2007 年度成功大學土木系博士班(乙組)入學考試試題

1.在黏土及砂土地層上方各分別放置一柔性及剛性基礎，試繪圖並說明當承受載重時，各基礎下方之立即沈陷圖(Immediate settlement profile)及接觸壓力(contact pressure)分佈情形。

2.有一土壤試體承受

初始均向靜水壓為側向應力(σ_h)＝垂直向應力(σ_v)＝50 kPa，當

(a) σ_h 保持一定，σ_v 增加至 100 kPa。

(b) σ_v 保持一定，σ_h 增加至 100 kPa。

(c) σ_h、σ_v 皆增加到 100 kPa。

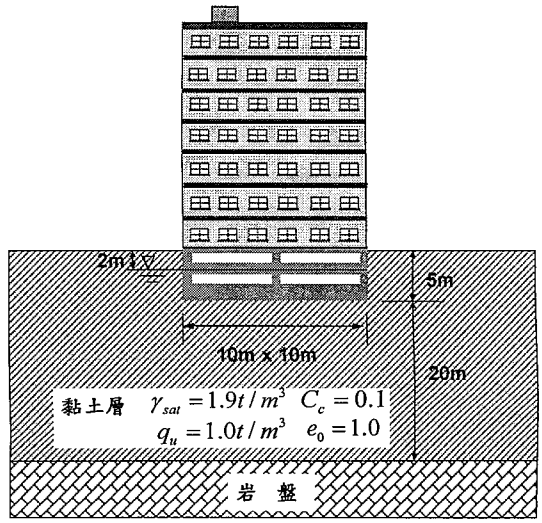
(d) σ_v 保持一定，但 σ_h 減少到 10 kPa。

(e) σ_v 增加 25 kPa，同時 σ_h 減少 25 kPa。

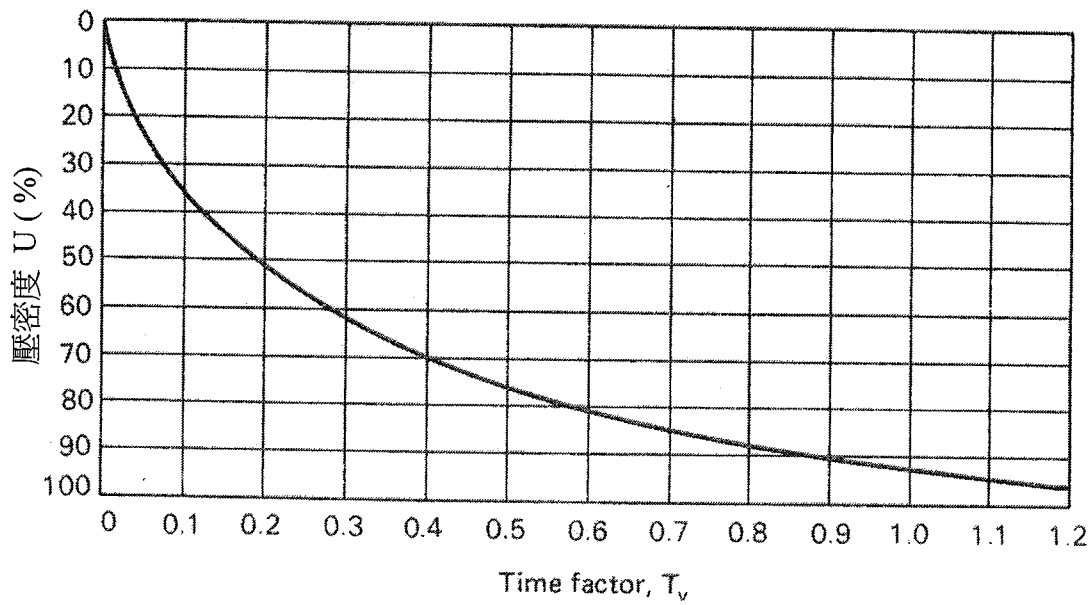
試將上述 5 種載重狀況的應力路徑繪出。

3.

