

An Analysis of Survivor's Egress Route Classified by each Train during Daegu Subway Fire

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Abstract

The purpose of this research is to analyze the survivor's egress route classified by each train during Daegu subway fire and to offer the basic data for the design of underground space and fire suppression, rescue. The making up questions were executed twice. Those consist of first making up question to find survivors' general subject during the fire time and second making up question to find the refuge pattern and situation during the fire time. The train passengers were classified as passengers of NO. 1079 and NO. 1080

1. Introduction

1.1 The purpose of research

The fire which was from 2003 February 18th Daegu subway is caused by incendiaries. There were casualties of 342 people and property damages. The fire from the special situation like the underground space brought to the enormous damages.

It cannot help investigating precisely the accident because of the tremendous damage and the fact that is not well equipped with the precautions in Korea, and similar case may happen in the future again. The tragic accident such as Daegu Subway Fire caused by overcrowding of cities, the rise of land

prices and insufficiency of a plane land space may break out in the future if we should take advantage of the underground space and rely on it more and more.

Therefore, we must reflect on the tragedy and then it is required that we make efforts to reduce the damages that may happen in the underground space in the future.

The purpose of this research is to analyze of survivor's movement route classified by each train during Daegu subway fire and to offer the basic data of a design of underground space and fire suppression, rescue.

1.2 The research scope and method

The research data investigated 146 person 2003 February 18th Daegu subway fire survivors. This data analyzed the data of 128 people about 1st question investigations and that of 102 people about 2nd question investigations.

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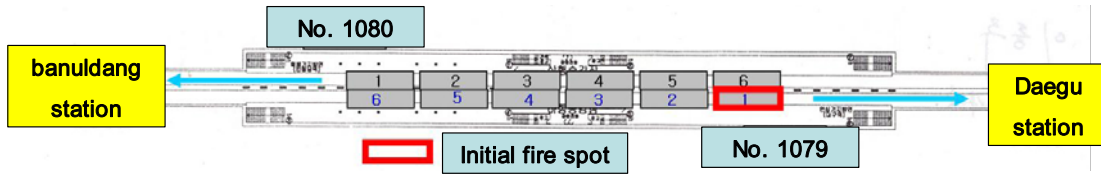


Figure 1. Stopping location of subway train at junganglo station

The recognition of fire which was from Daegu subway fire is composed of 1st question investigations and the item of 2nd question investigation is composed of the questions of total 60 things. Respondent of question classified with the subway on-board passengers and the users. The subway passenger classified with NO.1079 passengers and NO.1080 passengers especially fractionated each section.

2. Theoretical consideration

2.1 Overview of the Daegu subway

There was the fire in the Junganglo station of the Daegu subway line 1 at February 18, 2003.

The fire broke out at coach 1 of no.1079 subway train which was operating from the Jincheon station to the Anshim station. The breaking out time of the fire was about 9:53am and the time of putting out the fire was 1:38pm. The cause of the fire was the commitment of fire with arson that was used 4ℓ of volatile material. After the fire of no.1079 subway train, no.1080 subway train in the opposite direction was stopped at the Junganglo station and the fire was spreaded at no.1080 subway train. In the breaking out time of the fire, the number of passengers was supposed to about 640 persons, and the human damage because of the fire was total 440 persons that consisted of 192 persons of the death, 148 persons of the injured. The dead persons consisted of 142 persons in subway train, 49 persons out of train, and 1 person in recognition. The distribution of the

dead persons in electrical train was as follows.

2.2 a fire progress situation

We are as follows if we express in sequence of time about situation

occurrence between a NO.1080 train, a NO.1079 train, a subway briefing room, subway station, the fire fighting and police.

(a) 9:52:43, NO.1079 train went the banuldang station and approached into the junganglo station. The incendiaries to be on a first passenger coach set fire the just before the train approached at the station.

(b) 9:52:55, Train stops. The moment incendiary set fire after scatter the benzine in passenger coach. passengers began to come down and come down for the door of a NO.1079 train at 9:53 after a 5~6 seconds, incendiary came out to the passenger coach outside with attaching the fire to its body on. The moment the flame was wrapped the NO.1079 train up and passengers began to escape through the door to be opened.

