# DOWNLOAD PDF PCA SLAB ON GRADE DESIGN

## Chapter 1 : PCA StructurePoint Reinforced Concrete Building & Design Software

*PCA Design Method â€¢ Two failure modes considered: Fatigue failure due to slab flexure - Erosion failure due to foundation compression â€¢ Edge loads produce the worst stresses.*

The new proposal for designing slabs on grade for industrial floors has been called the Camero method. Industrial floors should be capable of sustaining an infinite number of load applications year life if designed with the Camero method; on the other hand, if designed using PCA and WRI methods they will only last one year in this example the number of axle load applications in a 1-year period was equal to the number of allowable repetitions because they will not be able to sustain an infinite number of load applications. The article develops a set of equations for analytically calculating the bending moment applied to the slab by forklift truck loads. A new method for designing industrial floors is suggested herein referred to as the Camero method. An example is for comparing the behaviour of an industrial floor designed by the Camero method with one designed by PCA and the WRI methods. Figures 2 and 3 show the loaded axle working on the slab. Figures 1 , 2 , and 3 define: It has been demonstrated in texts on the mechanics of materials that, for beams, the relationship between bending moment and radius of curvature is as follows: The direction of the axes is illustrated in Figure 4. How to calculate the bending moment applied on the slab Equation 3 is generally applied to pavements and industrial concrete floor designs. It has its origin in deflection analysis of a slab acting as a beam with the following hypotheses Camero,  To calculate the applied bending moment, the structural analysis of the industrial floor slab in Figure 3 must be considered. The equilibrium differential equations must be born in mind when calculating the bending moment: For Figure 5 and with equation 3, we have: The bending moment between point 0 and L see Figures 2 , 3 and 4 is then calculated by adding the bending moments caused by each load for equilibrium. From Figure 3 and equation 4, we have: This results from load y1. Then from equation 6 and for the conditions of Figures 2 , 3 and 4 , we have: The following is obtained by developing the previous equation: Calculating the bending moment for the rest of the loads using the same methodology and using the same notation, we have: Where My1 is defined by equations 8 and 9 and My2, Mp1, Mp2 by equations 10, 11 and 12, respectively. This gives the bending moment calculated on the slab by any type of vehicle forklift truck or truck. Equation 13 is also applicable to pavements for any type of vehicle. Proposed design methodology Camero method Calculate the bending moment applied to the pavement, in accordance with equation  If designing a plain concrete slab without reinforcement , continue as follows: Calculate the maximum bending stress applied to the slab pavement. The following flexural equation should be born in mind: The stresses should not exceed the elastic limit at any point. The following maximum compression and tension stress are recommended: The usual way to do this calculation is to use a 1. If it is not satisfactory, increase the slab thickness. Verify that the reaction on the subgrade is smaller than the bearing capacity of the same. Confirm this with equation 1. Do not forget to consider slab weight, which has not been included in equation 1 because, when the slab is continually supported on the ground, slab weight does not produce bending. Calculate the distance between joints according to concrete shrinkage, temperature and creep. Verify slab shear stress resistance due to load action. If an ultimate strength design is required, see Camero,  Example for calculating bending moment Example 1: Calculating the bending moment for designing an industrial floor with the following values: Characteristics of the materials, site: Slab width where the forklift truck goes was determined by Figures 2 and 3: Graph 1 illustrates the bending moment applied on the slab calculated with equation 13 Camero method: The preceding results would be identical if highway pavement were to be designed instead of an industrial floor. The question was thus posed: If the concrete is subjected to repeated flexure, then repeating the same load produces material fatigue and thereby slab pavement failure. MA Minor has investigated the subject and found that if a load produces bending stresses greater than half concrete rupture modulus, then such load induces material fatigue. The previous safety factor allowing only 50 repetitions of loaded axles explains why the slab pavement works well at the beginning but begins to fail from fatigue within a short period of time. It shows storage racks with a narrow aisle where the aisle width is similar to forklift truck width plus a small margin. This article explains how industrial floors designed by traditional methods reduce useful floor life. Industrial floor design using the Camero method can sustain an infinite amount of traffic whilst floors designed by traditional methods will only sustain a limited amount of traffic limited number of load repetitions ; in other words, for a useful life of 50 years, a floor designed by the Camero method will last 50 years. The same floor designed with traditional methods can only last one year because it will support a smaller amount of traffic in this example, in 1 year period, the number of axle load applications on the concrete is equal to the number of allowable repetitions. The PCA and WRI slab on grade design methods for industrial floors led to a design for concrete fatigue, even though 2. When the preceding occurs, the bending moment applied by the forklift truck loads is greater than that proposed by the PCA and WRI methods; the slabs so designed will allow a smaller amount of load repetitions to fail by fatigue. Designing slabs on grade for industrial floors should use the recommended process Camero method , having a safety factor of 2. Notation The following symbols are used in this paper: Maximum bending stress applied to the industrial floor slab in direction x M: Distributed load on the slab by forklift truck vehicle axle load â€” slab pavement â€” subgrade interaction and with downward direction positive vertical force: Distributed load on the slab by the forklift truck vehicle axle load â€” slab pavement â€” subgrade interaction and with upward direction M y1: Indicates the bending moment caused by load y1 M y2: Indicates the bending moment caused by load y2 M p1: Indicates the bending moment caused by load P1 M p2: Compressive strength of plain concrete as measured from standard cylinder [6 inch x 12 inch mm x mm ] test Ec: Modulus of concrete elasticity MR: Modulus of concrete rupture k: Modulus of subgrade reaction Bibliographic Yoder, E.

