

---

## Study on evaluation method of mechanical properties of compacted soil in construction site

Hiroyuki NAGAI

---

This study focused on the technique to realize rationalization of construction and quality improvement of embankment structure by upgrading of compaction management in embankment construction. First, this paper explains the challenge of i-Construction with the aim of productivity improvement of the whole construction in addition to the present compaction management methods such as the quality regulation system and method regulation system. It shows the importance of new compaction management technology which realizes the rationalization of construction and quality improvement of embankment structures.

On the other hand, as the current compaction management issues that need to be solved in order to realize a new compaction management method, ensuring the immediacy of the quality measurement method and the necessity of upgrading a quality evaluation technique by modifying the gravel rate correction formula (hereinafter referred to as the WH formula) by Walker-Holtz are shown. From this, field and laboratory experiments were conducted with the aim of evaluating the compaction characteristics by the acceleration response method and the sophistication of the gravel rate correction formula. The quality information of the embankment structure was measured in real time and in a set area, and the results were obtained. A new compaction management method that enables highly accurate quality evaluation by applying the gravel rate correction formula was proposed. This method was applied to the actual construction and the effectiveness was clarified.

Chapter 1 of this paper outlines the features of embankment compaction management and explains the damage situation of embankment structures due to the intensification of natural disasters in recent years, as well as the estimation of i-Construction for the purpose of improving construction productivity. It shows the importance of a new compaction management method to realize the rationalization of construction and quality improvement of embankment structures.

Chapter 2 presents the knowledge obtained so far regarding the compaction management of embankments, ensuring the immediacy of the quality measurement method as the

---

purpose of this study, and the necessity and issues of upgrading the gravel rate correction formula are shown.

In Chapter 3, for the purpose of ensuring the immediacy of the quality control method, an efficient compaction control method using the ground rigidity index was examined. A compaction test was conducted using a full-scale compaction machine in a large soil tank, and the relational expression between the ground rigidity index such as the acceleration response value (hereinafter referred to as the *CCV* value) and the dry density  $\rho_d$ , saturation  $S_r$ , and water content ratio  $w$  were established. The *CCV* value is the most suitable method for the rationalization of construction which is one of the targets of this study, because real-time and planar measurement are possible during construction.

In Chapter 4, the effect of the difference in the maximum particle size  $D_{max}$  of the ground materials handled in the laboratory test and the field test on the mechanical properties was clarified, and the method that upgrades the WH formula using the maximum dry density ratio  $X$  was proposed.

In Chapter 5, based on the conclusions of Chapters 3 and 4, the paper presents an application method to actual works, while it systematically arranges a quality measurement method by *CCV* values and a new compaction management method combining the advanced WH formula.

Chapter 6 summarizes the conclusions obtained in this study and future developments and issues. This study verified that it is possible to evaluate the quality information of embankments with high accuracy by adding it in real time and in planar fashion. On the other hand, as remaining issues, it is necessary to develop a real-time and planar evaluation method for the water content ratio, and improve the estimation accuracy of the dry density  $\rho_d$  by the *CCV* value using that measured water content ratio value.