有一總重為 2400 噸之鋼筋混凝土大樓採用筏式基礎，相關土壤參數與尺寸詳如圖示。試求基礎埋置深度為 5 公尺時，抵抗剪力破壞之安全係數，並求基礎版中央之壓密沉陷量。

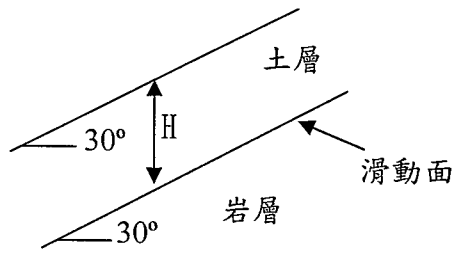


4.有一厚 2.44m 之高壓縮性黏土層，$\gamma = 17.27kN/m^3$，$e_0 = 1.20$，壓縮指數$C_c = 0.20$。其上方為夯實良好之砂礫層，厚度為 3.66m，$\gamma = 21.2kN/m^3$，黏土層下方則為不透水岩盤。今在上層砂礫地表建造結構物，造成土層中間之應力增量為$28.8kN/m^2$，又從單向度壓密試驗得知，黏土之壓密係數 C_v 為 0.0186 ㎡/月，試求：(1)無地下水時，黏土層之壓縮沈陷量？(2)地下水位位於地表時，黏土層之壓縮沈陷量？(3)沈陷量一半時所需時間？(4)建造後二年內所產生之壓密沈陷量？



5.美國統一土壤分類法(Unified Classification System)需要作哪些試驗才能進行分類? 統一土壤分類法中所用 Pt、GP-GM、CH 與 OL 等英文字母所代表的意義為何?

6.如下圖一無限邊坡，土層單位重 18kN/m^3，滑動面剪力參數 C=5kN/m^2、φ=20°，當安全係數=1 情況下，土層最大厚度 H?



* 任選五題作答，每題二十分，請標明題號。

國立成功大學土木系九十六學年度博士班入學考試運輸工程試題

1. Please translate and comment the paragraph below. (25%)

ITS technologies may be grouped together into functional systems, such as advanced traffic management systems (ATMS), advanced traveler information systems (ATIS), and advanced vehicle control systems (AVCS). In this classification, ATMS includes systems intended to manage the flow of traffic, such as coordinated traffic signal systems, ramp metering systems, and incident management systems; ATIS includes systems intended to disseminate information to the public (traffic condition information, route guidance, etc.); and AVCS includes automated highway systems and onboard control systems (collision avoidance, vision enhancement, etc.) intended to promote safety. ITS may also be seen as including traffic surveillance systems, communications systems, and traffic control system.

2. Please translate and comment the paragraph below. (25%)

Most civil engineering activity related to the provision of physical facilities is what might be called *physical civil engineering*. This includes the design, construction, and maintenance of fixed transportation facilities and involves the full spectrum of civil engineering specialties. A major highway project, for instance, will involve not only the sizing and geometric design of the roadway, which is normally thought of as a part of transportation engineering, but also the design and construction of bridges and other structures, which requires structural engineering; drainage design, which requires hydraulic and hydrological engineering; consideration of earthwork compaction and slope stability, which require geotechnical engineering; construction management; and surveying.

3. Please translate and comment the paragraph below. (25%)

Most civil engineering activity related to planning and operation of the transportation system, on the other hand, is what might be called *system engineering*. This involves transportation planning, including the analysis of transportation demand; the analysis of system capacity and operation characteristics; and the design of traffic control and operation strategies. The design of traffic control and operation strategies includes highway traffic engineering and operational design (that is, design of operating strategies) of freight and mass transit systems. Transportation engineering is probably unique among the civil engineering specialties in the importance of its systems engineering aspects.

4. 請依據鐵路運輸、公路運輸的優缺點，並參酌下列節錄文字，申論目前台灣運輸模式比例的現況與方向. (25%)

今後交通建設的經濟效益評估應特別注意的主要課題包括：

（1）軌道系統之外部效益未充分反映在評估中：軌道系統有許多外部效益，如果不評估在內時，會使其效益低估而導致不可行。

（2）公路系統之外部成本未充分反映在評估中：相反，公路系統常有外部成本，未評估在內會導致扭曲結論

Highway Engineering
National Cheng Kung University
Entrance Exam for Ph.D. Students
12 May, 2007

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

1. Hard work is a trait that most great scientists have. Edison said that genius was 99% perspiration and 1% inspiration. Newton said that if others would work as hard as he did then they would get similar results. Hard work is necessary but it is not sufficient. Most people do not work as hard as they easily could. However, many who do work hard -- work on the wrong problem, at the wrong time, in the wrong way, and have very little to show for it.

