A Study on Improvement of Views across the Sea from a Modern Remain of Fortress in a National Park

Takatoshi Yasuda, Nobuo Mishima, and Takayuki Fuchikami

***Abstract*—In the Meiji era, a fortress for defense against the external threats was built in various parts of Japan. Currently, the fortress is located in a national park, in a place with a good viewing landscape to prevent enemy invading from the sea. However, the national park law is applied to that place, regulation is restrictive and strict concerning the extraction and logging of trees among others. There is, therefore, a place where a good viewing landscape across the sea is not guaranteed. In this research, the purpose is to clarify the viewpoint of modeling landscape, and to understand how to improve the view with minimal environmental impact.**

***Index Terms*—National park, modern fortress, vista potential, view improvement method.**

I. Introduction

In Japan, the modern fortifications established from the end of the Tokugawa period to the Meiji era are left in various places, some of which are located in national parks (Fig. 1). Although the modern fortress is often in a good place as a viewing place to the sea, they are restricted by tree felling by the Natural Park Law, and there are places where the view is obstructed by trees (Fig. 2). In this research, we aim to clarify the methodology of the view improvement on the modern fortress site located in the national park model.

In this research, we appropriately use the reference materials of [1]-[6]. [1]-[3] are detailed materials on the fortress constructed in the Meiji Period, and [4]-[6] are documents on the history of Shimonoseki.

In the past research, there are research on view scenery, research on landscape and plan of national parks, research on gaze characteristics and attraction landscape, and so on.

First of all, in the study on view scenery, Kuriyama et al. [7] has set a new evaluation indicator of the risk of loss of view in a sloping urban area where viewing subjects are likely to change due to building action. Under the scale of the degree of urgency and the degree of importance with which the viewing subject is lost, the view subject to conservation is materialized. Honma *et al.* [8] proposes a noteworthy viewpoint selection method to predict and evaluate the visual influence of wind power generation on the surroundings. In order to select the viewpoint, it is evaluated by the visible region, the visible radix, the appearance of the wind turbine, the viewing distance, and the region interfering with the landscape resource. Sendai and Yokoyama [9] considers the "tourist landscape" that appears through urban tourism as representing one aspect of urban identity, and analyzes the historical transition of the tourist landscape.

In the plan concerning the landscape and plan of the national park, Mizuuchi *et al*. [10] They are studying how the national park and its target landscape are conceived by the landscape architect Tsuyoshi Tamura.

Okano *et al.* [11] have clarified on what kind of viewpoint the importance was attached to landscape evaluation related to the selection of national parks.

Hori [12] made it clear by analyzing changes in the actual situation of planning and management of national parks by age. Itoh H. [13], [14] clarifies the position of Matsushima's many island scenery in the national park administration by document, for Matsushima's landscape in Miyagi prefecture. The field of view uses the 60 ° cone theory, and the angle looked down from the view point to the object and the distribution of islands in the visible region are used as an indicator of the view.

In the study on the landscape conservation plan, Okamura *et al.* [15], [16], on the premise that the view scenery is caught as a viewpoint, a foreground, a view subject, a view scenery as a whole, has value or meaning. By defining the landscape guidance scope and typifying it, we compare it with other types and consider it.

In the research on gaze characteristics and attraction landscape, Dokyu [17] divides it into the surrounding landscape of the near view and the distant view about the absolute height restriction aimed at preserving the historic landscape, and considers it. Matsumoto *et al*. [18]-[20] are conducting a view scenery evaluation for each height of the viewpoint. The characteristics of the viewing landscape with the height of each viewpoint were grasped from evaluation by composition evaluation, impression evaluation, attractiveness, and clarified the relationship. Also, the view from the altitude has many elements to be targeted, and since it has a three-dimensional depth, it makes a diverse group in the simplest good form. By clarifying the relationship between this unit property and the attraction landscape, they are considering a method of making attractive landscapes. In the research by Yokoyama *et al*. [21], when people looked at the landscape from the viewpoint, the impression of the landscape changed according to the shielding elements and the texture near the viewpoint. The viewing landscape is classified by describing the shielding elements and textures of each viewing field in front, back, up and down, left and right, and summarizing the situation of the viewpoint.

