

IN-HOUSE VE FOR CONSTRUCTION WORK BY EAST JAPAN RAILWAY

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Since 1989, when East Japan Railway introduced VE, the author has been an active member of the VE promotion committee in the Tokyo construction work office; he became a Class II engineer in 1992, and became a VE instructor in the following year. Since then, he has worked as an in-house lecturer for VE skills training. At present, he is in charge of the VE promotion secretariat in the Tokyo construction work office, and draws up VE plans as a member of the VE promotion working group in the Construction Work Department.

ABSTRACT

This paper introduces the circumstances of in-house VE in East Japan Railway's Construction Work Department, and presents examples of previous in-house VE activities and the five steps of the Priority VE method, an efficient VE method that was developed recently.

1. INTRODUCTION

East Japan Railway's Construction Work Department has been striving to reduce costs in all stages of the planning, designing and execution of the construction and improvement work of railway facilities.

We promote cost reduction through various means, including in-house VE by our company's employees, promotion of cost reduction proposals, technological development and implementation, expansion of VE contracts, and so forth.

In particular, in 1996 we developed the five steps for Priority VE for efficient VE activities; these steps can easily be applied to the Construction Work Department. We are promoting VE activities through this Priority VE together with Basic VE, which is the general 10-step VE method. In 1997, we carried out Priority VE on a full scale, and our in-house VE activities greatly reduced costs in the Construction Work Department.

2. IN-HOUSE VE

(1) First-Term Five-Year Plan

The first five-year plan of East Japan Railway's Construction Work Department ran from when VE was introduced in 1989 until 1993, and VE activities were encouraged through training and awareness efforts. We set up and have promoted VE activities with a VE management committee and VE promotional committee.

Our promotion efforts include five kinds of VE training courses, VE Manager Training, VE Skills Training, VE-WSS (Work Shop Seminars), VE Development & Design Training, and VE Instructor Training. These VE courses are held at our Central Training Center, and are given by lecturers invited from SANNO College.

We trained eight VE instructors in 1992, and since 1993, 60 technicians have been trained every year, receiving VE Skills Training from these instructors instead of from external lecturers. As of this year, the number of VE technicians has reached 360.

To provide teaching materials suitable for the Construction Work Department's VE skills training, the VE instructors have prepared texts using examples of previous railway construction work.

The contents of each training course are outlined below.

① **VE Manager Training**

This is given to employees involved with management, to learn the roles of managers in VE activities and develop VE management capabilities, based on the view that VE relies on a top-down approach.

② **VE Skills Training**

This teaches employees how to carry out in-house VE, teaching them the concepts and methods of VE.

③ **VE-WSS (Work Shop Seminars)**

We form various project teams consisting of employees who have completed the VE Skills Training course and are using VE activities in their daily work. Each team conducts VE activities on a particular theme (the name of the project actually being carried out). During a six-month period, we hold 12 meetings on each theme, and we ask each team to apply the results of its project to practical business.

This VE-WSS training is recognized by SANNO College, and each trainee who has successfully completed this course receives the Engineer Class II title and is qualified to apply for CVS testing.

④ **VE Development & Design Training**

This course teaches the concepts and techniques for designing VE methods for minimizing cost, by giving trainees an understanding of the VE method at the project-planning stage, as well as the functions required by users, so that trainees can develop new ideas to satisfy the requirements.

Design here means creating and analyzing structures with specific functions and performance, preparing various alternative plans based on the analysis results, and choosing the optimum plan from among these alternative plans.

⑤ **VE Instructor Training**

This is given to employees who have qualified as Class II engineers, to train them as in-house lecturers for VE Skills Training.

