

98 年度博士班入學考試大地工程試題

一、試述 Newmark 影響圖(Newmark's influence chart) 如何製作出? 如何使用? 使用 Newmark 影響圖計算土層新增壓力相較於使用其他應力圖有何優缺點?(10%)

二、某一正常壓密黏土試樣，進行壓密不排水試驗，試驗後得到下列結果:

$\sigma_3 = 70 \text{ kPa}$ ，軸差應力 $(\Delta\sigma_d)_f = 50 \text{ kPa}$ ，孔隙水壓力 $(\Delta u_d)_f = 34 \text{ kPa}$ 。試計算此

試樣之壓密不排水試驗之(a)總應力之摩擦角為若干?(b) 有效應力之摩擦角

為若干?(c) 其破壞時之孔隙水壓力參數 A_f 為若干? (15%)

三、(a) 試述德札基(Terzaghi) 之淺基礎支承力理論之基本假設 (至少五點)。(5%)

(b) 試說明德札基之淺基礎支承力公式中，包含那三大項目? 其分別所代表

之意義或所考慮之要素為何?(5%)

四、Derive the equation of the moist unit weight of soils γ_m (10 %) :

$$\gamma_m = \frac{\gamma_s + S_r \cdot e \cdot \gamma_w}{1 + e}$$

五、A concrete pile with a solid circular section, an outer diameter of 0.4m, and a length of 15 m was driven into a saturated uniform clayey ground with an undrained strength $c_u = 100 \text{ kN/m}^2$ and $\gamma_{\text{sat}} = 18 \text{ kN/m}^3$;

(a) Use the α -method ($\alpha = 0.5$) and Meyerhof's bearing capacity factor $N_{cd} (= 9.3)$ to calculate the ultimate bearing capacity of the pile (in kN), (15%).

(b) If this pile carries a load $Q = 300 \text{ kN}$ at its top, what is the safety factor of the pile against bearing capacity failure? (10%)

六、某地層由 n 層土層組成，每一層的水平滲透係數為 $k_{H1}, k_{H2}, k_{H3}, \dots, k_{Hn}$ ，垂直滲透係數為 $k_{v1}, k_{v2}, k_{v3}, \dots, k_{vn}$ ，每層土厚 $H_1, H_2, H_3, \dots, H_n$ ，試推導該土層水平與垂直方向等效滲透係數(10%)

七、一厚為 10cm 之正常壓密飽合黏土夾於二砂土層間，假設該黏土層承受載重，產生 6cm 的沉陷量，此時之壓密係數為 $0.002 \text{ m}^2/\text{min}$ ，則產生 50% 之沉陷量將費幾天(10%)

八、一水平砂性地盤其抗剪角為 ϕ ，(a) 請分別繪出土壤中主動土壓與被動土壓之莫耳應力圓與破壞包絡線之相對關係?(5%) (b) 利用上圖之輔助證明 Rankine 土壓係數 $K_a = 1/K_p$ (5%)

98 年度博士班入學考試大地工程試題

一、試述 Newmark 影響圖(Newmark's influence chart) 如何製作出? 如何使用? 使用 Newmark 影響圖計算土層新增壓力相較於使用其他應力圖有何優缺點?(10%)

二、某一正常壓密黏土試樣，進行壓密不排水試驗，試驗後得到下列結果：

$\sigma_3 = 70 \text{ kPa}$ ，軸差應力 $(\Delta\sigma_d)_f = 50 \text{ kPa}$ ，孔隙水壓力 $(\Delta u_d)_f = 34 \text{ kPa}$ 。試計算此

試樣之壓密不排水試驗之(a)總應力之摩擦角為若干?(b)有效應力之摩擦角

為若干?(c)其破壞時之孔隙水壓力參數 A_f 為若干? (15%)

三、(a) 試述德札基(Terzaghi) 之淺基礎支承力理論之基本假設 (至少五點)。(5%)

(b) 試說明德札基之淺基礎支承力公式中，包含那三大項目? 其分別所代表之意義或所考慮之要素為何?(5%)

四、Derive the equation of the moist unit weight of soils γ_m (10 %) :

$$\gamma_m = \frac{\gamma_s + S_r \cdot e \cdot \gamma_w}{1 + e}$$

五、A concrete pile with a solid circular section, an outer diameter of 0.4m, and a length of 15 m was driven into a saturated uniform clayey ground with an undrained strength $c_u = 100 \text{ kN/m}^2$ and $\gamma_{\text{sat}} = 18 \text{ kN/m}^3$;

(a) Use the α -method ($\alpha = 0.5$) and Meyerhof's bearing capacity factor $N_{cd} (= 9.3)$ to calculate the ultimate bearing capacity of the pile (in kN), (15%).