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II. Research Method

The study area is *Hinoyama* park (Shimonoseki city, Yamaguchi prefecture) with a fortress ruins in one of Seto Inland Sea National Park. We evaluate the cultural property buildings, military facilities and townscape in the shooting range as viewing points around the ruins of the fortress. We evaluate each viewpoint and make effective view improvement from minimizing the influence on the environment from the viewpoints with the highest evaluation (Fig. 3).

Fig. 1. Hinoyama turret (fourth turret ruins).

Fig. 2. Inhibition of the view by trees.

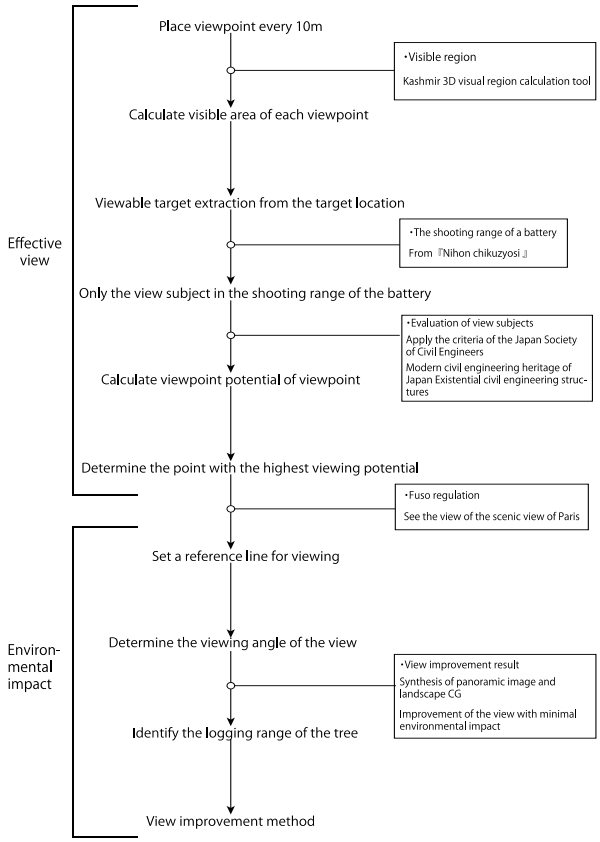

Fig. 3. Conceptual diagram.

III. The Modern Fortress Located in National Park

A. Seto Inland Sea National Park

The Seto Inland Sea National Park is the largest national park in the country, and the remains of the Shimonoseki Fortress, Yura Fortress, Hiroshima Fortress, Geiyo Fortress and Houyo Fortress, which were former fortresses in the park, are present.

B. Regulation by the Natural Park Law

Fortified ruins located in the Seto Inland Sea National Park are designated as special areas. From Article 20-3 of the Natural Park Act, the following acts shall obtain permission from the Minister of the Environment for special areas within the National Park (Table I).

TABLE I: Partial Excerpt from Article 20-3 of the Natural Park Act

Article 23-3 of the Natural Park Act	
Regulation on tree cutting	In the national park, the following acts require permission from the Minister of the Environment. 2, To cut dowm the trees. 3, To damage the trees within the area designated by the Minister of the Environment. 10, To clear the land and change the shape of the other land. 11, To collect alpine plants or other plants specified by the Minister of the Environment or to damage them. 13, To capture or kill an animal or other animal inhabiting a mountain designated by the Minister of the Environment, or collect eggs or damage the animal.

C. Vegetation of Hinoyama

The vegetation of Hinoyama consists shrubs such as morning glory, cherry blossoms, azaleas, and yamabuki. In the Seto Inland Sea National Park, there are designated plants that cannot be collected unless permission is granted, but there are no designated plants forbidden. Based on this fact, we will examine the view improvement method.