(2) **Second Five-Year Plan**

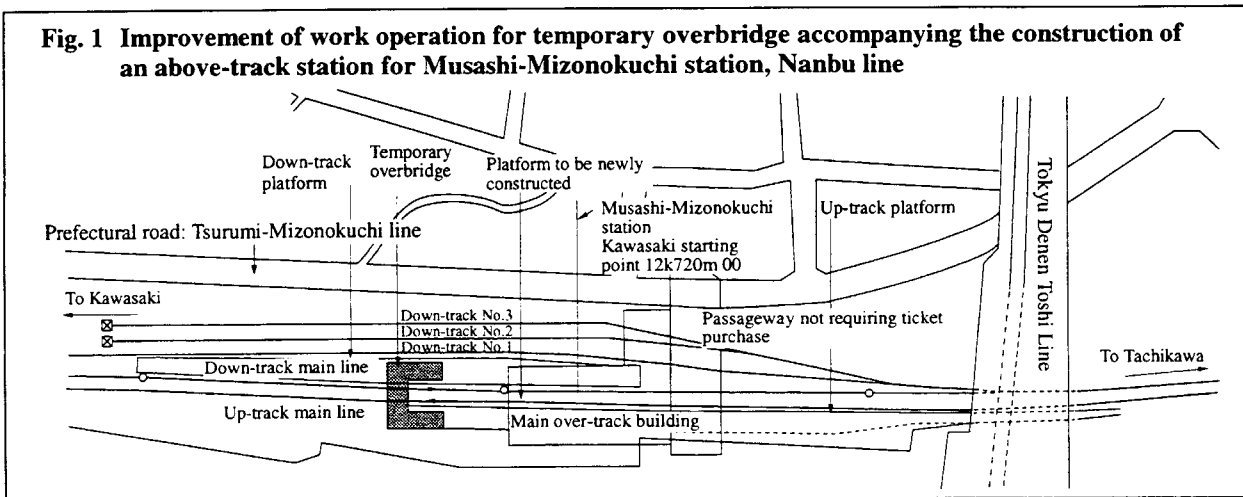
In the second five-year plan for 1994 to 1998, we expanded in-house VE and strengthened the VE system, based on a top-down approach, to improve quality. We set a target cost reduction of ¥10 billion in total over five years for the entire Construction Work Department, and achieved this in the fourth year, one year earlier than planned.

We divided the in-house VE into three stages, Plan and Concept VE, Basic Plan VE, and Design and Operation VE, according to the stages of project progress, and carried out the activities. Each of the four construction work offices held a meeting each year to present the results.

3. IN-HOUSE VE PRECEDENTS

As a specific example of in-house VE, we introduce here the construction work to improve a temporary overbridge as part of "the construction of an above-track station for Musashi-Mizonokuchi station on the Nanbu line". This station construction work involved building a new passageway for which no ticket is required, and developing an above-track station building as part of the redevelopment project for the station area being carried out by Kawasaki city as shown in Fig. 1. The existing overbridge obstructed construction of the above-track station building, so a temporary overbridge was built to ensure passenger flow while the station building was being built (about 18 months). After use of the above-track station building began, this overbridge was to be removed and the up-track platform extended in the direction of Kawasaki by 63 meters.

