【過去問公開用】

「社会基盤学」問題冊子
Question Booklet of “Civil Engineering”

2022 年度　大学院入試
東京大学大学院工学系研究科社会基盤学専攻　修士課程

The 2022 Entrance Examination
Master’s program, Department of Civil Engineering,
Graduate School of Engineering, The University of Tokyo

2021 年 8 月 30 日（月）　9:00 – 12:00（日本時間）
August 30th, 2021 (Monday) 9:00 – 12:00 (in JST)

注意事項 / Notices

○ 日本語もしくは英語で、手書きで解答すること。Answers must be handwritten in Japanese or English.

○ 事前に申告した２分野に対して解答すること。申告と異なる分野の回答は採点されません。Answer the questions in the two exam fields which you have selected in advance. If you answer questions in exam fields different from your selection, your answers will not be scored.

○ 分野ごとに、指定された解答用紙を使用してください。Please use the designated answer sheets for each exam field.

○ すべての解答用紙の受験番号欄に受験番号を記入してください。Please fill your examinee number for all the answer sheets.

○ 本試験はオープンブック形式の試験です。インターネットを含め、ノートや参考書を使用しても構いません。Examinees are permitted to refer to any documents including materials on the website to answer the questions (Open book style).

○ 試験終了後、分野ごとに解答用紙を指定されたサイトにアップロードしてください。白紙答案の場合も、アップロードは必要です。After the exam, please upload your answer sheets for each exam field to the designated website. You need to upload your answer sheets even if they are blank.

○ 試験終了後、解答用紙は速達書留で社会基盤学専攻に郵送してください。Answer sheets should be mailed to the Department of Civil Engineering, University of Tokyo by postal mail using registered express mail.

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【過去問公開用】

分野 1 / Field 1: (Structures / Design)

Question 1

Consider the cantilever beam with a rectangular cross-section shown in Fig. 1. Assume that the Young's modulus E varies along the cross-section according to the following formula

$$E = E_0(\alpha + \beta\, f(y)),$$

where α, β and E_0 are constants, and $f(y)$ is an even function (i.e., $f(y) = f(-y)$). Answer all the following questions, assuming that the Euler-Bernoulli beam theory is valid for this beam.

(1) Write the main assumption of the Euler-Bernoulli beam theory (i.e., simple beam theory).

(2) Consider the deformation of the beam segment of length dx shown in Fig. 2(a) and (b); R is the radius of curvature. Obtain an expression for the axial strain of a fiber located y distance from the neutral plane when the ends are subjected to a moment M.

(3) Considering the equilibrium in the x-direction, show that the neutral plane is located at $y = 0$.

(4) Answer the following questions considering the moment equilibrium about the z-axis.

a) Write an expression for the moment M in terms of $b, h, R, E_0, \alpha, \beta, y$ and $f(y)$.

b) Briefly explain which out of the following two cases experience the largest deformation when subjected to identical loading.

case 1: $\alpha = \beta = 1$ and $f(y) = y^2$

case 2: $\alpha = \beta = 1$ and $f(y) = h^2 - y^2$

c) Propose another method to obtain the same sectional moment capacity of case-1 when the Young's modulus is E_0 anywhere over the cross-section (i.e., $E = E_0$).

d) Do the method you propose in b) and case-1 have identical maximum stresses? Briefly explain your answer.

(5) Derive the 4th-order governing equation for the cantilever beam shown in Fig. 1 considering the vertical equilibrium and moment equilibrium of a beam segment of length dx. You may use the approximation that $\frac{1}{R} = \frac{d^2w}{dx^2}$, where w is the vertical displacement (i.e., in y-direction) of the beam.

(6) Consider the above case-1 with $\alpha = \beta = 1$ and $f(y) = y^2$. A crack appeared along the neutral plane (i.e., $y = 0$) completely splitting the cantilever beam into two independent beams of identical dimensions. Note that the distribution of the Young's moduli of the two beams are mirror image of each other about the xz-plane since $f(y) = f(-y)$. Assume that the two beams do not touch each other. If each of the two beams carries identical load P at their ends as shown in Fig. 3, does the lower beam deform more than the upper beam? Briefly explain your answer.

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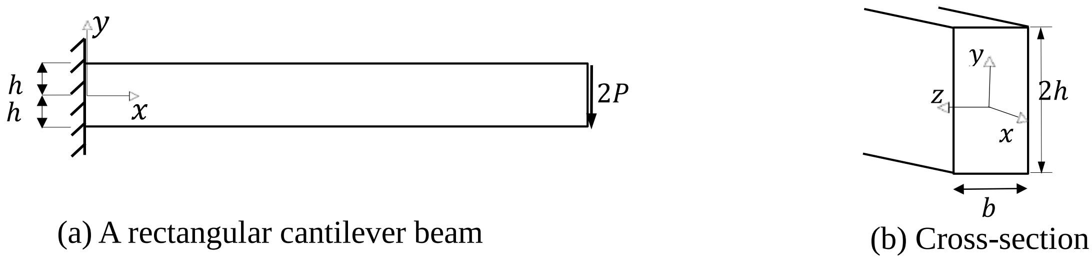


Figure 1. A rectangular beam with a varying Young's modulus $E = E_0(\alpha + \beta f(y))$. The height and the width of the beam are $2h$ and b, respectively.