2. Without courage you are unlikely to attack important problems with any persistence, and hence not likely to do important things. Courage brings self-confidence, an essential feature of doing difficult things. However, it can border on over-confidence at time which is more of a hindrance than a help. There is another trait that took me many years to notice, and that is the ability to tolerate ambiguity. Most people want to believe what they learn is the truth: there are a few people who doubt everything. If you believe too much then you are not likely to find the essentially new view that transforms a field, and if you doubt too much you will not be able to do much at all. It is a fine balance between believing what you learn and at the same time doubting things. Great steps forward usually involve a change of viewpoint to outside the standard ones in the field.

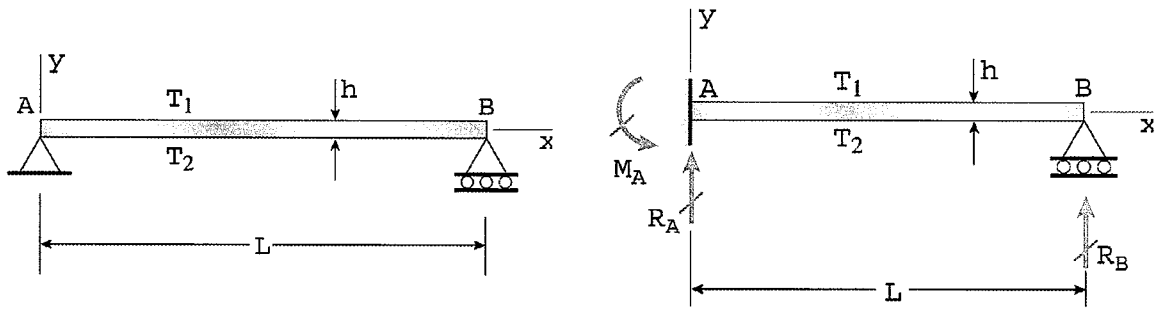
1. What are the rutting parameter and the fatigue parameter of the Superpave asphalt binder specification? How the parameters are established? (35%)

2. Describe the methods of determining the optimum asphalt content for Marshall mix design and Superpave mix design method. (35%)

3. Describe the characteristics of an ideal pavement binder. (30%)

1. (a) A simple beam AB of length L and height h as shown in Fig. (a) undergoes a temperature change such that the bottom of the beam is at temperature T_2 and the top of the beam is at temperature T_1. Given the thermal coefficient of expansion of the beam, α, determine the equation of the deflection curve of the beam. What is the maximum stress of the beam? The flexural rigidity of the beam is constant EI .

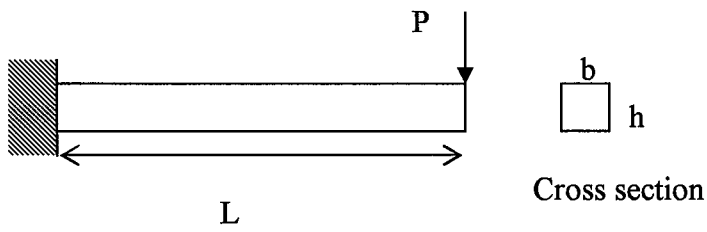
(b) A beam shown in Fig (b) is subjected to a temperature differential with temperature T_1 on its top surface and T_2 on its bottom surface. Use the results of (a) and superposition method to find all reactions of the beam. The flexural rigidity of the beam is constant EI .



(a) (b)

2. (a) Determine the strain energy of the cantilever beam, taking into account the effect of both normal and shear stress.

