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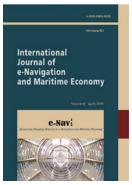

Original article

A Study on the estimation of service life on Aids to Navigation

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Abstract

Given the technological innovations of the fourth industrial revolution, cutting-edge ICT technology has been applied in research on aids to navigation, and due to the emergence of new types of equipment and technological advancements, it is necessary to apply realistic standards to the designation of service lifetimes to aids to navigation facilities' equipment and components. In addition, it is necessary to prepare a legal basis for the effective operation of aids to navigation facilities' equipment and component. Therefore, in this paper, improvements in the designation of realistic service lifetimes are suggested by investigating the service life management and operation status of domestic and foreign aids to navigation, providing on-site surveys on the management status of aids to navigation facilities in Korea, and with a questionnaire survey to gather expert opinions.

Keywords: Aids to Navigation, service life, the standard of service life designation

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1. Introduction

Korea is surrounded by the sea on three sides, and in particular, the west coast and the south coast have complex coastlines and many islands, which poses a risk to ship navigation. So, the importance of Aids to Navigation facilities used for safe navigation of ships is increasing.

As the technological innovation of the 4th industrial revolution spreads to the maritime field, autonomous surface ship is being developed, and technological changes are required for Aids to Navigation that is the basic infrastructure for maritime safety. Accordingly, new technology has been introduced in the field of Aids to Navigation.

In addition, the service life of Aids to navigation facilities equipment and component is designated and operated in accordance with the Navigational Aids Act and management guideline of Aids to Navigation, but due to the emergence of new types of equipment such as self-contained signal lantern and advancement of technology, it is necessary to re-designate the actual service life.

For this purpose, it is urgent to understand the current status of existing and new types of Aids to Navigation facilities, and it is necessary to designate the service life of new types of products manufactured by the introduction of new technologies. In addition, it is necessary to prepare a legal basis for effective equipment operation through the amendment of the law on new types of Aids to Navigation facilities equipment and component.

Therefore, in this paper, the standard for designation of realistic service life and a legal basis are suggested through investigating the service life management and operation status of domestic and foreign Aids to Navigation, on-site survey on the management status of Aids to Navigation facilities in Korea, questionnaire survey and expert opinions.

2. Literature review

Researching the cases related to the service life, most of them were based on value evaluation to estimate economic value.

Oh and Jo (2018) conducted an estimation of average service life in appraisal by using Korea National Wealth Survey Data.

In this study, the final average service life was calculated by fitting the national wealth survey data using the Iowa curve by estimating the critical value at which the survival curve and the predicted life curve coincide with the discarded lifespan.

Baek and Park(2016) attempted to compare and analyze the current state of operation of firefighting equipment systems in Japan, the United States, and Korea to legislate the service life of firefighting equipment, and to suggest practical directions through a survey. However, only differences of opinion on the selection of the useful life period were confirmed and no specific alternatives were suggested.

Korea association of Aids to Navigation (2009) proposed a consumer-oriented designation proposal of the service life of Aids to Navigation equipment and component through a service life research related to equipment and component of marine transportation facilities. The service life designation cases and management status related to domestic and foreign Aids to Navigation equipment and component were investigated, and opinions on the service life of major products were investigated for Aids to Navigation companies and those results are reflected to the service life designation(draft).

Oh·Kim·Suh·Cho(2007) analyzed the discard rate and distribution pattern of manufacturing facilities using the survival function to calculate the economic service life of semiconductor manufacturing facilities, and presented the average service life through this. The Iowa curve function was used as the survival function, and although it meant that a large amount of analysis was performed on semiconductor manufacturing facilities, it has limitations in that it lacks basic data and that the analysis results are not significantly different from those of other industrial facilities.

Hwang and lee (2002) constructed a performance change model through 1000 simulations by analyzing the relationship between the performance and cost of each facility to estimate the service life of military facilities.

