

국내항공법의 장애물 관리규정 연구

A Study on the Obstacles of Domestic Aviation Law

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I. Introduction

Considering the statistics shows that 70% of air accident happens take off and landing phase around aerodromes, it is much important to control of obstacle around aerodromes plays an important role in safe operation in terms of preventing the air accident and ensuring the long term existence of aerodromes.

However, within a scope of ensuring safe operations, the application of Shielding is one of the issues to be importantly considered to manage efficiently the obstacles limitation around aerodromes, to dissolve the private asset privilege limitation from regulation on aerodrome circumference, and to decrease the pains to manage the obstacles, in terms of not only operating safely but also utilizing efficiently the airspace around aerodromes.

Actually the ICAO and other aviation-advanced states mitigate the construction limitation or exempt the obligation of obstacle sign by applying the shielding theory that the obstacles are not regarded as obstacles where are below the shadow surface. It does not, of course, follows such shielding theory is not applied with some internationally unified standards. Furthermore it is applied and controlled with conditions of each countries or aerodromes under the judge of not being harmful to safe operation via certifying the shielding of new obstacles and making scientific study .

The Republic of Korea inserted the new regulation including the applying shielding similar to ICAO on Aviation Act and regulations. It is, however, hard to manage the aviation obstacles around aerodrome efficiently with these new regulation. Particularly, there exists much rooms to dispute because it cannot suggest the specific standard which is necessary to apply shielding theory at airspace of aerodromes.

Therefore, in this study, the international standards on aviation obstacles were reviewed, analyzed and compared with those of domestic status. The direction of which the guideline for control of aeronautical obstacles applicable within a domestic circumstances as well as correspondent with international standard was suggested. Particularly, as far as the disputable application of

shielding theory is concerned, the alternatives for aviation safety and efficient airspace operation by suggesting the clear standards alternatives were suggested.

II. Review and analysis for international standards on aviation obstacles limitation and control

1. ICAO's obstacles limitation

The Annex 14 to International Civil Aviation Convention Aerodrome treats the Standards and Recommended Practices(SARPs) on standards for obstacles limitation around international aerodromes.

In a detail, the annex 14 Chapter 4 Obstacle limitation and Removal"set a series of airport restriction surface standard which define the limit height of obstacles by each airport zone district as shown <Figure 1> <Table 1> in order to ensure safe operation of aircraft and prevent airport from not being able to use.

Also the specific guideline to inform the applying obstacles limitation surface and the fact that , in case of irremovable obstacles, sheilding surface is principally applied are suggested in detail at Airport Services Manual(Doc. 9137 AN898/2) Part 6 Control of Obstacle.

- The objectives of the specifications in this chapter are to define the airspace around aerodromes to be maintained free from obstacles so as to permit the intended aeroplane operations at the aerodromes to be conducted safely and to prevent the aerodromes from becoming unusable by the growth of obstacles around the aerodromes.

- Obstacle limitation surfaces : Outer horizontal surface, Conical surface, Inner horizontal surface, Approach surface, Inner approach surface, Transitional surface, Inner transitional surface, Balked landing surface,

Take-off climb surface.

· The requirements for obstacle limitation surfaces are specified on the basis of the intended use of a runway, i.e. take-off or landing and type of approach, and are intended to be applied when such use is made of the runway.

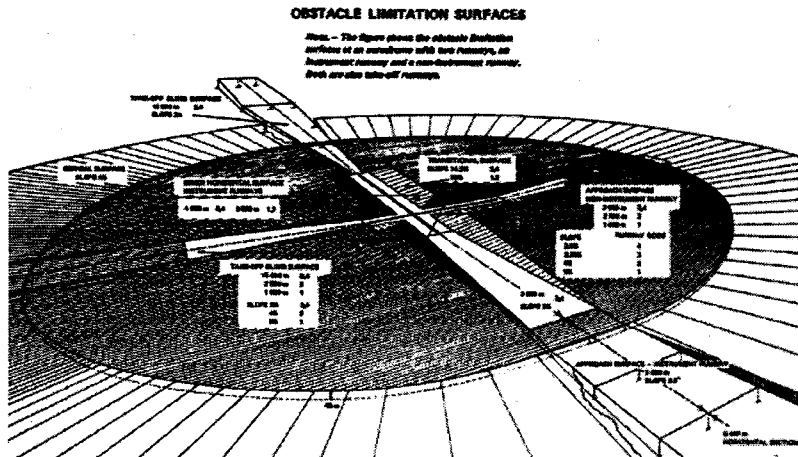
– Non-instrument runways : conical surface, inner horizontal surface, approach surface; and transitional surface.

– Non-precision approach runways : conical surface, inner horizontal surface, approach surface; and transitional surfaces.

– Precision approach runways : for a precision approach runway category I : conical surface, inner horizontal surface, approach surface; and transitional surfaces ; for a precision approach runway category II or III: conical surface, inner horizontal surface, approach surface and inner approach surface, transitional surfaces, inner transitional surfaces; and balked landing surface.

– Runways meant for take-off : take-off climb surface.

· Objects outside the obstacle limitation surfaces : In areas beyond the limits of the obstacle limitation surfaces, at least those objects which extend to a height of 150 m or more above ground elevation should be regarded as obstacles, unless a special aeronautical study indicates that they do not constitute a hazard to aeroplanes.



<Figure 1> Obstacle limitation Surfaces

2. FAA's obstacles limitation

The U.S, whose aviation industry is highly-advanced, to ensure the safe operation of aircraft, aside from the routine flight regulation 14 CFR Part 91, has and applies specific standards on regulating construct or install the obstacles around aerodromes. They are 14 CFR Part 77.13(Construction or alteration requiring notice.), Part 77.15(Construction or alteration not requiring notice), Part 77.23(Standards for determining obstructions), Part 77.25(Civil airport imaginary surfaces) and Part 77.28 (Military airport imaginary surfaces).