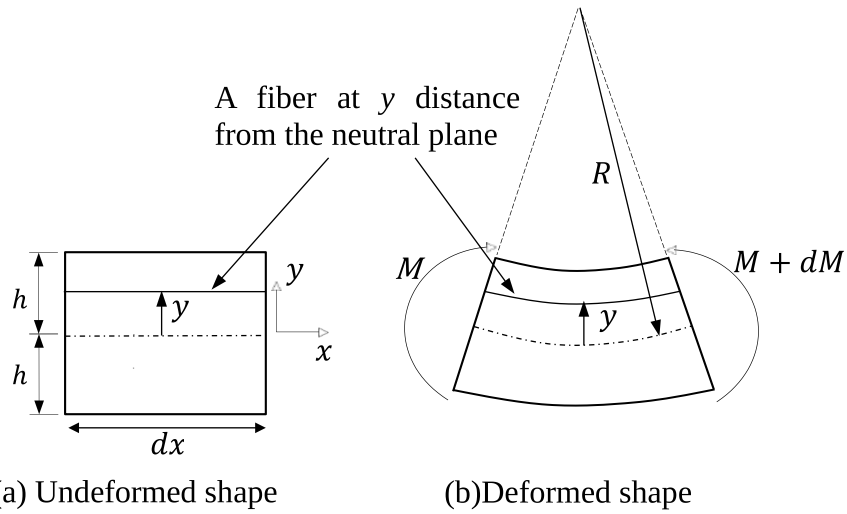


Figure 2. Undeformed and deformed shapes of an infinitesimal beam segment of length dx subjected to a bending moment M

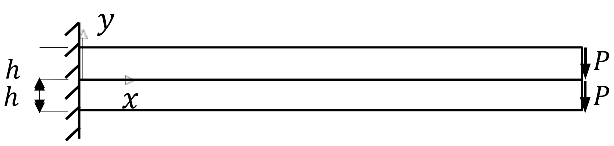


Figure 3. Configuration after a crack horizontally split the beam into two independent beams with equal dimensions. The end of each beam is subjected to a load of *P.*

Cantilever beam: 片持梁, Young's modulus/moduli: ヤング率, Even function: 偶関数, Euler-Bernoulli beam: ベルヌーイ・オイラー梁, radius of curvature: 曲率半径, neutral plane: 中立面, split: 分割する, mirror image: 鏡像

【過去問公開用】

Question 2

A vehicle passing over a bridge can be approximated as a point load P_0 moving at speed v over a simply-supported beam of length L as shown in Fig. 4. The beam and the moving load is further simplified as a single degree-of-freedom system subjected to the external load $p_0(t)$ as shown in Fig. 5. The load $p_0(t)$ is defined as

$$p_0(t) = \begin{cases} P_0 \sin \dfrac{\pi v}{L} t \ \ \left(0 \le t \le \dfrac{L}{v}\right) \\ 0 \ \ \left(t < 0, t > \dfrac{L}{v}\right) \end{cases}.$$

The mass, stiffness, and damping coefficient of the system are m, k, and c, respectively. Let t denote time. The displacement of the mass is $x(t)$. Answers may be simplified by using $\omega_0 = \sqrt{\frac{k}{m}}$.

(1) Derive the equation of motion of this single degree-of-freedom system in the vertical direction.

(2) Obtain the displacement response $x(t)$ $(t \ge 0)$ when the moving load goes over the beam. Note that the beam is in static equilibrium before the load is applied, i.e. $x(t) = 0$ for $t < 0$ and that the moving load satisfies the condition $v = \frac{\omega_0 L}{2\pi}$. The damping of the bridge is small and c can be assumed to be zero.

(3) When a train passes over the bridge, the train load is modeled as a series of moving point loads. The single-degree-of-freedom system is subjected to load $p_1(t)$ defined as

$$p_1(t) = \sum_{i=0}^{n} p_0(t - t_i).$$

Consider a case of $t_i = \frac{iL}{v}$ $(i = 0, 1, 2, \ldots, n)$. The beam is in static equilibrium before the first load is applied, i.e. $x(t) = 0$ for $t < 0$. Each moving load satisfies the condition $v = \frac{\omega_0 L}{2\pi}$. Obtain the displacement response $x(t_i)$ and the velocity responses $\dot{x}(t_i)$ $(i = 0, 1, 2, \ldots, n)$ to the load $p_1(t)$. The damping of the bridge is small and c can be assumed to be zero.