This study is meaningful in that it developed a performance estimation model using the metric analysis.

However, the application of a research model based on estimates and assumptions in a situation where there are no performance evaluation standards for facilities in Korea indicates a limitation in that it is biased toward theoretical research with insufficient reliability.

Ko (1998) estimated the optimal economic lifespan of a multi-housing complex from the perspective of economic lifespan theory. To predict the economic service life, MAPI theory and LCC theory were used. The service life of the multi-housing complex according to the MAPI theory was predicted to be 35 years, and the service life of the multi-housing complex according to the LCC theory was predicted to be 36 years. Although it is meaningful to optimize the lifespan of an asset from an economic perspective, an application model limited to real estate was used, and the limitation of applying the service life under the tax law, which lacks realistic data for the main assumptions for economic analysis, was taken into account.

The previous studies for estimating the service life had developed quantified research models such as the Iowa curve function, MAPI, and LCC research models and applied them to specific cases to estimate the useful life. Also, various research methods were applied, such as a method of estimating the service life through a survey of actual conditions and a questionnaire survey to collect opinions from the field.

Each research method clearly had advantages and disadvantages. In the case of the Iowa function curve method, it showed a disadvantage in that it lacks realism with the service life of the actual assessed asset by relying on a statistical perspective. In the case of the performance change simulation method, there was no standard for judging the performance change in Korea, so it had a limitation in developing a subjective model that relied on estimation and assumption. In the case of the MAPI and LCC research models, there was a sense of disparity from the consumer-oriented evaluation of service life, as the research results were limited to economic feasibility and lack of realistic estimation of the research model.

Therefore, this study intends to apply a research method focused on on-site survey and demand survey to overcome the limitations of previous studies and to improve the objectivity and reality of estimating the service life of Aids to Navigation aids facilities equipment and component.

To prepare a standard of designating the service life reflected comprehensive opinions, this study investigates operation status of domestic companies and management organizations of Aids to Navigation. And questionnaire survey to consumers is conducted based on data on the service life operation status of Aids to Navigation derived from domestic and foreign research.

3. Current status research of the service life of Aids to Navigation in Korea and other countries

3.1. Foreign current status of the service life

Foreign current status research was conducted in Japan, China, the United States, Singapore, Germany, Sweden and Canada. But Japan, China and U.S.A are analyzed because the service life of Aids to Navigation facilities in Singapore, Germany, Sweden, and Canada is not regulated by law.

3.1.1. Japan

In Japan, the service life of major depreciable assets is designated by the Ministry of Finance and is based on the evaluation guidelines for price revision of the national property ledger. Aids to Navigation facilities of Japan are installed and managed by the Transportation division of the Japan Coast Guard under the Ministry of Land, Infrastructure and Transport and Tourism. And the service life is classified into Legal service life and Actual service life. Legal service life is service life according to regulation of Corporate Tax Act for depreciation of fixed assets. And actual service life is Service life on practical contents determined by the experience of long-term practitioners and statistical processing of accumulated data. Equipment and component operators prepare a basis for disposing of equipment based on the legal useful life, but can use the equipment further by applying the actual service life depending on the budget, policy priorities, and condition of the equipment.

3.1.2. China

China’s State Administration of Taxation designates the service life of major depreciable assets and application standard of the service life based on the implementation of the enterprise income tax law.

Aids to Navigation facilities of China is being managed

and repaired by the China Maritime Safety Administration under the Ministry of Transport. The China Maritime Safety Administration managed and operated Aids to Navigation in accordance with Aids to Navigation ordinance and the service life was designated according to this ordinance.

3.1.3. U.S.A

Aids to Navigation facilities of U.S.A are managed by the Coast Guard under the Department of Home-land Security. And U.S Coast Guard provides buoys and support devices indicating straits and ports, navigational position signal. The navigation center in U.S Coast Guard is operated to manage and maintain Aids to Navigation facilities. The service life is designated for each item based on the "Ch-6 To AtoN Manual-Technical, COMDTINST M16500.3A" regulations.

