Management questions in tunnel reconstruction

Management Questions in Tunnel Reconstruction

Gestion des travaux de rénovation de tunnels

Management bei Tunnelsanierungen

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SUMMARY
In this breaf treatment of the topic "Management In Tunnel Reconstruction" the following points are touched upon: historical retrospective; experiences made especially in relation to partnership; setting priorities, division of responsibility and coordination; technical problems associated with the execution; human aspects.

RÉSUMÉ
Les aspects de gestion lors des travaux de rénovation de tunnels sont abordés dans cette contribution: historique; expériences de collaboration avec diverses entreprises; choix des priorités; responsabilités et coordination; problèmes techniques d'exécution; aspects humains.

ZUSAMMENFASSUNG
In diesem kurzen Abriss zum Thema "Management bei Tunnelsanierungen" werden folgende Punkte gestreift: geschichtlicher Rückblick; erstes Erfahrungspotential; Partnerschaft; Prioritäten; Verantwortlichkeiten und Koordination; ausführungstechnischer Problemkreis; menschliche Aspekte.

1. HISTORICAL RETROSPECTIVE

If we examine the age in relation to type of the various tunnel structures in Switzerland then the following picture emerges (see fig. 1):

Railway tunnels	70 - 120 years
Galleries for power plants	20 - 70 years
Road tunnels	10 - 25 years

In order to maintain safe operating conditions in the 70 to 120 year old railway tunnels it is imperative to carry out certain reconstruction and rehabilitation works. In the past 70 to 100 years both the frequency of trains (resulting in increased wear and tear of the tracks) and the operating conditions have changed considerably.

Some general problems arising in tunnel works are well-illustrated with reference to the railway tunnels.

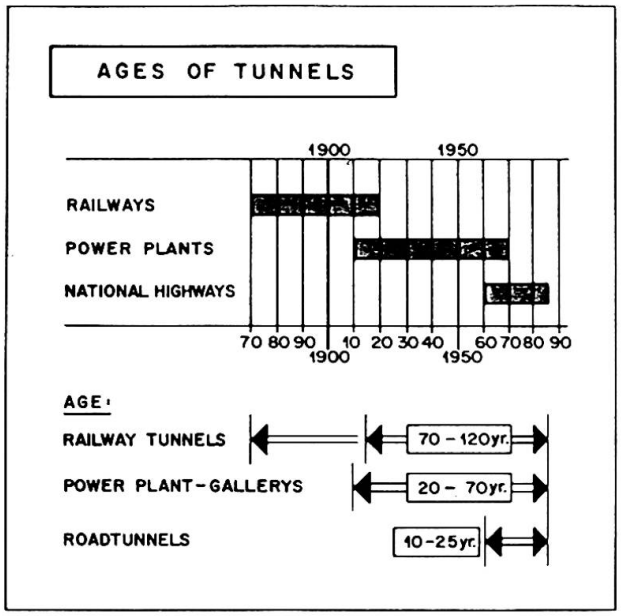

fig. 1

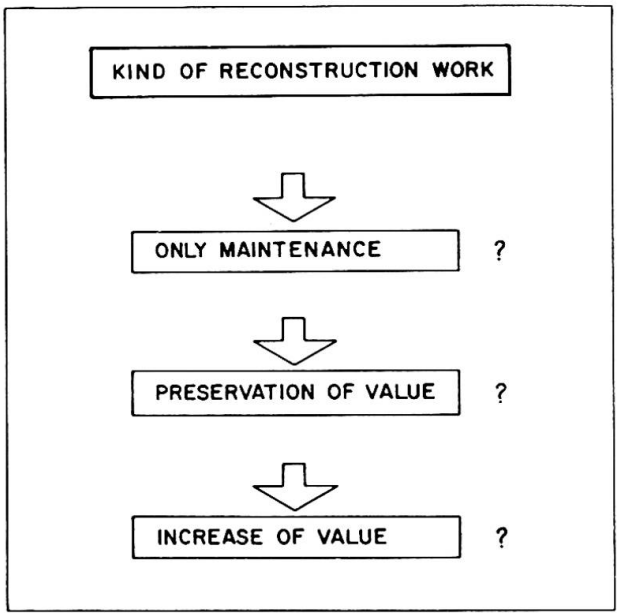

fig. 2

2.FIRST EXPERIENCES AND THE NEED FOR PARTNERSHIP

Since the sixties many railway tunnels have been the object of extensive rehabilitation. For the owner the question arose as to how this could be best achieved (see fig. 2). Would basic maintenance suffice, should increased maintenance be considered or should the tunnels be rehabilitated to the extent that their value is increased ? Thus questions were raised which the owner needed to clarify in the initial planning phase (see fig. 3).

