WHEN FLOORS GO WRONG

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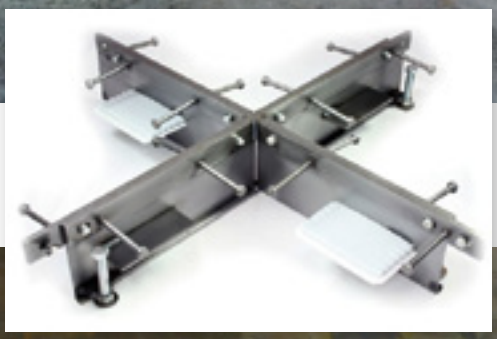


ABOVE: Poor floor joints.
LEFT: Armour joint.
BELOW: Finished joint repair.

The warehouse floor is the table top from which businesses run their operations. It is the one piece of the building fabric that interacts with all parts of their operations, yet all too frequently its importance is either overlooked or undervalued.

Problems often occur as a result of a poorly designed or constructed floor or a lack of investment in maintenance. This can end up costing businesses thousands of dollars, or even run into millions when things go really wrong. It often takes an accident or for equipment to get damaged before issues are addressed.

Defects in floors affect warehouse productivity, can cause potential OH&A issues and ultimately affect the bottom line of the business. A poor floor will give poor performance, operations will slow down and equipment will get damaged. It is a negative cycle that will not fix itself unless floors are properly maintained. When a floor is maintained properly, most of the problems can be eliminated.

In this article we are going to focus on ways you can safeguard your investment and maximise your productivity through fixing common problems with floors. We'll leave the design and construction challenges to another article and focus on issues with existing floors.

The most common problems with existing warehouse floors are joints, cracking, slab movement, surface durability (abrasion resistance) and flatness, especially in VNA (very narrow aisle) operations.

Floor joints

Floor joints are often the greatest source of maintenance problems in an operational warehouse. Their edges or arrises are vulnerable to damage and tend to spall under the impact of hard wheel traffic such as forklift trucks. Most warehouses will have joints with spalled edges, and these should be seen as an early indication of more serious potential long-term damage.

If left untreated, joint damage never gets better, it always gets worse. You are not only creating a bigger problem with your floor, but the damage inflicted on your material handling equipment (MHE) will significantly increase your maintenance costs and loss of productivity.

The size and cost of joint repairs can be kept to a minimum if the damage is detected and repaired at an early stage.

When cracking occurs in the floor, it is not necessarily a sign of a serious problem – rather, it can be the natural occurrence in new floors due to drying shrinkage of the concrete as it sets or thermal changes in the concrete.

If cracking appears, the best way to know if it is going to be a problem is to monitor it to ensure it is not growing or the crack is not opening as MHE run over it.

Common causes of cracking on existing floors

A properly designed and constructed floor would have joints to control the shrinkage and reduce the risk of random cracking, which should be designed and positioned to allow the floor to move without restraining that movement. Wide joints increase the risk of arris spalling due to the impact of MHE wheels as they cross the joints.

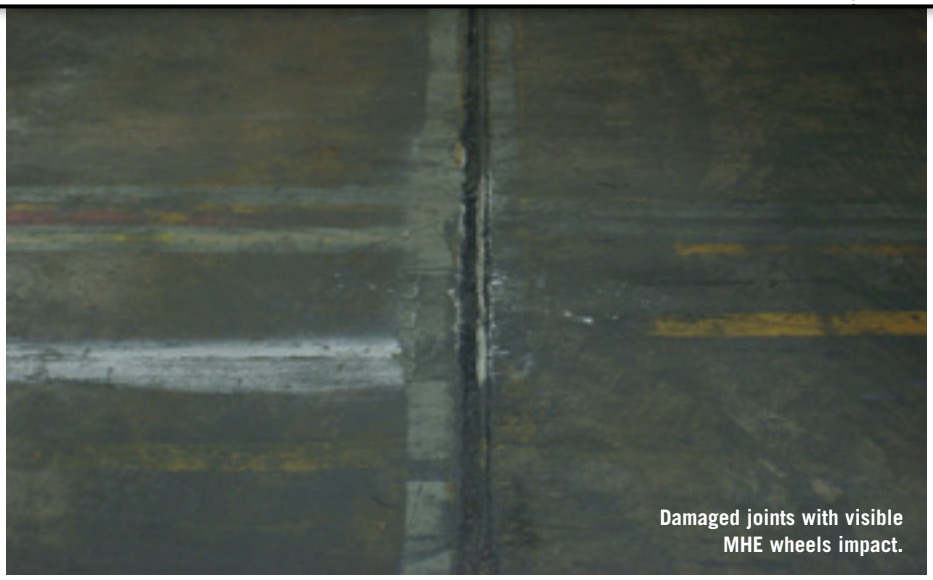
Other common causes include overloading the floors' designed strength, or movement of the sub-base that is supporting the floor through subsidence. More serious problems of cracking can be due to poor design where the joint design is inadequate to counter the effects of dry shrinkage; incorrect concrete mix; adding too much water at the time of construction that weakens the concrete; and slabs that are too thin for their intended purpose.

