

TOTAL EXAMINATION PROGRAM

PEO Syllabus of Examinations, 2004 Edition

TRANSPORTATION ENGINEERING

PROFESSIONAL EXAMS – SPECIFIC TO TRANSPORTATION ENGINEERING

GROUP A

07-TRA-A1 Introduction to Transportation Engineering

Fundamentals of transportation systems and the application of engineering, mathematical and economic concepts and principles to transportation issues, including transportation planning; public transit; traffic engineering; geometric design; pavement design; and the economic, social and environmental impacts of transportation.

07-TRA-A2 Highway Design

Basics of highway engineering geometric design, including vehicle traction and resistance; principles of braking; stopping sight distance and passing sight distance; highway horizontal and vertical alignment; intersection layout design; channelization; grade separation and interchange design; and cut and fill calculations.

07-TRA-A3 Traffic Engineering

Fundamental techniques of traffic systems analysis with emphasis on congested traffic networks. Topics include: transportation demand; supply and equilibrium; traffic assignment; network equilibrium; system optimality; traffic flow theory; shockwaves; highway capacity analysis; introduction to deterministic and stochastic queuing analyses; intersection signal control types and related timing methods; traffic simulation; and introduction to the basic elements of Intelligent Transportation Systems (ITS).

07-TRA-A4 Pavement Materials, Design and Management

Basics of flexible and rigid pavement analysis, design and management and pavement materials; pavement types; axle loading; pavement stress and deflection; theoretical and empirical pavement design methods; pavement design life; performance and failure criteria; ride quality; pavement distress types; pavement maintenance; pavement subgrade; subbase; base and surface layer materials; asphalt types and characteristics; asphalt mix tests; mix design; pavement construction; and an introduction to modern pavement management.

07-TRA-A5 Transportation Planning and Demand Analysis

Elements of design and execution of an urban transportation planning study; introduction to travel demand modelling; analysis of environmental impacts; modelling transportation-land use interactions and transportation project evaluation; contemporary transportation planning issues and policies; role of

planning within the wider context of transportation decision-making and the planning and design of urban areas; applications to person-based travel in urban regions; freight and intercity passenger transportation; transportation-related environmental, social, and economic sustainability issues.

07-TRA-A6 Geotechnical Materials and Analysis (SAME AS 16-CIV-A4)

Materials: origin of soils; soil identification and classification; compaction; permeability; pore water pressure and effective stress; compressibility and consolidation; shear strength; stress paths; and critical states; frost action; associated laboratory tests. Analysis: elastic stress distribution; settlements; times of settlements; introductory analysis of lateral earth pressures, bearing capacity, and slopes; seepage; well flow and confined 2-D flow problems.

GROUP B

07-TRA-B1 Transit Systems

Role of transit in urban areas; classification of transit modes; transit performance and operational analysis; capacity analysis; scheduling; line and network design; systems planning and mode selection; transit economics.

07-TRA-B2 Intelligent Transportations Systems

Modern techniques to optimize the performance of a transportation system with emphasis on traffic networks in congested urban areas; Intelligent Transportation Systems; analysis of advanced traffic management and information systems; history of ITS; ITS user services and subsystems; ITS interoperability and system architecture; enabling technologies for ITS; introduction to telecommunication technologies for ITS; introduction to control theory for transportation systems; traffic flow modelling; static and dynamic transportation network analysis; incident detection; freeway control; and surface street network control.

07-TRA-B3 Logistics and Goods Movement

Introduction to the structure of the freight industry and its relationship to business logistics and planning of supply chains; planning of freight services at the strategic, tactical, and operational levels and modelling of international, inter-city, and urban freight movements; shipper behaviour related to mode choice, carrier selection, adoption of 3-PL and information technology; introduction to the role of advanced technologies (ITS) for freight operations, and the implications of e-commerce on planning of freight services; overview of policy issues, data sources and needs; and the particularities of the freight-transportation context.

07-TRA-B4 Air Transportation

Nature of civil aviation; structure of the airline industry; aircraft characteristics and performance; aircraft noise; navigation and air traffic control; airport planning and design; runway length and orientation; airline operations; aviation system planning.