## Chapter 2 : Analysis of Concrete Slabs on Grade Spreadsheet-Download Free

*PCA - , Prescriptive Design of Exterior Concrete Walls for One- and Two-Family Dwellings, EB This publication provides a simplified approach to the design of concrete footings, foundation walls, and above-grade walls, both load bearing and non-load bearing, intended primarily for use in detached one- and two-family dwellings.*

Specifically, a concrete slab on grade may be subjected to concentrated post or wheel loading. Then for the given parameters, the slab flexural, bearing, and shear stresses are checked, the estimated crack width is determined, the minimum required distribution reinforcing is determined, and the bearing stress on the dowels at construction joints is checked. The ability to analyze the capacity of a slab on grade subjected to continuous wall line-type load as well as stationary, uniformly distributed live loads is also provided. Program Assumptions and Limitations: This program is based on the following references: The "Slab on Grade" worksheet assumes a structurally unreinforced slab, ACI"Type B", reinforced only for shrinkage and temperature. An interior load condition is assumed for flexural analysis. That is, the concentrated post or wheel load is assumed to be well away from a "free" slab edge or corner. The original theory and equations by H. Westergaard as modified by Reference a in item 1 above are used forthe flexual stress analysis. Some of the more significant simplifying assumptions made in the Westergaard analysis model are as follows: Slab acts as a homogenous, isotropic elastic solid in equilibrium, with no discontinuities. Slab is of uniform thickness, and the neutral axis is at mid-depth. All forces act normal to the surface shear and friction forces are assumed to be negligible. Deformation within the elements, normal to slab surface, are considered. Shear deformation is negligible. Slab is considered infinite for center loading and semi-infinite for edge loading. Load at interior and corner of slab distributed uniformly of a circular contact area. Full contact support between the slab and foundation. Other basic assumptions used in the flexural analysis of the "Slab on Grade" worksheet are as follows: Slab viewed as a plate on a liquid foundation with full subgrade contact subgrade modeled as a series of independent springs - also known as "Winkler" foundation. Modulus of subgrade reaction "k" is used to represent the subgrade. Slab is considered as unreinforced concrete beam, so that any contribution made to flexural strength by the inclusion of distribution reinforcement is neglected. Combination of flexural and direct tensile stresses will result in transverse and longitudinal cracks. The "Slab on Grade" worksheet allows the user to account for the effect of an additional post or wheel load. Refer to the input comment box for recommendations. All four 4 worksheets pertaining to the PCA Figures 3, 7a, 7b, and 7c from Reference f in item 1 above are based on interior load condition and other similar assumptions used in the "Slab on Grade" worksheet. Other assumed values used in the development of the Figures 3, 7a, 7b, and 7c are as follows: In the four 4 worksheets pertaining to the PCA Figures 3, 7a, 7b, and 7c, the user must manually determine read the required slab thickness from the design chart and must manually input that thickness in the appropriate cell at the bottom of the page. View, Toolbars, and Drawing to manually draw in superimpose the lines on the chart which are used to determine the required slab thickness. Merely move the mouse pointer to the desired cell to view the contents of that particular "comment box".