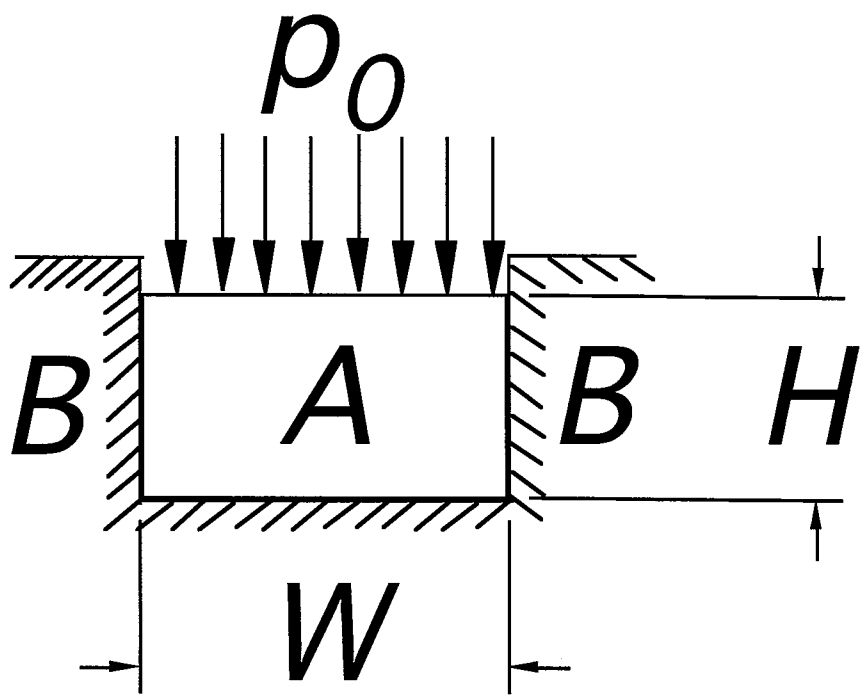
(b) Discuss that under what circumstance the effect of shear in computing the strain energy is negligible.



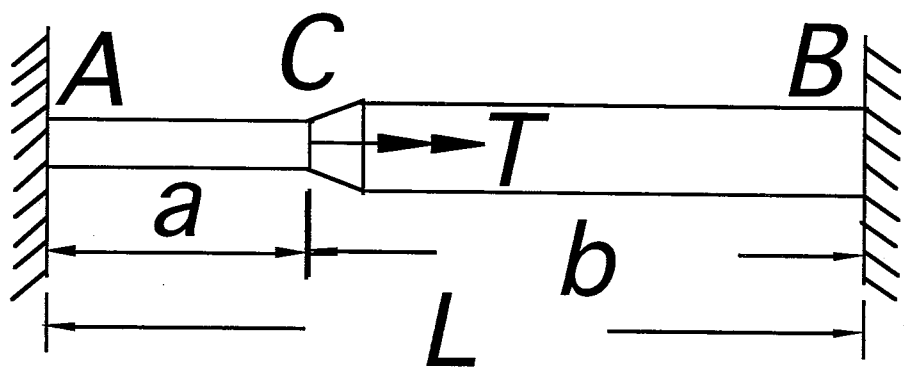
Ph.D. entrance exam

1 May 2007

1. A block of isotropic and homogeneous material, labeled as A, is confined between plane parallel rigid walls B. The height and width of the material are H and W, respectively. The material is not confined in the direction perpendicular to the plane of the paper. A uniformly distributed pressure p_0 is applied to the top of the material. Please answer the following questions.
   (a) Obtain a formula for the lateral pressure p between the material and the rigid walls. Express p in terms of p_0 and Poisson's ratio ν of the material A, and disregard friction between the rubber and the walls. Discuss the cases for $\nu = 0.5$ and $\nu = 0$.
   (b) Obtain a formula for the unit volume change e in terms of p_0, ν, and the modulus E. Please consider two cases: (1) $\nu = 0.5$ and (2) $\nu = 0$.
   (c) Assume that the material now has an out-of-plane dimension of D (i.e. depth into the paper), and is also confined along the direction. In other words, the material A, now, is placed in a 3D, rectangular cavity. Please repeat (a) and (b).



2. A solid circular steel shaft AB, held rigidly at both ends, has two different diameters. The shaft has diameters d_a and d_b in parts AC and CB, respectively. Assume $d_a < d_b$. A torque T acts at section C. Neglect the transition area at C.
(a) What should be the lengths a and b if the maximum shear stress is to be the same in both parts of the shaft?
(b) Under the condition obtained in (a), what's the total strain energy in the system?
(c) Assume the whole shaft is hollow with a thickness of h for both parts AC and CB. Repeat (a) and (b), and discuss two cases: (1) $h << 1$ and (2) h approaches $d_a/2$.
(d) Assume the cross-section of the shaft now is rectangular. Discuss the validity of the solutions in (a), (b) and (c).