First Section										
Length(m)	1,600	2,500	3,000	3,000	2,500	3,000	3,000	3,000	3,000	3,000
Slope(%)	5	4	3.33	2.25	3.33	2	2	2	2	2
Second Section										
Length(m)	-	-	-	-	-	3,600b	3,600b	12,000 b	3,600b	3,600b
Slope(%)	-	-	-	-	-	2.5	2.5	3	2.5	2.5
Horizontal Section										
Length(m)	-	-	-	-	-	8,400b	8,400b		8,400b	8,400b
Total Length(m)	-	-	-	-	-	15,000	15,000	15,000	15,000	15,000
Transitional Slope (%)	20	20	14.3	14.3	20	14.3	14.3	14.3	14.3	14.3
Inner Transitional Slope(%)	-	-	-	-	-	-	-	40	33.3	33.3
Balked Landing Surface										
Length of Inner Edge(m)	-	-	-	-	-	-	-	90	120	120
Distance from Inner edge(m)	-	-	-	-	-	-	-	0	1,800c	1,800c
Divergence(each side)	-	-	-	-	-	-	-	10%	10%	10%
Slope	-	-	-	-	-	-	-	4%	3.33%	3.33%
a) All dimension are measured horizontally unless specified otherwise b) Variable Length c) Distance to the end of strip										

source : ICAO(1999), Annex 14. Chapter 4 - Obstacle limitation and Removal, Table 4-1

Especially, the U.S standards on setting obstacles are suggested in Part 77.23 Standards for Determining Obstruction, Subpart C - Obstruction Standards of 14 CFR Part 77. The obstacles standards , should be pre-reported to apply 14 CFR Part 77.23, is also described in detail at FAA Advisory Circular AC70/7460-2K with the same context with 14 CFR Part 77.13(Construction or alteration requiring notice.),

If the side of obstacle management tries to be sufficient, "a suitable notice" will be given to the administrator of FAA for the construction or reconstruction of a kind specified in 14 CFR Part 77.11 for all plan masses' individuals. An administrator is notified of all construction or reconstruction that order persons go up from the index side of the spot by . and Part 77.13 which are demanded as giving an additional notice 48-hour before of the construction beginning at the time of a completion by 200 or more fts. Moreover, the runway whose length is 3,200 or more fts Notifying an administrator of all construction or reconstruction that go up from the nearest point to the nearest take-off run at the common airport which it has had a variety of in stock the bottom and the above more highly than the virtual surface which elongates with a branch that 100:1 inclines in the outside upper part 20,000 or more fts of level length It is demanded . with which can. Come and it is specified to be to the airport and helicopter place to shorter take-off run steeper to incline.

In a aspect of obstacles control, 14 CFR Part 77.11 specifies the locations and dimensions of the construction or alteration for which notice is required and prescribes the form and manner of the notice. It also requires supplemental notices 48 hours before the start and upon the completion of certain construction or alteration. Part 77.13 requires notice in case of Any construction or alteration of more than 200 feet in height above the ground level at its site and 100 to 1 for a horizontal distance of 20,000 feet from the nearest point of the nearest runway of each airport specified in paragraph (a)(5) of this section with at least one runway more than 3,200 feet in actual length. The more sharp inclination is specified to the aerodromes or heliport whose runways were shorter than above.

On the other hand, the notice is required for Any highway, railroad works or partial works within approach area, even in works the authority who placed the construction order is “airport operating entity” itself. The FAA issues the Advisory Circular, AC 70/7460-2G, and November 30, 1977 which specifies the process to suggest the construction plan and requirement for whom place the construction order.

FAA Advisory Circular 150/5190-4A Provides a model zoning ordinance to be used as a guideline to control the height of objects around airports. AC explains Aviation safety requires a minimum clear space (or buffer) between operating aircraft and other objects. When these other objects are structures (such as buildings), the buffer may be achieved by limiting aircraft operations, by limiting the location and height of these objects, or, by a combination of these factors.

<Table 2> 14 CFR Part 77.23 - (Standards for Determining Obstructions)

(a) An existing object, including a mobile object, is, and a future object would be, an obstruction to air navigation if it is of greater height than any of the following heights or surfaces:

(1) A height of 500 feet above ground level at the site of the object.

(2) A height that is 200 feet above ground level or above the established airport elevation, whichever is higher, within 3 nautical miles of the established reference point of an airport, excluding heliports, with its longest runway more than 3,200 feet in actual length, and that height increases in the proportion of 100 feet for each additional nautical mile of distance from the airport up to a maximum of 500 feet.

(3) A height within a terminal obstacle clearance area, including an initial approach segment, a departure area, and a circling approach area, which would result in the vertical distance between any point on the object and an established minimum instrument flight altitude within that area or segment to be less than the required obstacle clearance.

(4) A height within an enroute obstacle clearance area, including turn and

termination areas, of a Federal airway or approved off airway route, that would increase the minimum obstacle clearance altitude.

(5) The surface of a takeoff and landing area of an airport or any imaginary surface established under ?77.25, ?77.28, or ?77.29. However, no part of the takeoff or landing area itself will be considered an obstruction.

(b) Except for traverse ways on or near an airport with an operative ground traffic control service, furnished by an air traffic control tower or by the airport management and coordinated with the air traffic control service, the standards of paragraph (a) of this section apply to traverse ways used or to be used for the passage of mobile objects only after the heights of these traverse ways are increased by:

(1) Seventeen feet for an Interstate Highway that is part of the National System of Military and Interstate Highways where overcrossings are designed for a minimum of 17 feet vertical distance.

(2) Fifteen feet for any other public roadway.

(3) Ten feet or the height of the highest mobile object that would normally traverse the road, whichever is greater, for a private road.

(4) Twenty-three feet for a railroad, and,

(5) For a waterway or any other traverse way not previously mentioned, an amount equal to the height of the highest mobile object that would normally traverse it.

Moreover, proposals to solve the dispute on being limited of exercising private property right around aerodromes, the zoning rule examples are suggested in appendix 1,2 and 3

3. Standards of other aviation-advanced countries

1) Standard of Japan

Similarly with ICAO's standards, the obstacles limited area of Japan is

composed of strip, approach surface, extended approach surface, transitional surface, horizontal surface, conical surface, and outer horizontal surface. Compared with Korea's standards, outer horizontal surface was added and can limit obstacles to the extent of broader scope.,

The slope degree of approach surface , however, is restricted to 1/50 or more and the length of extended approach surface and approach surface is restricted to 15,000m. This is same with Korea domestic standards. It is also similar with Korea's standards in that the horizontal surface is centered from aerodrome mark point and set length by the Japan Ministry of Land, Infrastructure and Transportation.(MLIT) as radius.