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## Chapter 3 : GRDSLAB - Concrete Slab on Grade Analysis Spreadsheet

*For Slab Subjected to Concentrated Post Loading (for k = pci) Per PCA "Slab Thickness Design for Industrial Concrete Floors on Grade" - Figure 7b, page 10 Instructions for Use of Figure 7b: 1. Enter chart with slab stress = 2.*

This Excel calculation can be downloaded by ExcelCalcs subscribers. Please login or Subscribe. Calculation Preview Calculation Description: Specifically, a concrete slab on grade may be subjected to concentrated post or wheel loading. Then for the given parameters, the slab flexural, bearing, and shear stresses are checked, the estimated crack width is determined, the minimum required distribution reinforcing is determined, and the bearing stress on the dowels at construction joints is checked. The ability to analyze the capacity of a slab on grade subjected to continuous wall line-type load as well as stationary, uniformly distributed live loads is also provided. This program is a workbook consisting of eight 8 worksheets, described as follows: This program is based on the following references: Porter Iowa State University, e. Packard Portland Cement Association, g. The "Slab on Grade" worksheet assumes a structurally unreinforced slab, ACI"Type B", reinforced only for shrinkage and temperature. An interior load condition is assumed for flexural analysis. That is, the concentrated post or wheel load is assumed to be well away from a "free" slab edge or corner. The original theory and equations by H. Westergaard as modified by Reference a in item 1 above are used forthe flexual stress analysis. Some of the more significant simplifying assumptions made in the Westergaard analysis model are as follows: Slab acts as a homogenous, isotropic elastic solid in equilibrium, with no discontinuities. Slab is of uniform thickness, and the neutral axis is at mid-depth. All forces act normal to the surface shear and friction forces are assumed to be negligible. Deformation within the elements, normal to slab surface, are considered. Shear deformation is negligible. Slab is considered infinite for center loading and semi-infinite for edge loading. Load at interior and corner of slab distributed uniformly of a circular contact area. Full contact support between the slab and foundation. Other basic assumptions used in the flexural analysis of the "Slab on Grade" worksheet are as follows: Slab viewed as a plate on a liquid foundation with full subgrade contact subgrade modeled as a series of independent springs - also known as "Winkler" foundation. Modulus of subgrade reaction "k" is used to represent the subgrade. Slab is considered as unreinforced concrete beam, so that any contribution made to flexural strength by the inclusion of distribution reinforcement is neglected. Combination of flexural and direct tensile stresses will result in transverse and longitudinal cracks. The "Slab on Grade" worksheet allows the user to account for the effect of an additional post or wheel load. Refer to the input comment box for recommendations. All four 4 worksheets pertaining to the PCA Figures 3, 7a, 7b, and 7c from Reference f in item 1 above are based on interior load condition and other similar assumptions used in the "Slab on Grade" worksheet. Other assumed values used in the development of the Figures 3, 7a, 7b, and 7c are as follows: In the four 4 worksheets pertaining to the PCA Figures 3, 7a, 7b, and 7c, the user must manually determine read the required slab thickness from the design chart and must manually input that thickness in the appropriate cell at the bottom of the page. View, Toolbars, and Drawing to manually draw in superimpose the lines on the chart which are used to determine the required slab thickness. Merely move the mouse pointer to the desired cell to view the contents of that particular "comment box".

## Chapter 4 : Reinforced Concrete Floor Slab Analysis & Design Software

*FEM analysis & design of foundations, mats, combined footings, pile caps, slabs on grade, & buried structures. Featuring integration with spColumn via export to CTI functionality in v Multi-purpose structural modeling and finite element analysis software for two- and three-dimensional buildings and structures with straightforward, robust.*

## Chapter 5 : Slab on Grade (PCA vs. Westergaard) - Structural engineering other technical topics - Eng-Tip

*This guide presents information on the design of slabs-on-ground, primarily industrial floors. It addresses the planning, design, and detailing of slabs. Background information on design theories is followed by discussion of the types of slabs,* *soil-support systems, loadings, and jointing.*

## Chapter 6 : â„¢ "Pca slab on grade design" Keyword Found Websites Listing | Keyword Suggestions

*ACI , "Design of Slabs-on-Grade", refers to this as a Type B slab. The Wire Reinforcing Institute recommends the use of the Subgrade Drag Theory for slabs up to feet in length.*

## Chapter 7 : calendrierdelascience.com - calendrierdelascience.com

*Also, design charts from the Portland Cement Association (PCA) are included to provide an additional method for determining/checking required slab thickness for flexure. The ability to analyze the capacity of a slab on grade subjected to continuous wall (line-type) load as well as stationary, uniformly distributed live loads is also provided.*

## Chapter 8 : PCA - Slab Thickness Design for Industrial Concrete Floors on Grade - PDF Free Download

*ndustrial slabs on grade take a lot of punishment, often serv- slab post-tensioned for Choosing Design Methods (PCA) method. P C A's charts and ta-.*

## Chapter 9 : R Guide to Design of Slabs-on-Ground

*The design method is presented in Slab Thickness Design for Industrial Concrete Floors on Grade* and is applicable as well to slabs on ground for outdoor storage and material-handling areas. Location and Frequency of Imposed Loads Slab cracking due to excessive loads can occur in response to flexural overstress.*