(b) If this pile carries a load $Q = 300 \text{ kN}$ at its top, what is the safety factor of the pile against bearing capacity failure? (10%)

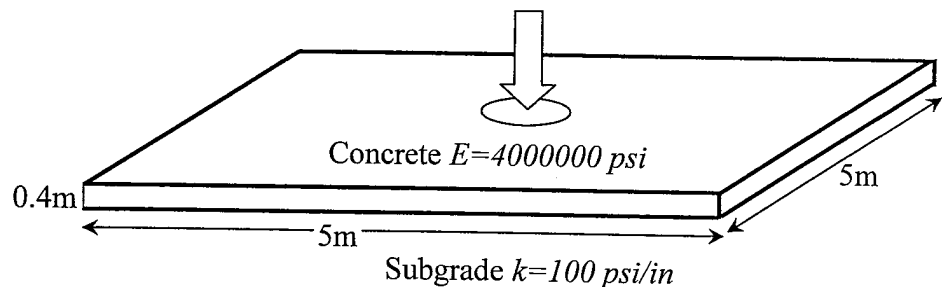
六、某地層由 n 層土層組成，每一層的水平滲透係數為 $k_{H1}, k_{H2}, k_{H3}, \dots, k_{Hn}$ ，垂直滲透係數為 $k_{v1}, k_{v2}, k_{v3}, \dots, k_{vn}$ ，每層土厚 $H_1, H_2, H_3, \dots, H_n$ ，試推導該土層水平與垂直方向等效滲透係數(10%)

七、一厚為 10cm 之正常壓密飽合黏土夾於二砂土層間，假設該黏土層承受載重，產生 6cm 的沉陷量，此時之壓密係數為 $0.002 \text{ m}^2/\text{min}$ ，則產生 50% 之沉陷量將費幾天(10%)

八、一水平砂性地盤其抗剪角為 ϕ ，(a) 請分別繪出土壤中主動土壓與被動土壓之莫耳應力圓與破壞包絡線之相對關係?(5%) (b) 利用上圖之輔助證明 Rankine 土壓係數 $K_a=1/K_p$ (5%)

國立成功大學土木系九十八學年度博士班入學考試丙組試題

1. For the slab shown as below
 - a. How would you explain the causes of discrepancies between results of Westergaard's solutions and finite element analysis? (10%)
 - b. Suppose two-dimensional and three-dimensional finite element analysis were both conducted, which one would give more accurate results? Why? Is this always true for any cases? (10%)
 - c. Please convert the subgrade k into metric unit. (10%)
 - d. Please calculate the radius of relative stiffness. (10%)



2. Please explain the concept and usage of Falling Weight Deflectometer. (20%)
3. How does pavement engineers obtain Present Serviceability Index? (20%)
4. Please translate the following text (20%)

The aim of pavement design is to select the most economical pavement thickness and composition which will provide a satisfactory level of service for the anticipated traffic.

To achieve this goal, the designer must have sufficient knowledge of the materials, the traffic, the local environment – and their interactions – to be able to predict the performance of any pavement composition. In addition, the designer must have knowledge of what level of performance, and what pavement condition, will be considered satisfactory in the circumstances for which the pavement structure is being designed.

Because of the many variables and interactions which influence the result, it is appropriate to adopt a systematic approach to pavement design. Depending on the amount of data which has to be provided or, conversely, on the number of assumptions which have to be made, a pavement design procedure may be very complex at one extreme or very simple at the other.

National Cheng Kung University
Entrance Exam for Ph.D. Students
9 May, 2009

Please translate the following paragraphs into Chinese, and briefly elaborate your thoughts on each paragraph. (50 points for each Question)

1. Little has been written on managing your own research (and very little on avoiding other people managing your research); however, your research is much more under your control than you may realize. We are concerned with great research here. Work that will get wide recognition, perhaps even win Nobel Prize. As most people realize, the average published paper is read by the author, the referee, and perhaps one other person. Classic papers are read by thousands. We are concerned with research that will matter in the long run and become more than a footnote in history. If you are to do important work then you must work on the right problem at the right time and in the right way. Without any one of the three, you may do good work but you will almost certainly miss real greatness.

2. Greatness is a matter of style. For example, after learning the elements of painting, you study under a master. While studying you pay attention to what the master says in discussing your work, but you know that if you are to achieve greatness then you must find your own style. Furthermore, a successful style in one age is not necessarily appropriate for another age. Cubism would not have gone over big during the realism period. Similarly, there is no simple formula for doing great science or engineering, I can only talk around the topic. The topic is important because, so far as we have any solid evidence, you have but one life to live. Under these circumstances it seems better to live a life in which you do important things (important in your eyes, of course) than to merely live out your life. No sense frittering away your life on things that will not even appear in the footnotes.

