

THE UNIVERSITY OF HONG KONG
MASTER OF TRANSPORT POLICY AND PLANNING (MTP&P)

GEOG7001 Survey and Data Analysis in Transport Studies

1. Course Description

Surveys are commonly used to collect useful data in transport studies. A myriad of survey methods and instruments are available. This course covers the major aspects including survey design, sampling, hypothesis testing, interview and questionnaire design, survey implementation and administration, data processing, analysis and retrieval, interface with big data, and report writing.

Different aspects of surveys are discussed with reference to the transport-related professions and disciplines in different political and socio-economic contexts. Examples include travel characteristics, origin-destination, freight and public transport surveys conducted in Hong Kong and the other parts of the world. The fundamentals of spatial and non-spatial data analysis are covered using selected software.

2. Teaching Schedule

2.1 Lectures

Lectures are on Wednesdays from 7 pm to 9 pm at CPD-2.19.

Week	Topic
1-2	Overview of Transport Survey Methods (03/09/2025 & 10/09/2025) <i>- This section provides an overview of the major transport survey methods commonly used in different parts of the world is given. It covers key concepts, such as the importance of survey design, the typology of survey methods, and the use of different survey instruments.</i>
3-4	Designing Questionnaires and Data Coding in Transport Surveys (17/09/2025 & 24/09/2025) <i>- This section covers the techniques of questionnaire design to obtain accurate and reliable factual and attitudinal data. In relation, we shall discuss the principles and procedures of data coding for both spatial and non-spatial data.</i>
5	Mobile Mapping (08/10/2025) (Guest lecture by Dr. Sheng Bao) <i>- This section provides students with an overview of mobile mapping systems and their practical applications in the transport field. It covers several essential aspects—from data acquisition to processing and applications.</i>
6-7	Applying Descriptive Statistics in Transport Studies (22/10/2025 & 05/11/2025) <i>- This section introduces various descriptive statistics of survey data. We shall approach this topic by illustrating the proper use of different descriptive statistics through case studies and examples. It also covers the basics of the Graph Theory for describing the connectivity and complexity of transport networks.</i>
8-9	Sampling, Data Weighting and Data Expansion in Transport Surveys (12/11/2025 & 19/11/2025) <i>- This section covers the concept of probability and highlights the importance of using probability sampling in transport surveys. You will learn different</i>

	<i>probability sampling methods, compare the advantages and disadvantages of different sampling methods, and understand the importance of choosing wisely with consideration of the specific case at hand. We shall also introduce newer data sources, such as big data and crowdsourced data, newer technology, such as Internet of Things, and smart mobility. Finally, we shall also explain the importance and procedures of data weighting and expansion.</i>
10-11	Probability and the Scientific Method in Transport Studies (26/11/2025 & 01/12/2025*) - <i>This section introduces the concepts of probability distribution, sampling distribution and univariate and bivariate inferential statistics. It covers statistical inferences using point estimation, interval estimation and hypothesis-testing.</i>
12	Latest Developments in an Era of Big Data and Artificial Intelligence (03/12/2025*) - <i>This section provides an overview on the most recent applications of big data in the transport sector. It covers key concepts and procedures of data acquisition, data processing, big data analytics and data visualisation. We shall conclude by discussing the opportunities and challenges of applying big data in transport studies.</i>

* Supplementary lectures beyond the last day of teaching are needed this year due to two public holidays on 01/10/2025 and 29/10/2025.

Attendance of all lectures in person is required. An attendance sheet, however, is no longer kept by the teacher. Students who have obligations to show proofs of lecture attendance, for example, by their employers or other funding schemes should approach the teachers for signature of attendance at each lecture. The teacher will not sign the attendance sheet retrospectively or if the student arrives late for more than 30 minutes. In case you are sick or cannot attend the lectures in person due to exceptional circumstances, please write (with documentary proofs) to the Programme Officer at mattp@hku.hk at least three hours before the start of the lecture. Upon approval, a Zoom meeting link will be provided to you.

2.2 Practical Exercises

Practical exercises are designed for students to gain hands-on experience on the use of relevant software, such as IBM Qualtrics®, SPSS Statistics® and Gelphi®. Students can complete the self-paced practical exercises, which have been developed and updated by previous and current post-doctoral fellows and research students. This year, apart from the Programme Officer, the practical exercises will be supported by PhD students, Mr. Zhucheng Huang and Mr. Zhixuan Li. Students may arrange for a group workshop with the respective teaching support (listed at the end of each Practical Exercise) at a mutually convenient time. A group workshop is expected to have at least five students.