The conical surface is centered from aerodrome mark point below 16,500m and set the length by the same law as radius The outer horizontal surface is centered from aerodrome mark point below 24,000m and set the length by the same law as radius. This suggest the Japan's regulation can limit obstacles to broader area, comparing Korea's regulation which applies only conical surface to the maximum 1,100m from outer horizontal surface.

2) Standards of U.K

The U.K specifies the types of obstacles limited surface and specification at 'CAP 168 Licensing of Aerodromes', This is somewhat differ from ICAO's standards in terms of types of obstacles and specification., but the only difference is that the U.K applies more simplified standards than that of ICAO and similar in nature..

In particular, Clause 11, Chapter 4 Evaluation and Treatment of Obstacles, describes " According to the National and Regional Plan (Aerodrome) of 197, the civil aviation authority should protect some important major aerodromes from the potential future development which would be disadvantageous for the actual/potential use for flight purposes. Therefore, the regional planning authority have the protection region map which contains the limit altitude of newly build construction around the aerodrome which may keep the use of aerodrome.

On the other hand, the planning authority is required to be consulted by civil

aviation agency on the all kind of development which can exceed the standards. The authorized airport(airport operator), in his thoughts, he gets to know the development plan which can constraint future development of aerodrome or infringement of certain, he should request planning authority may consider this when they judge to issue the construction permission.

The obstacle surfaces applied in U.K are the obstacles limit area, take-off ascending surface, approach surface, transitional surface, inner horizontal surface, conical surface, and outer horizontal surface. Compared with Korea's standards, outer horizontal surface was added and can limit obstacles to the extent of broader scope. Contrary to the ICAO's standards that the outer horizontal surface is applied when aerodromes whose runway length is 1,200m or more and the outer obstacles in conical surface is 150m or above., the U.K set the outer horizontal surface to the all aerodromes. It could imply the U.K strengthened the standards than ICAO.

3) Standards of German

From Articles 12 to 19 of German Aeronautics Act treats the control the permitted construction works within adjacent area around aerodromes. The paragraphs of the articles specifies, even the authority concerned who may issue the construction permission of the building cannot give permission to construction before getting agreement from aviation authority, when the construction is executed within 1.5 km from Aerodrome Reference Point(ARP) or take-off zone or safety zone.

Besides the consent from aviation authority is required in case the building is expected to exceed the altitude limitation when approaching within the larger radius than from ARP or approaching from specific distance from approach zone.

Ⅲ. Review and Analysis on domestic aviation obstacles limitation and control

1. Review on current aviation act and related regulation

The related regulation on aviation obstacles at domestic Aviation Act is described at the Article 82(Restriction, etc. on Obstacles) as below

- Limitation on public announcement of obstacles limit surface and leaving alone
- the demand to remove the obstacle which invades the limited (by airport installer)
- compensation for obstacles required to be removed under the conditions as prescribed by the Presidential Decree(airport installer)
- demand for the airport installer to purchase the obstacle or land under the conditions as prescribed by the Presidential Decree(the owner of obstacles or land)
- the order to remove the obstacles which the related parties fail to reach an agreement the related parties the Minister of MOCT)
- In case of failing to reach agreement between parties to compensate for the loss of removing obstacles (decided by the Minister of MOCT)

2. Review on related regulation of the Enforcement Decree of the Aviation Act

With relation to the Article 82(Restriction, etc. on Obstacles), the related regulation on aviation obstacles at domestic Aviation Act is described at Article 20(Request for Purchase of Obstacle, etc.) and Article 21(Compensation, etc. for Loss of Obstacle)

<Table 3 > Enforcement Decree's Article 20 & 21
Article 20 (Request for Purchase of Obstacle, etc.)

Any person who desires to demand any purchase of any obstacle or land on which the obstacle is installed, under Article 82 (4) of the Act, shall request the installer of the airfield for a purchase of such obstacle or land together with the following

documents:

- 1.Name and address of the owner and other interested persons;
- 2.Documents certifying that he has ownership of the obstacle or land;
- 3.The seat, kind, area and quantity of the obstacle or land;
- 4.Drawings indicating the obstacle or land; and
- 5.Particulars of compensation for loss.

Article 21 (Compensation, etc. for Loss of Obstacle)

If an airfield installer and a person holding the ownership or other right to the obstacle apply to the Minister of Construction and Transportation for a decision on compensation for any loss caused by a removal of the obstacle under the latter part of Article 82 (6) of the Act, they shall submit the application specifying the following matters together with documents certifying that he has the ownership or other right to the obstacle, and an explanatory statement on consultation, implementation plan of airfield installer and drawing indicating the obstacle, etc.: <Amended by Presidential

Decree No. 14447, Dec. 23, 1994>

- 1.Name and address of the owner and other interested persons;
- 2.Seat, kind, area and quantity of the obstacle and other matters relating to it;
- 3.Method and time of alteration, movement and removal of the obstacle; and
- 4.Particulars of compensation for loss.

The authority entrustment with aviation obstacles is specified at Article 63 (Delegation and Entrustment of Authority) as below <table 4>.

<Table 4> Enforcement Decree's Article 63 (Delegation and Entrustment of Authority)

Article 63 (Delegation and Entrustment of Authority)

...omitted...

③ The Minister of Construction and Transportation shall delegate the following authority to the directors of the local aviation offices under Article 154 (1) of the Act: <Amended on November 4, 2003>

...omitted...

22.The authority falling under each of the following items with respect to airfield or navigation safety facilities

...omitted...

(h) to remove aviation obstacles and determination of compensation for loss under Article 82 (5) and (6) of the Act;

3. Review on current regulation related to the regulation of aviation act

Concerning with the Article 82 of Aviation Act, its Regulation defines at Article 246(Specific Example of Obstacles Limitation) as <Table 5>.

