الآية

قال تعالي:﴿وَلَا تَمْشِ فِي الْأَرْضِ مَرَحًا إِنَّكَ لَنْ تَخْرِقَ الْأَرْضَ وَلَنْ تَبْلُغَ الْجِبَالَ طُولًا (37) كُلُّ ذَلِكَ كَانَ سَيِّئُهُ عِنْدَ رَبِّكَ مَكْرُوهًا (38) ذَلِكَ مِمَّا أَوْحَى إِلَيْكَ رَبُّكَ مِنَ الْحِكْمَةِ وَلَا تَجْعَلْ مَعَ اللَّهِ إِلَهًا آخَرَ فَتُلْقَى فِي جَهَنَّمَ مَلُومًا مَدْحُورًا (39)﴾

صدق الله العظيم

سورة الإسراء الآيات (37-38-39)

Dedication

This research thesis is dedicated to:

My parents, who continuously encouraged and supported me in countless ways,

My beloved brothers and sisters;

Acknowledgements

First and foremost, I must acknowledge my limitless thanks to Allah, the Ever Magnificent; the Ever-Thankful, for His helps and bless. I am totally sure that this work would have never become truth, without His guidance.

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Abstract

In this study the thickness of rigid pavement was determined using manual computations by applying two design approaches namely American Association of State Highway and Transportation Officials Method (AASHTO) and Portland cement Association Method (PCA). There are four types of rigid pavements; but this study focuses on Jointed Plan Concrete Pavement (JPCP) and Jointed Reinforced Concrete Pavement (JRCP).A computer program with Visual Basic software was developed, entitled GalalM-RP program, to determine the rigid pavement design thickness in accordance with PCA method. Al-Ilaifoun urban-rural highway was selected as a case study, the thickness of the rigid pavement was computed using manual method to verify the results obtained from GalalM-RP program. Comparison of the results showed that the difference between manual design and GalalM-RP software did not exceed 5%.The computer program GalalM-RP can be used reliably as design thickness program for rigid pavements with doweled joints and without concrete shoulders.

تجريد

في هذه الدراسة تم حساب سمك الرصف الخرساني بإستخدام الحسابات اليدوية من خلال تطبيق أسلوبين من أساليب التصميم مثل طريقة الجمعية الأمريكية للطرق والنقل AASHTO وطريقة جمعية الأسمنت البورتلاندي PCA . هناك أربعة أنواع من الأرصفة الخرسانية لكن هذه الدراسة ركزت علي الرصف الخرساني المربوط والرصف الخرساني المربوط المسلح. تم تصميم برنامج حاسوب بإستخدام لغة الفيجول بيزيك (Visual Basic) وسمي GalalM-RP لحساب سمك الرصف الخرساني استنادا علي طريقة تصميم جمعية الأسمنت البورتلاندي PCA لتصميم الطرق الخرسانية . تم إختيار طريق العيلفون (Al-Ilaifoun highway) كدراسة حالة. حسب سمك الرصف الخرساني بإستخدام الطريقة اليدوية للتحقق من النتائج التي تم الحصول عليها من برنامج GalalM-RP . أظهرت المقارنة بين النتائج أن الفرق بين التصميم اليدوي وGalalM-RP لم يتعدي ال 5% وشملت الإستنتاجات أن البرنامج الحاسوبي GalalM-RP يمكن إستخدامة بشكل موثوق به كبرنامج للتصميم الإنشائي للطرق الخرسانية التي تحتوي علي الأوتاد (dowel) دون الكتوف الخرسانية (without Concrete Shoulders).

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List of Abbreviations and Symbols

RPs : Rigid (or Concrete) Pavements

PCC : Portland Cement Concrete

JPCP : Jointed Plain Concrete Pavement

JRCP : Jointed Reinforced Concrete Pavement

CRCP: Continuous Reinforced Concrete Pavement

PCP : Prestressed Concrete Pavement

AASHTO: American Association of State Highway and Transportation Officials

PCA: Portland Cement Association

AI: Asphalt Institute

CBR: California Bearing Ratio

$\mathbf{N_A}$: Number of Axles per Trucks Surveyed, say 100

ADT: Daily Traffic, veh. /day in both directions

D: Direction Split (the larger value is used in the design)

$\mathbf{P_T}$: % Trucks

r: Annual Traffic Growth Factor for Design Period n

L: The Lane Distribution Factor which varies with the volume of traffic and the number of lanes.

$\mathbf{w_{18}}$: The Number of 18-kip (80-kN) Single-axle load applications

$\mathbf{Z_R}$: Normal deviate for a given Reliability R

$\mathbf{S_O}$: Overall Standard Deviation

D: Slab Thickness in Inches

Δ**PSI** : Present serviceability index

$\mathbf{P_t}$: The Serviceability at time t

$\mathbf{S_c}$: Modulus of Rupture of Concrete

$\mathbf{C_d}$: Drainage Coefficient

J: Load Transfer Coefficient

$\mathbf{E_c}$: Elastic Modulus

K : Modulus of Subgrade Reaction

$\Delta \boldsymbol{L}$: the Joint Opening caused by Temperature Change and Drying Shrinkage of concrete

$\boldsymbol{\alpha_t}$: The Coefficient of Thermal Expansion of Concrete, generally 5 t o

6 x 10^{-6} /°F (9 to 10.8 x 10^{-6}/°C)

$\boldsymbol{\epsilon}$: The Drying Shrinkage Coefficient of Concrete, approximately

0.5 to 2.5x10^{-4}

$\boldsymbol{L}$: is the Joint Spacing or Slab Length

$\Delta \boldsymbol{T}$: is the Temperature Range, which is the Temperature at placement minus the lowest mean monthly temperature

C: is the Adjustment Factor due to slab-subbase Friction, 0.65 for stabilized base and 0 .8 for granular subbase.

$\mathbf{A_s}$: is the Area of Steel required per unit width

$\boldsymbol{f_s}$: is the Allowable Stress in Steel.

f_a: Average Friction Coefficient between Slab and Foundation usually taken as 1.5

γ_c: is the Unit Weight of the Concrete

h: is the Thickness of the Slab

m: Number of Axle Load Groups

μ: The Allowable Bond Stress

F_i : Equivalent Axle Load Factor (EALF) for each axle load group.

n_i : Number of passes of the *i*th-axle load group during the design period

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