Students are highly encouraged to attend the activities of the [Institute of Transport Studies](#), the [Joint Lab on Future Cities](#) and the [Chartered Institute of Logistics and Transport in Hong Kong \(CILTHK\)](#) to get know more about the leading edge of transport and related research. In particular, the Distinguished Transport Lectures are highly relevant.

3. Learning Outcomes

This course has five learning outcomes. After taking this course, students are expected to:

- understand the strengths and limitations of the use of surveys;

- ii. know about the latest developments in the use of different types of transport surveys worldwide;
- iii. be able to lead in conducting surveys to analyze problems;
- iv. be able to analyze survey data by descriptive statistics and selected inferential statistics; and
- v. be able to interpret survey findings and write survey reports professionally.

These course learning outcomes align with the MATPP programme learning outcomes (PLOs), which are:

PLO1: Pursuit of professional excellence, critical intellectual inquiry and life-long learning in transportation

PLO2: Tackling novel situation and ill-defined problems in transportation

PLO3: Critical self-reflection and greater understanding of others, upholding professional ethics in transportation

PLO4: International understanding and global outlook in transportation

PLO5: Communication and collaboration

PLO6: Leadership and advocacy in transport policy and planning issues

A mapping table is shown below:

Course Learning Outcomes	Alignment with Programme Learning Outcomes (PLOs)						Course Learning Activities	Course Assessment Methods
	PL O1	PL O2	PL O3	PL O4	PL O5	PL O6		
understand the strengths and limitations of the use of surveys	✓	✓		✓			Lectures	Individual Assignments and Group Project
know about the latest developments in the use of different types of transport surveys worldwide		✓	✓	✓			Lectures	Individual Assignments
be able to lead in conducting surveys to analyze problems			✓			✓	Lectures	Group Project
be able to analyze survey data by descriptive statistics and selected inferential statistics	✓	✓			✓		Lectures and Practicals	Individual Assignments and Group Project
be able to interpret survey findings and write survey reports professionally					✓	✓	Lectures and Practicals	Group Project

4. Moodle

- Students may log in this Moodle course by following the simple instructions below:
- ➡ Go to the HKU Portal login page: <https://hkuportal.hku.hk/login.html>
 - ➡ Key in your UID & PIN
 - ➡ Go to “My eLearning”
 - ➡ Click into “click to access your Moodle courses, if any”
 - ➡ Choose “GEOG 7001ALL Survey and Data Analysis in Transport Studies (2025)” from the course list

After logging-in, simply go to the topic you want, and then select and click the file you would like to read, print and/or save. Students should download and print their own handouts for the lectures. ***The handouts are intended to facilitate your learning and may not be identical to the lecture presentation slides.***

Assessment

100% coursework (50% individual assignments; 50% group project)

4.1 Individual Assignments (50% of the Final Grade)

Students are required to complete 2 exercises on selected aspects of transport surveys. Each exercise carries 25% of the final grade.

4.2 Group Project (50% of the Final Grade)

Form a project team of 4-5 persons (each team should have at least one full-time and one part-time student or one MTP&P and one MUDT student) to conduct an online survey with a minimum sample size of 50.

Students should identify their own research problem (with strong justifications) and formulate their own research hypotheses. The research problem must have a transport dimension and the key data collected must be related to travel characteristics. Students should go through the entire survey process, including sampling, compiling the list of target population, designing the questionnaire, conducting the survey, analyzing the data and finally submitting the project report.

As this assignment involves human participants, the proper research ethical approvals must be obtained before the main survey is conducted. The latest Ethical Application Form for Taught Postgraduate Dissertation should be used. The completed form should be submitted as part of the Progress Report.

Survey data should follow proper data structure. SPSS® for windows is recommended for data entry and analysis. All data files should be kept for checking.

The Final Report must include a statement about the division of labour, signed by all members.