(4) Explain two approaches to suppress the vehicle-induced vibration of the bridge under the loading conditions considered in (3). Each approach should be explained within 3 lines in English or 2 lines in Japanese.

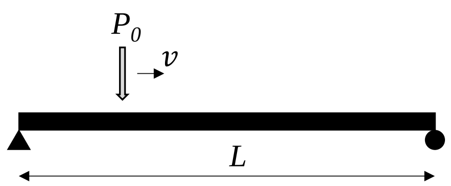


Figure 4 Simply-supported beam and a moving point load

【過去問公開用】

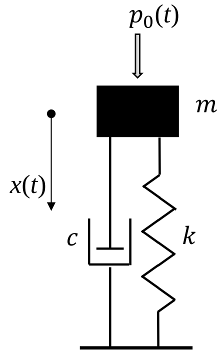


Figure 5 Single degree-of-freedom system subjected to the external load $p_0(t)$

simply-supported beam: 単純支持梁, point load: 点荷重, in static equilibrium: 静的つり合い状態にある, suppress vibration: 振動を抑制する

【過去問公開用】

分野 2 / Field 2 (Concrete engineering / Geotechnical engineering)

Question 1

(1) Consider a steel-reinforced concrete (RC) member subjected to the following environmental conditions.

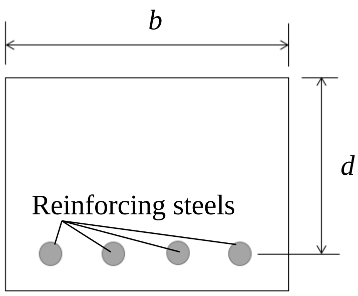
(i) There is an upper structure and the RC member is not subjected to rain.
(ii) There is no upper structure and the RC member is subjected to rain.
(iii) The RC member is immersed in river water.

The concrete member is not subjected to any salt attack. You may add necessary conditions as far as they are reasonable. Answer the following questions.

a) Arrange (i), (ii), and (iii) in descending order of carbonation rate and explain the reason in about 3 lines in English or 2 lines in Japanese.
b) Arrange (i), (ii), and (iii) in descending order of corrosion rate and explain the reason in about 5 lines in English or 4 lines in Japanese.

(2) Consider the section of an RC member with properties given in Figure 1, which is subjected to only flexural moment. Reinforcing steels are arranged in the tensile side only. Answer the following questions. Do not use safety factors.

a) Calculate the balanced reinforcement ratio.
b) Calculate the ultimate flexural capacity when the reinforcement ratio is equal to the value obtained in a).
c) Use a figure to illustrate how the ultimate flexural capacity changes when the reinforcement ratio changes between 1% and 6%.



b = 800 mm
d = 500 mm
Yielding strength of reinforcement: f_y = 350 N/mm^2
Elastic modulus of reinforcement: E_s = 200,000 N/mm^2
Compressive strength of concrete: f'_c = 30 N/mm^2
Ultimate compressive failure strain of concrete: ε'_u = 0.0035

Figure 1 Reinforced concrete section and material properties

【過去問公開用】

(3) The durability of concrete does not always increase when the strength of a concrete increases. Give two examples and explain the reasons in about 4 lines in English or 3 lines in Japanese, for each.

(4) Answer the following questions regarding alkali silica reaction of concrete.

a) Describe the expected crack pattern due to alkali silica reaction in concrete without reinforcement, in one line.

b) Consider a bridge girder reinforced with steel bars in longitudinal direction. Describe the changes in the expected crack pattern compared to the non-reinforced concrete, and explain the reason for the changes in about 3 lines in English or 2 lines in Japanese, in total.

Reinforced concrete member: 鉄筋コンクリート部材, Environmental conditions: 環境条件, Immersed: 浸された, Salt attack: 塩害, Upper structure: 上部構造, Carbonation rate: 炭酸化速度, Corrosion rate: 腐食速度, Flexural moment: 曲げモーメント, Reinforcing steel: 補強鉄筋, Balanced reinforcement ratio: 釣り合い鉄筋比, Ultimate flexural capacity: 曲げ耐力, Yielding strength: 降伏強度, Elastic modulus: 弾性係数, Compressive strength: 圧縮強度, Ultimate compressive failure strain: 圧縮破壊ひずみ, Degradation: 劣化, Alkali silica reaction: アルカリシリカ反応, Bridge girder: 橋桁, Longitudinal direction: 長軸方向

【過去問公開用】

Question 2

Answer the following questions. In your answers to (1) through (6), include descriptions of relevant geotechnical principles, such as typical mechanical behavior of soils. If needed, you may add illustrations.

(1) Compaction of saturated sandy soil layers is frequently used as a countermeasure against liquefaction-induced damage to structures. Explain the reason why it is effective as a countermeasure.