3.1.4. Comparison of the service life by country and implications

Table 1 shows a comparison of the service life of Japan, China, and U.S.A, which have legally designated the service life. In order to compare each country, the service life of Aids to Navigation facilities equipment and component of Korea was compared as a standard, and only the overlapping parts compared with Japan, China, and the United States were summarized.

Table1:Comparison of the service life of Aids to Navigation facilities equipment and component

ITEM	Korea	Japan	China	U.S.A
Solar cell(Light house)	15	15	-	20
Remote controller	9	10	-	-
Air siren	15	15	-	-
Electronic horn	13	10	-	-
Lead storage battery	3	6	3~4	2~4
Maintenance free lead storage battery	4	6	-	-
Marine signal lantern LED-200(3,5,7NM)	9	-	-	12
Marine signal lantern LED-200HI(9NM)	9	-	-	12
Marine signal lantern 250mm	9	-	-	12
Leading light	10	-	5	-
Illuminating light	10	-	5	-
Direction light	10	-	5	-
Bridge light	9	-	5	-
Buoys	15	15	10~15	-
Solar cell (Lighted buoy)	12	15	-	-
Remote terminal unit	9	10	-	-
Monitoring and control unit	10	10	–	–
Control/monitoring equipment	10	10	-	-
Tidal signal electronic display	25	30	-	-
Computer	5	-	4~10	-
Monitor	5	-	4~10	-
Diesel generator	11	15	15	-
Uninterruptible power supply	10	15	-	-

A total of 47 items were designated for service life of Aids to Navigation equipment and component in Korea, 17 in Japan, 9 in China, and 5 in the United States. As a result of comparing Korea's items with its service life, it was found that Japan had three short-term items, China had four, Japan had ten long-term items, China had four, and the United States had seven similar items and China had one to Korea.

As a result of investing foreign cases, the following implications could be drawn.

First, in case of overseas, there are few government regulations and they are managed as consumables. These are to encourage market competition and technology development by reducing designated items with service life.

Second, most of the items are similar or long-term service life to domestic ones. This is to flexibly designate the service life according to technical

properties in consideration of service life and economic life.

Therefore, through overseas cases, flexible service life designation and management are required in consideration of the technical properties and economic service life of Aids to Navigation in Korea as well

3.2. Domestic current status of the service life

3.2.1. Public procurement service

The Public Procurement Service designates the service life for items that require management based on the Commodity management Act. The service life was designated for 1,671 major items, divided into 60 fields. In determining the service life of these items, the average years of use, the durability period stipulated by other laws or legislation of self-government, and the durability period stipulated by the Korea real estate board were taken into consideration.

Although the service life is not designated for all items, the service life is designated for large amounts of goods, large quantities of goods, and goods commonly used by many organizations.

3.2.2. Korea real estate board

According to the Enforcement ordinance of the Commodity management Act amended in 2016, the Act was enacted to consider the durability period set by the Korea real estate board among the standard for calculating the service life of the Public Procurement Service. Therefore, the Korea real estate board publishes the service life of tangible fixed assets, which are importantly used in calculating the appraisal value of various assets, determining the tax base, business accounting, and national wealth survey data. And this was used as an important basis for calculating the service life of the Public Procurement Service. The service life table of tangible fixed assets showed economic service life for 5,300 types of assets based on standard of industry classification codes.

3.2.3. Ministry of oceans and fisheries

The service life of Aids to Navigational equipment and component of Korea is stipulated in the service life table announced in the management guidelines of Navigational Aids Act. Based on this service life table, each regional office of Oceans and Fisheries under the Ministry of Oceans and Fisheries was in charge of maintenance, repair and management of Aids to Navigation.