D. Outline of Research Area

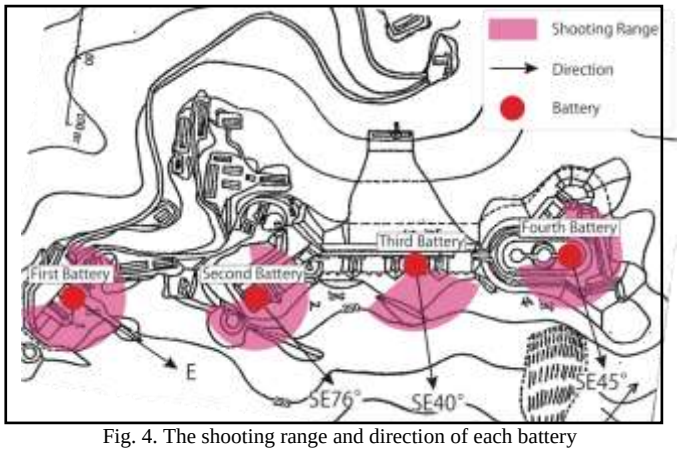

Fig. 4. The shooting range and direction of each battery (source: [1]-[3]).

TABLE II: OBJECT THAT CAN BE VIEWED FROM THE MOUNTAIN OF FIRE AND EVALUATION
SOURCE: [8]-[10]

Historical cultural property	number	Shimonoseki city area	Score	number	Chofu area	Score	number	Moji area	Score
Country designation	1	Old British Consulate	3	13	Maeda-battery	3	17	Mojiko Station	3
	2	Tadamitu-Nakayama grave	3	14	Manzyu-Forest	3	18	Former Mitsui Club	3
	3	Ayaragi township remains	3	15	Kanzyu-Forest	3	19	Former Osaka Mercantile Moji branch	3
	4	Kazikuri-hama Ruins	3				20	Kyushu Railway Memorial Hall	3
	5	Jinma mountain tumulus	3				21	Moji ward office	3
	6	Mica basalt in Muture-island	3						
	7	Shimonoseki Southern Post Office	3						
Prefecture designation	8	Yamaguchi Bank(former head office)	2	16	Large ginkgo of Shoen temple	2			
City designation	9	Former Akita Shokai	1						
	10	Former Yon-ken dog	1						
	11	Inzyo-temple gate	1						
	12	Fossil layer of Hikoshima Nishiyama	1						

War remains	number	Shimonoseki city area	Score	number	Moji area	Score
Shimonoseki Fortress	22	Ryouzyusen-base	2	31	Moji-battery	0
	23	Ichiriyama-base	1	32	Kozyo-battery	1
	24	Senjogahara base	1			
	25	Konpirasan-battery	1			
	26	Oinoyama-battery	0			
	27	Suziyama-battery	0			
	28	Shimonoseki Fortress Headquarters	0			
	29	Ohhata- Ranger Field	0			
	30	Shimonoseki Army Hospital	0			

Townscape	number	Shimonoseki city area	Score	number	Chofu area	Score	number	Moji area	Score
	33	Shinchi-nishi town	1	36	Samurai-town	3	38	West side of Moji Port National Route 2	3
	34	Karato-town	3	37	Maeyahata-town	0	39	East side of Moji Port National Route 2	0
	35	Kifune-town	0						

Hinoyama Park was once responsible for the defense of the Kanmon Strait as one of the batteries of Shimonoseki Fortress. At the time of the Meiji period there were four turrets in the premises, but now the first and second batteries are almost inexistent and the third and fourth turret remains. The four turrets have different shooting direction and shooting range (Fig. 4).

IV. ANALYSING VIEWING POINT FROM THE FORTRESS

We set the viewing point every 10 m so as to surround the fortress ruins on the park and calculate the visible area from each viewpoint using Kashmir 3D. Then, we narrowed down to only viewing subjects that can be viewed from each viewpoint (Table II).

V. KASHIMIR 3D

Kashmir 3D is a kind of Geographic Information System (GIS). It is possible to three-dimensionally display a mountain and to calculate a visible region from the viewpoint field. In this research, we used a system for calculating thevisible region when extracting the view subject. The visible region of the viewpoint is colored on the map and displayed (Fig. 5).

VI. THE EVALUATION OF THE VIEW SUBJECTS

At the Japan Society of Civil Engineers, we evaluate modern civil engineering heritage by using three criteria of technology, design, genealogy.