(2) Excluding the above compaction method, pick up another method of ground improvement (i.e., a technique that improves the engineering properties of the treated soil) as a countermeasure against liquefaction-induced damage to structures. Explain the reason why it is effective as a countermeasure.

(3) Apart from the ground improvement methods in general, pick up another countermeasure against liquefaction-induced damage to structures. Explain the reason why it is effective as a countermeasure.

(4) Preloading on soft clayey soil layers using temporary embankments is frequently used as a countermeasure against consolidation-induced damage to structures. Explain the reason why it is effective as a countermeasure.

(5) Pick up another effective method that uses partial vacuuming and is equivalent to the preloading method using temporary embankments. Describe the mechanism that explains how it is equivalent to the preloading method.

(6) Pick up a method that can be combined with the preloading method to enhance the positive effects as a countermeasure against consolidation-induced damage to structures. Explain the reason why it enhances the positive effects.

(7) Execution of the compaction method and the preloading method, as the countermeasures against liquefaction- and consolidation-induced damage to structures, respectively, may also bring about negative impacts. For each of the two methods, explain the reason why it may bring about negative impacts.

Relevant geotechnical principles: 関連する地盤工学上の原理原則, Typical mechanical behavior of soils, 土の典型的な力学挙動, Compaction: 締固め, Countermeasure: 対策, Liquefaction-induced damage to structures: 液状化による構造物被害, Ground improvement: 地盤改良, Engineering properties: 工学的性質, Apart from ~: ~以外で, Preloading: 事前載荷 (プレロード), Temporary embankments: 一時的な盛土, Consolidation-induced damage to structures: 圧密による構造物被害, Partial vacuuming: 部分的な真空載荷, Equivalent to ~: ~と等価な, Enhance the positive effects as ~: ~としての効果を高める, Execution: 施工, Bring about negative impacts: 悪影響をもたらす

【過去問公開用】

分野３/ Field 3: (Hydrospheric engineering)

Question 1

The flow of a river can be expressed by the continuity equation [1] and the momentum equation [2] under 1-dimensional shallow water approximation,

$$\frac{\partial h}{\partial t}+\frac{\partial q}{\partial x}=0 \ , \qquad [1]$$

$$\frac{1}{g}\frac{\partial v}{\partial t}+\frac{v}{g}\frac{\partial v}{\partial x}+\frac{\partial h}{\partial x}+\frac{\partial z}{\partial x}+i_f=0 \ , \qquad [2]$$

where h is water depth, v is depth-averaged velocity, q is unit-width discharge, z is bed elevation, g is gravity acceleration, i_f is friction loss slope, x is axis along the river, and t is time.

These equations can be applied to various river flow problems with <u>appropriate modifications depending on purposes</u>(1). The <u>analysis of steady-state water surface profile</u>(2) is one example of the applications, which is used to design river cross-sections and structures. For applications to non-steady flow such as flood-wave propagation, <u>specific techniques are proposed</u>(3) because these equations cannot be solved analytically. Advances in computational science enable us to apply these equations to flood simulations without approximation, though simplified forms such as <u>the kinematic wave or diffusion wave equations</u>(4) are still widely used for large-domain flood forecast models due to limitations in computational resources or data availability. Combined use of models with different levels of approximation is also recommended for practical purposes. For example, use of <u>flood hazard maps</u>(5) precalculated by a comprehensive-but-slow flood inundation model can help to estimate the potential impact of an upcoming hazard predicted by a simplified-but-fast flood forecast model.

Answer all the following questions related to the underlined parts.

(1) By assuming the flow is in a steady state and the friction loss is negligible, derive Bernoulli's theorem by modifying equation [2].

(2) Consider a constant discharge q is flowing through a river section with a constant bed slope i_0 ($=\partial z/\partial x$). As friction loss is not negligible in actual rivers, a change of specific energy E_s balances with energy gain due to bed elevation change and energy loss due to friction. Assume the friction loss slope is given by Manning's law $i_f=n^2h^{-4/3}v^2$, where n is the roughness coefficient.

a) Derive the uniform-flow depth h_0 as a function of q.

b) Prove that the specific energy E_s increases (decreases) downstream when the water depth is larger (smaller) than h_0.

c) Find the condition of bed slope i_0 when the flow of the considered section is supercritical.

d) Prove that downstream water depth converges to the uniform-flow depth regardless of the upstream depth boundary condition when the bed slope satisfies the condition in c), by considering the energy loss/gain balance discussed in b).

