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CASE STUDY

Void Filling at Welspun Factory, Vapi - 20/2/09

Background.

Welspun India Ltd. (WIL) started its activities in 1985 as Welspun Winilon Silk Mills Pvt. Ltd, a synthetic yarn business which went on to become Welspun Polyesters (India) Ltd. Finally, Welspun India Limited emerged in the year 1995.

Today, WIL is Asia's largest and amongst the top 4 Terry Towel producers in the World, with business spread across continents and a distribution network in 32 countries including U.S.A., U.K., Canada, Australia, Italy, Sweden and France. 94% of the total products are exported.

WIL offers a variety of products like towels in different sizes and qualities, bed linen using state of the art technology and the best quality of Egyptian cotton.

The Welspun factory at Vapi is a new, state of the art plant, enabling Welspun to remain competitive and profitable in the new millennium. Therefore, they have invested in the world's best technology for the plant.

Overview - Factory

The Welspun factory at Vapi, Gujarat is a modern factory built to western specifications.

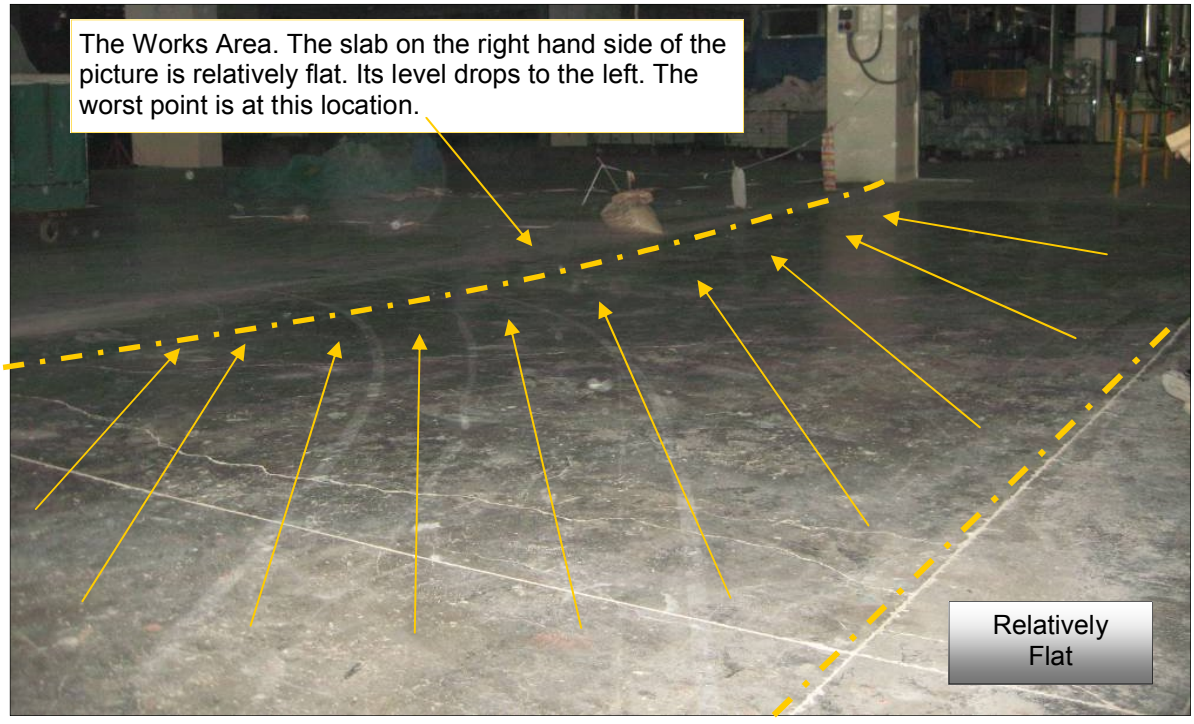
Unfortunately, although built to high engineering standards, the soil it was built on was below par, and has subsequently subsided since completion.

The factory is now faced with the question of how to fix the factory floor without impeding production. Other options considered by management to resolve the problem include:

- cut out and replace the slabs; or
- re-level them using a self levelling epoxy layer.

Some slabs are below expensive and heavy machinery (Weaving looms), and have already been releveled twice, and still appear to be sinking.

The Vapi Welspun factory was a perfect candidate for a demonstration of Uretek Slab Lift (USL) and Uretek Deep Injection (UDI). The question was where to start, and in what area. The worst slabs were 160mm down, whilst a large percentage was between 20mm to 80mm down. To fix one area, without attending to the area next to it would leave large differences in height between one slab and the next. Therefore a treatment area was chosen where it could be shaped to the surrounding flooring.