<Table 5> Article 246(Specific Example of Obstacles Limitation) (Revised)

Article 246(Specific Example of Obstacles Limitation) ①
Pursuant to paragraph 1 provision of article 82 of the Act, obstacles which can establishment or let alone after get an acceptance from airfield establisher is as each of the following document one.

1. Installation building, pursuant to the building law, lighting rod installation, or an antenna(include to the similar construction)less than 7 meter which install on the roof of the construction.
 2. Pursuant to paragraph 6 of article 2 of the Act, as airport facilities which necessitate for airfield operation.
 3. Due to the geographic characteristics, mountain and hill which unable to removal artificially.
 4. Relating to topography or existing objectives, especially objectives which is one of the following flight safety should not damage which is one of the following.
 5. Laser beam launcher which shall not interfere with safe flight operation.
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IV. Comparison and analysis on international and domestic standards on aviation articles

1. Comparison and analysis for correspondence with international standards

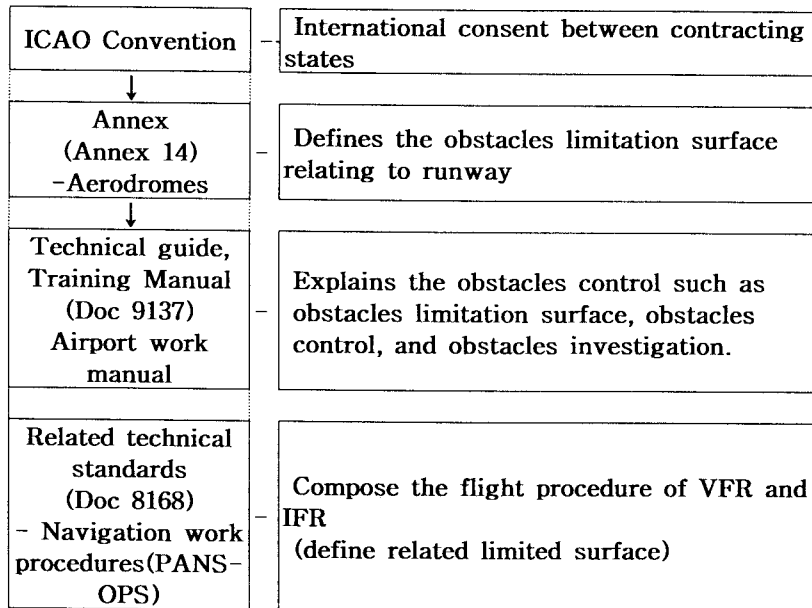
The ICAO contracting states, in terms of safe operation and efficient management of airport circumference, have prepared regulation to set aviation obstacles surrounding airport and manage them comparatively strictly. The domestic has not greatly improved yet despite of recent frequent revision of aviation act.

Although regulation concerning an aviation obstacle is suggested on the basis of in Article 82 of the Aviation Act, corresponding with international standards, this is fairly not sufficient in applying the new circumstances such as construction of an airport, reconstruction, and airport circumference development with this regulation. The absence of the regulation on management of such aviation obstacle is pointed out with another blame that it failed to systemize each organization and agency. Consequently it cannot respond to compensation and public complaint due to the unclear responsibility and standards. This made the necessity for establishing legal standards urgent.

As seen Chapter II on this study, the aviation obstacles control is systematically managed by specifying limited surface, purpose of use, control and investigation of obstacles around airport(aerodrome, in case of the ICAO and other aviation-advanced countries

First of all, in ICAO system, international standards, the obstacles control standards is established at the annex to the Civil Aviation Convention and Technical Guidance. The obstacles related contents can be found another related documents. Most of ICAO contracting states are recommended to comply with this international standards to the ICAO Convention. In addition, the respective countries legislated and maintains the related laws and regulations according to the annexes. The other detailed technical things in

ICAO technical guide or training manual are specified as regulation, principles, advisory circular.



<<Figure 2> ICAO standards system relating to aviation obstacles

The ICAO contracting states have set the ICAO standard as a statute law complying with each countries legislative system. This is not exceptional in case of Korea. The Korea's legislative system constitute upper laws, lower laws and complimentary laws; there are the law which has declarative meanings is set, enforcement decree and regulation which explains them, specifically in case of aviation plenty of technical international standards, the related regulation supports the law system. Such a system is, although the system of ICAO is not explained correctly, include various standards in the legislative system complying with the international standards.

In the case of the United States, aviation advanced nation, although it cannot be made to connect with our system because the governmental organization is different from that of Korea. It can, however, be divided into federal law and

state law when applying with ICAO standards according to such kind of legislative system

U.S legal system is compose of two system; one is federalism and the other is the principal of authority separation. Namely, it is composed of federal law, the basic law of the government and state law, that of state government. The federal law defines the authority of federal government and all the other matters are under the authority of state government. The matters the federal government can regulate state government is restricted only in case the federal law gives authority to the federal congress. When conflict between federal law and state laws, the former is prior to the latter. As for the aviation law, It obey the aviation act based on federal law which complying with ICAO standards since it is important for aviation to keep the standards and regulation between states, thought it reaches itself international level in terms of volumes and technology.

14 CFR AC 70/7460	⇒	ICAO Annex 14 - Aerodromes	⇒	Aviation Act / Enforcement Decree
Regional autonomy law or state law	⇔	Technical guidance DOC 9137 Part 6. Control of obstacle	⇔	Regulation Technical Standards, Notification

<Figure 3> Correspondence on legislative system with international/foreign standards

Seen in <Picture 3> the aviation obstacle standard around aerodromes is set by ICAO annex 14 and the control is treted by technical guidance. This is corresponding to domestic laws and regulation; the obstacle limitation paragraph in Article 82 of Aviation Act, obstacles purchase and compensation for the loss in the Enforcement Decree, and the special exemption of obstacles limitation in Regulation. The obstacle limitation surface is constituted at

Chapter 4 Obstacle limitation and Removal of Annex 14, and the applicability is explained in detail at Doc 9137 Airport Service Manual.

