

A Development of Assessment Model for Maintenance of Type R Fire Alarm System in the Building

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Abstract

Type R fire alarm is required intelligent buildings and height buildings which was based on automatic system. But in Korea, maintenance of fire alarm system is very poor. In this study, we developed assessment model for the type R fire alarm system which was assessed by using 96 checklist items.

The assessment model was tested through the actual 4 buildings with type R fire alarm system.

It is shown that present model can be applied for the assessment of all buildings through the examination of the suitability of assessment model by actual assessment. Also, it was made easily fire manager to carry out checklist for type R fire alarm system in buildings.

1. Introduction

Recently type R fire alarm system was more automatical than other fire protection system and required high accuracy. Also, It must have capacity which can detect fire or not, fire scale, confirmation of fire source place and search skill. So this system often needs check with a measured apparatus, but it is very far from the reality of our society.

For a development of model for maintenance of type R fire alarm system in the buildings, (1) we have compared the type R fire alarm system with type P, (2) analyzed characteristics of each components of the type R fire alarm system, (3) analyzed type R fire alarm system that used in Korea, (4) made the checklist by that information, (5) assessed buildings with the checklist (6) and then developed the maintenance model for the assessment type R fire alarm system.

Whether the fire alarm system was an action to be no fire or was not act on a fire, the system got reduced reliability. So we had to study how to cope with the situation.

2. Main Discussions

2.1 Method of Assessment

To assess type R fire alarm system, we performed order as following.

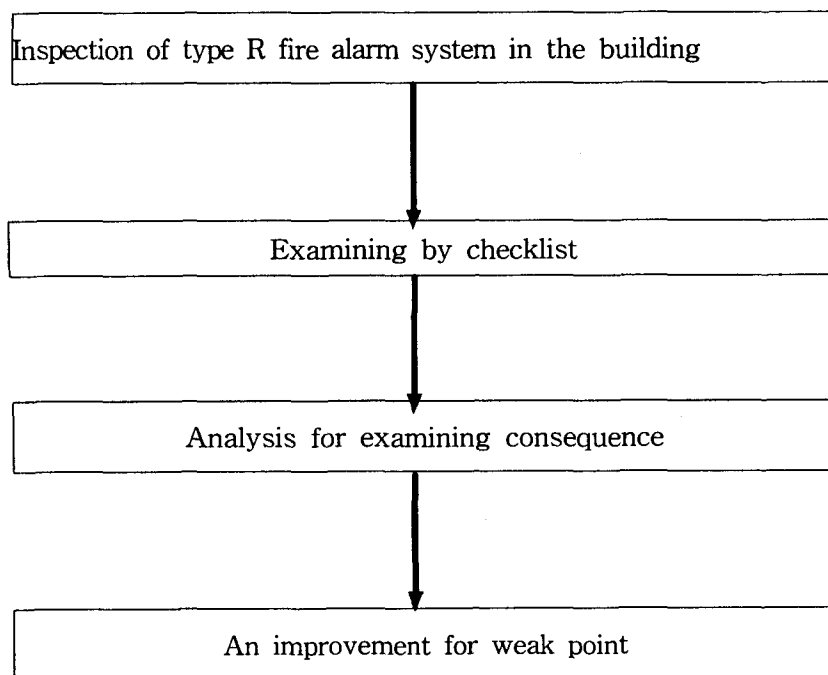


Figure 1. Proceeding of Assessment

2.2 Quantitive Analysis of Assessment

2.2.1 Weighted Values of the Factors Classified in Large

A questionnaire survey was conducted for the fire protection specialists (involved 5 P.E., 5 Expert).

We determined the weighted effects of 5 factors for type R fire alarm system in the building, and gained results as following.

Table 1. Weighted Values for the Assessment factors

Factors	The ranking of priority	Weighted Values
Supervisory Station	4	15%
Fire Alarm Annunciator	2	30%
Repeater	3	15%
Detector	1	35%
Alarm System	5	5%

2.2.2 Rating of the Factors for Assessment

Except for special cases, the weights were given to the checkpoints by classifying each of them into 3 classes and using differential weights for each class. Namely,

- Important : When a factor is important in terms of function or maintenance (10 points)
- Necessary : When a factor is not much important, but necessary (7 points)
- Ordinary : When a factor is an object of general management (4 points)

Calculation of scores for each factors get that the scores (10,7,4) were calculated by following equation

$$\text{Total scores} = \frac{\text{gaining scores}}{\sum \text{scores of the factors ed}} \times \text{class weight}$$

also average scores for each factors = (sum scores of the factors checked) / gaining scores × 100

Generalization table of the assessment scores is as shown in table 2.