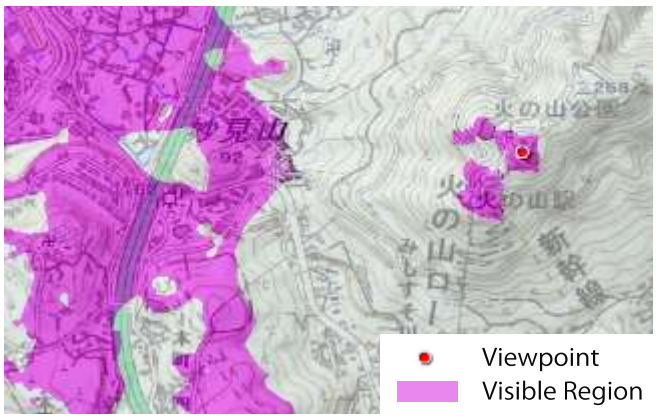

Fig. 5. Calculation of visible region.

In the present study, the same evaluation criteria were applied to cultural property buildings, and the townscape applied the same evaluation criteria for the remaining degree of historicity due to the city change. At the Japan Society of Civil Engineers, we evaluate by A, B, C, D rank, but in this research three points are equivalent to nationally designated important cultural assets, two points are equivalent to prefecture designated important cultural assets, one points is equivalent to a cultural property registered and a country registered cultural heritage or ward municipality cultural heritage (Table II). We narrow down to the view subject in the shooting range of each battery and identify the effective viewing landscape seen from each battery.

VII. VIEWING POTENTIAL

We set viewpoints at intervals of 10 m, and value of viewpoint evaluated by integration is taken as viewing

potential (TP). It divided into areas of 1st to 4th turret, and TP high viewpoint was extracted for each area (Fig. 6). It was revealed that trees block vision with a good view point with high TP.

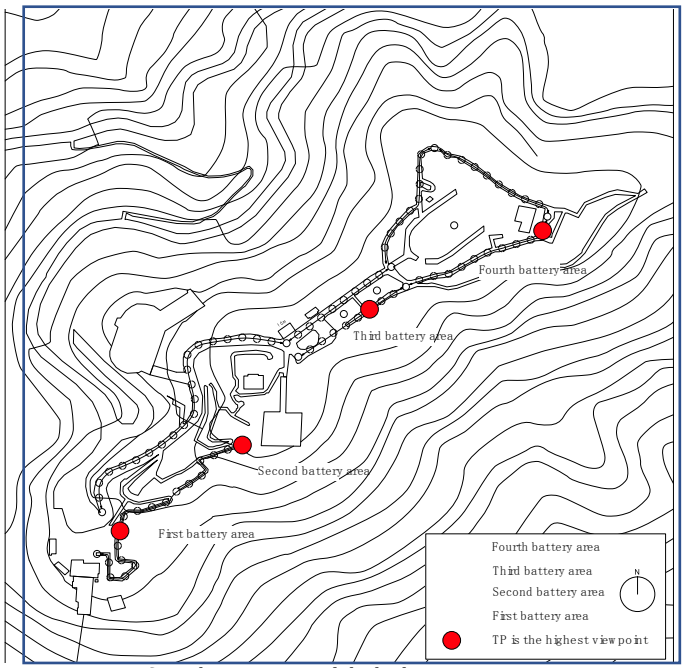

Fig. 6. Each turret area and the highest TP viewing point

VIII. On Reference Line Setting for Viewing Targets

In the fuseaux protection system of Paris used for preservation of its historical landscape, the reference line is set to the viewing targets. In this research, we will improve the view by using reference lines to minimize the environmental impact. On the reference line, there are perspectives, overlook scenes, cuttings scenery. In this study, it is a viewing from the fortress ruins, so we considered the environmental impact with reference to the overlooking scenes (Fig. 7).