Seen from suchs composition, all the contents over an obstacle are incorporated into Aviation Actand the commitment of obstacles tasks and the loss compensation is set only in enforcement decree and regulation; which is difficult to meet ICAO's standards.

In U.S. case, the aviation act is 14 CFR(Code of Federal Regulations)-Aeronautics and Space. Relating to aviation obstacles is regulated by AC (Advisory Circular) of FAR (Federal Aviation Regulation), and Order. And the regulation on the use of building and land around aerodrome is established by state law or local autonomy entity.

For example, likely with the case of Airport Zoning appeared in Zoning Ordinance on Development Regulation of FlanklinCounty, Washington State, the altitude limitation applied to all facilities which can act as a aviation obstacles in development around aerodromes.

This is an example of land district zoning laws which limit the altitude of material existing around aerodrome in DOC 9136 Part 6, Appendix 2. and is suggest as a standard applicable to each states' subordinate laws, standards, and advisory circular.

Actually, the content of appendix 2 refers to FAA AC150/5190-4 Model Zoning Ordinance to Limit Height of Objects Around Airports

<Table 6> The composition laws relating to aviation obstacles international and domestic

ICAO	FAA	Domestic aviation law system
Annex 14	14 CFR Part 77	Aviation Act, Enforcement Decree
Doc 9137 AN898/2	AC150/5190	Regulation
Doc 9137 AN898/2	FAR AC150/5190 Local government law, state law	Need Advisory Circular(draft) Cf) Aviation obstacles control regulation(draft)

Thus, regulation on aviation obstacles control should be composed as above <table 6> after reviewing the correspondence of domestic aviation system to those of ICAO and FAA.

2. Comparison of aviation obstacles limited zone

<Table7> comparison of aviation obstacles limited zone around aerodromes

Classification		Zone Scope						
		ICAO	Korea		U.S		Japan(m)	U.K. (m)
			Civil	Military	Civil	Military		
Inner horizontal surface		4,000m	4,000m	2,286m	10,000ft	7,500ft	4,000m	4,000m
Conical surface		2,000m	1,100m	2,134m	4,000ft	7,000ft	12,500m	2,100m
Outer horizontal surface		9,000m			(5mile)	30,000ft	7,500m	8,900m
The scope of limited zone	Radius total	15,000m	5,100m	4,420m	14,000ft (4,268) m	44,500ft (13,567) m	24,000m	15,000m
	Point of Center	Aerodrome	Basic Surface	The end of runway	Basic Surface	The end of runway	Aerodrome	Aerodrome
Approach surface	Outer width	4,500m	4,500m	4,877m	16,000ft (4,877m)	16,000ft	4,500m	4,500m
	Length	15,000m	15,000m	15,240m	50,000ft (15,240) m	50,000ft	15,000m	15,000m
<ul style="list-style-type: none"> · base in aerodrome which capable precise approach · the point of center of obstacles limit zone radius is different by each states · meter conversion: 1m = 3.2808 ft (by ICAO) 								

In case of there is possibility of being hazardous to flight safety by establishing far narrower obstacles limit zone than international standards. For example, in case there's obstacles of 150m or more from outward the conical surface of aerodrome (above ICAO 3,4 trade, Aviation Act G) whose the length of runway is 1,200m or more, the obstacles limit surface radius is 14,400m from the end of runway by ICAO standards, contrarily, that of domestic law is only 5,100m

When applying to the common aerodrome of Korea use runway length is 2,700m, the obstacles limit zone of ICAO is 706.85Km, and that of Aviation Act is 81.67km². This corresponds only 16% than that of ICAO. <Table 7> shows comparison by each countries with the scope of obstacles limit surface which can be a scope of altitude limitation by obstacles limit surface. The standards of the objective states of comparison U.S, Japan and the U.K is same or similar with ICAO

Although the U.S limit standards seem to be low than ICAO due to not applying outer horizontal surface in civil aerodromes, It is same as applying it from aerodrome center to 5 miles from outward of conical surface because it limit to 5 miles by increasing every 100ft from aerodrome center in 14 CFR 77.23

V. Comparison and analysis of international and domestic on aviation obstacles shielding

1. The obstacles shielding theory

The obstacles shielding theory is developed to ease the limit of private property rights restricted by the aerodrome circumference through mitigating the regulation within the scope of ensuring safe navigation, and to ease the effort in controlling the obstacles. Therefore, the influence of shielding theory can be differ according to legal definition of obstacles zone around aerodrome

as above chapters.

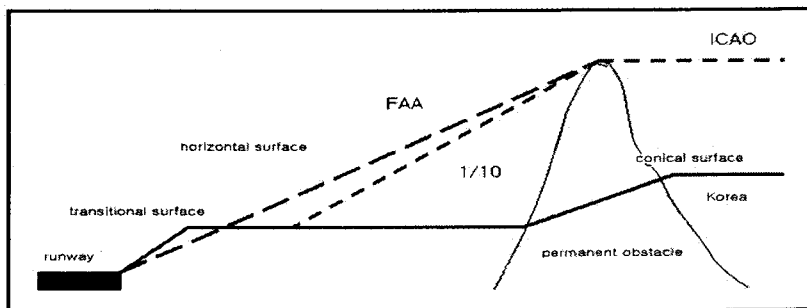
As seen in <Figure 4>, the object to apply the shielding theory is that of shadow surface which shielded by irremovable permanent obstacles and invaded already the obstacles limitation surface of aerodrome zone.

ICAO applies the shielding formula based from the upper part of obstacles to the horizontal surface reflected as outward runway, to the surface of 10% descending slope as inward runway. Whatever obstacles in below two surfaces is regarded as shielded. This means buildings and structure construction is possible because it is not regarded as obstacles, though higher than the obstacles limit surface in the shadow surface shielded by the permanent obstacle.

In annex 14 Aerodrome, the conditions of obstacles limitation under the VFR approach, non-precision approach, precision approach, take-off runway, each conditions do not permit to install new obstacles, except when, in the opinion of the appropriate authority the object is shielded by an existing immovable object or after aeronautical study it is determined

that the object would not adversely affect the safety or significantly affect the regularity of operations of helicopters.