Deadlines for submissions

Group Project: Names of project team members (Assign a team member as the contact person . He/She will make submissions in Moodle for the group, including the member list, ethical approval application, and final report.)	09/09/2025 (Tuesday)
Group Project: Ethical approval submitted (the questionnaire must be included)	07/10/2025 (Tuesday)
Exercise 1 (release on 14/10/2024)	28/10/2025 (Friday)
Exercise 2 (release on 18/11/2024)	25/11/2025 (Tuesday)
Group Project: Final report	02/12/2025 (Tuesday)

4.3 Plagiarism and Improper Use of Generative Artificial Intelligence (GenAI)

2025-2026

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To compile with the coursework requirements, you need to submit a soft copy of your paper to Turnitin in Moodle. Turnitin is a software programme which checks papers for signs of plagiarism and the use of GenAI. To submit your paper to Turnitin, select “Coursework” under the Coursework Assignment section on Moodle.

Follow the instructions and choose “Submit Paper”. Input the Submission Title in the format of the assignment and then your identity. Some examples are “Exercise 1: u3012471”, “Group Project Final Report: u3012471”. For submissions related to the Group Project, only one student (i.e. the contact person of the group) should make the submission online. Please note that you can upload your essay to Turnitin **only once**. In other words, you must make sure that only the **final** version is submitted to Turnitin. To avoid confusion, the Turnitin link will only be available one week before the submission deadline.

The course instructor and the course TA will check the originality report prior to marking. We view breaches of copyright and plagiarism very seriously. When the detected AI percentage surpasses the threshold of 30%, course teachers will provide the relevant students with the AI detection reports, and ask them to explain the process whereby they arrived at the submitted assignment, accompanied with any supporting documents (e.g. initial drafts and references read). When grading the assignments with AI detection rate over the threshold, the teachers will consider the AI detection report (including which part of the writing is flagged) together with the student explanation. Plagiarized work or work with improper use of AI will receive a fail grade. There may also be disciplinary action against the student who commits the above offence. The University is committed to upholding the highest standards of academic integrity, and has in place a [Policy on Student Plagiarism in Undergraduate and Taught Postgraduate Curricula](#) and a [Policy on Use of Generative Artificial Intelligence for Teaching and Learning website](#). By adhering to these guidelines, we aim to maintain a fair and honest academic environment for all students.

5.5 Course Grade Descriptors

A	Excellent foundation knowledge of the subject. Demonstrate evidence of original thought, logical thinking, and strong analytical skills. Excellent organizational and presentation skills.
B	A good foundation knowledge of the subject. Demonstrate evidence of critical and analytical thinking and skills. Good organizational and presentation skills. No serious flaws in the answer.
C	Reasonable foundation knowledge of the subject. Little evidence of critical thinking or insight, although the answer has some structure/coherence. Mostly descriptive in the work. Some flaws in the answer.
D	Limited foundation knowledge of the subject. Mainly descriptive with limited evidence of critical thinking and poor structure/coherence. Not well organized in presentation. A number of flaws in the answer.
Fail	No foundation knowledge of the subject. Major flaws in the answer. Poor organizational and presentation skills.

5. References

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6.1 Key References

Richardson, Anthony J. and Elizabeth S. Ampt and Arnim H. Meyburg (1995) *Survey Methods for Transport Planning*. Parkville: Eucalyptus.

Bonnel, Patrick, Martin Lee-Gosselin, Johanna Zmud and Jean-Loup Madre, editors (2009) *Transport Survey Methods: Keeping Up with a Changing World*. Bingley: Emerald.

6.2 Additional Readings by Topic (*denotes “highly recommended/required”)

Lectures 1 - 2 (Overview of Transport Survey Methods)

Batty, M. (2017). “Data about cities: redefining big, recasting small.” In *Data and the City* (pp. 31-43). Routledge.

Gong, H., C. Chen, E. Bialostozky and C.T. Lawson (2012). “A GPS/GIS method for travel mode detection in New York City.” *Computers, Environment and Urban Systems*, 36: 131-139.

Hanson, S. (1998). “Off the road? Reflections on transportation geography in the information age.” *Journal of Transport Geography*, 6(4): 241-249.

Hong Kong (China). Transport Department (2004-) *Transport Planning & Design Manual*. Hong Kong: Transport Department.*

Institute of Transportation Engineers., Box, P.C., Oppenlander, J.C., Association of Casualty and Surety Companies., & Institute of Traffic Engineers (1976). *Manual of Traffic Engineering Studies*. Arlington, Va: Institute of Transportation Engineers.