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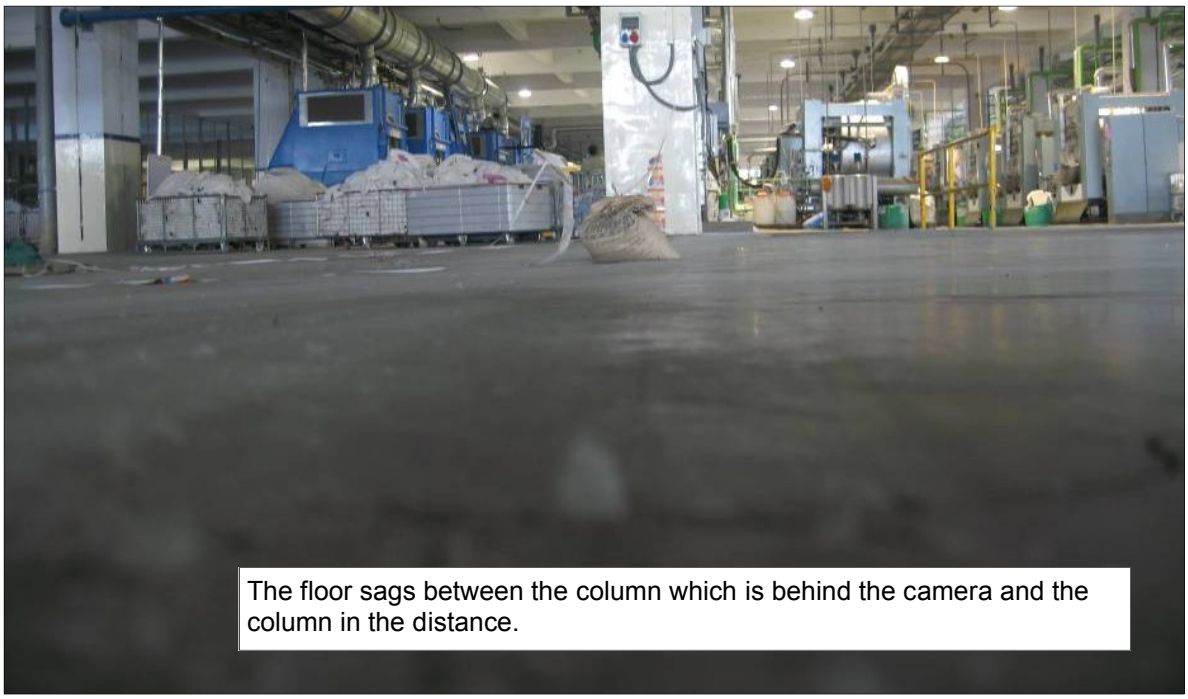

The floor sags between the column which is behind the camera and the column in the distance.

Purpose of Uretek Demonstration

- Confirm presence of voiding - also confirmed by photographs whilst onsite (see below).
- Underseal slabs and fill voids in area of trial
- Deep Inject under the sub-base to compact the soils to prevent further subsidence of slabs in that location
- Raise sunken slabs and re-level with respect to adjacent slabs

Voiding underneath the factory slabs.

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Methodology

- The factory was surveyed and a treatment area was chosen. The area chosen was 2.8m x 7.2m. We considered this as the main treatment area, however the area that we ultimately supported and improved was equivalent to 5m x 9m.
- The area had settled and at its worst point was 39mm down - dishing from left to right between two columns.

Drilling

A series of holes were drilled at approx. 900-1000mm centres. In all approx. 21 holes were drilled in the treated area.

The holes were drilled using 16mm x 900mm and 16mm x 1500mm bits. Distinct voids could be felt between the slab and the base slab (approx 50mm void) and then as the drilling continued through the bottom of the base slab voiding was present underneath. The soil underneath the base slab was surprisingly soft and easy to drill.

Monitoring of movement and relative vertical lift between adjacent slabs.

This was done by using a fine beam rotating laser placed on a remote slab with finely calibrated receivers mounted on staffs placed on the slab being injected and also the next adjoining slab. The receivers have digital read out in millimetres and are capable of detecting movement in parts of a mm.

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A string line was also used as a levelling aid and to record the total lift.

Resin Injections

1000mm to 1500mm injection tubes were cut and inserted in the lowest part of the demonstration area.