Often the sub-base that is laid to provide the floor its foundation can settle, particularly if the floor has been built on swamp or reclaimed land, which can lead to subsidence and cracking. This in turn can cause differential movement (rocking or upward and downward movement) of the floor at the joint and that can further increase the problems of damage at the joints as the MHE runs over it.

Floor joint solutions

The good news is there are solutions to all problems, and if caught early, can be cost-effective to fix.

Joint and crack repairs are actually a lot more scientific than they are given credit for. Everything from the material used to the repair process itself will determine the effectiveness of the repair and how long it lasts.



Damaged joints with visible MHE wheels impact.

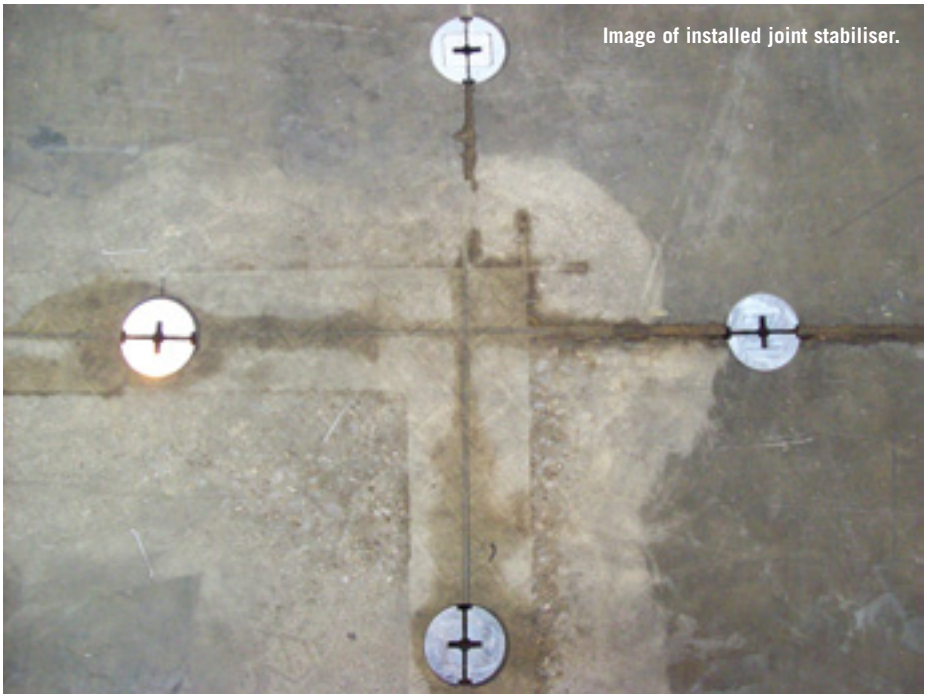
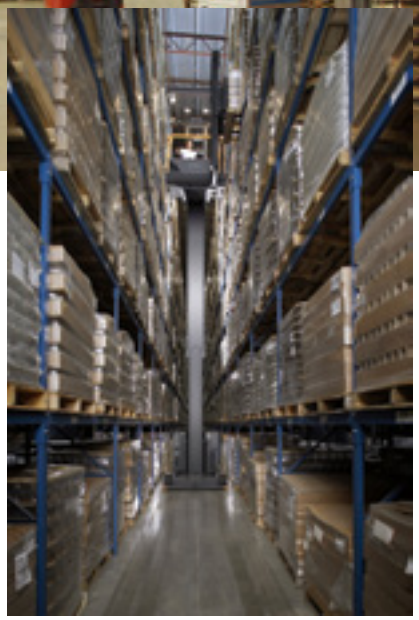


Image of installed joint stabiliser.



