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MAJOR PROBLEMS ASSOCIATED WITH THE INDUSTRIAL FLOORING

Manjusha Shinde[1], Dr.Madhav Kumthekar[2]

[1] Post Graduate Student, S.P.S.M.B.H's College Of Architecture, Kolhapur, Maharashtra, India
[2] Professor, Department of Civil Engineering, Dr.Daulaotrao Aher College Of Engineering, Karad, Maharashtra, India

Abstract: This paper presents the issues encountered in industrial concrete floors on the ground. The issues encountered are shrinkage, acid attack, concrete quality, cracking, curling, durability problems, and temperature restraint effects. The problems presented in this section have been commonly observed in the construction industry. Overall it has been seen that floors are extremely prone to a range of issues. Case studies have been included to illustrate the issues and show how designs can be done to avoid such problems. When problems occur, guidelines for repairing surface flooring are proposed. Overall, it is clear that floors are extremely vulnerable to a wide range of issues. However, high-quality surfaces for the industrial sector can be provided through good design and construction practices.

Index Terms – Concrete floor, Problems, Shrinkage, Concrete quality, Durability, Uneven floors, Surface problem, Floor Coatings, Proper design.

I. Introduction

Surface industrial concrete floors frequently experience problems as a result of design, construction, and usage failures. This paper investigates the problems associated with industrial concrete floors, with a focus on case studies. Much of the information presented was obtained through consultation with industry groups. The purpose of this paper is to make designers aware of common problems so that they can be avoided. Floors with problems are recommended to take corrective action.

Concrete for ground-level industrial floors must have adequate flexural strength, abrasion resistance, and dimensional stability. Floors are sawcut to direct where cracks will form, i.e. crack initiators. By reducing the time between casting and sawcutting, the possibility of moisture changes, increased shrinkage, and cracking is reduced. As a result, it is recommended that concrete mixes be designed to achieve higher early strength. Adapters should be managed to avoid in general due to decreased abrasion resistance, as discussed below. The slump of concrete used in industrial floors should be between 70 and 120mm when hand compaction is used, and between 50 and 80mm when vibration is used.

1. SHRINKAGE

When concrete is placed, it shrinks. Shrinkage increases significantly as moisture evaporation occurs and the moisture process progresses. Excessive shrinkage can result in cracking, joint opening, decreased longevity due to the ingestion of harmful material, poor visual quality, and so on. Joints are usually provided to control cracking in order to address the problem of shrinkage. Joints are typically spaced 4.5m apart, but they can be as close as 7.5m off from each other. Random cracking may occur if concrete joints are cut later than necessary, as shown in Fig - 1.

Fig-1: Concrete random cracking. Cracks run parallel to and perpendicular to saw cut joints.

The crack in Fig.2 was caused by poor floor design and did occur at a re-entrant corner. The concrete shrank in two directions, increasing the stresses along the diagonal crack path. To avoid such issues, a saw cut along the dotted yellow line should have been made, or diagonal reinforcement should also have been placed across this section. This crack may not impair the floor's performance, but it is unsightly and was included on the claim against by the consultant and design engineers.

Figure 2.Typical crack at a re-entrant corner.

2. CONCRETE QUALITY

When organic or reactive materials are used in concrete, localized problems can occur. Fig.3 depicts one of several "pop-outs" that occurred on an industrial floor as well as tends to result in a claim against the contractor. However, the external mediator stated that the problem was caused by impurities in the ready-mix concrete supplied to the site and was not the contractor's fault. It's possible that the pop-outs were caused by organic material or another type of material present. Such an issue is relatively simple to solve with screeds or epoxies.

Figure 3: Concrete floor pop-out due to impurities

3. DURABILITY

As seen in Fig.4, severe abrasion damage has been done to surface beds and bunkers. The existence of extenders (together with specific factory procedures) in certain surface beds is thought to have caused more than 60mm of wear in a matter of a few months.

Figure 4: Exposed rebar due to the abrasion

4. ACID ATTACK

One of the largest supermarket chains in South Africa. When the supermarket has become aware of the unhygienic situation of the concrete floors, the bakery was almost forced to close. Sweeteners and other chemicals have caused widespread floor deterioration due to acid attack. Fig.5 shows that concrete quality is significantly low in the vicinity of the drain. When floors are washed, acidic waste water accumulates from the nearby areas and flows into the drains, causing this condition. Damaged joints hasten the deterioration of concrete by allowing acids to enter.

Figure 5: An acid attack on the flooring.