【過去問公開用】

(3) Kleitz-Seddon's law is used to approximate the travel time of flood wave (i.e. celerity). Here, by approximating the momentum equation as a kinematic wave, the continuity equation can be modified as

$$\frac{\partial h}{\partial t} + \frac{dq}{dh}\frac{\partial h}{\partial x} = 0 \qquad [3].$$

Equation [4] can be derived by assuming flood wave shape does not change downstream:

$$\frac{\partial h}{\partial t} + c\frac{\partial h}{\partial x} = 0 \ , \qquad [4]$$

where c is celerity. Assume flow velocity is given by Manning's equation $v = n^{-1}h^{2/3}{i_0}^{1/2}$.

a) Obtain celerity c as a function of flow velocity v.

b) Find the peak depth of a flood wave that traveled 1 km in 200 seconds, when the bed slope is 1/900 and the Manning's roughness coefficient of 0.025 $m^{-1/3}s^{-1}$.

(4) The kinematic wave equation and the diffusion wave equation predict different wave behaviors due to the consideration of the pressure term.

a) In case of the kinematic wave equation, the relationship between water depth h and discharge q during flood wave passage for a given location can be schematically illustrated as in Fig. 1. Draw a schematic illustration of the depth-discharge relationship in case of the diffusion wave equation, and explain how it differs from the case of the kinematic wave equation in 3-5 lines.

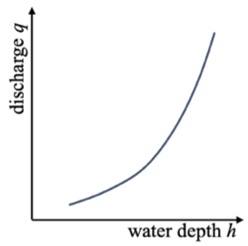


Figure 1: h-q relationship for kinematic wave

b) The use of the kinematic wave equation in river flood models could lead to underestimation of flood risk in some locations, compared to using the diffusion wave equation. Provide one example of the location where flood risk may be underestimated, and explain the reason focusing on the phenomena which cannot be simulated by kinematic wave equation in 2-4 lines.

(5) In Japan, flood hazard maps are being prepared for a potential-maximum magnitude hazard. However, the need for flood hazard maps covering multiple magnitudes is recently being discussed. How would this "flood hazard maps covering multiple magnitudes" contribute to disaster mitigation? Describe your opinion in 3-5 lines.

continuity equation: 連続式, momentum equation: 運動方程式, shallow water approximation: 浅水波近似, friction loss slope: 摩擦損失勾配, steady state: 定常, water surface profile: 水面形, non-steady flow: 非定常流, flood wave propagation: 洪水波の伝搬, kinematic wave: 運動波, diffusion wave: 拡散波, Bernoulli's theorem: ベルヌイの定理, specific energy: 比エネルギー, Manning's law: マニング則, uniform flow: 等流, supercritical flow: 射流, celerity: 波速, Kleitz-Seddon's law: クライツセドン則, pressure term: 圧力項, schematic illustration: 概略図,

【過去問公開用】

Question 2

Answer all the following questions. Clearly state any assumptions you make in your answers with discussions about the validity of your assumptions. If necessary, you may create sketches to clarify your discussions. The length of your answers for each survey should be around half a page including sketches.

(1) Suppose that you are requested to carry out a survey to estimate the Manning's roughness coefficient, *n*, of the wide rectangular waterway, in which the steady current flows. Describe your survey plan and how you will estimate *n*.

(2) A regular wave is obliquely incident on a long straight beach as seen in Fig. 2. You are requested to conduct a field survey to estimate the offshore wave height, period and incident angle relative to a shore-normal direction of this regular wave. Describe two separate survey plans A and B and explain how you will estimate these wave properties when you can use the following instruments in each plan.

Survey plan A: Two pressure sensors, which can be separately installed on the sea bed, and can record time-varying pressure.

Survey plan B: A single flow velocity meter, which can be installed on the sea bed with known water depth, and can record the time-varying velocity components in two different horizontal directions.

(3) A regular wave is normally incident on a breakwater installed in a sea with a constant water depth. You are requested to estimate the wave reflection rate of this breakwater. Describe your survey plan and explain how you will estimate the wave reflection rate when you can use an instrument, which is installed on the sea bed, and can record synchronized time-series data of velocity components and pressure.

regular waves: 規則波, obliquely incident wave: 斜め入射波, long straight beach: 長い直線海岸
normally incident on a breakwater: 防波堤に直角に入射する, constant water depth: 一様水深
reflection rate: 反射率, synchronized: 同期した

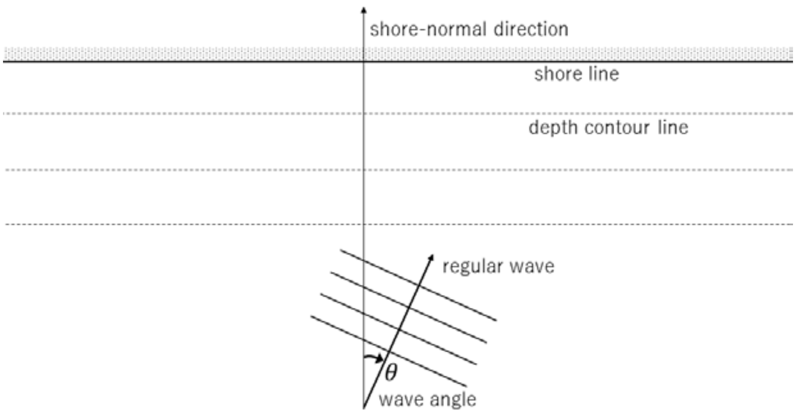


Figure 2 Top-view of a regular wave obliquely incident on a long straight beach

【過去問公開用】

分野 4 / Field 4: (Transportation / Spatial information engineering):

