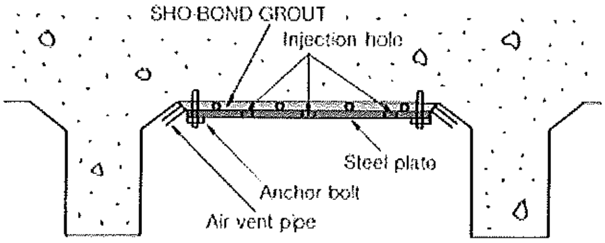
SHO-BOND STEEL PLATE BONDING METHOD

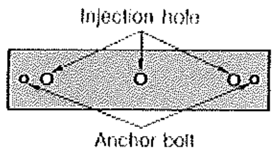
In this method, steel plates are bonded to the tensile surface of existing slabs to integrate the steel plates with the existing concrete.
The SHO-BOND STEEL PLATE BONDING METHOD consists of the two kinds described below.

(1) INJECTION METHOD
This is the method in which SHO-BOND GROUT is injected into that gap, with an average gap of 5mm set up between the slab surface and steel plate.

■ Detailed Sectional Drawing

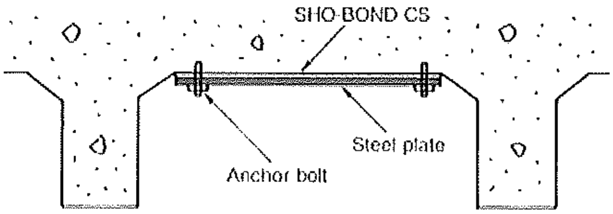


■ Detailed Drawing of Plate Holes

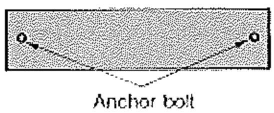


(2) PRESSURE ATTACHING METHOD
This is the method in which SHO-BOND CS is first applied to the slab and steel plate, after which, the two are joined under pressure.

■ Detailed Sectional Drawing



■ Detailed Drawing of Plate Holes



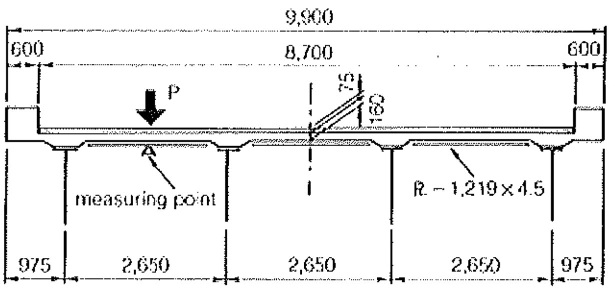
● FEATURES

1. The load-bearing force is increased by bonding to the tension-side of the slab, steel plates that play a role equivalent to that played by reinforcing bars.
2. Because of the strong bonding force the adhesive materials possess plus the fact that they do not contain any volatile solvent, there is no hardening shrinkage.
3. Permits work to be executed with the bridge opened to traffic.

● REINFORCED EFFECTS

Test results obtained with actual bridges are given below.
Details of test: Comparison of generated stress intensities for before and after reinforcement using wide steel plates.
Measuring position: At tension bars and bonded steel plates located at center point of slab span.

■ Reinforced Cross-section



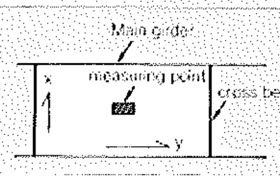
● VEHICULAR LOADING WEIGHT

	Total Weight (kg)	Front Wheel Weight (kg)	Rear Wheel Weight (kg)
Before reinforcement	20,000	4,750	14,900
After reinforcement	20,100	4,750	15,000

SHO-BOND STEEL PLATE BONDING METHOD

● The respective generated stress intensities for before and after reinforcement are as listed below.

● **TEST RESULTS**

		Before reinforcement (kg/cm^2)	After reinforcement (kg/cm^2)	Rate of stress decrease due to reinforced effects (%)	Remarks
Reinforcing bar	Main reinforcing bar	409	66	83.8	
	Distribution bar	262	23	91.2	
Steel plate	x-direction		141		
	y-direction		66		

(NOTE):The above values are average measured values obtained by taking a total of nine measurements (3 at 3 locations) and averaging them.

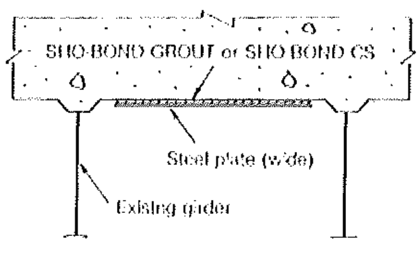
In this test the strain in the steel plate was measured prior to injecting grout, that is, with the steel plate attached to the slab by means of anchor bolts alone. The measurement revealed that practically no stress had generated in the steel plate.
This implies that, not the anchor bolts, but the bonding material (SHO-BOND GROUT or SHO-BOND CS) plays an instrumental role in transferring stress to the steel plate.

■DESIGN METHOD

After converting the steel plates to be bonded into the equivalent amount of reinforcing bars, the same calculations as those performed for ordinary reinforced concrete cross-sections are carried out. When the steel plate to be bonded to the slab is too thin, it not only means that no allowance for future corrosion is provided, but it also makes the plate susceptible to deflection by its own weight during construction. This will result in a tremendous drop in working properties. For this reason, normal practice is to use steel plates of thicknesses of 4.5～6.0mm.