3.2.4. Comparison of service life by each institution and implications

In Korea, on the basis of the service life designated by the Public Procurement Service, the service life was designated by a separate law according to the goods managed by each institution. In addition, the service life of tangible fixed assets published by the Korea real estate board was used as the basis for designating the service life by the Public Procurement Service. Therefore, the service life of the Public Procurement Service and the Korea real estate board related to the navigational aid facilities was designated with almost similar standards.

Considering these results, the results of comparing the service life of the Public Procurement Service and Aids to Navigation and implications are as follows.

First, among Aids to Navigation facilities equipment and component, compared to the Public Procurement Service, 8 items were short-term, 5 items were long-term items, and 34 items were same standard.

Second, most of service life related to Aids to Navigation are designated according to standards similar to those of the Public Procurement Service.

Third, the service life designated by the Ministry of Oceans and fisheries is subdivided compared to the items of the Public Procurement Service, and there are some differences in the designation of the service life by reflecting environment and technical characteristics.

Therefore, it is required to use the standard of the Public Procurement Service as a basis for additional items and items with a change in service life in the future, but to designate service life reflecting environmental, technical, and economic characteristics for subdivided items.

4. Research of field condition of the service life on Aids to Navigation in Korea and questionnaire survey

4.1. Research of field condition of service life on Aids to Navigation in Korea

Research of field condition of the service life on Aids to navigation facilities equipment and component was

conducted on various Aids to Navigation under the each regional office of Oceans and Fisheries and the National Maritime PNT Office. Each office of Oceans and Fisheries managed major Aids to Navigation facilities through a computerized management system. Therefore, the survey was conducted by using the computerized management system but the National Maritime PNT Office and tidal signal station were not connected with computerized management system, so an online document investigation was conducted.

Since all items were not managed in the computerized management system, the items managed in the computerized management system were mainly investigated and the average years of use and the number of discards required to calculate the useful life were investigated, and opinions were collected from field managers.

The average age of was calculated as the age of use of items that have been treated as insoluble. Table 2 shows the average service life and discarded quantity.

Table2: Average years of use and discarded quantity

Item		Average year of use	Discarded quantity
Marine signal lantern	LED-200	7.4	789
	LED-200HI	6	126
	250mm	10	1,277
	300mm	8.8	50
	400mm	7.75	10
	750mm	-	0
Racon	-	13.5	55
Lead storage battery	Light house, lighted buoy	8	16,817
Maintenance free lead storage battery	Light house, lighted buoy	7	5,414
Solar cell	Light house	14.8	2,429
	lighted buoy	7.1	1,736
Charge and discharge controller	Light house, lighted buoy	10.6	1,455
Buoys	Steel	15.2	513

4.2. Questionnaire survey

A questionnaire survey was conducted to collect the opinions of field managers on the designation of the service life of Aids to navigation facilities. The survey was conducted for two months from July 20 to September 19, 2020, and the general details of the respondents are shown in Tables 3,4.

Table3: Affiliated organization

Division	Frequency	Percentage (%)
Aids to Navigation Division of regional office	186	91.6
National Maritime PNT office	8	3.9
Companies related to Aids to Navigation	9	4.4
total	203	100.0

Table4: Career

Career	Frequency	Percentage (%)
Below 4 years	36	17.7
5~9 years	39	19.2
10~14 years	21	10.3
15~19 years	40	19.7
Over 20 years	67	33.0
Total	203	100.0

The contents of the survey were conducted by examining whether the existing items were selected and their service life. Maintenance free enclosed type Battery, AIS Aids to Navigation, Maritime meteorological observation apparatus, Oceanographic observation apparatus, Maritime meteorological Observation Data logger, Drone and Small boat are increasingly installed as a result of field survey. So, these items were included in the survey. And Table 5 shows the survey results. As a result of the survey, most items were maintained, but items related to antenna types and tidal signal systems were not maintained. In addition, the result of wanting to exclude Lead storage battery from the designation of their service life is considered to be a result of the trend of decreasing use of Lead storage battery. Regarding

the service life proposal, there were many items with a shorter service life than the current service life.