以下三題任選二題作答。每題 50 分。

請最多回答二題，切勿三題全部作答。

1. 若欲提昇中山高速公路維護管理的績效，您認為有那些較重要的決策問題需要分析？針對這些決策問題，請分別建議可協助作出正確決策的方法或程序。

2. 附件是 Transportation Research Part B 第 41 卷一篇社論的一部份。試以約 150 字的篇幅寫出其大要，再以約 150 字的篇幅評論之。

3. 請用中文簡述下列句子,須將內容表達清楚

(1) Claims relating to time shall be made in accordance with applicable provisions of the Subcontract Documents. This Article does not preclude recovery of damages for delay by either party. If the Contract provides for liquidated or other damages for delay beyond the completion date set forth in the Contract, and such damages are assessed by the Owner against the Contractor, then the Contractor may assess such damages against the Subcontractor in proportion to its share of the responsibility for such delay and damage, but no more. The amount of such assessment against the Subcontractor, if any, shall not exceed the Subcontractor's proportionate share of the responsibility for such delay and damage and shall never exceed the amount assessed against the Contractor by the Owner.

(2) The Contractor shall be deemed to have satisfied himself as to the correctness and sufficiency of the Tender and of the rates and prices stated in the Bill of Quantities, all of which shall, except insofar as it is otherwise provided in the Contract, cover all his obligations under the Contract (including those in respect of the supply of goods, materials. Plant or services or of contingencies for which there is a Provisional Sum) and all matters and things necessary for the proper execution and completion of the Works and the remedying of any defects therein.

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Guest editorial

Advanced modelling of train operations in stations and networks

When studying the papers on scheduling of railway operations published in international scientific journals, one gets the impression that many authors are not fully aware of the state-of-the-art of railway traffic engineering in different European countries, especially in Germany, France and Italy. Many papers dealt with scheduling of trains in low-frequency single-track networks typical for American rail freight transport and only a minority came from engineering disciplines. At the same time, substantial advances were being made in the theory and practice of railway operations and scheduling for highly complex, high density, scheduled rail networks in Europe and Asia by railway researchers, typically with an engineering background, but this work was not reflected in the international scientific journals for transport. Meanwhile many authors who had no close relationship with the railway industry made valiant efforts to solve scheduling problems by means of new mathematical programming techniques without having fully reviewed the current state of traffic engineering theory and practice. Furthermore, European transport deregulation policy, privatization of British Railways and European Railway Directives contributed, in first instance, to some confusion and fragmentation of the railway research community.

In view of the problem of very limited international and interdisciplinary knowledge diffusion in the railway operations research area, the railway operations research team at TU Delft, which consists of engineers and mathematicians, organised the 1st International Seminar on Railway Operations Modelling and Analysis in Delft. We invited well-known researchers from different countries to give lectures on scheduling, or analytical models or optimization models. Surprisingly, the seminar attracted so much interest from academia and the railway industry that the seminar grew to a full conference with more than 40 abstracts and papers submitted, reviewed and presented during June 8–10, 2005. More than 80 participants from 15 different countries, 13 universities, 5 national research centers, and in total 16 different companies from the railway industry exchanged their knowledge and views in plenary and special sessions on Capacity Management, Timetabling, Robustness, Stochastic Modelling, Traffic Management, and Simulation.

The organizing committee together with the keynote speakers nominated a number of best papers for detailed review and publication in a Special Edition of this journal. From these, seven papers have been selected and reviewed in detail by experts from different countries and revised by the authors. The following selected papers by authors from Great Britain, France, Germany, Italy and The Netherlands represent a rich variety of scientific methods and cover different phases of railway timetabling and modelling of operations. The topics extend from estimation of scheduled waiting times and stability analysis of timetables to stochastic modelling of train delay propagation and real-time traffic management support.

First, Wendler approaches the estimation of inherent waiting times in a timetable due to independent requests of train operators for train paths by means of a Semi-Markovian queuing model. The requests for certain train arrival times and frequencies are expressed by a stochastic matrix of conditional train-sequence probabilities, while the minimal headway times between each pair of trains are expressed by a certain service time distribution. He derives explicit solutions for the estimated waiting time using M/SM/1/∞ and M/GI$^{(r)}$/1/∞ models depending on respectively equal and different ranking of the trains and compares the performance

doi:10.1016/j.trb.2006.02.001