Although it can say that such a shielding standard is a rational deregulation method which permits expansion and contraction of the building around aerodrome under the condition of securing the flight safety, in case of the standars of applying shielding is ambiguous area such side surface of the take-off and landing pass, it is recommended to prevent the generating of obstacles by securing the target region.



<Figure 4> The standards of judging shield surface of ICAO, FAA and Korea(transverse section)

2. The principles of obstacles shielding

At FAA, the shielding principles is applied to minimize the installation requirement of obstacles cover and marking and lighting that are shielded and to minimize the requirement for the removing obstacles or building restriction, etc.

The permanent obstacles irremovable is being considered in flight safety already, so the objects shielded by this is not be regarded as obstacles.

As in <Figure 4> the shielding standard of FAA is decided by the shadow plane projected by a line which connecting from top of permanent obstacles and the end of runway within landing approach of runway and departing area to the outer direction and whatever obstacles exists in the shadow plane is not regarded as obstacles. Therefore it enables construct building or structure higher than obstacles surface. Below <Table 8> suggest the shielding standards by each ICAO contracting states.

<Table 8> The examples of shielding standards of each ICAO contracting states

States	Standards
Austria	Take-off climb and approach surface : Permit new obstacles within 60m from the highest obstacles to the height of the lowest permanent obstacles transitional surface : permit the exiting obstacles' height horizontal and conical surface: : permit the exiting obstacles' height
France	Shielding the smaller obstacles by the lager obstacles: In case of locating 15% descending plane around aerodrome, it is regarded as shielded
India	To 2,500m from standard point of aerodrome transitional and to 3,000m from inside end of inner horizontal surface and approach and take-off climb zone, the shield principle is not applied. In other zones except above, the shielding stardards of 10% descending plane from permitted obstacles
Spain	there applies respectively as shielding standards within the scope of horizontal 150m from obstacles, side to opposite runway side horizontal surface of same height of obstacles, and to runway side, 10% of descending plane

Source : "Study on the applying of shielding theory, prof. Yang Han Mo(2002), The Journal of Korea Society of Transportation, v.20, n.5, pp.55-66

VI. Proposal to improve domestic standards relating to aviation obstacles

1. Proposal to improve domestic aviation act and regulation relating to aviation obstacles

The example of domestic aviation act, its enforcement decree and its regulation relating to aviation obstacles are mentioned in detail at Clause 4, Chapter II of this study. <Table 9> is the result of summarizing them

At Article 82 of the Aviation Act, it specifies the standards to solve the problems between flight safety and private property rights

In detail, there suggested the broad scope of solution such as the notification of obstacles limit surface, minimization of invasion, compensation for loss when the obstacle is removed and the solution for the possibility of public complaint.

Moreover, in Article 20,21 of the enforcement decree of same act, there defines the solution process of public complaint which can be generated from removing the obstacles mentioned at Article 82 of the Aviation

Article 246 of Regulation specifies to review the scope of the obstacles can be permitted and these obstacles' influence to flight safety

<Table 9> The composition of domestic aviation act, its enforcement decree, and its regulation relating to aviation obstacles

<p>Article 82(Restriction, etc. on Obstacles) of Aviation Act</p>	<ul style="list-style-type: none"> ① Limitation on public announcement of obstacles limit surface and leaving alone ② the demand to remove the obstacle which invades the limited (by airport installer) ③ compensation for obstacles required to be removed under the conditions as prescribed by the Presidential Decree(airport installer) ④ demand for the airport installer to purchase the obstacle or land under the conditions as prescribed by the Presidential Decree(the owner of obstacles or land) ⑤ the order to remove the obstacles which the related parties fail to reach an agreement the related parties (the Minister of MOCT) ⑥ In case of failing to reach agreement between parties to compensate for the loss of removing obstacles(decided by the Minister of MOCT)
<p>Article 20 (Request for Purchase of Obstacle, etc.) of enforcement decree</p>	<p>the request to purchase obstacles or land ? airport installer(Based on the paragraph ④, Article 82, Aviation Act)</p>
<p>Article 21 (Compensation, etc. for Loss of Obstacle) of enforcement decree</p>	<p>Application for compensation for loss by the Minister of Transportation and Construction(Based on the paragraph ⑥, Article 82, Aviation Act)</p>
<p>Article 246 (Special examples for object limitation) of enforcement decree</p>	<ul style="list-style-type: none"> ① Obstacles to be installed or neglected by the permission of airport installer ② Certifying the hazardousness to flight safety by obstacles expected to be permitted

The current composition of Aviation Act, its Enforcement Decree, and its Regulation seems to be lack of meeting the requirement of obstacles management requirements which is prescribed by ICAO, FAA and other aviation-advanced countries. Therefore, some improvement should be included or considered in aviation obstacles related regulations such as aviation act, its enforcement decree and its regulation are suggested through this study on aviation obstacles related regulations.

- Making obligatory to report immediately on plan for constructing new building and obstacles which may affect to safe operation of aircraft.
- Setting a standard to manufacture and install such obstacle as air navigation facility irremovable
- Suggesting specific standard of applying shielding theory
- Noticing the Aviation Obstacles Management Regulation(draft)
- Preparation of liason method between Aviation Act, its Enforcement Decree, its Regulation and the guideline for cotrol of aeronautical obstacles
- Introducing of Zoning Concept by each airport
- Making obligatory to setting regulation on Zoning Distinction by each airport which should be included in guideline for cotrol of aeronautical obstacles
- Designating the airport operator or manager who takes charges of limiting obstracles
- Composing the adjustment committee and appointing the committee members
- By each airport of regional autonomy entity, allotting authorized person who arrange and for adjusting dispute on installing and removing obstacles
- In case of applying shield, it should be guided to apply within a reasonable scope after investigation by adjustment committee

2. Developing the guideline for cotrol of aeronautical obstacles

In domestic laws and regulations, there are substantial parts which does not comply with those included in ICAO international standards and FAA

regulations.