Table5:Result of questionnaire survey

Item	Navigational Aids ACT	questionnaire	
		Selection of designation	Suggestion of service life
Solar cell (Light house)	15	○	10
Charge and discharge controller (Light house)	10	○	10
Remote controller	9	○	9
Air siren	15	○	14
Electronic horn	13	○	12
Lead storage battery	3	X	3
Maintenance free lead storage battery	4	○	4
Marine signal lantern LED-200(3,5,7NM)	9	○	8
Marine signal lantern LED-200HI(9NM)	9	○	8
Marine signal lantern 250mm	9	○	8
Marine signal lantern 300mm(11,15,18NM)	9	○	8
Marine signal lantern 400mm(20,26NM)	15	○	11
Marine signal lantern 750mm(27NM)	15	○	11
Leading light	10	○	9
Illuminating light	10	○	9
Direction light	10	○	9
Bridge light	9	○	8
Buoys	15	○	12
Solar cell (Lighted buoy)	12	○	9
Charge and discharge controller (Lighted buoy)	6	○	7
Remote terminal unit	9	○	7
DGNSS beacon transmitter	10	○	10
DGPS triangle guyed transmission antenna	20	○	16
DGNSS RSIM receiver	10	○	9
GNSS receiving antenna	10	○	9
DGNSS beacon receiver	10	X	9
Loran(Loran, eLORAN) transmitter	20	X	17
Loran(Loran, eLORAN) triangle guyed transmission antenna	20	X	17
Loran(Loran, eLORAN) receiver	10	X	10
Cesium atomic clock	20	X	16
Racon	10	○	9
Control/monitoring equipment	10	X	9
Sensor	10	X	9
Transmitter and Receiver	10	X	9
Tidal signal electronic display	25	X	20
Operation server	-	○	7
Monitor	5	○	5
Diesel generator	11	○	11
Uninterruptible power supply	10	○	10
Thermo-hygrostar	9	X	9
Maintenance free enclosed type Battery	-	○	4
AIS Aids to Navigation	-	○	7

Maritime meteorological observation apparatus	-	X	6
Oceanographic observation apparatus	-	X	6
Maritime meteorological Observation Data logger	-	X	6
Drone		○	6
Small boat		○	9

5. Improvements to the designation of service life of Aids to Navigation facilities equipment and component

The designation of the service life of Aids to Navigation facilities applies the standard of The Public Procurement Service. But The following are improvements that reflect the domestic and foreign status analysis, 2 persons of the fifth rank official, two persons of the junior official, on-site survey and questionnaire survey.

5.1. Improvements to existing Aids to navigation facilities equipment and component

1) Solar cell

Since solar cells are used interchangeably with light house, lighted buoy, and lighted beacon, it is necessary to manage them as the same item. Therefore, it is reasonable to change the standard for Aids to navigation, which has the meaning of including light houses, lighted buoys, and lighted beacons. In addition, since the current service life is 15 years for lighthouses and 12 years for light buoys, which is longer than the 10 years standard of the Public Procurement Service, it is reasonable to apply the standard of the Public Procurement Service.

2) Remote controller

The service life of the remote controller is stipulated by the Public Procurement Service as 10 years. But the current service life announcement for Aids to Navigation facilities stipulates that it is 9 years under the same name. The remote controller notified by the Public Procurement Service and the remote controller in the service life notice of Aids to Navigation facilities equipment and component has different uses and cannot be used together on land and at sea, so their name of items should be distinguished.

3) Lead storage battery, Maintenance free lead storage battery

Lead storage battery and Maintenance free lead storage battery are used interchangeably in light house, lighted buoy, lighted beacon and light pole, and they are not produced separately for light house and lighted buoy. Therefore, it is necessary to change the standard for Aids to Navigation, which can comprehensively mean the places where Lead storage battery and Maintenance free lead storage battery are used, such as light house, lighted buoy, lighted beacon and light pole.