Tunnel rehabilitation work introduces for the parties involved problems which have previously been given little attention. To what extent is the owner with his operating services a partner in the whole business ? This aspect of partnership is vital in the case of railway tunnels, but is also valid in a reduced form in the case of road tunnels.

If during the rehabilitation work the tunnel is put out of operation the problems are greatly reduced. For the contractor the problem is then only one of reconstruction.

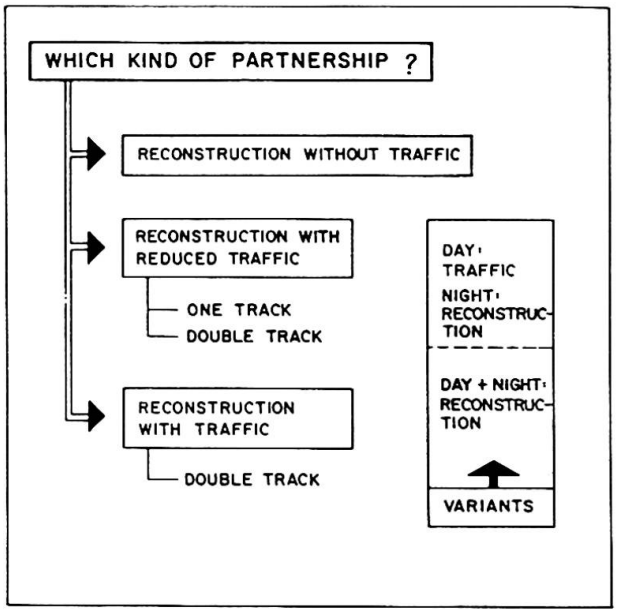

fig.3

On the other hand, if the work must be carried out while partial or full rail services are kept running, the problems become extremely complex (see fig. 4). Rehabilitation under traffic conditions necessitates close cooperation between the owner and the contractor for the period of the reconstruction work. They share a common task through thick and thin.

With his rail services the owner provides the framework. The owner´s operating system governs the contractor´s activities. He supplies the rolling stock and some of his personnel for certain aspects of the work.

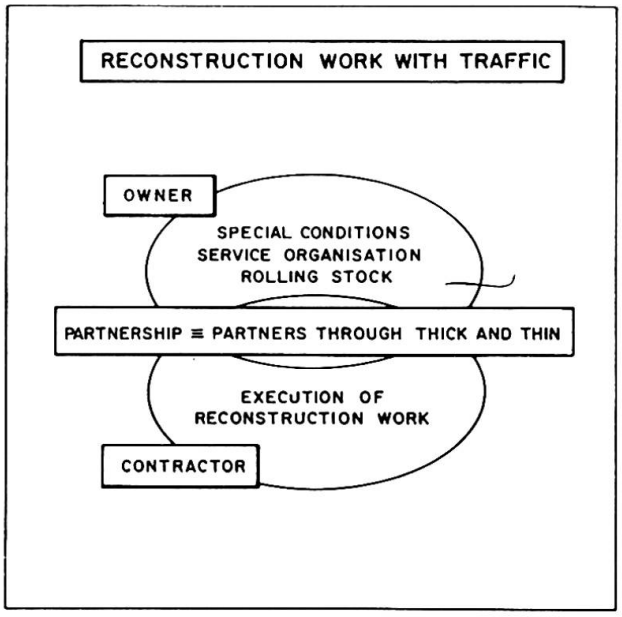

fig. 4

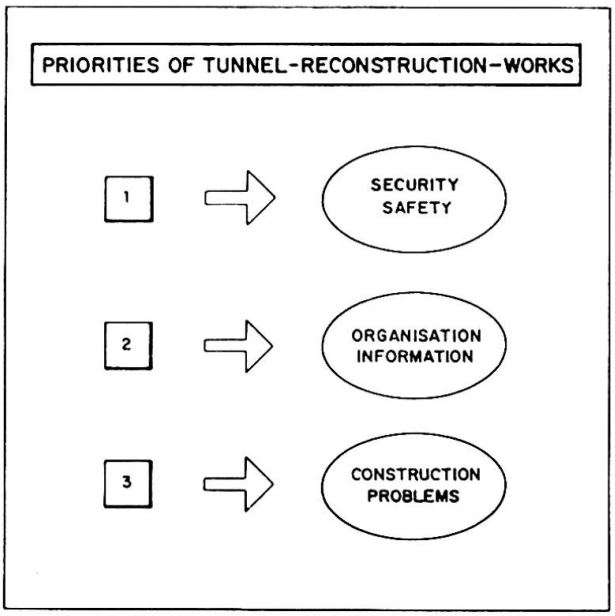

fig. 5

3. PRIORITIES, RESPONSIBILITIES, AND COORDINATION

Reconstruction work involves a clear sequence of priorities (see fig. 5).

