ICUS

HONMA LAB.

[Management of Urban Environmental Systems]

International Center for Urban Safety Engineering

http://www.honma-lab.iis.u-tokyo.ac.jp/

Urban Environmental Mathematical Engineering

Department of Architecture

Management of Urban Environmental Systems

Mathematical Engineering for Sustainable Society

Urban environmental systems in present society have become large and complicated. In our laboratory, we have proposed to manage the above systems and grasp the basic structures using the “mathematical model”.

Urban and Architecture

◆Analysis of Landscapes Based on Computational Geometry

$$R = \alpha + \beta + \gamma - \pi$$

$$\alpha = \arccos\left(\frac{\cos a - \cos b \cdot \cos c}{\sin b \cdot \sin c}\right)$$

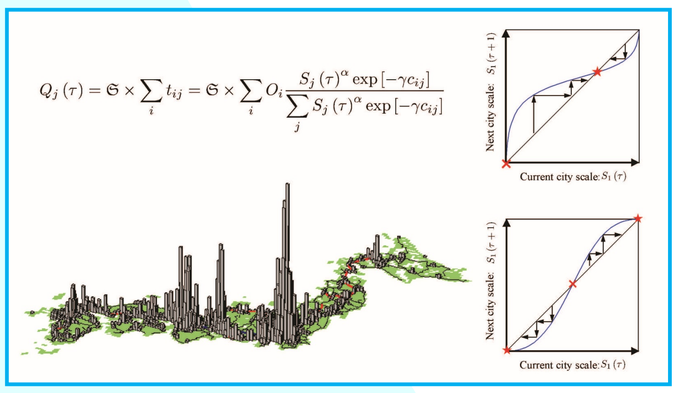
$$a = \arccos\left(\frac{\langle \overrightarrow{OB}, \overrightarrow{OC} \rangle}{||\overrightarrow{OB}|| \cdot ||\overrightarrow{OC}||}\right)$$

SHIBUYA 109

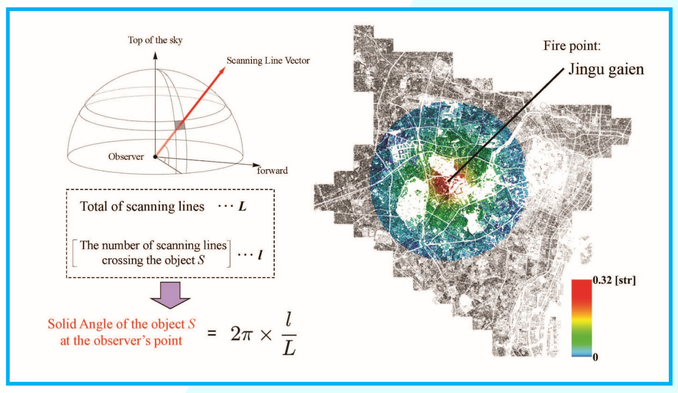
scramble intersection

◆Urban Concentrations by Japanese Railway Networks

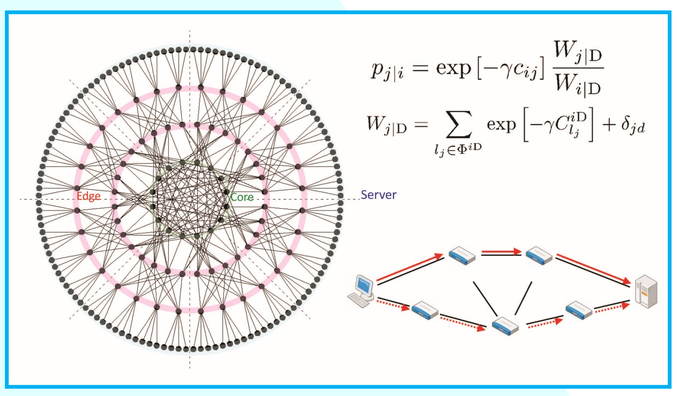
$$Q_j(\tau) = \mathfrak{S} \times \sum_i t_{ij} = \mathfrak{S} \times \sum_i O_i \frac{S_j(\tau)^\alpha \exp[-\gamma c_{ij}]}{\sum_j S_j(\tau)^\alpha \exp[-\gamma c_{ij}]}$$



◆Analysis of Fireworks Using Building Data



◆Information Network for Sustainable Environment



$$p_{j|i} = \exp[-\gamma c_{ij}] \frac{W_{j|D}}{W_{i|D}}$$

$$W_{j|D} = \sum_{l_j \in \Phi^{iD}} \exp\left[-\gamma C_{l_j}^{iD}\right] + \delta_{jd}$$

◆Sight-seeing Behavior Focused on Trip-chain

Human

$$O_i = \sum_{k \in \Phi_i} t_{ik}$$

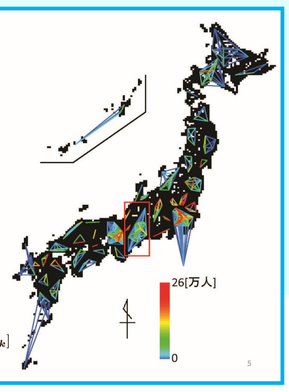
$$M_k = \sum_{l=1}^{L} \sum_{i=1}^{I} \sum_{\{k \in \Phi_i | k_l = k\}} t_{ik}$$

$$C = \sum_{i=1}^{I} \sum_{k \in \Phi_i} t_{ik} c_{ik}$$

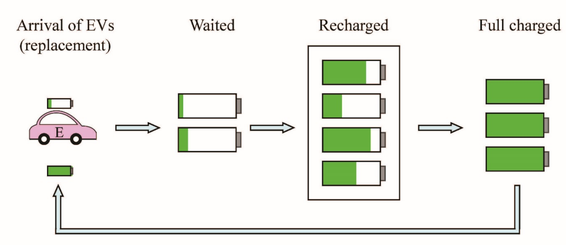
$$t_{ik} = A_i O_i \left(\prod_{l=1}^{\Lambda} E_{k_l} M_{k_l}\right) p_{ik} \exp[-\gamma c_{ik}]$$

$$A_i^{-1} = \sum_{k \in \Phi_i} \left(\prod_{l=1}^{\Lambda} E_{k_l} M_{k_l}\right) p_{ik} \exp[-\gamma c_{ik}]$$

$$E_k^{-1} = \sum_{l=1}^{L} \sum_{i=1}^{I} \sum_{\{k \in \Phi_i | k_l = k\}} A_i O_i \left(\prod_{l^* \neq l} E_{k_{l^*}} M_{k_{l^*}}\right) p_{ik} \exp[-\gamma c_{ik}]$$



◆Safety Stock in EV Battery Switch Stations



$$p_N = \frac{s^s}{s!}\rho^N \left(\sum_{n=0}^{s} \frac{(s\rho)^n}{n!} + \frac{s^s}{s!} \sum_{n=s+1}^{N} \rho^n\right)^{-1} \leq \delta$$

Environment