ABOVE: Free movement area.
RIGHT: Defined movement area.

The importance of the right choice of repair materials is paramount for a successful joint repair. All too often the right materials have been used but an unsuccessful repair method has been carried out.

An epoxy resin formula is by far the most effective material to use for joint repairs. It is highly durable and can withstand years of material handling traffic. It is also resistant to most chemicals, and with the right preparation it can be used for repairs in chiller rooms without the risk of contaminating food stocks.

Preparation is key to an effective joint repair solution, which involves ensuring that the concrete around the repair is cut to the correct depths and widths. Once the damaged concrete has been removed, the new joint should be prepared with primer before the epoxy repair mortar is added. Finally, the joint must be re-instated with a saw cut no more than 5 mm wide along the length of the repair before a flexible sealant is added to seal the joint. Once completed, the joint should be hand ground perfectly smooth to create an impact free transition for wheeled traffic.

A properly repaired joint using the right materials and methods can last for many years.

Modern warehouse floors are often designed to include steel joints, also known as armour joints, that further protect the joint against potential damage from MHE. They also offer excellent protection against load transfer issues. Armour joints have to be integrated at the time of construction.

Rocking slabs

Movement in floor joints or rocking of slabs known as differential movement is a common problem that can be the cause of damage to joint arrises. This is due to the floor dropping as the weight of MHE rides up to and across the joint, causing the hard wheels to impact the opposing side of the joint arris. Over time, the arris of the joint gets damaged and the repeated impact also damages MHE.

Laser-guided grinding.

There are two easy solutions to address this problem without ripping out the slabs and rebuilding.

One involves pumping or injecting expansive structural resins under the floor to lift the floor, another to fit a joint stabiliser device in the joint, as joint stabilisers are an effective solution when inserted between two slabs. When expanded, the pressure provides the interlock needed restore load transfer and eliminates slab movement.

Both solutions offer effective results that can prevent further damage to the floor and joint.

Flatness and why it's important

The warehouse floor is the all-important surface that affects the speed, efficiency and often the safety and movement of the distribution centre operatives and their manually operated hardware.

As the demand for faster, more efficient warehouse technology increases and truck developments continue, floor flatness is the most important factor that can affect a warehouse operation.

There are two categories that define an area in the warehouse specific to its purpose.

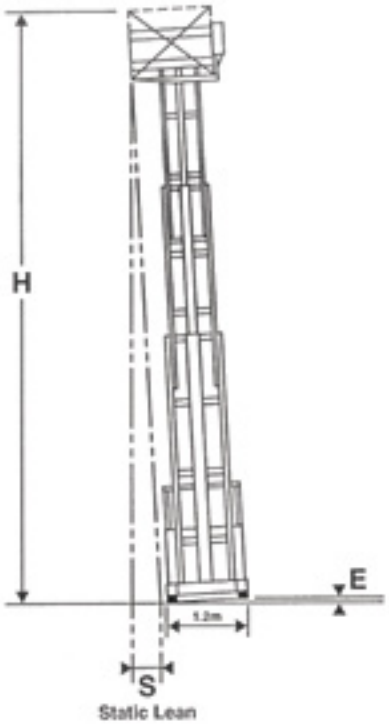
Free movement: areas outside of the racking or areas where there is wide-aisle racking.

Defined movement: areas within the racking, particularly very narrow aisle.

In free movement areas, if a floor is not level it can cause driver discomfort, potential health and safety risks if there are more severe level problems, and premature maintenance on MHE.

However, in a defined movement area, floor flatness is more important due to the restricted width of the aisle and the increased risk of collision with the racking as the fork truck travels at height. Fork lifts can travel at heights up to 17 metres carrying a 1 tonne load. It can be a scary affair for the operator if the truck is swaying around in the air and not least with the risk of injury if a collision occurs with the racking. The diagram at right demonstrates how a tiny difference in levelness can cause big problems at height.

If a floor is not flat to the forklift manufacturer's specification, the truck will be unable to run at its designed speed, which will affect its throughput capabilities, meaning significantly reduced pallet movements per hour. An uneven floor will also affect the forktrucks' electronics, put unnecessary strain on its welds and can cause the fork truck to come off wire guidance systems.