(c) 9:53, the letter "The fire alarm" is found in the CCTV screen and there comes a fire alarm. But Men on duties ignored not to report at the synthesis commander's room because a fire alarm's failure was frequent

(d) We had an initial statement at a 9:54:40 fire fighting headquarter situation room. The deployment direction is sentenced at a 9:55:13 at the northern part fire station

(e) 9:55, Subway situation room report a occurrence of junganglo station's fire at the driving commission. NO.1079 train is fired at the same time the NO.1080 train started

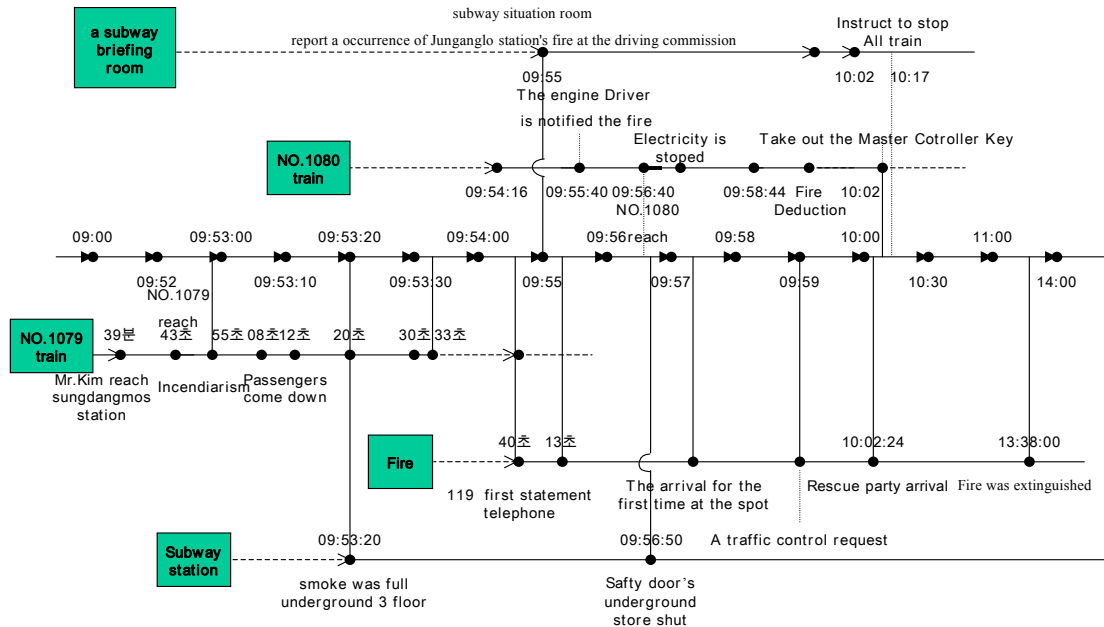


Figure 2. A fire occurrence Timetable

the daegu station at a 9:55:35 and was coming in to the junganglo station

(f) The smoke was full at an underground third floor at a 9:56:20

(g) A NO.1080 train starts from an opposite direction of daegu station at a 9:56:40 and approach Junganglo station. The safety door shut the underground store at a 9:56:50 by the fire sensor.

(h) 9:58, A NO.1080 train engine driver informed of the emergency situation at the synthesis commander's room. But there were not escape passengers at this time.

(i) The synthesis commander's room and NO.1080 train was mutually stopped the exchange of message at 9:59. The fire shifted opposite side of NO.1080 train from the heat of the NO.1079 train at this time. There was a fire at the ceiling and the seat covered with inflammable materials. And the fire spread rapidly.

(j) They requested the traffic control to a 9:59 police. 10:2 spot command posts are established. At the same time a NO.1080 engine driver takes out the Master Controller Key

(k) Passengers escaped through a NO.1 passenger coach and NO.4 passenger coach which opened the door to the manual. But many passengers could not open the door and were imprisoned.

(l) From AM.11 to AM.12 an identity authentication task and the number of a corpse confirmed by an emergency medical treatment organization. From AM.12 to PM.1 the medical treatment information center requested to convey a little injured person to small hospital.

(m) 13:38 the fire was extinguished and the director of a bureau of fire commanded in the spot at 14:11.

