Trains running through urban railroad sections in large cities are an important means of transportation for many passengers. In 2019, the number of passengers using the Seoul Metropolitan Railway reached 2.9 billion. The drivers are responsible for the safe operation of the numerous passengers repeatedly going two to three minutes apart, looking only at the railroad tracks in the dark underground section. Although the urban railway system is becoming state-of-the-art and accidents are caused by system errors and human error continue, so the train drivers must exert a high level of concentration to prevent accidents. This professional nature has led to considerable job stress for drivers, and the annual subway accident is feared to cause depression, bipolar disorder, obsessive compulsive disorder, and various mental disorders and panic disorder caused by post-traumatic stress disorder. In this paper, while the accident lessons and measures are active in railway operation institutions after the occurrence of various railway accidents, the measures for drivers have been taken away from the very insufficient existing methods and considered the engineer as a special class of high-risk groups, and the application of the psychological stability program of firefighting officials, who are currently high-risk. The meaning and necessity of developing human psychological stability program for railroad engineers were presented by analyzing these.

(Keywords) Train-Driver, Job Stress, Human-Error, Post-Traumatic Stress, Psychological Stability

1. Introduction

In 2019, about 8 million urban railroad users in Seoul and 2.9 billion people a year took up 40 percent of the city’s transportation share. The safety of the driver who carries passengers at the front line of the railway can be said to be a direct factor responsible for the safe transport of passengers, as an accident on such an urban railroad would result in massive casualties as well as property damage.

The urban railroad system is also called the foot of citizens as it is deeply involved in the lives of citizens to the extent that it determines the daily lives of urban citizens. Accidents on urban railroads have a direct impact on the lives of passengers, and even minor mistakes have resulted in delays and interruptions of trains. In addition, most urban rail users use it as a necessary means of near-field travel rather than long-distance travel, so the economic and time-consuming losses to users in the event of an accident are highly personal and difficult to measure. The timetable for train operations, known to users, is a promise announced to potential customers long before the start of operation, and since customers will decide to move in accordance with this promised time, it is also the responsibility of the city rail operator to have the best respect for the safety and time value of its customers[1].
The role of the train driver is very important to fulfill these duties, with the special job characteristics of most of them having to maintain the time pressures of working conditions such as underground tunnels, the time pressures of running the promised time, and the tension against unexpected anomalies.

These characteristics face a variety of stress environments at all times, and the resulting physical and mental fatigue directly and indirectly adversely affects safety behavior and human error, thus increasing the likelihood of accidents occurring. And due to the nature of the driver's work, the driver is under latent stress to cope with the ongoing unusual situation, and is deeply linked to the uncertainty of not only the case facing the situation but also the future unusual situation that may occur at any time[2].

An unusual situation is an unusual and unexpected situation always handled by a driver, and there is always anxiety from concerns that an accident may occur in any environment or situation. If the driver fails to take effective action in the event of an unusual situation, and the train is delayed or stopped, or if there is a loss of life, the driver's fear of a disadvantage or injury causes unpredictable stress. In addition to these unpredictable stresses, the unusual situation also affects the driver's cognitive processes and physical responses, especially those who have experienced accidents in the past or experienced child accidents that do not lead to direct accidents in an accident situation, it is believed that the stress from such unusual situations will be aggravated[3].

Among the unusual situations that urban railroad drivers say are the most unpredictable and stressful, and the subway trains are the subway trains. According to the Ministry of Land, Infrastructure and Transport, 47 passengers per year died after jumping into the subway, 35 in 2016 and 33 in 2017 and 17 in 2018 respectively. The number of deaths has been on the decline every year, but the reality is that more than one passenger a month is still throwing himself onto the subway tracks. Most of the subway lines are equipped with screen doors, so it is estimated that the number of accidents caused by jumping into the subway has decreased. The trauma of drivers who have been in a jumping accident is also increasing, and drivers who have experienced a jumping accident or have received information from a fellow engineer can also check an interview article that says their hair stands up and their hearts fluctuate greatly when they pass through a jumping area[4].