5. CURLING

In Fig.6 depicts the damage caused at a big supermarket warehouse in Fourways. The collapsed construction joint was most probably caused by curling, which lifted the slab off the ground. This floor may have not been properly cured, or it may have been affected by high temperatures. When curling occurs, there are several options for resolving the issue. Diagonal cuts are made at curled corners to enable them to lie flat, floors are ground to a required level, voids are filled with grout, curled areas are patched, and dowels are installed. Curling can quickly deteriorate joints due to the regular effect of forklift wheels if not properly addressed.

Figure 6: Damage caused, collapsed, and curled construction joints.

6. SEALANT

For the development of high floors, sealants are essential. Nevertheless, determining when to cut joints is never simple. The construction joints should be placed as long as possible, ideally after immediate shrinkage has taken place, to get them closer to their final size. Additionally, joints must be sealed as quickly as possible because they need to be safeguarded. In general, the American Concrete Institute (ACI) advises delaying the joint filling by 60 to 90 days after the time of pouring. The bare minimum amount of time is thirty days. Fig.7 is a case where a series of joints failed as shown below.

Figure 7 Photograph of a sawcut joint that has been improperly sealed and damaged

7. UNEVEN FLOORS

The plant close to Johannesburg was the site of the delamination of the flooring seen in Fig.2.8. It is thought that the issue was brought on by rain during the floor's casting and floating, as well as by the contractor's application of cement to the floor during floating to give the concrete a burnished appearance. After the flooring had been scarified, a screed of 15 to 22mm was poured onto the surface to give a smooth finish. Screeds with high strength can be made to handle a number of issues. Within 24 hours, these screeds can become sufficiently durable to be used for traffic.

Figure 8: Delamination of a floor

8. SURFACE PROBLEM

The floor depicted in Figure 9 shows crazing, most likely as a result of excessive trowelling. Although this issue is frequently merely cosmetic, it may reduce the quality of the surface finish.

Figure 9: Crazing occurring in a floor due to excessive trowelling

9. TEMPERATURE AND RESTRAINT EFFECTS

A related issue arises when the relatively warmer inner layers of concrete constrain the cooling and shrinkage of the outermost layers of concrete following hydration. Thermal contraction cracking may result from this, as demonstrated in Fig.10.

Figure 10: Concrete floor thermal contraction cracking

III. CONCLUSION

Giving attention to detail like, specifying good mix designs and correct construction procedures the majority of problems can be avoided. At this stage a large variety of repair methods can be used to bring floors back into serviceability. Repairs which are correctly done will minimize the need for future remedial work. The Remedial work such as Concrete Laser Flooring (CLF), Steel fibre reinforced concrete (SFRC) floor, Joint sealants and floor coating like epoxy can be used for better durability and cost effective.

REFERENCES

[1] Abramyan S G, Piunov Ye M, Kurbanov I Z 2018 The Summary Overview of Scientific Publications: Modern View on the Problem of Study and Use of Fiber-Reinforced Concrete (Don's Engineering Bulletin) 2. (In Russian).

[2] Ballim, Y. and Basson, J. 2001. Durability of Concrete, in Fulton's Concrete Technology, 8th ed. Editors: Addis, B, and Owens, G. Concrete and Cement Institute, Midrand.

[3] Perrie, B. 2009. Common failures in concrete floors and designing and specifying to prevent them. Presentation made at CSSA, Midrand, for the Concrete and Cement Institute on 7 July.

[4] Report: Technical Report No 34, Concrete Industrial Ground Floors - A guide to design and construction. Third Edition (The Concrete Society, 2003).

[5] R.S. Walls, S.E. Ekolu, "An investigation into failures and problems of industrial floors on the ground – with an emphasis on case studies." International Conference on Concrete Repair, Rehabilitation and Retrofitting, ICCRRR, April 2012.

[6] Tremper, B., and Spellman, D. C. 1993. Shrinkage of concrete – comparison of laboratory and field performance. Hwy. Res. Rec. No. 3, 30-61. Presented in Mailvagan et al (2001).

[7] Violeta Medeliene & Vigantas Antanas Žiogas (2010) Making solutions for choosing industrial concrete floors and expedience of reliability evaluation, Journal of Civil Engineering and Management.

[8]Voilokov I A, Gorb A M 2009 Certain Mistakes in Engineering and Construction of Concrete Flooring in Buildings (Construction Engineering Magazine) 5. (In Russian).

[9] Z. Pająk, M. Wieczorek, Builder, 12, pp. 84-89 (2016) [in Polish].