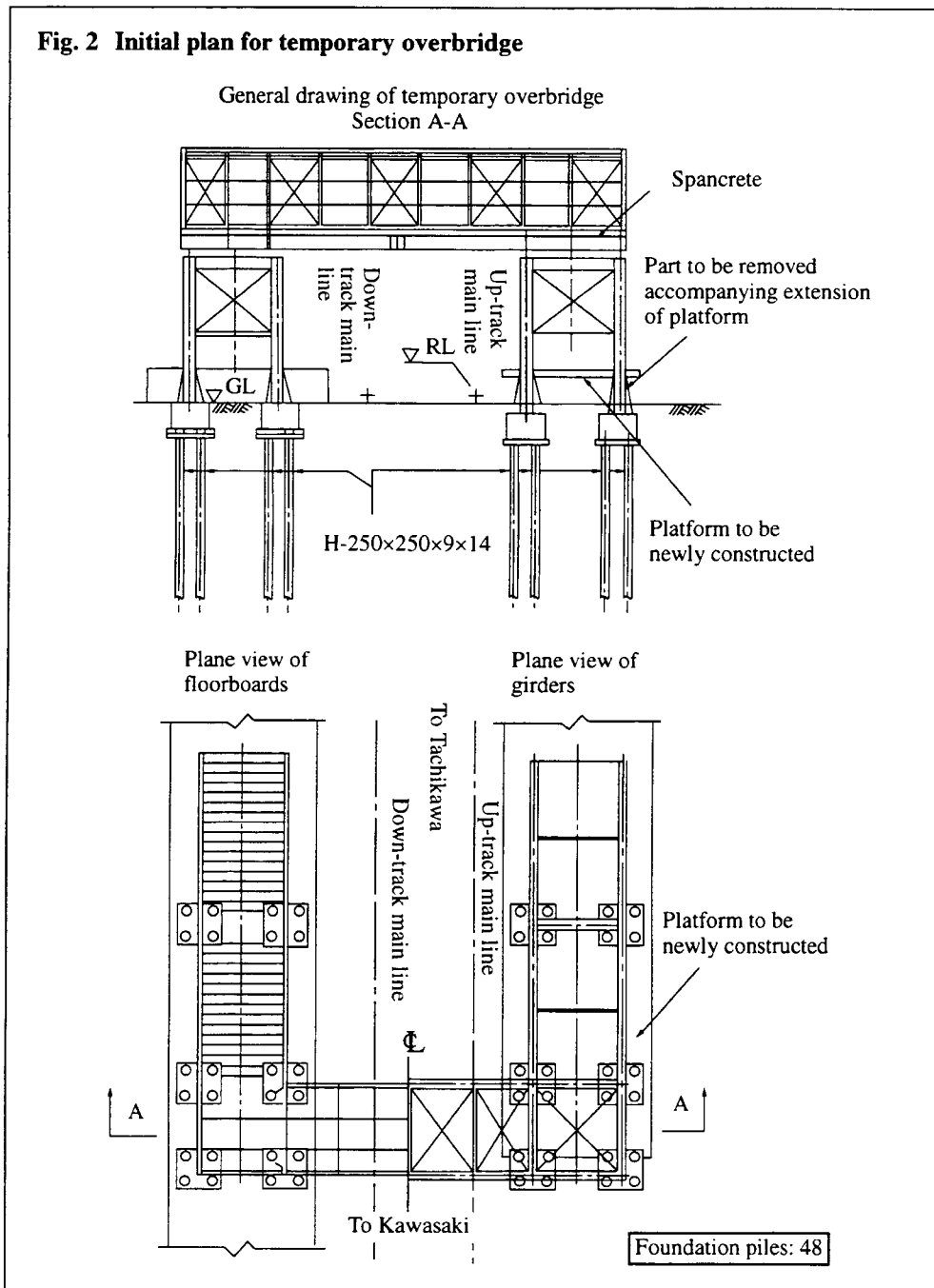
Fig. 1 Improvement of work operation for temporary overbridge accompanying the construction of an above-track station for Musashi-Mizonokuchi station, Nanbu line



We decided to carry out the function definition, evaluation of functions, and preparation of alternative plans in line with the 10-step basic VE activities. Specifically, we developed original ideas for each of the functions of: supporting the load, ensuring sufficient height, and creating space for moving, for the temporary overbridge, as defined in the function definition step, and prepared alternative plans.