As a result, Seoul Transportation Corporation has established a psychological center in charge of the mental health of drivers who have experienced accidents since 2019 to conduct counseling, but the pain of the past remains intact as it excludes drivers who experienced accidents in the past. If the drivers who experienced the accident are left unchecked, the subway will no longer be a workplace but a place of fear.

So In this study, I want to find out about the job characteristics of the driver and identify the type of job that is called the engineer is also a special class that belongs to high-risk groups such as police and firemen. It is worth noting that the Ministry of Public Safety and Security has recently been running a "psychological stabilization program for fire officials" due to internal demands for support measures for mental health disorders such as PTSD, depression and sleep disorders caused by the disastrous field experience of firefighters. In the case of urban railroads, the railroad operator has been indifferent to the psychological stability of the drivers as it has been bent on taking physical measures and coping with the accident.

At times, most of them returned to work without in-depth counseling support, only taking a rest for three to five days at the discretion of their managers. Other newspaper articles reported that the driver who had jumped into the accident suffered from trauma and eventually jumped into the scene of the accident. To prevent these unfortunate incidents from happening any more, we will raise a plan for the operation of a systematic human psychological stabilization program for railroad drivers after the accident as well as a thorough examination of the work environment that drivers are in.
2. Understanding of Urban Railroad Engineers

2.1. Recruitment procedure for urban railroad drivers

Under the current railroad safety law, the enforcement ordinance and the enforcement rules of the same law stipulate that in order to become a railway engineer, he or she is only entitled to take a written test if he or she passes the written test, and only those who pass the written test can obtain a railroad driver’s license. In addition, in the course of employment as a driver and job performance, the institution is required to complete regular aptitude tests and physical examinations as well as a certain safety education as prescribed by the law.

Because of the nature of the railway, it is highly probable that a momentary human error will result in a large-scale accident. In the event of an accident, the resulting social impact as well as human and material losses is so great, we will apply strict standards from the process of obtaining a driver’s license to minimize the possibility of a safety accident[4].

2.2. Physical examination and aptitude test

Under the Railroad Safety Act, those who want to obtain a license for the operation of a railroad car, which is a necessary process for engaging in the operation of a railroad car, are required to perform train operation tasks safely. Those who wish to obtain a driver’s license for a railway vehicle to become a driver must pass a physical examination conducted by the Minister of Land, Infrastructure and Transport to determine whether they are fit to operate a railway vehicle(Article 23 of the Railway Safety Act), which sets standards such as vision and hearing, especially for color-weak or color-blindness, will fail the physical examination.

And it is clearly stipulated in the Enforcement Decree of the Railroad Safety Act that those who wish to obtain a railway vehicle driver’s license must pass the aptitude test conducted by the Minister of Land, Infrastructure and Transport(Article 23 of the Railroad Safety Act) that there are largely questions and answers, and there are selective test of their ability, their ability to measure their ability, their ability to respond. In other words, such a physical and aptitude test can be called a system for determining whether a railway driver’s license to become a driver has the proper body and aptitude for train operation from the acquisition stage, thus preventing human errors that may occur during train operation in advance and selecting the right person.

Under the Act, those who are already licensed and currently engaged in the operation or control of railroad vehicles, or those who are engaged in the tasks prescribed under the Presidential Decree, are also required to undergo physical and aptitude tests on a regular basis. The Ministry of Land, Infrastructure and Transport stipulates the timing, method, and acceptance criteria of such physical and aptitude tests. If a person who is already engaged in the railway service fails the regular physical and aptitude test standards, the head of the railway authority shall no longer be allowed to engage in such work. This shows that those who want to become drivers or those who are already drivers and are engaged in the operation must maintain their fitness and fitness for the operation through continuous physical and aptitude tests. Noteworthy is that a special inspection can be conducted only on the person concerned if the leader of the agency determines that it is unfit to perform the work smoothly due to a disease or other reasons other than regular aptitude tests, and the compliance of personality is an important item for the special prosecutor. As a person ages, his or her physical condition changes, and external factors can change his or her aptitude. Therefore, the driver himself needs to thoroughly manage himself.