國立成功大學土木系九十八學年度博士班入學考試丙組試題

1. Give a brief comment about the following statement. (20分)

“Although pavement design has gradually evolved from art to science, empiricism still plays an important role even up to the present day.

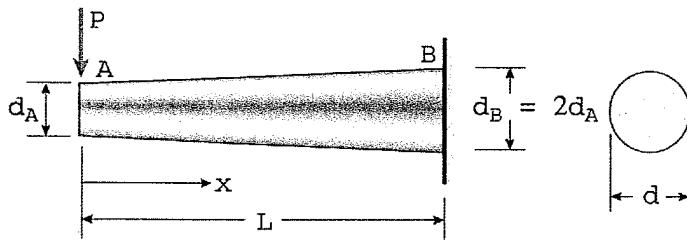
2. Briefly describe the Superpave mix design method. (30分)

3. What kind of properties should the ideal pavement binder have?
(30%)

4. Translation (20%)

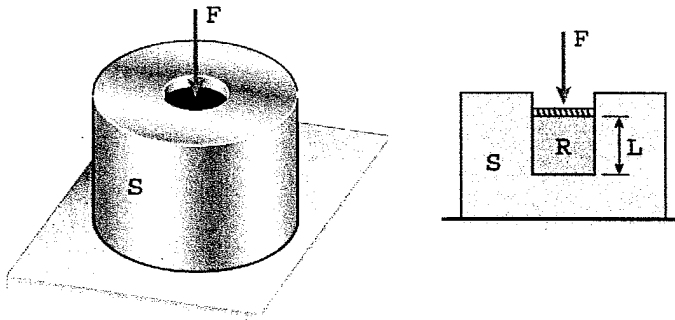
Pavement management is not a new concept; management decisions are made as a part of normal operations every day in highway agencies. The idea behind a pavement management system is to improve the efficiency of this decision making, expand its scope, provide feedback as to the consequences of decisions, and ensure the consistency of decisions made at different levels within the same organization.

1. The tapered cantilever beam AB shown in Fig has a solid circular cross section. The diameters at the end A and B are d_A and $d_B = 2d_A$, respectively. Determine the equation of the deflection curve as a function of position x due to load P. (20%)

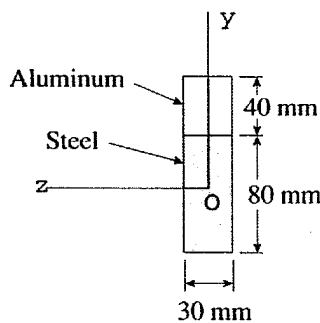


2. For problem 1, use Castigliano's theorem to determine the deflection at A. (15%)

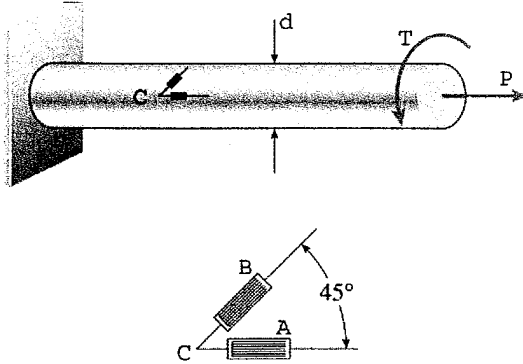
3. A rubber cylinder R of length L and cross-sectional area A is compressed inside a steel cylinder S by a force F that applies uniformly distributed pressure to the rubber. (a) Find the lateral pressure p between the rubber and the steel. (Disregard friction between the rubber and the steel, and assume the steel cylinder is rigid when compared to the rubber. (b) Find the shortening δ of the rubber cylinder. (15%)



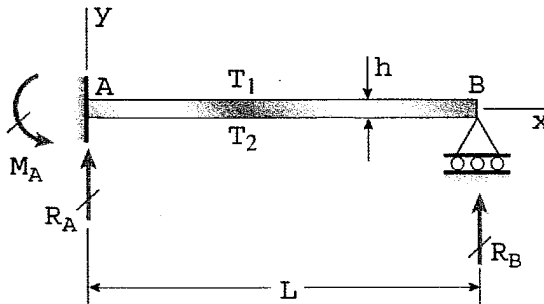
4. The cross section of a composite beam made of aluminum and steel is shown in the figure. The elastic moduli are $E_a = 75GPa$ and $E_s = 200GPa$. Under the action of a bending moment that produces a maximum stress of 50 MPa in the aluminum, what is the maximum stress σ_s in the steel? (15%)