In the correspondence comparison with international standards as described above, the articles included domestic aviation obstacles related laws and regulation system, except for few, they are not much sufficient for the regulation for aviation obstacles control regulation. There it is necessary to draw a new regulation for it. If the guideline for control of aeronautical obstacles is established, this will be possible through amending or adding to the articles prescribed at current Aviation Act, its Enforcement Decree, and its regulation. As for its regulation and the additional technical matters, it is desirable to include to guideline for control of aeronautical obstacles. In addition, it is necessary to insert the articles for liaison between Aviation Act, its Enforcement Decree, and its regulation and guideline for control of aeronautical obstacles. (please refer to <table 10>)

<Table 10> Blueprint for law and regulation system relating to aviation obstacles

Aviation Act
+ amend or add

Enforcement Decree of Aviation Act
+ add
+ liaison with aviation act

Regulation of Aviation Act
+ add
+ liaison with aviation act and its enforcement decree

Notify the guideline for control of aeronautical obstacles

Establish for Aviation Obstacles Control Regulation by each airports

Constituting the adjustment committee

Suggesting shielding theory

Although there is some difference between international standards and FAA's, it is desirable to coincide with the system of domestic aviation law system, in terms of establishing the definition, objects, and the scope as a superior law,.

As far as the detail matter is concerned , it is more efficient to notify like ICAO Document or FAR AC. The content should be incorporated into guideline for control of aeronautical obstacles excepting the superior law(Aviation Act, its Enforcement Decree and its Regulation) should be composed of the General, Main, Supplementary, and the Tables according to the domestic law system on the basis of analyzed and investigated as above. And the content included to the Regulation should be composed of the articles which are not currently exist within domestic regulation

3. Suggesting the specific shielding standards(draft)

The Article 246(special examples of object restrictions) in the Regulation of Aviation Act suggested in the recent amendment proposal has meaning in terms of including the content of shielding applied internationally into the aviation law system and suggesting the standards of shielding

That is, if the obstacles invading already the obstacles limit surface exists, the building or structure is permitted and not regarded as obstacles, though it invades the obstacles limit surface. It will be the pertinent standards to obstacles installation related part which has much possibility of public complaint.

The shielding standards which most of aviation-advanced countries heading from ICAO defines it is possible to install the building or structure under the negative 1/10 slope degree towards aerodrome. This negative 1/10 slope degree have been applied in domestic, though it is not executed by the prescribed law.

Each states, however has different standards in applying the detail standards of shielding. That is , the definition of the point of standards being applied the shielding surface and the definition of direction around obstacles(front, rear, side, etc) is not clear, there is much dispute in domestic relating to this part.

Therefore, on the basis of reviewing a variety of international standards, the three specific standards(proposal) for shielding obstacles which is pertinent to

the domestic conditions is suggested.

The clear legislative law base is suggested, in line with "D", paragraph 2, Article A246, the Regulation of Aviation Act as below to prevent the possibility of public complaint from shielding.

1) Content applied as same as all the detailed application standards (proposal)

(1) Obstacles invading the approach surface or take-off climb surface,

In case of obstacles invading the approach surface or take-off climb surface, the cope which can be permitted as shielding should include: <please refer <Figure 5>

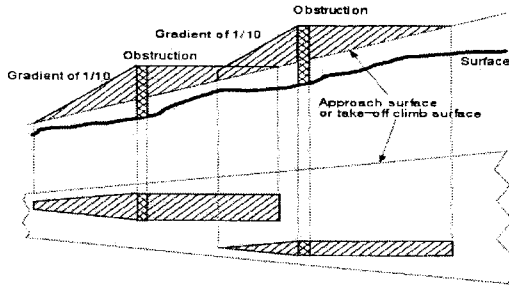
- The direction towards runway on a standard from obstacles has with the negative 1/10 slope degree from the top of each obstacle. under the plane extended to the point which these lines are converged on the penetration surface or the takeoff ascending surface, or meets when the line of imagination is drawn on the outside ship and straight line of the penetration surface or the takeoff ascending surface
- It is a portion under the plane which extended the obstacle on the standard to the point which meets the penetration surface and the takeoff ascending surface by width like the width of an obstacle towards the runway opposite direction becoming far from the top of each obstacle on a runway and which carried out the level.

(2) Obstacles invading the transitional surface,

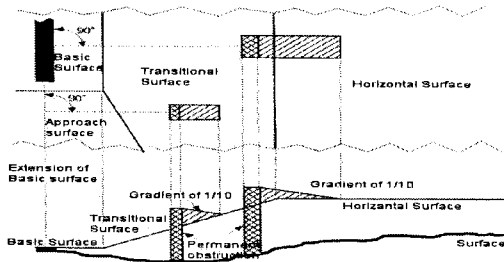
In case of obstacles invading the transitional surface, the obstacles is regarded as shielded which located in the lower part go down with negative 1/10 slope degree from the top of permanent irremovable obstacles at center line of closest basic surface or approaching surface., except that, the front surface permanent obstacles(basic surface of approaching surface direction) is regarded as the object of shielding.(please refer to <figure 6.)

As suggest above, the content in (1) Obstacles invading the approach surface or take-off climb surface, and (2) Obstacles invading the transitional

surface, is applied equally in line with each specific shielding application standards(proposal) as below:



<Figure 5> shielding obstacles at approach surface or take-off climb surface

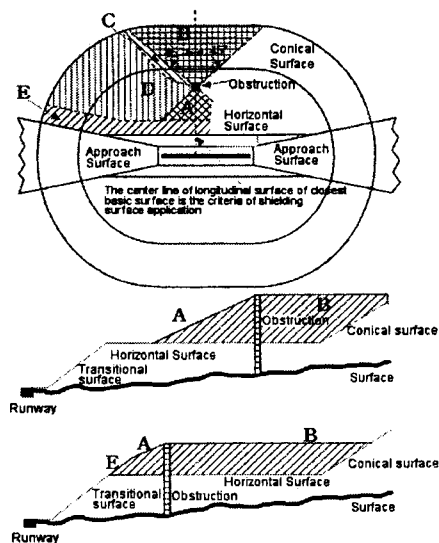


<Figure6> shielding obstacles at transitional surface

2) The alternative for specific shielding application

<Table 11> alternative for specific shielding application at horizontal surface or conical surface

class	Name	Slope degree
A	Front surface	negative 1/10 slope degree on obstacles
B	Rear surface	a level of same height with obstacles
C	boundary surface	plane with negative 1/10 slope degree from obstacles or rear boundary surface
D	Side surface	plane with negative 1/10 slope degree from obstacles
E	Extended transitional surface	plane with positive 1/7 slope degree form obstacles existing transitional surface or approaching surface



<Figure7> Alternative shielding obstacles at horizontal surface of conical surface

- (1) In case of obstacles invading approach surface or take-off climb surface
 - Same with above "(1)" of 1)
- (2) In case of obstacles invading transitional surface
 - - Same with above "(2)" of 1)
- (3) In case of obstacles invading horizontal or conical surface

In case of obstacles invading horizontal or conical surface, the scope of being permitted as shield should include (please refer to <Figure 7>).