07-TRA-B5 Railway Transportation

Design, construction and operation of railway lines, railway stations and station structures; signal operations; railway structures (bridges, tunnels, etc.); tramway and other railroads; underground railways; harbour linkages.

07-TRA-B6 Highway Construction

Clearing and excavation; earthworks; compaction and stabilization; highway drainage; rock drilling and blasting; asphalt and cement concrete pavement construction; inspection and quality control.

07-TRA-B7 Transportation Economics

Introduction to the major theories, methods and policy issues in the field of urban transportation economics, including examination of fundamental issues of planning and financing transportation “infrastructure” (roads, ports, airports); demand analysis and forecasting; congestion pricing of highways and transport infrastructure; cost structure and economies of scale; pricing and regulation; network economics; use of analytical techniques for the analysis of real-world urban transportation issues and policy-making.

07-TRA-B8 Operations Research

Models for the design and operation of systems; linear programming; the simplex algorithm; sensitivity analysis and duality; the assignment problem; network design; probabilistic inventory models; Markov chains; nonlinear, integer, and dynamic programming; and probabilistic dynamic programming.

07-TRA-B9 Traffic Safety

Theory and evidence in accident analysis and prevention; crash data analysis; traffic enforcement; road safety advertising; fleet safety; road safety audits; vehicle safety and program evaluation.

07-TRA-B10 Geomatics (SAME AS WRSE-A7-2)

Satellite-based positioning systems (GPS); observations and development of mathematical models used for absolute and differential static and kinematic positioning; error analysis; quantitative remote sensing methods using optical, infrared and microwave radiation; physical principles, including governing equations; imaging system geometries; space and airborne sensor systems; radiometric corrections, including calibration and atmospheric correction; geometric corrections; geographic Information Systems (GIS); characteristics of GIS data structures and database management systems; applications to map projections; geodetic datums; coordinate systems; georeferencing; spatial modelling and analysis.

Transportation Engineering Suggested Text Listing

07-Tra-A1, Introduction to Transportation Engineering

Fundamentals of Transportation Engineering: A Multimodal Systems Approach/Jon D. Fricker, Robert K. Whitford
 Publisher: Pearson Prentice Hall, Upper Saddle River, NJ 07458, 2004.
 ISBN 0-13-035124-5

07-TRA-A2 Highway Design:

(1) "Geometric Design Guide for Canadian Roads" by Transportation Association of Canada (1999, with 2007 Update) This does not have an ISBN. Product Code PTM-GEODES99. This Guide is offered at a special reduced price for students. Please contact Transportation Association of Canada office at 613-736-1350, Ext. 221.

(2) Any Engineering Surveying Textbook which includes Earthwork calculations - Cuts, Fills and Mass Diagrams

(3) The following free downloads from the Internet on earthwork calculations:

http://www.u.arizona.edu/~mhickman/CE466/earthwork_notes.pdf

http://en.wikibooks.org/wiki/Fundamentals_of_Transportation/Earthwork

<http://www.globalsecurity.org/military/library/policy/army/fm/5-430-00-1/CH3.htm>

07-Tra-A3, Traffic Engineering

The candidates must be very thorough with the Canadian Capacity Guide for Signalized Intersections as this is the only publication which is strictly applicable to Canadian traffic conditions.

(1) Principles of Highway Engineering and Traffic Analysis

by Fred L. Mannering and Scott S. Washburn

- Publisher: Wiley; 5 edition (March 27, 2012)
- ISBN-10: 1118120140
- ISBN-13: 978-1118120149

(2) Traffic Engineering (4th Edition)

by Roger P. Roess, Elena S. Prassas, and William R. McShane

- Publisher: Prentice Hall; 4 edition (July 4, 2010)
- ISBN-10: 0136135730
- ISBN-13: 978-0136135739

(3) Traffic and Highway Engineering - Fifth Edition

Nicholas J. Garber and Lester A. Hoel

- **Publisher: Cengage Learning; 5 edition (January 1, 2014)**
- **ISBN-10: 113360515X**
- **ISBN-13: 978-1133605157**

(4) Canadian Capacity Guide for Signalized Intersections - 2008 edition

This guide can be freely downloaded from the following web site. This is the only book written for Canadian traffic conditions and it is very important that the students are thorough with the entire book.