4) Marine signal lantern

According to the function and specification standards of Aids to Navigation facilities equipment and component announced by the Ministry of Oceans and Fisheries, the maritime signal lantern is divided into flash and rotary type according to the character of light, and subdivides into visibility of light and power system. Considering that the name of item currently stipulated in the service life of Aids to Navigation is different from the function and specification standards of Aids to Navigation facilities equipment and component, it is necessary to change the product names with the service life to the name of item and specification that meet the functional and standard. Therefore, the names of LED-200(3,5,7NM), LED-200HI(9NM), 250mm, 300mm(11,15,18NM), 400mm(20,26NM), and 750mm(27NM) are unified as marine signal lantern. And the standard of LED-200(3,5,7NM), LED-200HI(9NM), 250mm, 300mm(11,15,18 NM) that are flash type should be classified as “medium/small, flash”, and the standard of 400mm(20,26NM) and 750mm (27NM) lights that are rotary type should be classified as “medium/large, rotary”.

In addition, the service life of the marine signal lantern LED-200(3,5,7NM), LED-200HI(9NM), 250mm, 300mm(11,15,18NM) is 9 years, which is less than stand of the Public Procurement Service, but As the regular inspection period was changed from 3 years to 4 years according to the management guidelines of Navigational Aids Act, it is reasonable to adjust the service life to 8 years in consideration of management efficiency.

5) Bridge light

Marine signal lantern LED-200 and LED-200HI are currently being used for bridge light through the field survey. Therefore, it is reasonable to delete the bridge light since it can be managed as marine signal lantern rather than separately managed.

6) Charge and discharge controller

The standard of the charge and discharge controller of Aids to Navigation is prescribed for the lighted buoy. But the charge and discharge controller was used interchangeably in light houses, lighted buoy, lighted pole. Therefore, it is necessary to change it to Aids to Navigation.

7) Remote terminal unit

The remote terminal device is currently managed under the name of RTU in Aids to Navigation computerized management system, and the equipment is also marked as the RTU for Aids to navigation. Therefore, it is necessary to unify the name used in the field, the name managed in the computerized management system, and the name specified in the regulations for the service life, so it is appropriate to change it to RTU.

8) DGPS triangle guyed transmission antenna, DGPS bending type transmission antenna, Loran(Loran, eLORAN) triangle guyed transmission antenna

DGPS triangle guyed transmission antenna, DGPS bending type transmission antenna, Loran(Loran, eLORAN) triangle guyed transmission antenna, which are managed only by the National Maritime PNT office, are iron tower structure and are managed as national property. So, it is reasonable to delete it in Aids to Navigation because these overlap with Aids to Navigation facilities equipment and component.

9) DGNSS RSIM receiver

As the current RSIM receiver is changed to Software RSIM, it is necessary to delete RSIM and change its name to DGNSS receiver, and it is appropriate to adjust the service life to 8 years by reflecting the opinions of experts that the performance improvement cycle of the DGNSS receiver is about 7 years.

10) Cesium atomic clock

When a cesium atomic clock breaks down, the repair cost is 70% of the purchase price, and about 3 million won is also consumed for fault diagnosis. And the service life suggested by the manufacturer is 10 years. When maintaining the current 20 years, high cost due to failure occurs and considering the fact that the useful life suggested by the manufacturer is significantly different, it is judged that applying the manufacturer's service life will be effective.

11) Computer, monitor

Computers and monitors are general items that are not specially classified as Aids to Navigation, and are specified in the regulations of the Public Procurement Service. So, it is appropriate to delete it from the service life regulations of Aids to Navigation.

5.2. Designation of additional service life of Aids to Navigation facilities equipment and component

1) Maintenance free enclosed type Battery

Although the manufacturer suggested 5 years in consideration of the design lifespan, it is reasonable to designate the 4 years suggested in the questionnaire survey considering the exposure to the poor marine environment.