Question 1

There are 42,000 people commuting from a residential area to an office area per hour by rail. The commuters choose remote work (RW) or office work (OW) under the pandemic. The utility function of work style is expressed as $U_{\mathrm{W}} = V_{\mathrm{W}} + \varepsilon_{\mathrm{W}}$, where U_{W} is a utility, V_{W} is a deterministic term and ε_{W} is an error term, and W is RW or OW. The deterministic term of OW is:

$$V_{\mathrm{OW}} = \beta_{\mathrm{time}}(x_{\mathrm{ridetime}} + x_{\mathrm{waittime}}) + \beta_{\mathrm{fare}} x_{\mathrm{fare}},$$

Parameters: travel time $\beta_{\mathrm{time}} = -0.2$, travel fare $\beta_{\mathrm{fare}} = -0.005$,

Variables: ride time in train $x_{\mathrm{ridetime}} = 27$ [min], train's fare $x_{\mathrm{fare}} = 200$ [yen].

The deterministic term of RW is constant: $V_{RW} = -7$. x_{waittime} is the commuters' waiting time at their station, defined as $x_{\mathrm{waittime}} = \frac{1}{2} \cdot \frac{60}{F}$, where F is the operation frequency of train per hour. The cumulative distribution function of the difference of error terms $\varepsilon' (= \varepsilon_{\mathrm{RW}} - \varepsilon_{\mathrm{OW}})$ is shown in Fig. 1.

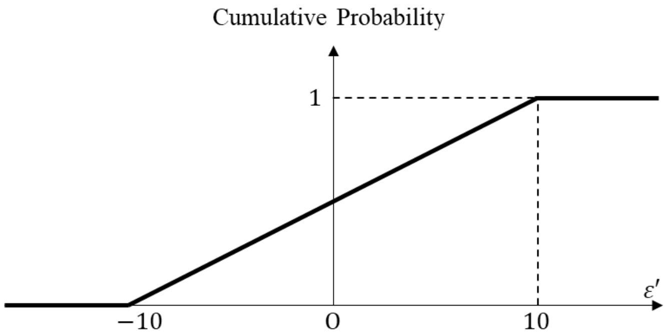


Figure 1 Cumulative distribution function of ε'

(1) Calculate the expected number of people who choose OW per hour when $F = 10$, and show the calculation process.

(2) People feel congestion disutility when there are many passengers on the train. The updated deterministic term of OW is:

$$V'_{\mathrm{OW}} = V_{\mathrm{OW}} + \beta_{\mathrm{cng}} x_{\mathrm{cng}},$$

Parameter: congestion $\beta_{\mathrm{cng}} = -3$,

Variable: congestion state $x_{\mathrm{cng}} = 1$ when the number of passengers is more than 2,400 people in a train, otherwise $x_{\mathrm{cng}} = 0$.

Calculate the expected numbers of people who choose OW per hour when $F = 10$ and $F = 5$, and show the calculation process.

Explain how the decrease of operation frequency can affect the number of people who choose OW and train congestion using the calculation result, within about 3 lines in English or 2 lines in Japanese.

(3) Raise two measures that can be adopted by traffic management agency to promote a remote work, and explain their strengths and weaknesses, in about 4 lines in English or 3 lines in Japanese for each measure.

utility function: 効用関数
utility: 効用
deterministic term: 確定項
error term: 誤差項
operation frequency: 運行頻度
cumulative distribution function: 累積分布関数
congestion disutility: 混雑不効用

【過去問公開用】

Question 2

Answer the following questions.

(1) An airborne gravimetry project is being carried out by the government of Japan. Explain the purpose and expected benefits of the airborne gravimetry project, showing its relationship to elevation, in about 10 lines in English or 8 lines in Japanese. Figures can be used if necessary.

(2) Answer the following questions about error adjustment. Variables should be defined by yourself.

a) Write three assumptions of the generalized least squares method and explain any differences from those of the ordinary least squares method.

b) Write the generalized least squares estimator and give one example of the application of the method in surveying.

c) Explain the solution flow of the nonlinear least squares method and give two examples of the applications of the method in surveying (there is no need to show mathematical expressions).

(3) Answer the following questions about photogrammetry.

Figure 2 shows stereo images of a target object (AB). The flying height above the base of the target object (point A) shown in Fig. 2 is 1,200 m. The length of the baseline is 400 m. The specifications of the camera and the images are as follows:

Principal distance of the camera $-c$ = 15 cm;

Pointing accuracy of image coordinates σ_p = 0.0020 mm.

a) Calculate the height of the target object (AB) from the given measurements in Fig. 2.

b) Calculate the theoretical accuracy of the target object's height.