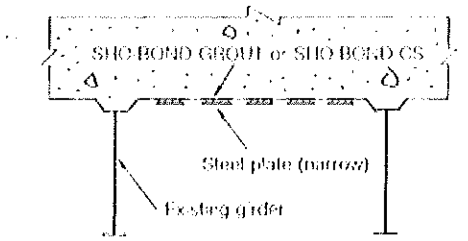
■WIDE PLATES

Used for the purpose of reinforcing the slab both in the main reinforcing bar direction and distribution bar direction.



■NARROW PLATES

Narrow plates are used when there is an apparent lack in the amount of reinforcing bars in either the main reinforcing bar direction or distribution bar direction, in comparison with the generated stress intensity, and when it may be judged so from the damaged condition. The plates are bonded in the direction where there is a shortage of reinforcements. In other words, reinforcement is performed only for one direction.



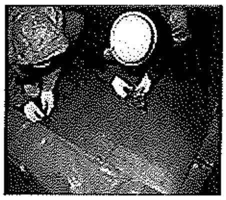
SHO-BOND STEEL PLATE BONDING METHOD

● WORK METHOD

■ PRELIMINARY TREATMENT

(Plateworking)

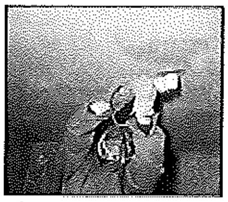
1. Treat the surface of the steel plate so as to bring out its texture.
2. Drill such holes as anchor holes and work the steel plate to the desired dimensions.



Surface treatment of steel plate

(Slab Preparation)

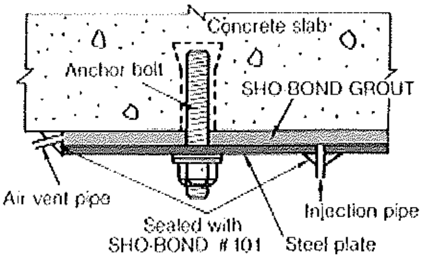
1. Scrape the surface of the concrete slab with a disc sander, or the like, and level the surface irregularities using SHO-BOND # 101.
2. Install anchors for anchor bolts into the slab.



Sandering treatment for bottom surface of slab

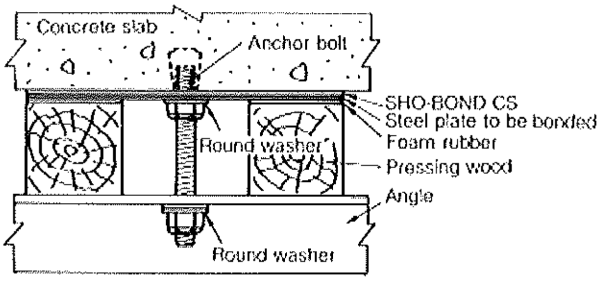
■ INJECTION METHOD

1. After confirming that pretreatment both for the steel plate and slab has been properly executed, proceed to the following work.
2. Clean the plate surface, using SHO-BOND THINNER.
3. Attach the injection pipes and air vent pipes.
4. Fit on the steel plate and clamp it with anchor bolts.
5. Using SHO-BOND # 101, seal the peripheral area of the steel plate as well as the area surrounding the injection holes.
6. Inject SHO-BOND GROUT through the injection holes.
7. Upon completion of curing, paint the area.

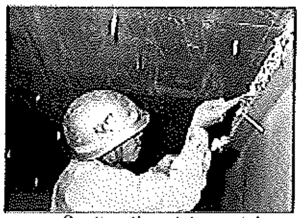


■ PRESSURE ATTACHING METHOD

1. After confirming that pretreatment both for the steel plate and slab has been properly executed, proceed to the following work.
2. Clean the plate surface using SHO-BOND THINNER.
3. Apply SHO-BOND CS to the plate surface and concrete surface.
4. Pressure-attach the steel plate to the slab using anchor bolts, etc.
5. When the material has cured, withdraw the pressure attaching equipment and paint the area.



Fitting on the steel plate

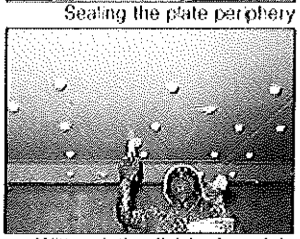


Sealing the plate periphery

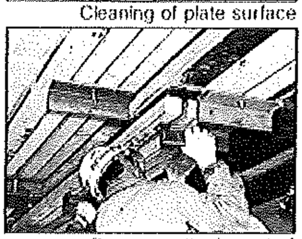
Cleaning of plate surface

Application of SHO-BOND CS

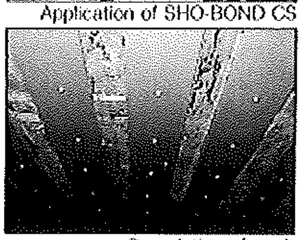
Injection of SHO-BOND GROUT



With painting finished, work is completed.



Pressure attachment of steel plate



Completion of work