- The Uretek resins were combined in the proprietary Uretek DuoPump and injected at 1500 psi in the liquid state. The chemical reaction between the two components causes up to 30 times expansion which creates extremely high pressures.
- The pressures generated force the resins through the voiding and when voiding has been filled and the soil compacted, counter pressures rise and lift is the result. Reaction time is less than one minute and lift ceases shortly after injections cease so fine control of lifting is achieved.
- There was a high use of material and lift was slow. This indicated voiding and poor soil compaction. This was reconfirmed when the resin was seen to travel up to 1 metre and erupt from other drilling holes
- This job used a considerable amount of mixed resin before lift was seen. Three factors accounted for this-
    1. Voiding between the slab and its supporting base. As we filled the void under the base, the concrete base slab was lifted back into a position where it was re-supporting the slab. Lifting of the base until it is supporting (touching) the above slab is not noticed by a casual observer as the top slab does not move.
    2. Because of the extensive voiding under the base slab, large quantities of resin flowed laterally supporting a considerably larger area than the treatment area.
    3. Low soil bearing pressure which resulted in compaction before lift.
- Levelling was completed over 1½ days.
- For completion, undersealing and void filling was then carried out on all of the injection holes with 4-8 kgs being injected into each hole so that finally, an area of approx. 45 m2 was undersealed. Voiding was proven by the fact that the resins travelled under the slabs and came up holes 1000mm away. No water was pushed from any of the holes, as conditions were relatively dry at this time. Had water been present in the voids then the Uretek Resins would have expelled this during the filling process.

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Hole filling and cleanup

All holes were redrilled 50mm and then filled.

Filling compound was Fosroc Nito Mortar PE, which is a first class internationally recognized product for this application. This product has quick curing times, high strengths, and low shrinkage.

Whilst the holes were being filled, equipment was repacked into the Uretek Rig and final cleanup carried out.

Results

The outcome was a vastly improved level in the slab (please refer to graphs), however as discussed in the methodology, it is still not 100% level as it slopes away to other subsided slabs. With treatment of the neighbouring slabs, all slabs could be brought to level easily.

Further Deep Injection is indicated to be required under the subsided area to compact the soils and limit further movement.

Undersealing of 45 m2 of slabs however was achieved, limiting further ingress of water, eliminating voiding and preventing sub-sequential destruction of slabs because of lack of support.

Uretek demonstrated the fine levels of control over lift inherent with the Uretek Method.

440 kgs. of mixed resin was used. Of this material approximately 150 kgs was used to lift the slabs, 160 kgs was deep injected to compact soils further down, and approximately 130 kgs was used to void fill. Given the size of the problem encountered in this project, these quantities are more conservative than we expected, but they demonstrate ably the capabilities of the very strong Uretek resins.