2.3 The damage status from disaster of Daegu subway

The damage status from the disaster of Daegu subway is as follows. A loss of lives is 192 the deceased and 148 the wounded. Total is 340. the immovable properties burned platform about 2,004 square meters of underground 3rd floor and 8,443 square meters of underground 1st~2nd floor among the area of 10,437 square meters. The

movable property burned the service facilities, waiting room machinery, tools, 12 passenger coach, communication equipment and platform equipment

Total property damage is around 47 billion won. The restoration expenditure is presumed to the 516 billion won as a great economic loss

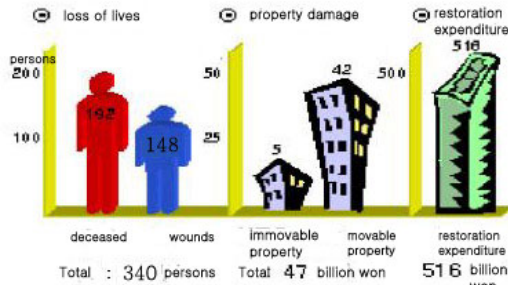


Figure 3. The damage current situation

2.4 A Junganglo station of the Daegu subway

The Junganglo station of the Daegu subway line 1 was at the length of 700m with nearby the Banouldang station and the Daegu station. And the Junganglo station was located in the center of town of Daegu city, traffic is complex and there were many of passengers and it was combined with the underground stores. There were the stop location of the subway train and the location of the exit to lead from the platform to 2nd underground floor in figure 2. The structure of the Junanglo station is the steel-concrete structure, it is consisted that the platform is on the 3rd underground floor, the ticket gate and lobby on 2nd underground floor, and the space of 1st underground floor is used as lobby and connected the Jungang underground stores.

The coach 3,4 of the subway train was located the middle stairs, each end of the subway train was located the edge stairs to take upstairs. The longest distance between the subway train and stairs is 60m, the fire originated from unit 1 of the no.1079 electrical train. The shortest moving distance, not turn back, from the platform of 3

underground floors to ground exit is 120m in case of no.1080 subway train. And the longest moving distance is 171m. Passengers can move the shortest distance at coach 1, and the longest distance at coach 6. The moving time of normal adult man is required over 2 minutes from the coach 1 of no.1080 subway train to the ground exit, and over 3minutes from the coach 6 of no.1080 subway train to the ground exit.



Figure 4. the route map of the Daegu subway inel

3. The survivor's evacuation analysis of 2003 February 18th Daegu subway fire

3.1 The classification of survivor 's occupation

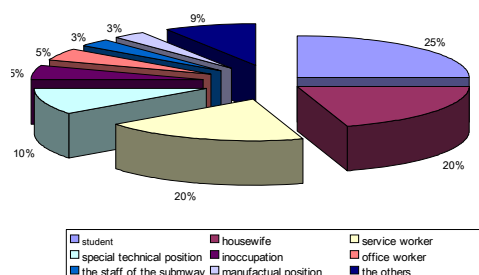


Figure 5. distribution of survivor by job

According to the result of a 1st poll, the students in the survivor of 128 people were 32 people. And then, the housewife and the service worker were each 26 people and 25 people. Because of the accident occurrence in the morning approximately 9:35, the

damage of the students and the house wives was occurred plentifully

3.2 The distinction of sex

According to the result of a 1st poll, the sex of survivors was composed of 58 men and 70 women. Each of age-group was indicated with the picture 6. The ratio of the female is higher than the male from age above 20.

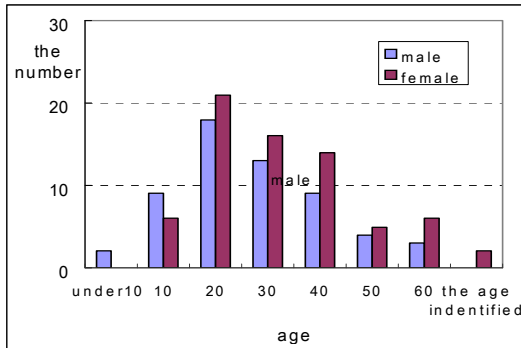


Figure 6. sex ratio of survivor by age

rescue party is the highest. If the female and the male are separately investigated, the woman got the help from the rescue party plentifully but the male escaped more own ability than the rescue party's help. When it analyzed the whole, the rescue by the rescue party was the highest. However, the escape of survivor's own ability was high between age above 20 and age under 40.