The best solution is always to ensure the floor is designed and built for its intended purpose in the first place, but with existing warehouse operations where it is neither cost-effective nor practical to build new, there are effective solutions.

Achieving floor flatness

In a free movement area, depending on the extent of the floor flatness problem, simple manual grinding can rectify a lot of issues. In some cases overlays or screeds can be applied.

A word of caution regarding Epoxy overlays though as there is a misconception when the term 'self-levelling' is used. Self-levelling does not mean the epoxy levels perfectly flat, instead it actually levels to the contours of the floor, so whatever problem you have, whether a hollow or a bump in the floor, the self-levelling epoxy will simply mould to that contour. A better term would be 'self-smoothing'. In addition, self-levelling epoxies do wear and can give off static discharge. Where the correct preparation has not been applied at the time of installation, there will be a risk of delamination.

It is always best to try and use the existing concrete floor itself, so grinding should be the first choice where possible.

In a defined movement area, achieving the high level of flatness required is much more important and challenging. A manual grinding process is possible but it is exhaustive, very time consuming and can be quite dirty.

A more modern-day approach uses a fully self-contained, laser-guided grinding system to achieve the precise floor flatness required. The Laser Grinder was developed to provide precision grinding with minimum disruption to an operational warehouse. The self-contained system, which does not require power cables or water pipes when it operates in the aisles, provides a clean, quick and very effective way of achieving the desired level of floor flatness. It has been designed to grind either the individual wheel tracks of a forklift truck or the whole aisle width, and floors can return to service immediately upon completion.

When planning to upgrade an existing floor or if you have problems with truck efficiency, independent advice and a survey are always recommended. Whatever the problem you have with concrete floors, there is a solution.

For more information call 1300 802 558, email info@cogriaustralia.com.au or visit www.CoGriGroup.com.au *mhd*

Over the past 15 years, there have been 12 generations of optimisation solving engines beyond the basic spreadsheet. These have been consistent with the now revised Murphy's Law: The power of computing doubles / the costs halve every year.

Decision support tools are needed

Critical to success in today's economic climate, along with the carbon tax, natural disasters, global trade increasing in velocity and volume, is your ability to know which of your supply chain taps to turn on or off, by how much and when to do so, and how this impacts on other planning disciplines.

Management needs the capability to assess the balance between profitability and risks (and sustainability for that matter), to find and to test for robust optimality in all three - not a black box single number solution that is fragile and can fold like a pack of cards, should anything unexpected happen.

You need something more powerful than Excel, with proven industrial strength, that integrates with your existing management systems, provides visibility over the whole supply chain, provides flexibility to change as circumstances change, agility to respond rapidly to unexpected events, and provides answers to a range 'what if' questions and comparisons.

You need to involve all your resources (sources, materials, equipment, manpower, transportation, supply chain partners). These need to be integrated (see Part 2 of this series) from end to end, and synchronised for the different levels of planning.

Also in Part 2, we used mining supply chains as an example, as they have a higher level of 'variability' and 'unpredictability' than conventional supply chains. Here they use discrete event simulation (DES) modelling to anticipate risks of unexpected or unpredictable events. If things do not run like clockwork in your supply chain, then you may need to look at the business case for risk modelling and rapid 'what if' scenario building, should such events occur.

Figure 2. Best practices in managing / modelling risk.

The business case for risk modelling

Large companies such as BHP Billiton were quick to realise the importance of not only risk modelling their operational pit-to-port risks (done through DES), but the need for decision support on a whole range of 'what if' scenarios to determine the optimal ways to resolve unexpected interruptions.

They engaged APS Technologies to review leading-edge technologies at the time (10 years ago), including their own artificial intelligence / neural networking tools developed for a steel plant at Newcastle. Their primary need was for a tool that provided flexibility, agility, responsiveness and visibility in resolving unexpected pit-to-port events or occurrences in the most optimal way.

The key attribute we were looking for back then (and still are today) was the rapid re-building, re-configuring of pre-configured models by BHP power users or modellers. Unless you have pre-built models, designed for a range of 'what if' scenario planning, then you are likely to be too late in responding efficiently and effectively to any sudden disturbance in the supply chain.