Loo, Becky P.Y. (2003) “Tunnel traffic and toll elasticities in Hong Kong: Some recent evidence for international comparisons.” *Environment and Planning A*, 35: 249-276.

Loo, Becky P.Y. (2010) “Cross-boundary container truck congestion: The case of the Hong Kong-Pearl River Delta Region” *Transportation*, 37(2): 257-274.

Loo, B.P.Y. and K.L. Tsui (2016) “Contributory factors to critically wrong road-crossing judgments among older people: An integrated research study.” *Hong Kong Journal of Emergency Medicine*, 23(1):13- 24.

Mahmassani, H.S., T. Joseph and R-C Jou (1993) “Survey approach for study of urban Commuter choice dynamics.” In *Innovations in Travel Survey Methods*. Transportation Research Record, no. 1412: Planning and Administration ed Transportation Research Board, National Research Council, pp. 80-89. Washington, D.C.: National Academy Press.

Matherly, Deborah W. (1996) “Stream-of-traffic interview truck survey: Methodology and recommendations on traffic volume thresholds.” In *Freight Transportation Data and Planning Issues, Trucking, and Marine Transportation* ed Transportation Research Board. National Research Council, pp. 18-26. Washington, D.C.: National Academy Press.

Miller, K.S., T.N. Harvey, P.W. Shuldiner and C.W. Ho (1993) “Using video technology to conduct 1991 Boston Region External Cordon Survey.” In *Innovations in Travel Survey Methods*. Transportation Research Record, no. 1412: Planning and Administration ed Transportation Research Board, National Research Council, pp. 46-56. Washington, D.C.: National Academy Press.

Milne, D., & Watling, D. (2019). “Big data and understanding change in the context of planning transport systems.” *Journal of Transport Geography*, 76, 235-244.

Ortuzar, J.deD., J. Armoogum, J-L Madre and F. Potier (2011) “Continuous mobility surveys: The state of practice.” *Transport Reviews*, 31(3): 293-312.*

Richardson, Anthony J. and Elizabeth S. Ampt and Arnim H. Meyburg (1995). *Survey Methods for Transport Planning*. Parkville: Eucalyptus, pp. 1-71.

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- Stopher, Peter R. and Stephen P. Greaves (2007) "Household travel surveys: Where are we going?" *Transportation Research A*, 41: 367-381.
- Transport Department (2020) [*The Annual Traffic Census 2023*](#). Hong Kong: Transport Department.
- Vincent, E.N. (1984) "A rural origin-destination survey." In *Traffic Survey Methods*. One of the Series of ESSO-Monash Short Courses in Traffic Science Held at Normanby House, Monash University on 17-19 September 1984 ed Michael A.P. Taylor, pp. 149-158. n.p.: Monash University.

Lectures 3 - 4 (Designing Questionnaires and Data Coding in Transport Surveys)

- Doherty, Sean T. and Eric J. Miller (2000) "A computerized household activity scheduling survey." *Transportation*, 27: 75-97.
- Elvik, R., & Bjornskau, T. (2005). "How accurately does the public perceive differences in transport risks? An exploratory analysis of scales representing perceived risk." *Accident Analysis and Prevention*, 37(6), 1005-1011.
- Fowler, Floyd J. (1993) *Survey Research Methods*. Applied Social Research Methods Series, vol. 1, 2nd ed. Newbury Park: Sage, pp. 54-131.*
- Gong, H., Chen, C., Bialostozky, E., & Lawson, C. (2012). "A GPS/GIS method for travel mode detection in New York City." *Computers, Environment and Urban Systems*, 36(2): 131-139.
- Jones, Peter, Regine Gerike and Giorgia Servente. (2009) "Surveys for behavioural experiments: Synthesis of a workshop" In Bonnel, P., M. Lee-Gosselin, J. Zmud and J-L Madre, Editors. *Transport Survey Methods: Keeping up with a Changing World*. Bingley: Emerald, pp. 113-123.
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- Loo, Becky P.Y. (2006) "Validating crash locations for quantitative spatial analysis: A GIS-based approach." *Accident Analysis and Prevention*, 38 (5): 879-886.
- Loo, Becky P.Y., S.C. Wong and Timothy D. Hau. (2006) "Introducing alternative fuel vehicles in Hong Kong: Views from the public light bus industry." *Transportation*, 33, no. 6: 605-619.
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- Oppenheim, A.N. (1992) *Questionnaire Design, Interviewing and Attitude Measurement*, New Edition. London and New York: Pointer.
- Pratt, Joanne H. (2003) "Survey instrument design." In Stopher, Peter and Peter Jones, Editors. *Transport Survey Quality and Innovation*. Amsterdam: Pergamon, pp. 137-150.
- Richardson, A.J. (2006) "Proxy responses in self-completion travel diary responses." *Transportation Research Record*, 1972: 1-8.
- Transport Department (1993) *Travel Characteristics Survey: Final Report*. Hong Kong: Territory Transport Planning Division, Transport Department.
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- Wong, S.C., N.N. Sze, W.T. Hung, Becky P.Y. Loo and Hong K. Lo (2006) "The effects of a traffic guidance scheme for auto-toll lanes on traffic safety at toll plazas." *Safety Science*, 44, (9): 753-770.
- Wong, S.C., N.N. Sze, Becky P.Y. Loo, Alice S.Y. Chow, H.K. Lo and W.T. Hung (2012) "Performance evaluations of the spiral-marking roundabouts in Hong Kong" *ASCE Journal of Transportation Engineering*, 138: 1377-1387.
- Zmud, Johanna (2003) "Designing instruments to improve response." In Stopher, Peter and Peter Jones, Editors. *Transport Survey Quality and Innovation*. Amsterdam: Pergamon, pp. 89-108.