In the initial plan, the temporary overbridge

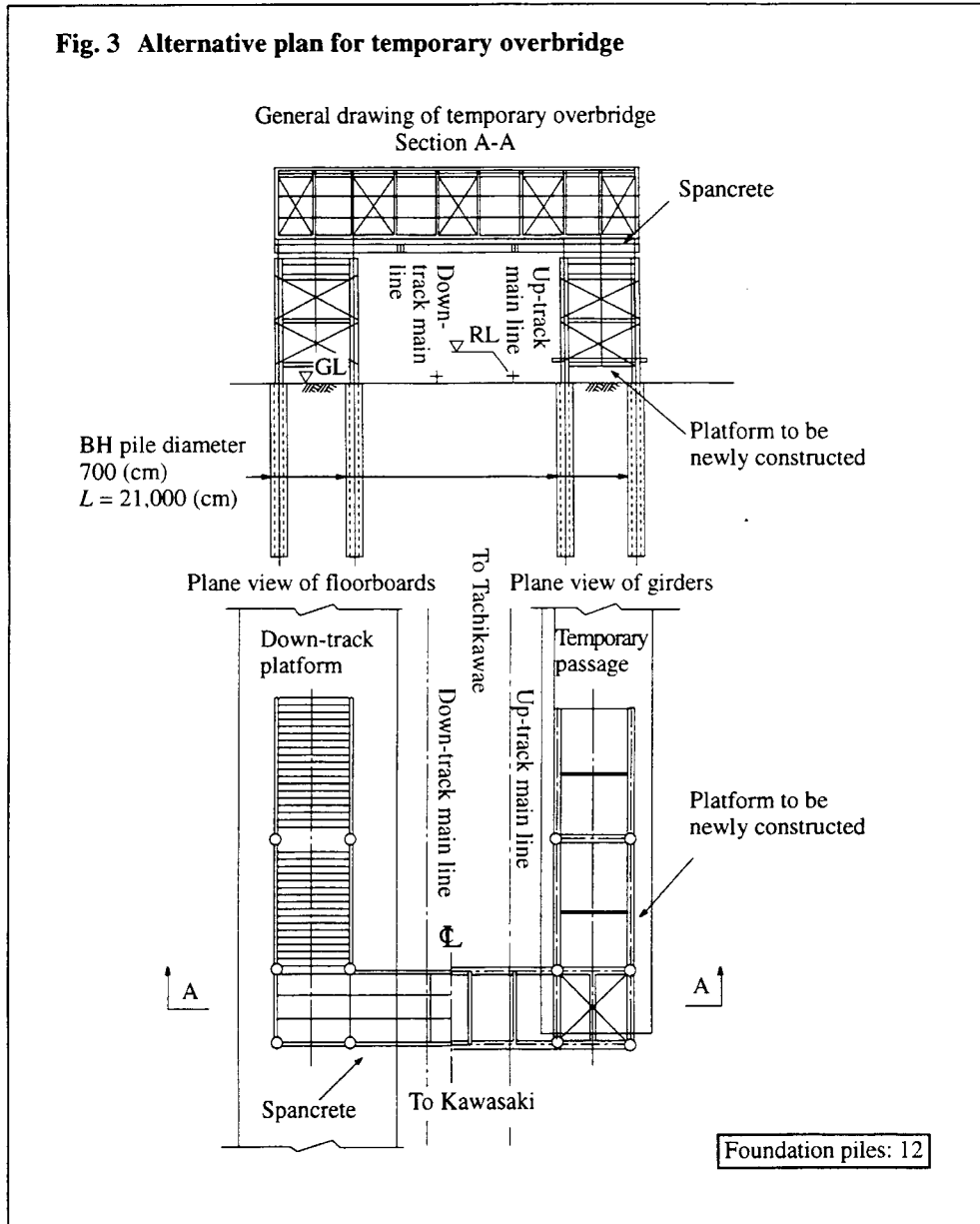
structure was designed to have one footing and four H-shaped steel piles (H250) support the load for each column of the temporary overbridge as shown in Fig. 2, with a total of 48 piles needed. Also, the position of the temporary overbridge overlapped the extension planned for the platform, and so the upper section of the temporary overbridge above the footings would have to be removed before starting the platform extension work.



In the alternative plan, however, we decided to use one foundation pile for each column of the temporary bridge, in other words, to use a total of 12 piles, by adopting BH piles (diameter 700 (cm)) for pile foundations as shown in Fig. 3. We also unified the BH piles with the abutment and pier columns which do not need footings, and designed the position and

structure of the six foundation piles in the section overlapping the extension portion of the platform so that they could be used as platform foundation piles after removing the temporary overbridge.

As a result, we were able to reduce the cost by about 30% and shorten the work period by one month.