The regular physical examination cycle is two years and the aptitude test cycle is ten years. However, it was judged that due to the perception that train accidents are mainly caused by human error of railway workers, the 10-year regular aptitude test cycle of railway workers was too long, making it difficult to properly manage personnel. Accordingly, the Ministry of Land,
Infrastructure and Transport continuously manages the capability of workers by reducing the frequency of aptitude tests for railway workers who perform safety-related tasks such as operation and control from the last 10 years to five years[5].

2.3. Job characteristics of urban railway operators

In a nutshell, the job characteristics of the drivers of the urban railroads are said to be those that require a high degree of concentration and sincerity. Under any circumstances, the driver should seek safe operation of the train, especially since he works in the driver's room, a limited space for the moving train, so he should concentrate on his work while maintaining constant tension.

Therefore, a responsible attitude is required for the crew to faithfully perform a given task with a high degree of concentration under any circumstances. Since the driver works according to the schedule of the train operation, he or she works non-periodic shifts with different commuting hours from day to day and irregular alternation. In addition, the overall operation conditions vary from day to day depending on the trains assigned on the working day, so the work procedures must be followed and implemented as specified by the relevant regulations or instructions. This pattern of service requires a thorough compliance spirit that is well informed of the work schedule in advance and complies with commuting and alternation times, and that during a flight, it is in accordance with the relevant regulations and instructions. In addition, the capacity required for the driver should be the quantity of up-and-coming trade in which he or she can accurately judge the situation and provide emergency measures. This is because the driver should take proper initial actions without being embarrassed when various unusual situations or operational failures occur during the train operation, so the driver must have knowledge of the overall task and the volume of up-and-coming trade for the first step[6].

As the urban railroad driver's operation is highly mentally and physically tired due to the high pressure of safety operation and the characteristics of working alone within a limited space, the schedule and schedule of the train run from early morning to late night are irregular, as well as the frequent fluctuations of sleeping places and short sleep hours caused by night duty. Such heavy work pressure and fatigue of the drivers of the urban railroads may act as a task stress, leading to human error such as causing unstable behavior or causing a safety insensitivity to safety, and misjudging of the initial situation, which could seriously affect the safety of citizens.

Job analysis of railway safety workers has confirmed that the time pressure of the drivers is very high and the probability of human error is high. Against this backdrop, it can be inferred that the unusual level of stress among the agencies, which used to be a two-person crew pattern, is very high, depending on the universalization of single operation due to the trend of cost reduction and system automation, the significant civil service provision caused by the rapid speed of railways and the increasing desire of customers for on-time, and the extent or severity of the damage to passengers in the event of errors during accidents and operations.

2.4. Changes in duties according to changes in the railway operating system

The nation's railway operating system is gradually becoming automated and unmanned thanks to the development of high-tech technologies. The ID Dangseon, which already runs on a completely unmanned aerial vehicle, the Busan Kimhae Gyeongjeon Railway, the Incheon Metropolitan Railway Line No. 2, the Yongin Gyeongjeon Railway and the latest Gimpo Gold Line, which opened by the Incheon Metropolitan Rapid Transit Railway, are also operating as non-human.

Such an automatic operation system can also be a fundamental way to eliminate the cause of driver human error. However, the switch to unmanned driving systems across all sections of big cities, including Seoul, will have to be pursued from a long-term perspective, given the number
of customers using the system, the frequency of train operations, the complexity of communication between various functions and the cost of building the system. As the automatic operation system became possible due to the development of technology, a single-person crew with no conductor from the two-person (engineer, conductor) crew was carried out.

All subway operations, except for unattended driving, require a certain part of the role of the driver. When operated as a single crew member, the driver will also be responsible for the duties of the conductor, which were carried out on the existing two-person crew, including monitoring the arrival of trains, opening doors, checking the opening, monitoring the passenger occupancy status, broadcasting passenger guidance, closing the doors, confirming the departure response mark, confirming departure signs, and checking for platform faults. It is believed that the changes in the driver’s work caused by the switchover of the one-man crew also affected the cause of the railway accident.