Lectures 5 - 6 (Applying Descriptive Statistics in Transport Studies)

- Adler, Thomas J. (2003) "Reducing the effects of item nonresponse in transport surveys" In Stopher, Peter and Peter Jones, Editors. *Transport Survey Quality and Innovation*. Amsterdam: Pergamon, pp. 529-541.
- Arentze, Theo., Ilona Bos, Eric Molin and Harry Timmermans (2005) "Internet-based travel surveys: Selected evidence on response rates, sampling bias and reliability." *Transportmetrica*, 1(3), pp. 193-207.*
- Badoe, D.A. and Steuart, G.N. (2002) "Impact of interviewing by proxy in travel survey conducted by telephone." *Journal of Advanced Transportation*, 36(1): 43-62.
- Chen, C., C. Claramunt and C. Ray (2014) "A spatio-temporal modelling approach for the study of connectivity and accessibility of the Guangzhou metropolitan network." *Journal of Transport Geography*, 36: 12-23.*
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- Richardson, A.J. (2006) "Proxy responses in self-completion travel diary surveys." In *Travel Survey Methods, Information Technology, and Geospatial Data*. *Transportation Research Record*, no. 1972 ed. Transportation Research Board, pp. 1-8.
- Taafe, E.J., H.L. Gauthier and M.E. O'Kelly (1996) *Geography of Transportation*, 2nd ed. Upper Saddle River: Prentice Hall, pp. 249-286.

Lectures 7 - 8 (Sampling, Data Weighting and Expansion in Transport Surveys)

- Armoogum, Jimmy and Jean-Loup Madre (1998) "Weighting or imputations? The example of nonresponses for daily trips in French NPTS." *Journal of Transportation and Statistics*, October 1998, 53-63.
- Babar, M., and F. Arif. (2019) "Real-time data processing scheme using big data analytics in Internet of Things based smart transportation environment." *Journal of Ambient Intelligence and Humanized Computing*, 10 (10): 4167–77.
- Fielding, Pete. (1985) "Obtaining bus transit service consumption information through sampling procedures." In *New Survey Methods in Transport: 2nd International Conference: Hungerford Hill, Australia 12-16 September 1983* eds Elizabeth S. Ampt, Anthony J. Richardson and Werner Brog, pp. 227-242. Utrecht: VNU Science.
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- Jestico, B., T. Nelson, and M. Winters. 2016. "Mapping ridership using crowdsourced cycling data." *Journal of Transport Geography*, 52 (April): 90–97.
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- Loo, Becky P.Y. and Wang, Bo (2018) "Factors associated with the home-based e-working and e-shopping in Nanjing, China." *Transportation*, 45(2): 365-384.
- Ray, A.F., J.E. Pelletier, and A.P. Zukoski. (2020) "Bicycle and pedestrian manual count programs: Assessing the feasibility and value for measuring local active transportation work." *Journal of Transport & Health*, 16 (March): 100833.
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- Scheaffer, R.L., W. Mendenhall III, R.L. Ott. (1996) *Elementary Survey Sampling*, 5th ed. Belmont: Duxbury.
- Stopher, Peter R. and Cheryl Stecher (1993) "Blow up: Expanding a complex random sample travel survey." In *Innovations in Travel Survey Methods*. Transportation Research Record, no. 1412: Planning and Administration ed Transportation Research Board, National Research Council, pp. 10-16. Washington, D.C.: National Academy Press.
- To, David K.B., K.T. Yau and Alfred Lam (2005) "Travel characteristics survey: Method of expanding household interview survey data." *Transportmetrica* 1(3), pp. 247-260.*
- Wilmot, Chester G. and Thomas J. Adler. (2003) "Item nonresponse." In Stopher, Peter and Peter Jones, Editors. *Transport Survey Quality and Innovation*. Amsterdam: Pergamon, pp. 555-566.