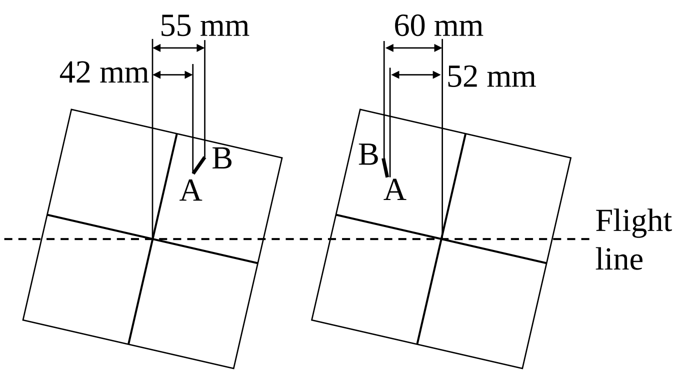


Figure 2. Stereo images of a target object.

(4) Answer the following questions about remote sensing.

a) Explain spectral reflectance characteristics.

b) Choose one example of remote sensing data analysis, and discuss the role of spectral reflectance characteristics in about 5 lines in English or 4 lines in Japanese.

airborne gravimetry: 航空重力測量

error adjustment: 誤差調整

【過去問公開用】

the generalized least squares method: 一般化最小二乗法

the ordinary least squares method: 通常最小二乗法

the generalized least squares estimator: 一般化最小二乗推定量

the nonlinear least squares method: 非線形最小二乗法

baseline: 基線

principal distance: 画面距離

pointing accuracy of image coordinates: 画像座標の読み取り精度

spectral reflectance characteristics: 分光反射特性

分野 5 / Field 5: (Urban / Landscape)

Question 1

Answer the following questions about the difficulties in the restoration and reconstruction period after a severe natural disaster occurs in a metropolitan area, e.g., Tokyo or Osaka.

(1) The difficulties will be different from difficulties experienced during past natural disasters in less populated areas, e.g., the 2011 Japan Earthquake and Tsunami, the 2016 Kumamoto Earthquake and the 2018 Japan Floods. Discuss your idea about the difficulties that are particular to disasters in a metropolitan area, within 13 lines in English or 10 lines in Japanese.

(2) What kind of afflicted residents should be prioritized when providing a limited number of available <u>neighbor</u> temporary housing for prompt restoration and reconstruction? Discuss your idea about the prioritizing criteria, within 11 lines in English or 8 lines in Japanese.

Restoration and reconstruction: 復旧・復興
The 2011 Japan Earthquake and Tsunami: 東日本大震災
The 2016 Kumamoto Earthquake: 2016 年熊本地震
The 2018 Japan Floods: 平成 30 年 7 月豪雨
Temporary housing: 仮設住宅

【過去問公開用】

Question 2

The following text is an extract from the European Landscape Convention, which was concluded among the member States of the Council of Europe in 2004. Answer the following questions related to the underlined parts [i], [ii] and [A].

> Preamble
>
> The member States of the Council of Europe signatory hereto,
>
> […]
>
> Concerned to achieve sustainable development based on a balanced and harmonious relationship between social needs, economic activity and the environment;
>
> Noting that the landscape has an important public interest role in the cultural, ecological, environmental and social fields, and constitutes a resource favourable to economic activity and whose protection, management and planning can contribute to job creation;
>
> Aware that the landscape contributes to the formation of local cultures and that it is a basic component of the European natural and cultural heritage, contributing to human well-being and consolidation of the European identity;
>
> [A]<u>Acknowledging that the landscape is an important part of the quality of life for people everywhere: in urban areas and in the countryside, in degraded areas as well as in areas of high quality, in areas recognised as being of outstanding beauty as well as everyday areas;</u>
>
> Noting that developments in agriculture, forestry, industrial and mineral production techniques and in regional planning, town planning, transport, infrastructure, tourism and recreation and, at a more general level, changes in the world economy are in many cases accelerating the transformation of landscapes;
>
> Wishing to respond to the public's wish to enjoy high quality landscapes and to play an active part in the development of landscapes;
>
> Believing that the landscape is a key element of individual and social well-being and that its protection, management and planning entail rights and responsibilities for everyone;
>
> […]
>
> Have agreed as follows:
>
> Chapter I – General provisions
>
> Article 1 – Definitions
>
> For the purposes of the Convention:
>
> a [i] <u>"Landscape" means an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors</u>;
>
> […]
>
> f [ii] <u>"Landscape planning" means strong forward-looking action to enhance, restore or create landscapes</u>.
>
> […]

(1) Concerning the underlined part [i], explain the meaning of "Landscape" more specifically by giving a real example of the action and interaction of natural and/or human factors, within eight lines in English or five lines in Japanese.