The standards to apply shielding sets a basis from the center line of longer side of basic surface which is the closest from obstacles

The recognition between front and side plane is based on the parallel line with outer line of horizontal or conical surface from obstacles, and the rear plane is recognized as inner part from $\pm 45^\circ$ line from outward of obstacles extending the straight line from the basic surface to the rear plane of obstacles.

Front(plane "A" of <Figure 7>), side(plane "D" of <Figure 7>) means the

lower part which the level descending down of negative 1/10 slope degree from obstacles meet extended plane of horizontal or conical or transitional surface.

·Rear plane("B" of <Figure 7>) is the lower part crossed with the conical surface at the height of obstacles or the end level extended to the conical surface.

·The boundary part of front and rear (plane "c" of <Figure 7>)means the lower part which the level descending down of negative 1/10 slope degree from obstacles meet extended plane of horizontal or conical or transitional surface

(4) Others

When applying shielding, no obstacles cannot be set higher than the extended plane of the transition surface(<Figure 7> plane"E"). If the top is identified such as in the steel tower or mountain, The standard of front and side can be set as one point.

VII. Conclusion and Suggestion

The ICAO contracting states, in terms of safe operation and efficient management of airport circumference , have prepared regulation to set aviation obstacles surrounding airport and manage them comparatively strictly.

In a detail, the annex 14 Aerodrome treats "SARPs"as a standard on obstacles restriction surrounding international airport. Particularly, in order to ensure safe operation of aircraft and prevent airport from not being able to use, the Volume I. Chapter 4. Obstacle limitation and Removal sets a series of airport restriction surface standard which define the limit height of obstacles by each airport zone district.

In addition, as specific technical guide, the specific technical standards such as setting an obstacles restriction surface, obstacles management, obstacle investigation are suggested on Airport Services Manual(Doc. 9137 AN898/2) Part 6 Control of Obstacle.

Similarly with the SARPs of ICAO, the U.S FAA defines the obstacle management specifically on 14 CFR Part 77 - Objects Affecting Navigable Airspace and its technical guidebook, FAA AC 150/5190-4A - Model Zoning Ordinance To Limit Height Of Objects Airports.

The Republic of Korea, correspondingly with international standards, has shown the regulation on aviation obstacles on the basis of the Article 82 of the Aviation,, however, the current composition of Aviation Act, its Enforcement Decree, and its Regulation seems to be lack of meeting the requirement of obstacles management requirements which is prescribed by ICAO, FAA and other aviation-advanced countries.

Therefore, in order to solve such a problem, this research was executed to do comparative analysis on the international standard and domestic standard concerning aviation obstacle and to develop an and guideline for control of aeronautical obstacles. it was carried out aviation obstacle related municipal law it is just going to propose the next under the improvement matter by which must be included in a law or considering must be carried out .

- Suggest clear obstacle limitation surface and standards of setting (relating Article 2 of the aviation act)

- Constitute the minimized invasion to obstacle limitation surface

- Insert the related article on obstacle investigation (initial investigation, fixed investigation, etc)

- Setting an application standards at aerodromes which are commonly used by military and commercial

- According to the international examples, it is desirable that the order to remove aviation obstacles and determination of compensation for loss is laid under the authority of Director of CASA (Article 82 of Aviation Act-the Minister of MOCT, Article 63 of the enforcement decree of aviation act – the directors of local aviation office)

- Making obligatory to report immediately on plan for constructing new building and obstacles which may affect to safe operation of aircraft.

- Setting a standard to manufacture and install such obstacle as air navigation facility irremovable

- Suggesting specific standard of applying shielding theory
- Noticing the Aviation Obstacles Management Regulation(draft)
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1. ICAO ANNEX 14 - Aerodromes
2. ICAO Doc 9137 Part 6 - Control of Obstacles
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4. FAA AC70/7460-2K - Proposed Construction or Alteration of Objects that may affect the Navigable Airspace
5. FAA AC150/5190-4A - A model Zoning Ordinance to Limit Height of Objects around Airports
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Control of obstacle Enforcement Decree Regional autonomy law or state law AC 70/7460

초 록

항공기사고는 약 70%가 이·착륙단계에서 일어나는 CFIT사고이다. 그러므로 비행장주위의 장애물 관리는 사고방지에 매우 중요하다. 국내에서도 비행장주위의 장애물제한을 항공법에 규정하고 있고, 최근 개정안으로 제시된 동법 시행규칙에서 ICAO의 차폐기준의 적용을 포함하였으나 이 규정만으로는 비행장 주위의 장애물의 체계적인 관리가 어려우며, 특히 국내 비행장 주위의 차폐이론적용에 필요한 세부기준이 명확하지 않다. 본 연구는 항공장애물과 관련된 ICAO의 규정 및 항공선진국들의 관련 규정을 검토 분석하고 국내 현황과 비교분석한 후 국제기준에 비추어 국내 환경에서도 적용 가능한 비행장 공역에서의 항공장애물관리규정(안)의 방향을 제시 하였고 특히 논란의 여지가 많은 차폐이론의 적용의 명확한 기준방안을 제시하였다.

Key Words: Airfield airspace(비행상공역), Obstacles(장애물), Surface obstacles limitation(장애물제한표면), Obstacles control(장애물 관리), Shielding theory(차폐이론)