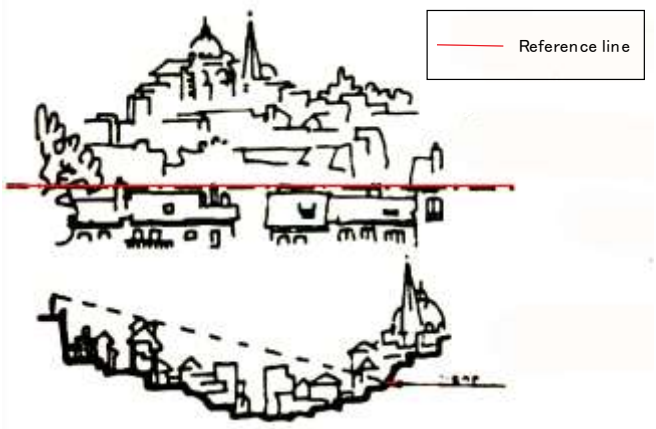

Fig. 7. Reference line in the fuseaux protection system of Paris

IX. Determination of View Range

The viewing range is decided by connecting the viewing range of each view targets. Since the fortress ruins which is the viewing targets is on the top of the mountain, we set the viewing range to the mountain edge and the edge as the viewing range. Then, we set the viewing range of the view other than the fortress ruins as shown in the figure. By connecting these, we decide the viewing field range seen from the viewpoint (Fig. 8).

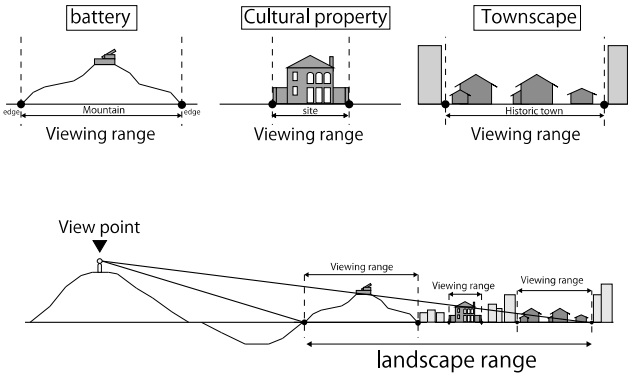

Fig. 8. Viewing area.

X. Determination of Tree Cutting Range

After determining the viewing range, we clarify the logging range of trees when the view is improved.

Tree cutting is done so that each viewable target can be seen using a reference line from the viewpoint. We set trees as 10m high and cut or prune trees on the line that linearly connects the view point and reference line.

We calculated the viewing angle necessary for effective viewing from the viewpoint of each battery area, and the ratio of the cut area in the park. The results are shown in the table (Table III). It is clear that viewing improvement can be done between 0.1% and 3% even if the ratio of the cut area of each battery is compared.

XI. Conclusion

For Hinoyama park, the current viewpoint was analyzed and evaluated by calculating the viewing potential with the respecting to the historical resources, with the modern fortress located in the national park as the viewpoint.

As a result, it became clear that the view is obstructed by the trees about the viewpoint where the viewing potential to historical resources is high. The logging is prohibited from tree cutting in Article 20-3 of the Natural Park Act. As a result of examining the evaluation method of the view impediment to TP and the extraction method of the range of effective tree cutting logging etc., it is possible to calculate the ratio of the cut-off area in the park. We made the image combining the panorama image and the landscape CG. It was able to express the situation after improvement by creating landscape CG (Fig. 8.-Fig.16.)

In conclusion, in this research, we evaluated what is expected as a visual target, and tried by creating a method to secure the view over the sea from the battery and the tree cutting range.

As an issue through this research, the evaluation of the historic townscape, which is the subject of the view, is not accurate, so new standards for townscape evaluation are necessary. Also, for viewing objects, objects within the visible range are extracted, but there are many problems such as not being able to determine whether it is actually visible

because the height of the building is not considered. I would like to solve these problems and develop research.