In case of manual operation, the driver’s human error may be the main cause, but in the automatic operation system, the system is the main cause and human error occurs in the process of correcting the system error. This suggests that the size of the accident may vary depending on how the driver responds in an unusual situation. In other words, even if the driver does not provide a direct cause in the occurrence of the accident, additional damage is determined by the judgment of one engineer. The future management of driver human error should be more diverse and in-depth as the task shared by the two-member crew has been aggravated by the driver’s work and the judgment in unusual circumstances makes it possible to make independent decisions[1].

The extent of damage is beyond imagination if accidents occur due to the same causes in the past as the railway operating system becomes fast and mass-produced. In the past, many railway accidents were caused by single factors, and preemptive repairs were implemented to prevent similar and similar incidents. However, with the introduction of new technologies, accidents are caused by a variety of complex factors, it is difficult to take preemptive action against the current system under individual management. The types of recent accidents account for the majority of human error accidents rather than mechanical ones, and the paradigm for safety management as well as driver human management is changing[7].

While mechanical safety can be improved as machine reliability improves with the development of science and technology, the possibility of an accident can be seen as higher as randomness exists in human interaction and thus puts it in an irregular situation. Even though railway operation is carried out through automation and dehumanization, more accidents are caused by human error, which is believed to be caused by human safety management areas being handled by machines, resulting in fewer caregivers, and the final decision being made by humans.

Therefore, it is necessary to consider changing the duties of one person who will change as the process progresses toward unmanned aerial vehicles. If unmanned, the area affected by one person’s judgment will eventually be widened, and if human error occurs, it is likely to cause a wider and more serious accident. Therefore, it is necessary to seek various ways to improve the possibility of human error in consideration of changes in duty[7].

2.5. The effect of job characteristics on drivers

Considering the situation where drivers must stay indoors and in deep underground for a long period of time and work continuously for more than two to three hours for a short period of time, drivers are expected to suffer greatly.

According to the data, which analyzed the work-related difficulties of urban railroad drivers for employees of the Seoul Metropolitan Transit Corporation, drivers generally expected the biggest stress
from the train failure to be the shutdown, but the results of the survey came as a result. They answered that they felt more stress from physiological phenomena or from crew quarters and bedding problems. This means that the drivers have no work to do outside of the flight hours, but have significant meaning in the middle of the intermission. Therefore, drivers feel that the importance of recreation management and the inability to address the most basic physiological phenomenon in humans have been identified as the biggest stressors. While these factors can increase the number of bed-clothes at the level of welfare, a solution can be found immediately, for the part of the physiological phenomenon, installing a portable toilet in the driver's room is a complex issue that needs to be considered from the stage of vehicle production design, it is not easy to find a solution. Another problem has been the fact that they were kicked out of their shift and are unable to eat properly, but due to the pressure of work time, they seem to need careful consideration from the operating system, which operates flexibly at the meal time.

In general, there are two main reasons why human error occurs in railways. The first is when the task is complicated or excessive, resulting in arbitrary omission of the process or errors due to tension. The second is when the work is so familiar and repetitive that you miss something to watch out for, and you don't even realize you made an error. The former is mainly due to human error by new employees, the latter to those who are skilled in the service. This is because new employees are not familiar with their jobs and are prone to mistakes because they are unable to perform as planned or because of high mental fatigue, while skilled workers are prone to errors that are overconfident or tactful and unable to proceed as planned.

And also, if a railway accident occurs and no obvious cause, such as mechanical failure, is found, the accident will be closed due to the driver’s reasons. This is because it is the easiest and most convenient way to handle accidents. However, if the accident is concluded in this way, it is not possible to find out the fundamental problem of why a person is forced to make an error, and it is highly likely that another type of accident will occur due to human error. Rather than expect systemic safety, such as automated and unmanned railways, more detailed attention and research is needed on conditions and the environment that can reduce human error. This is because it is a very important factor in the driver’s mental health care[8].

2.6. Cases of overseas research

In foreign countries, research on Posttraumatic stress disorder(PTSD) of railroad drivers and subway drivers who often experience accidents while driving is active. Norwegian railway drivers with accident experience reported that symptoms of type PTSD were common within hours to days after accident, and drivers with moderate-commercial levels of invasive stress continued to occur in their heads, and in relation to sleep, one-third showed a high acute awakening condition.