In the first place comes safety. Both owner and contractor have a common aim, namely, that under no circumstances should anything happen. This requires special safety provisions. Tunnel reconstruction is characterised preeminently by detailed safety measures, including safety personnel provided by the owner in the various working teams,and acoustic and optical warning and emergency equipment. Above all, however, all those involved have to be given training at an early stage in the construction process.

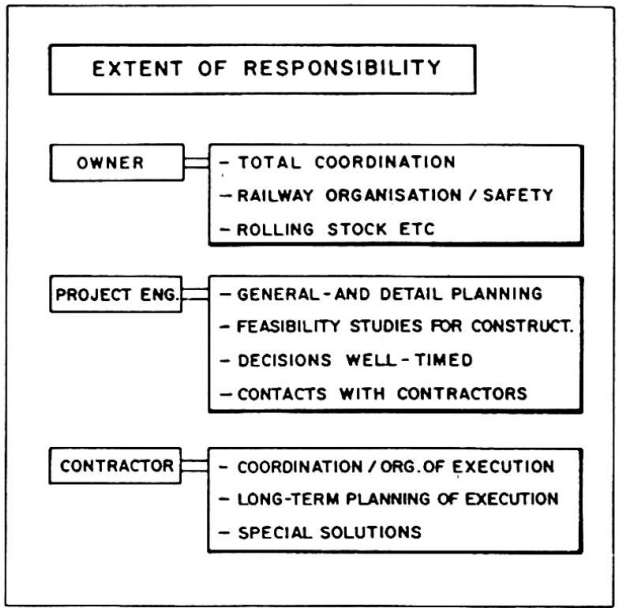

fig.6

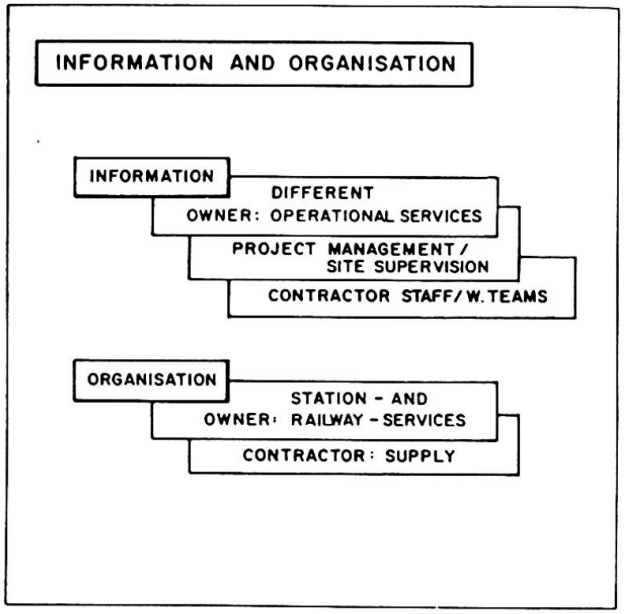

fig. 7

Compared to other construction projects, the owner has to give careful attention to details both in the initial planning stages and in the subsequent execution of the work. Due to the intertwining of the activities of the owner, the engineer in charge of the project and the contractor and thus also of their areas of responsibilitiy, information and organisation becomes especially important (see fig. 6). Only a comprehensive information base, including if necessary all departments of the railway, can guarantee a safe operation of the services (see fig. 7).

Tunnel reconstruction work is coupled to the plan of train services around the clock. The rail service clearly has priority, and the detailed organisation of the various contractors is subject to it. Only a perfect organisation permits the loading and unloading of wagons during change of working shifts.

The shunting work with the wagons supplied to the contractors, which often involve trains of a few hundred metres of length, requires great care and attention on the part of the railway personnel. Mistakes lead to loss of time. This would then lead to a poor performance on the part of the contractors affecting the time plan and also to unpleasant discussions about costs.

4. TECHNICAL PROBLEMS ASSOCIATED WITH THE EXECUTION

We now turn the question of what kinds of technical problems face the contractor and how he should go about the construction work. Depending on the condition and age of the tunnel widely varying rehabilitation work has to be carried out (see fig. 8,9). The geology and groundwater conditions are important contributory factors in relation to the nature and extent of the damage.