Table 2. Generalization table

Factors	A number of assessing items	Sum of scores of items	Weighted Value	Gained scores	Total scores
Supervisory Station	30	282	15%		
Fire Alarm Annunciator	29	263	30%		
Repeater	12	111	15%		
Detector	13	114	35%		
Alarm System	12	105	5%		
Sum	96	875	100%		

2.3 Results of Actual Assessment

We selected 4 buildings for actual assessment. There involved in A resort, B land, C laboratory, D thchnical center. The results of assessment scores are as shown in table 3 and figure 2.

Table 3. The results of assessment scores

Division	Supervisory Station	Fire alarm Annunciator	Repeater	Detector	Alarm System	Total Scores
A resort	71.31	91.25	82.88	77.19	79.05	81.47
B land	78.69	79.85	79.28	78.95	83.81	79.45
C laboratory	80.33	80.99	86.49	74.56	92.38	80.03
D technical center	80.33	87.45	81.08	78.95	88.57	78.55

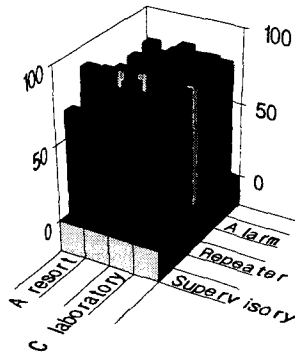


Figure 2. The results of assessment scores

2.4 Re-Assessment after improving of the weakest part

The results of assessment for 4 buildings with type R fire alarm system showed that the weakest parts were supervisory station and detector. So we selected 2 buildings with the weakest parts and improved the situation. Then, we carried out re-assessment of the buildings, the results are as shown in table 4.

Table 4. The results of re-assessment scores

Division	Supervisory Station	Fire alarm Annunciator	Repeater	Detector	Alarm System	Total Scores
A resort	93.44	91.25	82.88	77.19	79.05	84.77
C laboratory	80.33	80.99	86.49	85.96	92.38	84.02

It was found that the each scores increased from 81.47 to 84.77 and 80.33 to 84.02, which suggests that all parts correction would lead to a higher scores. If the items of checklist should be managed detail, safety of the buildings can be increased.

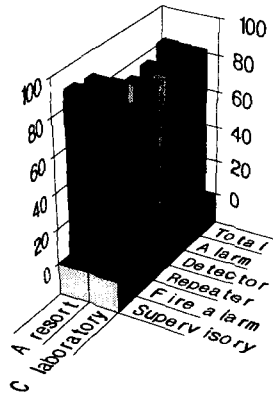


Figure 3. The results of re-assessment scores

2.5 Failure Mode of type R fire alarm system

We investigated failure mode on each factors of type R fire alarm system.

1. Fire alarm annunciator

- An incorrect operation of no fire situation
- Inferior supervisory signal for moving fire spread prevention system and other fire protection system
- A location on indicator pannel different from an actual location.
- No secondary power supply in Fire alarm Annunciator
- Fire door was closed automatically when detector operated.
- On operating printer, date and time is incorrect

2. Supervisory Station

- Service personnel was not qualified
- Non-maintained emergency luminaire is not in supervisory station
- Control room was used with different duty.

3. Repeater

- Each repeaters did not have address.
- False repeater

- Sign of desk pannel on Fire alarm Annunciator was different from input and output sign of repeater.
- Wiring in repeater was not orderly.

4. Detector

- Thermoresponsive part was painted.
- False detectors were not changed.
- Detectors were not located in environment conditions which was influence response.
- Detectors were not set up.

5. Alarm system

- Wiring was cut off between push button and fire alarm annunciator.
- Local alarm wiring was cut off
- Inferiority of telephone line

3. Conclusion

In this study, we assessed buildings with type R fire alarm system, and developed an assessment model for maintenance. The model consists of a total 96 items which would be rated to be weighted by 5 calssified factors to be converted into 100 percentage scores.

The research results are as following;

1. Problems of the type R fire alarm system are shown in this study orderly.
2. The suitability of assessment model for type R fire alarm system was confirmed to carry out evaluating 4 buildings by checklist method.

The results for 4 buildings are as follows ; A Resort town got 81.47, B Land got 79.45, C Laboratory got 80.03, D Technical town got 78.55. Supervising station, detectors found as major weak items. After improving major weak items, evaluation of A Resort town obtained 84.77 points increased by 3.30 points, C Laboratory obtained 84.02 points increased by 3.99 points. Also, it was reasonable to order the priority of assessment items for fire protection experts.

3. The assessment model for maintenance included supervising station, repeater, control unit, detector, alarm signal is very useful assessment items.

This evaluation model could conclude that the model could be applied to type R alarm system all buildings through the examination of the suitability by actual evaluation for buildings.

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