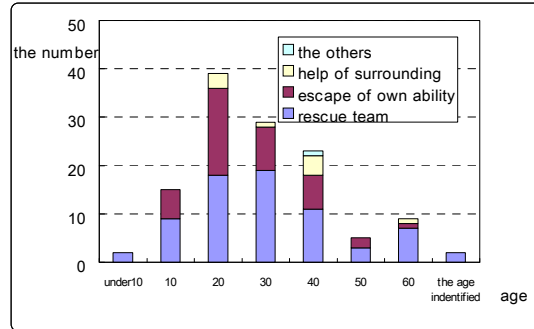


Figure 8. escape situation by age

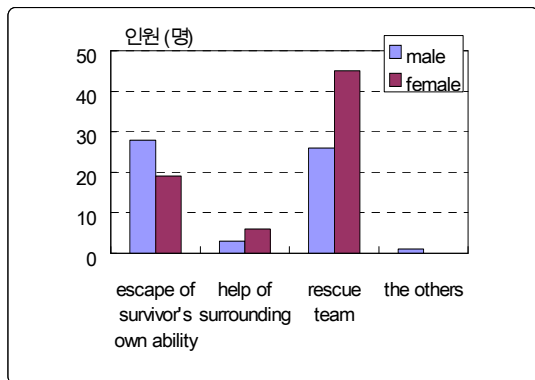


Figure 7. escape situation of survivor by sex

3.3 The escape condition of Survivors

According to the result of a 1st poll, the escape of survivor's own ability was 47 people and the person who had the help from the rescue party was 71 people. 9 people had the help from the surrounding people and a person was the other situation. When analyzing with the survivors upon the whole, the case which had the help from the

4. The survivor's reaction analysis of Daegu subway fire

4.1 The movement speed of a pedestrian

Walking speed of the adult is 81m/min and the walking speed of the stairway rising is 33m/min.

(1) NO.1080

The shortest distance which was the flat distance is about 85m from the B3 to the ground exit, and 36m from vertical distance. The greatest distance which was the flat distance is about 135m and 36m vertical distance. A movement time of the adult takes approximately 2 minute from the 1st coach of NO.1080 to the ground exit. The time of the movement which takes from 6 coach to the ground exit is required approximately 3 minute.

(2) NO.1079

The time of the movement is identical both NO.1079 and NO.1080

4.2 The analysis of the escape route

The whole of NO.1079

When it followed in 2nd question investigation for the 102persons, responder was available totally of NO.1079 train because of only 9persons there.

The survivors whom it escaped at the Academy Theater and the Dong-a department store were the maximum of 3 persons. Furthermore, the survivors who came out in the opposite exit were 3 people.

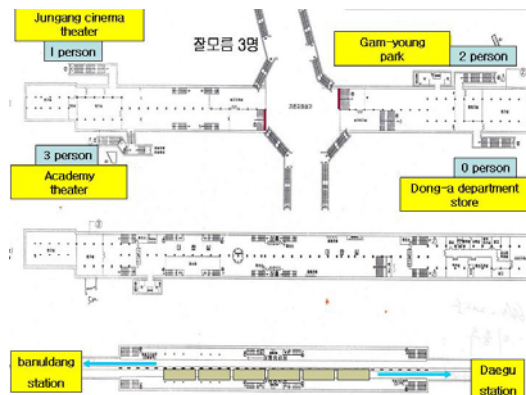


Figure 9. total survivor's escape route of NO. 1079 subway train

And remaining 3 people answer back that there is no memory for it

(2) 1st coach ~ 2nd coach of NO.1080

The survivors who rode on the 1st~2nd coach of NO.1080 were total 27persons. The evacuee of the shortest escape route was 3 persons. Although 2nd coach to Gam-young Park is the shortest course, the evacuee must cross once more in the B2.