2) AIS Aids to Navigation

The service life regulation of the Public Procurement Service stipulates that only AIS for ships is 10 years, and AIS Aids to Navigation is not stipulated, but AIS Aids to Navigation is exposed to a poorer environment than that for ships. 7 years was suggested in questionnaire survey. Therefore, it is appropriate to designate 7 years.

3) Maritime meteorological observation apparatus

Currently, the meteorological observation apparatus of the Korea Meteorological Administration is managed by applying the service life of the Public Procurement Service. Therefore, it is appropriate to designate 10 years by applying the service life of the Public Procurement Service.

4) Oceanographic observation apparatus

The Oceanographic observation apparatus currently used by the Korea Hydrographic and Oceanographic agency is managed by applying the service life of the Public Procurement Service. So, it is appropriate to designate 10 years by applying the service life of the Public Procurement Service.

5) Maritime meteorological Observation Data logger

Since the service life of maritime meteorological observation data logger is stipulated as 11 years by the Public Procurement Service. Standard of the Public Procurement Service is decided to apply.

6) Drone

The service life of the drone is designated as 5 years according to the service life of the Public Procurement Service, but the standard is determined for the use of Aids to Navigation.

7) Small boat

Small boat is mounted on a beacon maintenance ship and is managed and operated under relatively stable conditions, so it is reasonable to designate 7 years by applying the standard of the Public Procurement Service.

8) Buoys(Nonferrous metal)

Germany, which has been using nonferrous metal buoys since 2004, stipulates that the service life is more 12 years, and the service life of steel buoy is 15years in Korea, so it is appropriate to designate 12years in consideration of the export opinions.

6. Conclusion

As the technological innovation of the 4th industrial revolution spreads to the maritime field, cutting-edge ICT-based technologies are introduced into the Aids to Navigation field, and the realistic service life needs to be reassigned due to the emergence of new types of Aids to Navigation. In order to suggest a new standard for the designation of service life, the service life management and operation of domestic and foreign Aids to Navigation are investigated, and practical analysis and expert opinions are collected through on-site survey and questionnaire survey on the management status of domestic Aids to Navigation facilities equipment and component.

To summarize the details of the study, in foreign cases, market competition and technology development were being encouraged by reducing government regulation and stipulating few items of service life, and it was operated so that the service life could be flexibly designated by comprehensively considering the service life and economic life.

And as a result of comparing the domestic Public Procurement Service and the Korea real estate board, the service life of the current Aids to Navigation facilities equipment and component was subdivided, and there were differences due to environmental and technical characteristics. Therefore, in designating the service life, flexible designation and management of the service life can be made in consideration of technical attributes and economic lifespan, but since Korea has basic standard of Public Procurement Service, it was judged necessary to apply the standard of Public Procurement Service first.

Through on-site survey and questionnaire survey of Aids to Navigation and expert opinions, improvements were derived for delete, standard change and service life change on solar cell, remote controller, lead storage battery, maintenance free lead storage battery, marine signal lantern, bridge light, charge and discharge controller, remote terminal unit, DGPS triangle guyed transmission antenna, DGPS bending type transmission antenna, Loran(Loran, eLORAN) triangle guyed transmission antenna, DGNSS RSIM receiver, cesium atomic clock, computer, monitor. In addition, maintenance free enclosed type Battery, AIS Aids to Navigation, maritime meteorological observation apparatus, oceanographic observation apparatus, maritime meteorological Observation Data logger, drone, small boat, buoys(Nonferrous metal) were analyzed as items to be newly designated.

This study conducted analysis by mainly reflecting the field survey, questionnaire survey and expert opinions in order to reflect the reality. However, the analysis of technical characteristics of equipment and component was insufficient, so technical analysis of each equipment and component should be carried out in the future.

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