String level at commencement

Final String Level

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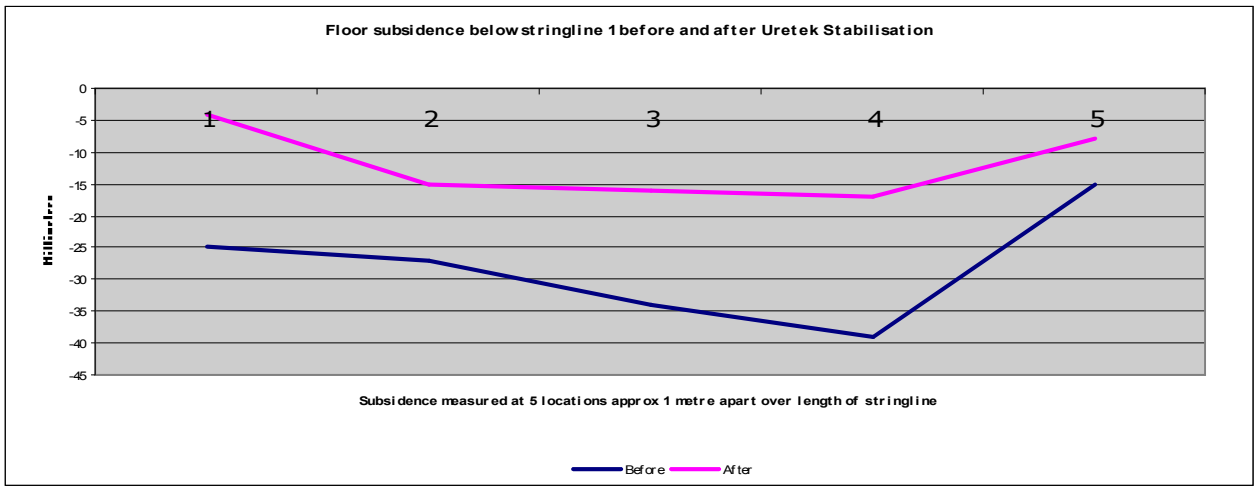
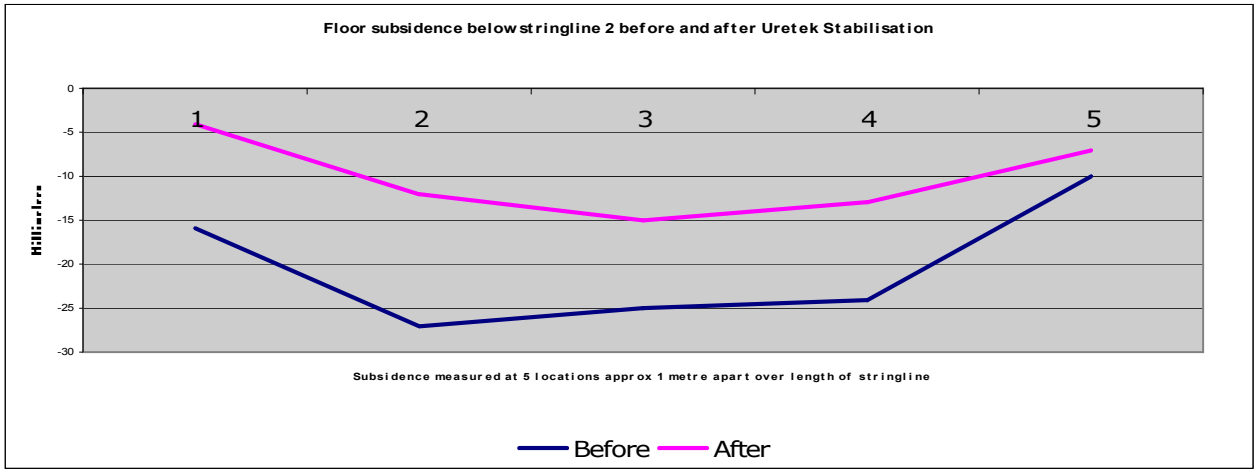
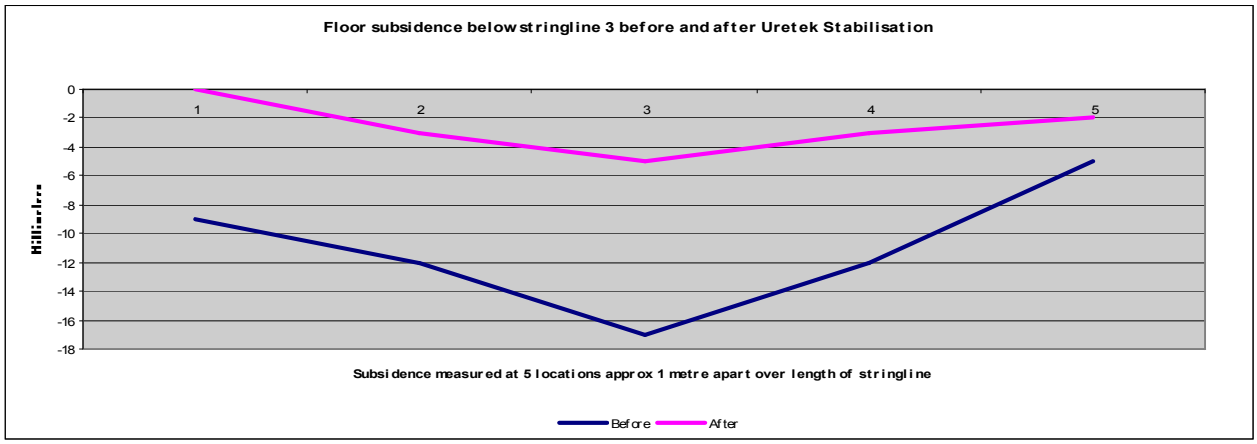
Graphs Showing the Lift Achieved by Uretek Along 3 Different String Lines at the Welspun Factory, Vapi.







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The Uretek Method - Ideal for Industrial Applications.

Many factories are located on soils which have not been sufficiently compacted. Resulting problems include:

- Sinking foundations;
- Concrete slabs deflecting (bending);
- Dynamic loads from heavy machinery pushing machinery mounts into the ground;
- Floors not level;
- Development of trip hazards which are dangerous to staff and to product;
- Cracking walls which destroy themselves if the problem is not resolved; &
- Inability to run some machines e.g. robots, printing presses and glass making because of out of level flooring.

Many factory owners attempt to overcome these issues by relocating plant and equipment. This is only a very temporary fix, even though it can be expensive depending on the type of machinery being re-located. Some owners even put in a self levelling epoxy floor which fixes the problem in the short term, but cracks as the slab continues to move.

The basic problem is the low bearing capacity of the soft soil. Even breaking out sunken slabs and recasting new ones in place will not increase the bearing capacity of the soft soils and further subsidence will result over time.

The solution is to compact and densify the underlying soils, improving their bearing capacity to the point where they support the factory's floor slabs and the load on the floor slabs.

To reduce the risk of future downtime due to failed concrete slabs, the Uretek Method can be adopted as a maintenance measure and applied under important areas of machinery**. This can be accomplished without losing any production days** as Uretek can be injected while the factory &/or machine continues to operate.

Uretek - the fast, cost effective way to keep your business in full production.