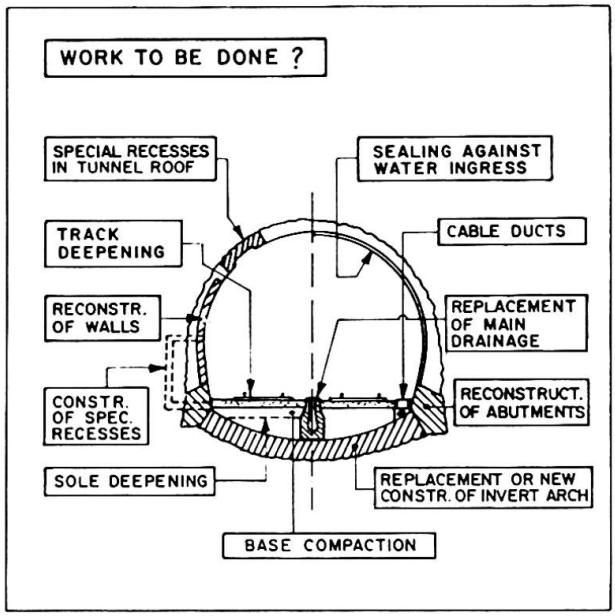

fig. 8

MAIN POINTS IN THE EXECUTION

	EXCAVATION	FOUND. LAYER	ROOF BOLTS/MESH	SHOTCRETE	FORMW./REINF./ CONCRETE	PREF. ELEMENTS
SOLE ADJUSTMENT	•	•				
ABUTMENT	•		(•)	(•)	•	
INVERT ARCH	•				•	
RECESSES IN WALL	•		•	•	•	
RECESSES IN ROOF	•		•	•		
ROOF SEALING			•	•		
DRAINAGE	•				•	•
DUCTS	•				•	•
WALL RECONSTR	•		(•)	(•)	•	
PROFIL ADJUSTMENTS	•		(•)	(•)		

fig.9

Mostly it is a question of rehabilitation which increases the value of the object, as the various railway authorities are in the process of modernising their technical facilities and adjusting to future needs (higher speeds, higher density of trains and a greater clearance in the tunnels, etc).

The problems encountered in a particular project usually lead to a one-off solution. It is left to the creativity of the contractor to come up with the best possible solution. Solutions involving short construction times are in the forefront, because one always has to take into account the costs of the equipment supplied by the owner. Generally the installations needed cannot simply be taken from the shelf, but have to be planned in detail, constructed, tendered, ordered and manufactured.

Special structural additions to railway rolling stock are time consuming in their preparation.
Consequently sufficient time must be allowed between the awarding of the contract and the start of construction (see fig. 10). Further, it must be taken into account that all equipment and installations mounted on rolling stock have to be approved by special railway departments and have to be removed afterwards.

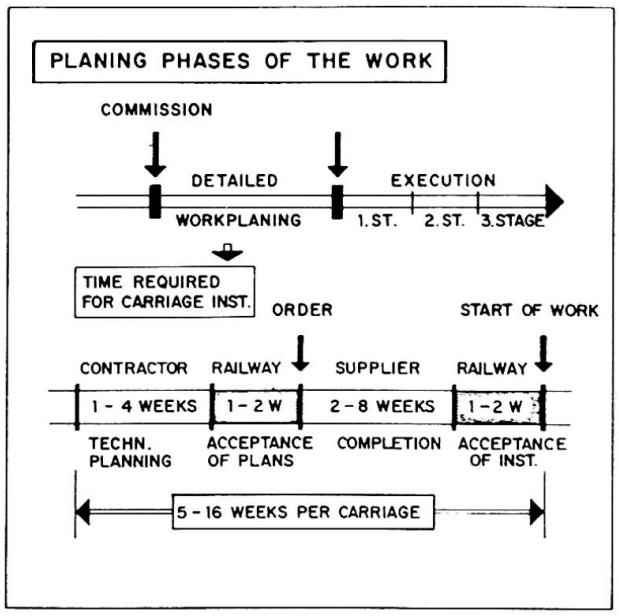

fig. 10

5. HUMAN ASPECTS

The demands placed on all involved in the work of tunnel reconstruction are very high. Success is only guaranteed if the work is carried out by skilled teams and high quality staff. Poorly qualified personnel will not earn their bread on such difficult sites.

In order to hold the working force together when working under such difficult conditions, a strong leadership is required. It is absolutely necessary that the representatives of the owner (i.e. the resident engineer), of the project management and of the site supervision speak the same language (metaphorically). Individualism and prestige-seeking have no place in a tunnel reconstruction project.

fig. 11

For all future tunnel reconstruction work, wether for rail or road, the author wishes the reader a wealth of good ideas in the planning and a well-organised and safe execution.