5. A solid circular bar of diameter $d = 1.5 \text{ in}$ is subjected to an axial force P and a torque T . Strain gages A and B mounted on the surface of the bar give readings $\varepsilon_A = 100 \times 10^{-6}$ and $\varepsilon_B = -55 \times 10^{-6}$. The bar is made of steel having $E = 30 \times 10^6$ psi and $\nu = 0.29$. (a) Determine the axial force P and the torque T . (b) Determine the maximum shear strain and the maximum shear stress in the bar. (20%)



6. A cantilever beam, fixed at the left-hand end A and simply supported at the right-hand end B, is subjected to a temperature differential with temperature T_1 on its upper surface and T_2 on its lower surface. Find all reactions for this beam. (15%)



博士班工程管理試題

1. 請用中文翻譯下列句子,須將內容表達清楚 (40%)

1.1. The dilemma for the owner in choosing project delivery methods is one of the price versus performance. Each project has distinctive requirements for problem solving, and some methods work better than others in solving problems. If the project is highly complex, such as a hospital, it requires close cooperation among the project participants. In this case, the owner wants to choose a method that emphasizes cooperation and performance. If the project is relatively simple, such as a warehouse, then the owner can opt for an approach with a lower price or an earlier completion date. The owner must choose a contract type by considering the price and the risk associated with different types of contracts. The contracts are usually categorized into unit price, lump sum, and cost plus fee. In addition, the project delivery methods are Design/Bid/Build, Design/Build, Construction Project Management, and Build-Operate-Transfer.

1.2. The Contractor shall take full responsibility for the adequate, stability and safety for all Site operations and methods of construction. Provided that the Contractor shall not be responsible (except as stated hereunder or as may be otherwise agreed) for the design or specification of Permanent Works, or for the design or specification of any Temporary Works not prepared by the Contractor. Where the Contract expressly provides that part of Permanent Works shall be designed by the Contractor, he shall be fully responsible for that part of such Works, notwithstanding any approval by the Engineer.

2. Please use BCWP (Budgeted Cost Work Performed), ACWP (Actual Cost Work Performed), and BCWS (Budget Cost Work Scheduled) three different curves to illustrate the following situations (1) under budget & on schedule (2) under budget & behind schedule (3) over budget & on schedule (4) over budget & behind schedule (20%)

3. Taiwan High Speed Rail Corporation (THSRC) is now in the financial difficulty and has reduced number of trains. Do you think such a course of action is appreciate to help THSRC ease the financial crisis? or not? Please state and analyze your observations and provide the possible solutions in your own perspective? (20%)

4. Please find the Early Start, Early Finish, Late Start, Late Finish, Total Float, and Free Float of each activity shown in Figure 1. (20%)

*all activity relationships are Finish-to-Start with No Lags.

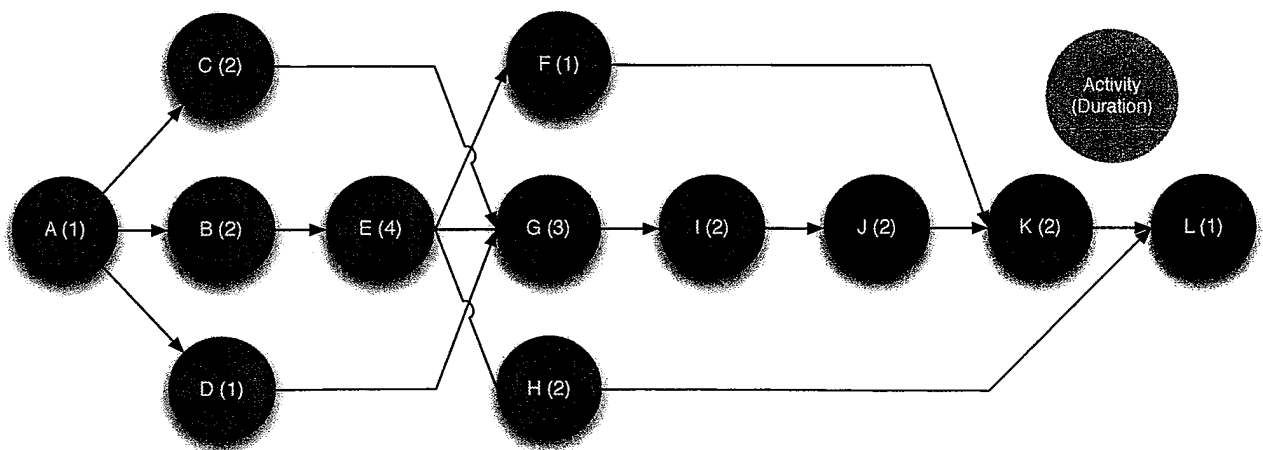


Figure 1