A trace of a Swedish subway driver showed that the driver who experienced the accident had more sick leave three weeks and a year after the accident compared to the driver who did not. Also, drivers who experienced accidents involving seriously injured victims were found to have been absent or taken sick longer than those who experienced minor injuries or deaths.

Among the drivers, those with panic disorder experience severe social aftereffects, and tend to regard their physical and mental health as being much higher in medical institutions and worse than the average person. And there are not yet many studies in Korea on panic disorder among urban railway drivers.

Most of the studies on the mental health of the nation’s subway drivers are surveys of accident conditions, and few studies on factors that can affect the stress response and mental health of subway drivers based on their accident experience are available. The management of the driver’s mental health is critical because the accident experience experienced by the drivers during the train operation not only threatens their mental health but also reduces their work
efficiency, thus threatening the safety of passengers.

In advanced countries, psychological support program Critical Incident Stress Management (CISM), or CISM, has become widely popular as the argument that proper rest and stress management programs are needed for jobs that are vulnerable to disasters or accidents, such as subway drivers and rescue workers who have been deployed to large-scale disaster sites.

However, the nation's situation has been limited to an extemporaneous, unstructured and unprofessional approach in terms of comfort, depending on the personal consideration of the boss. Attention should be paid to the development and dissemination of programs based on the results of the survey, as well as more active surveys.

3. The Human Psychological Stabilization Program of Fire Officers

3.1. Management of fire officers psychological stability program

Posttraumatic Stress Disorder (PTSD) is the total body of a variety of mental and physical symptoms that are seen by people who have experienced shock due to direct or indirect exposure to traumatic or stress events. Trauma Post-traumatic Stress Disorder (PTSD) first started in the study of soldiers who fought in the war, but the scope of traumatic events has been expanded in a variety of ways, including the experience of excessive exposure to such traumatic events as trams, disasters, natural disasters, assaults, robberies, rape, and murder, as well as divorce and death of parents, accidents and domestic violence, child abuse, or the treatment of metamorphoses.

In the preceding study of the factors in the trauma of fire officials, the higher the working period of fire officials, the higher the symptoms of post-traumatic stress disorder (PTSD) also reported that the higher the age and the more working years, the more experienced post-traumatic stress disorder (PTSD).

In the U.S., firefighters who witnessed the deaths are required to receive psychiatric counseling within three days, and PTSD diagnoses of soldiers who have returned from overseas service at hospitals operating directly under state agencies. In addition, there are more than 1,400 hospitals that specialize in treating PTSD and a number of resort-level specialized hospitals that specialize in managing PTSD.

When a firefighter comes back from a disastrous scene, Japan is required to conduct a mandatory inspection and seek counseling from psychiatrists and psychotherapists. Haslam and Mallon (2003) investigated firefighters in the UK and raised the need for in-depth research into the psychological response of firefighters, as well as support at the private level for PTSD mitigation [9].

In Korea, PTSD operates a national healing program for disaster victims, but it is not effective because it not only affects the personal health of firefighters but also the safety of firefighters engaged in firefighting activities. The mental health of firefighters has long been pointed out, but only 14 percent of 213 fire departments, or 30 "visiting psychological counseling centers," where specialists and psychological counselors visit fire departments to conduct preventive health counseling. Discussions on the construction of fire-fighting hospitals, which have been discussed since 2002, have yet to be carried out. In one country, you can specialize in PTSD symptoms.

In addition to securing manpower, a systematic infrastructure for professional hospital operations, PTSD healing facilities such as recreation centers is not well established [10].

However, the firefighting organization is constantly trying to establish programs to overcome the trauma stress disorder of fire officials, and it is also trying to select counselors who are qualified to consult directly among fire officials so that they can become peer counseling. In addition, the Central Fire and Fire Protection School and local fire schools are worth making various thoughts and efforts,
including a one-week course on trauma treatment and a chance to heal firemen suffering from post-traumatic stress [11].