Lectures 9 – 11 (Probability and the Scientific Method in Transport Studies)

- Banister, D. and R. Hickman (2013) "Transport futures: Thinking the unthinkable." *Transport Policy*, 29: 283-293.
- Blalock, Hubert M. (1979) *Social Statistics*, Revised 2nd ed. Auckland: McGraw-Hill, pp. 105-508.
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- Connor, L.R. and A.J.H. Morrell (1979) *Statistics: In Theory and Practice*, 7th ed. & reprint. London: Pitman, pp. 124-194.
- Leung, Kevin Y.K., Sebastian Astroza, Becky P.Y. Loo, Chandra R. Bhat (2019) "An environment-people interactions framework for analysing Children's extra-curricular activities and active transport." *Journal of Transport Geography*, 74: 341-358.

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- Nair, G.S., C.R. Bhat, R.M. Pendyala, Becky P.Y. Loo and W.H.K. Lam (2019) "On the use of probit based models for ranking data analysis." *Transportation Research Record*, 2673(4): 229-240.
- Richardson, Anthony J. and Elizabeth S. Ampt and Arnim H. Meyburg (1995). *Survey Methods for Transport Planning*. Parkville: Eucalyptus, pp. 305-321.*
- Soria-Lara, J. A., & D. Banister (2018) "Collaborative backcasting for transport policy scenario building." *Futures*, 95: 11-21.
- Soria-Lara, J. A., & D. Banister (2018) "Evaluating the impacts of transport backcasting scenarios with multi-criteria analysis." *Transportation Research Part A: Policy and Practice*, 110: 26-37.
- Tribby, C.P. and D. Tharp (2019) "Examining urban and rural bicycling in the United States: Early findings from the 2017 National Household Travel Survey." *Journal of Transport & Health*, 13:143-149.
- Tsoi, Ka Ho, Becky P.Y. Loo, Gil Tal and Daniel Sperling (2022) "Pioneers of electric mobility: Lessons about transport decarbonisation from two bay areas." *Journal of Cleaner Production*, 330: 129866.

Lecture 12 (Latest Developments in an Era of Big Data)

- Anda, C., A., Erath and P. J. Fourie (2017) "Transport modelling in the age of big data." *International Journal of Urban Sciences*, 21(sup1): 19-42.
- Antoniou, C., L. Dimitriou and F. Pereira (Eds.). (2018). *Mobility Patterns, Big Data and Transport Analytics: Tools and Applications for Modeling*. Elsevier.
- Chu, Kai-Fung, Albert Y.S. Lam, Becky P.Y. Loo and Victor O.K. Li (2019) "Public transport waiting time estimation using semi-supervised graph convolutional networks." 2019 *IEEE Intelligent Transportation Systems Conference*, art. no. 8917286, pp. 2259-2264.
- Fan, Zhuangyuan, Fan Zhang and Becky P.Y. Loo (2022) "Rhythm of transit stations: Uncovering the activity-travel dynamics of transit-oriented development in the U.S." *IEEE Transactions on Intelligent Transportation Systems*, 25(8): 12503-12517.
- Huang, Zhiran and Becky P.Y. Loo (2023) "Urban traffic congestion in twelve large metropolitan cities: A thematic analysis of local news contents, 2009-2018" *International Journal of Sustainable Transportation*, 17(6): 592-614.
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