(2) Concerning the underlined part [ii], explain the significance of "landscape planning" by giving

a real example that you consider "strong forward-looking action to enhance, restore or create landscapes", within eight lines in English or five lines in Japanese.

(3) Concerning the underlined part [A], give your opinion on why the landscape is an important part of the quality of life for people "everywhere" while referring to the contents of the preamble, within thirteen lines in English or ten lines in Japanese.

Extract：抜粋

European Landscape Convention：欧州ランドスケープ条約

Council of Europe：欧州評議会（1949 年に設立された、人権、民主主義、法の支配の分野で国際社会の基準策定を主導する汎欧州の国際機関。EU 全加盟国、旧東側諸国等を含む 47 か国が加盟）

Preamble：序文

【過去問公開用】

分野６/ Field 6: (International project / Management)

Question 1

In tackling growing needs for managing and updating rapidly aging infrastructure assets, the use of private finance has been explored in various ways. Some argue for a greater contribution of private finance in traditionally government-funded infrastructure projects, as it could incentivize efficient and effective delivery of the projects. Others claim that the same quality could be better achieved through undertaking bundled contracting for the design, construction, operation, and management of an infrastructure asset, even under fierce fiscal constraints on government spending.

Answer all the following questions. You may justify your explanation or proposal by referring to the existing theories and other sources. All answers should fit within a maximum of 2 pages.

(1) Explain the rationale behind each side of the above debate by referring to the relevant theories and/or empirical grounds that they are considered to rely on. You may use mathematical equations, figures, and tables if necessary.

(2) Choose one infrastructure sector (e.g., roads, water, railway, or energy), and propose a contractual scheme or a project delivery method that you consider forms the most desirable share of responsibilities between the public and the private sectors. Also, explain the merits and limitations of your proposal.

Bundled contracting: 包括契約　　Project delivery method: プロジェクト実施方式

【過去問公開用】

Question 2

Read the following text on “the role of transport infrastructure for the economy,” and answer all the questions related to the underlined parts.

Although there are numerous and different opinions concerning the influence of infrastructure and infrastructure investment on economic growth in literature, (1) <u>there does not exist an incontrovertible result to rely on</u>.

(…)

In a comprehensive study, Lakshmanan (2011) builds up to his earlier works that there exist wider economic benefits from transport infrastructure than only direct and indirect effects. (…) [They] are named as gains from trade and market expansion, technological shifts, processes of spatial agglomeration and (2) <u>processes of innovation and commercialization of new knowledge</u> in urban clusters.

(…)

Improved transport infrastructure reduces inventory costs of firms which lead to implementation of just-in-time strategies and allows for the realisation of economies of scale, together with interregional and global specialization. Furthermore, (3) <u>cheaper transport initiates accessibility to the demand and supply markets, enlarging firms’ markets, giving access to various and skilled labour, and cheaper and better neighbouring business services as input. The import and export activities become smoother</u>.

(…)

[T]here have been arguments over [negative] environmental effects of ports, airports and transport which could lower their public popularity (Meersman et al., 2011). Furthermore, (4) <u>the funds needed for transport infrastructure are high. These projects compete for public and private funding with other projects in the field of education, health care, care for aging population, environmental protection, etc.</u>

(Meersman, H., & Nazemzadeh, M. (2017). The contribution of transport infrastructure to economic activity: The case of Belgium. *Case Studies on Transport Policy*, 5(2), 316-324. Partly revised.)

incontrovertible: 決定的で議論の余地がない,　agglomeration: 集積,　economies of scale: 規模の経済, interregional and global specialization: 地域を越えたグローバルな産業の特化

(1) One of the reasons behind the underlined part (1) lies in the difficulties of empirically quantifying the causal impacts of infrastructure development on economic growth. Describe such difficulties by considering the characteristics of infrastructure projects, within 7 lines in English or 5 lines in

Japanese.

(2) Regarding the underlined part (2), there are several phases in “processes of innovation.” Raise one phase you consider the most important, and explain how transport infrastructure contributes to that phase, within 4 lines in English or 3 lines in Japanese.

(3) Regarding the international flows of goods as mentioned in the underlined part (3), answer the following questions:

a) Other than those related to physical infrastructure, there are several factors that cause negative impacts on the international flows of goods. Raise three such factors and describe their mechanisms, within 3 lines in English or 2 lines in Japanese for each factor.

b) In the globalized market, there are several difficulties faced by local firms in developing countries in receiving the benefits of international transport infrastructure as mentioned in the underlined part (3). Describe two such difficulties, within 3 lines in English or 2 lines in Japanese for each difficulty.

(4) Regarding the underlined part (4), central governments allocate public funds to the transport sector in view of other sectoral goals such as education, health, and so on. Propose what you consider the optimal allocation strategy for any central government, within 8 lines in English or 6 lines in Japanese.