When the fire was occurred, refugees touched the wall with the hand and moved about it sometimes. But, to cross the passage can be able to lose a sense of direction. Conclusively, the shortest escape route from 2nd coach is the nearest to the Jung-ang cinema theater. While evacuating, the experienced persons who crossed the passages over once were 16 persons

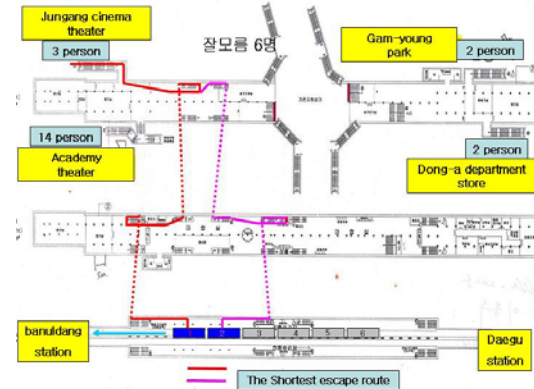


Figure 10. survivor's escape route of NO. 1080's 1st~2nd coach

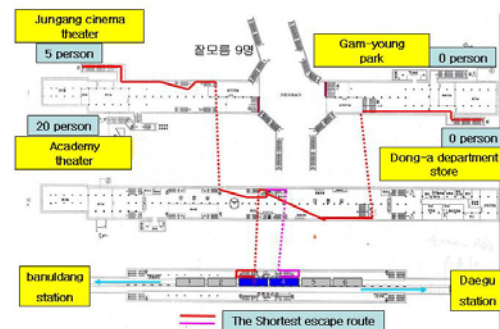


Figure 11. survivor's escape route of NO. 1080's 3rd~4th coach

(3) 3 coach ~ 4 coach of NO.1080

According to the result of poll from the 3rd coach ~ 4th coach, the survivors were the total 34person. The evacuee of the shortest escape route was the 5 persons. The survivors whom it escaped to the Academy Theater were the maximum of 20 persons. The survivors not to remember the escape gateway were 9persons.

(4) 5th coach ~6th coach of NO.1080

The responders who rode in 5th ~ 6th coach of NO.1080 were only 9persons. When compared to the different train, the rate of survivor is low. When the fire was occurred, The NO.1080 of train arrived at approximately AM9:45 in Jung-ang-ro

station. But the fire had been processed already when the 5th coach and 6th coach of a train arrived an initial ignition point, the front was not seen almost because of the smoke. When considering like this situations, the 5th~6th coach of NO.1080 is most inferior compared with the different train. In survivors of 9 persons, the survivors who escaped on the shortest escape course were a person in the 6th coach. The survivor who escaped at the Dong-a department store crossed the passages once more. And remaining survivors would cross the passages once more.

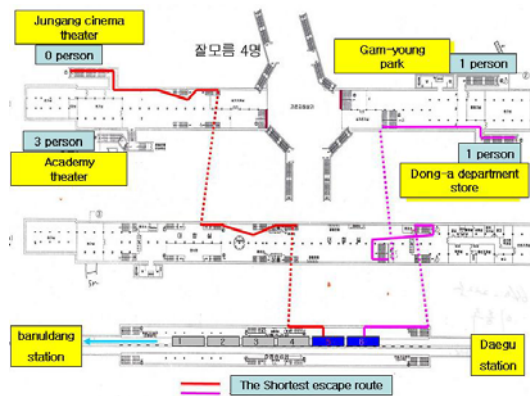


Figure 12. survivor's escape route of NO. 1080's 5th~6th coach

5. The conclusion & research subject of the future.

When it followed in 2nd question investigation to the 102 persons, Twelve percent of the refugees who were the maximum of the 12 persons were available to escape the shortest route. According to the result of the poll, the people to reply that we took the help of evacuation induction system did not exist because of problem of the existing refuge facilities. The evacuation induction system which depends only time to power failure are useful. Nevertheless; evacuation induction system becomes the deadwood, caused by the smoke in fire occurs. The development of the induction

equipment which is useful for the future will be necessary. This report is only made of research about the survivor. When the investigation against the rescue party is hereafter reinforced, we will investigate the relief route of the rescue party and the refugee's egress route, and grope the improvements of relief activity further.

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