4. DEVELOPMENT OF PRIORITY VE

(1) Development Objectives

Since introducing VE activities in 1989, the Construction Work Department has been developing the system and achieving better results each year. VE activities are now the main means of reducing cost. However, some employees consider that the VE method is too time consuming and labor-intensive, so we decided to develop a more efficient VE method to solve this problem and to expand in-house VE activities.

(2) Development of Priority VE Method

The Construction Work Department previously carried out VE activities using the Basic VE system consisting of 10 steps. This Basic VE system was used in the production department for the development and improvement of products. Its goals were to prepare alternative plans incorporating new ideas even if this took more time, and to obtain good results.

However, in VE for the production of a single on-site item such as a structure for construction work, efficient action in a short period is required. Therefore, in the Construction Work Department we needed to develop our own VE method, conforming to the Basic VE approach.

Before developing the new method, we clarified the objectives of the Basic VE system, compared them against actual VE activities, and identified which steps could be omitted.

As a result of our study indicated in Table 1, we

developed the Priority VE system in which the execution flow is concentrated in five steps, by selecting VE subjects for top-down action. In the basic step of defining Priority VE functions, the VE subject is selected; in the detailed step we unified the definition of functions and sorting of functions, as definition of functions, and make extensive use of collection of function definition precedents as needed.

Also, in the basic step for evaluating functions, we made good use of collection of cost information for the cost analysis, and unified the cost analysis for each function, evaluation of functions and selection of subject fields from the detailed steps, into the category, understanding of existing costs.

Because the Construction Work Department carries out VE activities while executing the project, we select employees responsible for construction work who have a good knowledge of the theme to be involved in VE activities, in the basic step of preparing alternative plans. Therefore, the ideas they create are likely to be feasible. We have therefore combined the rough evaluation, actualization and detailed evaluation detailed steps, into actualization.

5. CONCLUSION

As stated, this year is the 11th since East Japan Railway's Construction Work Department introduced VE activities in 1989. We shall continue to develop the VE techniques that we have built up, and apply in-house VE at all stages in the execution of projects, to improve results.

Table 1 Comparison of East Japan Railway Construction Work Department's Basic VE and Priority VE

[Basic step]	[Detailed step]	
	<Basic VE>	<Priority VE>
		<div style="text-align: center;"> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">VE plan meeting</div> <div style="text-align: center;">↓</div> </div>
<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">(1) Definition of function</div> <div style="text-align: center;">↓</div>	<div style="text-align: center;"> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">① Collection of information for subject VE</div> <div style="text-align: center;">↓</div> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">② Definition of functions</div> <div style="text-align: center;">↓</div> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">③ Sorting of functions</div> </div>	<div style="text-align: center;"> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">① Collection of information for subject VE</div> <div style="text-align: center;">↓</div> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">② Definition of functions</div> <div style="text-align: center;">↓</div> <div style="text-align: center;">(Practical use of "collection of function definition precedents")</div> </div>
<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">(2) Evaluation of functions plan</div> <div style="text-align: center;">↓</div>	<div style="text-align: center;"> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">④ Cost analysis for each function</div> <div style="text-align: center;">↓</div> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">⑤ Evaluation of functions</div> <div style="text-align: center;">↓</div> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">⑥ Selection of subject field</div> </div>	<div style="text-align: center;"> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">③ Understanding of existing costs</div> <div style="text-align: center;">↓</div> <div style="text-align: center;">(Practical use of "collection of cost information")</div> </div>
<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">(3) Preparation of alternative plan</div> <div style="text-align: center;">↓</div>	<div style="text-align: center;"> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">⑦ Creation of ideas</div> <div style="text-align: center;">↓</div> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">⑧ Rough evaluation</div> <div style="text-align: center;">↓</div> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">⑨ Actualization</div> <div style="text-align: center;">↓</div> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">⑩ Detailed evaluation</div> </div>	<div style="text-align: center;"> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">④ Creation of ideas</div> <div style="text-align: center;">↓</div> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">⑤ Actualization</div> <div style="text-align: center;">↓</div> <div style="text-align: center;">(Practical use of "collection of cost information")</div> </div>