this new perspective, effective strategies must be developed to address emerging needs.

The management of road safety in companies must be comprehensive, addressing all five pillars thoroughly. The involvement of top management is essential to strengthen institutional management, as their commitment is crucial for maintaining a fleet of vehicles in optimal conditions, having effective tools to manage infrastructure, establishing agile mechanisms to address emergencies, and developing strategies that positively influence employee behavior, as seen in the case of Aquaterra. Finally, it is necessary to promote the formation of safe habits and respect for compliance with current legal regulations, as this is essential to prevent accidents, improve the safety and health of workers, and increase productivity.

BIBLIOGRAPHICAL REFERENCES:

- [1]. WORLD HEALTH ORGANIZATION, Global Status Report on Road Safety 2013. [En línea]. 2021. [Consultado: 02 de abril 2021]. Disponible en: https://www.who.int/violence_injury_prevention/road_safety_status/2013/report/summary_es.pdf?ua=1
- [2]. PUBLIC HEALTH MAGAZINE, Primary prevention measures to control injuries and deaths in pedestrians and promote road safety (2010) [En línea], [Consultado el 09 de mayo del 2021], Recuperado de: https://www.scielosp.org/article/ssm/content/raw/?resource_ssm_path=/media/assets/rsap/v12n3/v12n3a15.pdf
- [3]. SECRETARÍA DEL SENADO, Artículo 94, [En línea], [Consultado: 27 de mayo del 2021], Recuperado de: http://www.secretariassenado.gov.co/senado/basedoc/ley_0769_2002.html
- [4]. MINISTERIO DE TRANSPORTE, Tránsito automotor – chalecos [En línea], [Consultado el 11 de mayo del 2021], Recuperado de: <https://www.mintransporte.gov.co/preguntas-frecuentes/62/transito-automotor---chalecos/>
- [5]. PUBLIC HEALTH MAGAZINE, Primary prevention measures to control injuries and deaths in pedestrians and promote road safety (2010) [En línea], [Consultado el 09 de mayo del 2021], Recuperado de: https://www.scielosp.org/article/ssm/content/raw/?resource_ssm_path=/media/assets/rsap/v12n3/v12n3a15.pdf
- [6]. AQUATERRA S.A.S, Nosotros, [En línea], [Consultado el: 21 de febrero del 2021], Recuperado de: <https://aquaterra.com.co/nosotros/>
- [7]. MINISTERIO DE TRANSPORTE, Decreto 2106 de 2019 [En línea], [Consultado el 27 de abril del 2021], Recuperado de: <https://www.funcionpublica.gov.co/eva/gestornormativo/norma.php?i=103352>
- [8]. SECRETARIA DEL SENADO, Ley 1503 de 2011, [En línea], [Consultado el: 28 de octubre del 2021], Recuperado de: http://www.secretariassenado.gov.co/senado/basedoc/ley_1503_2011.html
- [9]. MINISTERIO DE TRANSPORTE, Mintransporte establece nueva norma para que empresas actualicen los Planes Estratégicos de Seguridad Vial [En línea], [Consultado el 11 de mayo del 2021], Recuperado de:

- <https://www.mintransporte.gov.co/publicaciones/10363/mintransporte-establece-nueva-norma-para-que-empresas-actualicen-los-planes-estrategicos-de-seguridad-vial/#:~:text=Un%20Plan%20Estrat%C3%A9gico%20de%20Seguridad,y%20disminuir%20sus%20efectos%20nocivos.>
- [10]. PUBLIC FUNCTION, Law 2050 of 2020 [En línea], [Consultado el 15 de mayo del 2021], Recuperado de: <https://www.funcionpublica.gov.co/eva/gestornormativo/norma.php?i=139130>
- [11]. PUBLIC FUNCTION, Law 2851 of 2013 [En línea], [Consultado el 02 de agosto del 2021], Recuperado de: <https://www.funcionpublica.gov.co/eva/gestornormativo/norma.php?i=55853>
- [12]. FUNCIÓN PÚBLICA Decreto 2106 de 2019 [En línea], [Consultado el 20 de mayo del 2021], Recuperado de: <https://www.funcionpublica.gov.co/eva/gestornormativo/norma.php?i=103352>
- [13]. NACIONES UNIDAS, Resolución aprobada por la Asamblea General [En línea], [Consultado el 27 de septiembre del 2022], Recuperado de: <https://unece.org/fileadmin/DAM/trans/roadsafe/docs/A-RES-64-255s.pdf>
- [14]. FUNCION PUBLICA, Ley 2251 de 2022 [En línea], [Consultado el 27 de septiembre del 2022], Recuperado de: <https://www.funcionpublica.gov.co/eva/gestornormativo/norma.php?i=189806>
- [15]. REVISTA INTERFACES, Plan estratégico de seguridad vial para la empresa P&R Ingenierías SAS en la ciudad de Arauca, Arauca”, [En línea], [Consultado el 1 de octubre del 2023], Recuperado de: <https://revistas.unilibre.edu.co/index.php/interfaces/article/view/3678>