

# MECHANISM OF CROSS JET AND ITS APPLICATION

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**Abstract:** The main feature of cross jet grouting is to eject water from two nozzles attached to the jet monitor pipe. One jet directed upwards at some obliquity is made to meet with another jet directed downwards at a point of some distance from the jet monitor. By arranging the two jets in this way, the radial distance at which the energy of jetting is subsided is fixed, making the circumferential surface of the solidified column smooth, irrespective of existence of thinly stratified deposits of native soils. The mechanism of the cross jet grouting as above is first described briefly and two cases of its application are introduced in which it was used as a starting platform of the shield tunneling.

**Keywords:** Jet Grouting; shield tunnel; stratified soil deposit.

## 1. INTRODUCTION

Over a period of last three decades, the jet grouting has found a wide popularity in stabilizing soil deposits of any kind including clays, silts, sands and so on. This technique is useful particularly when the operating space is narrow and limited, surrounded by complicated existing structures. It is also a surest way to stabilize a specified zone of soil deposits under the ground. In the wake of its development, what is termed column jet was invented and used widely for improving native soil deposits. In this method, air-wrapped water is jetted first to cut and erode the soils, followed by the ejection of cement slurry to mix and form a solidified column in the ground. However, since the jet in the ground travels farther in sands as compared to cohesive clay materials, the cylindrical surface formed becomes zigzag or uneven. In order to avoid such undesirable conditions, the technique of the cross jet was explored and has been put into practice for important projects. In the following, the mechanism of the cross jet technique will be described together with its application in practice.

## 2. TECHNIQUE OF CROSS JET (X-JET)

The cross jet grouting is a kind of what is called "column jet" which is classified as the triple fluid method. In the column jet grouting, air-sheathed water is ejected first to cut, erode and churn soil deposits, as illustrated in Fig. 1(a) and then cement-mixed slurry is ejected. In the cross jet method, the first phase, that is, the air-wrapped water jetting, is performed from two nozzles, one directed upwards and the other directed downwards so that the two jetted water threads could meet at a certain distance from the monitor pipe. The ejection of the cements slurry is made afterwards as illustrated in Fig. 1(b). A schematic diagram is given Fig. 2 for illustration. In this method, the energy of jetting

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