TABLE III: IMPROVEMENT OF VIEW OF EACH BATTERY AREA

	View subjects	View angle of view	Depression	Logging horizontal distance	pruning・Logging area	Percentage of logging area in park area
First turret	Old British Consulate	164°	5.76°	60m	1515㎡	0.70%
	Suziyama-battery		1.21°	10m		
	Kozyo-battery		1.64°	50m		
	Former Osaka Mercantile Moji branch		4.39°	50m		
	Former Mitsui Club		4.34°	50m		
	Mojiko Station		4.02°	80m		
	Kyushu Railway Memorial Hall		3.76°	60m		
	Moji ward office		3.31°	50m		
	Moji-battery		9.66°	60m		
	Manzyu-Forest		1.50°	20m		
Second turret	Old British Consulate	93.6°	6.13°	170m	5737㎡	2.80%
	Suziyama-battery		1.35°	130m		
	Kozyo-battery		2.33°	40m		
	Former Osaka Mercantile Moji branch		4.70°	40m		
	Former Mitsui Club		4.70°	20m		
	Mojiko Station		4.46°	10m		
	Kyushu Railway Memorial Hall		4.05°	30m		
	Moji ward office		3.60°	10m		
	Moji-battery		10.29°	40m		
	Former Yon-ken dog		7.00°	150m		
	Inzyo-temple gate		7.36°	130m		
	Yamaguchi Bank(former head office)		4.74°	190m		
	Shimonoseki Southern Post Office		5.90°	160m		
	Former Mitsui Club		1.34°	130m		
	Former Akita Shokai		5.95°	160m		
Third turret	Kozyo-battery	34.4°	2.66°	40m	386.3㎡	0.10%
	Former Osaka Mercantile Moji branch		4.80°	40m		
	Former Mitsui Club		4.78°	40m		
	Mojiko Station		4.54°	50m		
	Kyushu Railway Memorial Hall		4.20°	40m		
	Moji ward office		3.68°	30m		
	Moji-battery		10.03°	30m		
Fourth turret	Kozyo-battery	216°	2.72°	40m	847.5㎡	0.40%
	Former Osaka Mercantile Moji branch		4.75°	20m		
	Former Mitsui Club		4.75°	20m		
	Mojiko Station		4.38°	20m		
	Kyushu Railway Memorial Hall		4.08°	30m		
	Moji ward office		3.67°	20m		
	Moji-battery		9.59°	40m		
	Ryouzyusen-base		0.67°	30m		

Fig. 9. First turret area before improvement

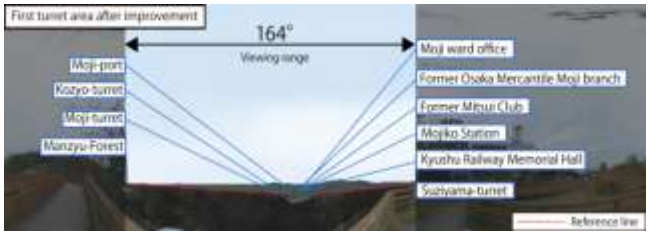

Fig. 10. First turret area after improvement

Fig. 11. Second turret area before improvement

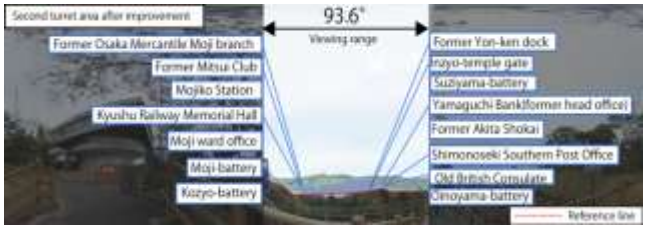

Fig. 12. Second turret area after improvement

Fig. 13. Third turret area before improvement

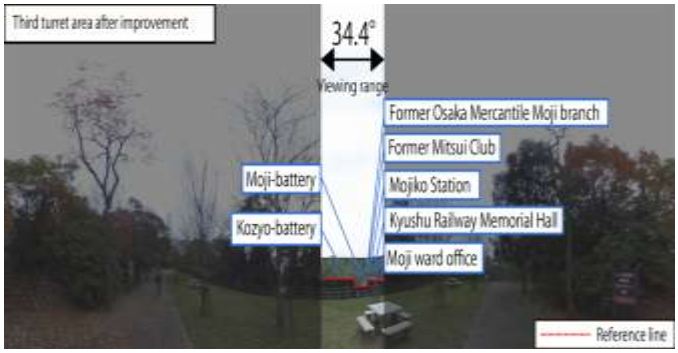

Fig. 14. Third turret area after improvement

Fig. 15. Fourth turret area before improvement.

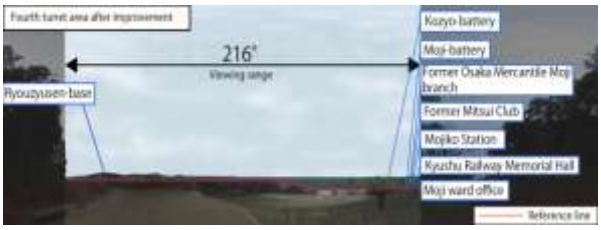

Fig. 16. Fourth turret area before improvement.

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