In addition, the organization of police officers has been studying problems related to post-traumatic stress disorder in earnest since 2015 and currently the National Police Agency has been operating a sympathetic healing process for a week, and has been conducting it in Jeju Island since last year with the aim of creating an environment that can be truly healed by being transferred to the headquarters of the National Police Agency. Of course, a week is very limited, but it is meaningful for police officers suffering from post-traumatic stress disorder to create time and opportunity to take care of themselves.

In addition, the company has contracted out outsourcing businesses related to counseling on a yearly basis to establish a system for police officers to be consulted on a regular basis [11].

3.2. Application of firefighting officers psychological stability program to railways officers

As mentioned in the above chapter, police organizations as well as firefighting organizations have already conducted research on post-traumatic stress disorder and are already making efforts to apply it to their members. However, railway organizations are aware of the importance of treatment for post-traumatic stress disorder that can be experienced by railway people, but their efforts to effectively introduce and apply programs on-site can be seen as visibly lacking.

For that reason, it would be one way to manage the contents of the post-traumatic stress-related programs of the firefighting organizations, which are thought, researched, organized and operated first, with educational programs suitable for the railway organization. In addition, counseling programs and counselors operated by fire and police organizations will have to be selected and deployed by the railway organization.

And also, the job training program, the special course for PTSD, which can heal post-traumatic stress, will also be operated as a special course. The reason for doing this is that psychological stability is a very important key to their successful performance of their work for railroad workers who take the initiative for the lives and safety of the people.

Since 7-8 years ago, there has been a shift in social awareness that psychological stability is important for railway people. But there is not enough research staff to do practical research. And the development and research of education programs on how to communicate smoothly with work colleagues or family members that can relieve the post-traumatic stress of individuals who are railways, and psychological management and mediation programs from experts will be needed.

4. Conclusion and Suggestions

The drivers' experience in accidents while operating will not only threaten their mental health but also reduce their work efficiency, leading to accidents caused by human error. Therefore, in order to eliminate the adverse effects of these stresses, we need to understand the psychological reactions and symptoms associated with accidents and develop programs to treat aftereffects such as post-traumatic stress disorder and panic disorder to actively utilize them [12].

Since there are differences in how to cope with the stress caused by drivers at different urban railway operators, it is necessary to carry out a customized program through one-on-one face-to-face consultation, and employees in the accident group will need to pay careful attention to prevent stress and panic disorder.

Also, drivers with accident experience should consider ways to minimize accident prevention and stress, such as creating a job environment where job stress can be overcome on their own by establishing self-diagnosis and supervision systems, and securing flexibility to offset negative experiences.
such as accidents and disabilities.

Suggestions for future research focusing on the limitations of this study are as follows.

First, the types of accidents that a driver may experience while in operation vary with machine failure, fire, friction with passengers, delay, and jumping accident, and there may also be differences in the mental aftereffects. Therefore, various questions related to accident types should be presented to distinguish the types of accidents and investigate them in more depth in the future.

Second, proper sampling for generalization is required, taking into account the total number of drivers. In addition, for a more accurate understanding of the mental health problems of drivers, the results of the survey may become more common if a full survey is conducted on those who have experienced accidents or committed suicide.

Third, multidimensional follow-up studies are needed to identify the critical factors that stress conditions develop from PTSD or panic disorders, including various variables such as lifestyle habits or demographic characteristics that affect mental health.

In foreign studies, investigations are conducted from at least several hours to weeks after accidents occur in operation, and long-term follow-up surveys are conducted from one month to one to three years later. Because this study also has the limits of recollection and traversal of the engineer’s individual, it is necessary to identify long-term trends from the acute stress reactions that may occur immediately after the accident, and to follow up with appropriate intervention at each time.

4. References

4.1. Journal articles


4.2. Thesis degree


4.3. Books

4.4. Additional references

5. Contribution

5.1. Authors contribution

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- A Study on the Fostering a Railway Tourism Specialist by Utilizing a Railway Erasmus Program, Korea Tourism Research Association, 30 (2016).

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5.3. Funding agency

This work was supported by Dongyang University Research Grant in 2019.