<http://www.cite7.org/resources/documents/CanadianCapacityGuide2008.pdf>

The following web sites contain a wealth of information on the various topics listed in the syllabus:

<http://www.cite7.org/resources/documents/CanadianCapacityGuide2008.pdf>

http://www.telecom.otago.ac.nz/tele302/ref/Stallings_QT.pdf

http://www.cengage.com/resource_uploads/downloads/0324237049_48187.pdf

<http://users.crhc.illinois.edu/nicol/ece541/slides/queueing.pdf>

http://www4.ncsu.edu/~hp/SSME_QueueingTheory.pdf

http://home.iitk.ac.in/~skb/qbook/Slide_Set_1.PDF

http://www.itscanada.ca/about/standards_resources/index.html

<http://www.tc.gc.ca/eng/innovation/its-menu.htm>

<http://www.tc.gc.ca/eng/innovation/its-ontario-quebec-1593.html>

07-TRA-A4 Pavement Materials, Design and Management:

(1) Asphalt Institute Manual Series MS-1: Thickness Design - Highways and Streets (ninth edition)
ISBN: 978-1-934-15401-4

(2) Asphalt Institute Manual: Mix Design Methods for Asphalt Concrete and other Hot Mix Types
(Sixth edition) ISBN: 978-1-934-15402-1

(3) Concrete Pavement Design, Construction and Performance by Norbert Delatte, Taylor & Francis,
2008 ISBN: 978-0-415-40970-4

(4) Pavement Design and Materials by A. T. Papagiannakis and E. A. Masad, John Wiley, 2008
ISBN: 978-0-471-21461-8

(5) Highway Engineering by Paul H. Wright and Karen K. Dixon, Seventh Edition, John Wile, 2004
ISBN: 978-0-471-26461-3

(6) The following free downloads from the Internet on introduction to pavement management:

<http://www.fhwa.dot.gov/infrastructure/asstmgmt/pmprimer.pdf>

<http://ntl.bts.gov/DOCS/pave.html>

<http://www.westvalley.edu/att/Pavement%20Management/index.htm>

<http://www.burlington.org/engineering/Pavement%20Management/PavementManagement.pdf>

07-Tra-A5 Transportation Planning and Demand Analysis

Juan de Dios Ortuzar, Luis G. Willumsen, *Modelling Transport*, 4th Edition, Publisher: Wiley, 2011, ISBN: 978-0-470-76039-0

07-Tra-B1 Transit Systems

VUCHIC, V.R. (2005). Urban Transit: Operations, Planning, and Economics. John Wiley & Sons, Inc. 2005. ISBN 0-471-63265-1

VUCHIC, V.R. (2007). Urban Transit: Systems and Technology. John Wiley & Sons, Inc. 2007. ISBN 0—471-75823X

07-TRA-B2 Intelligent Transportation Systems

(1) Authors: **Institute of Transportation Engineers, U.S. Federal Highway Administration**

Title: **Intelligent transportation primer**

Publisher: Institute of Transportation Engineers, Washington, D.C.

Year: 2000

ISBN: 0935403450

[Note: The entire book]

(2) Author: **Sussman, Joseph M.**

Title: **Perspectives on intelligent transportation systems (ITS)**

Publisher: Springer Science + Business Media, New York

Year: 2005

ISBN: 0387232575

[Note: The entire book]

07-TRA-B5, Railway Transportation

Railway Transportation Systems

Design, Construction, and Operation, 2nd Edition

by Christos N. Pyrgidis

07-TRA-B6 Highway Construction

Garber, N.J. and Hoel, L.A. Traffic & Highway Engineering. Fifth Edition, Cengage Learning, 2013.

07-TRA-B7 Transportation Economics

(1) Authors: **Millan, Pablo Coto and Inglada (Editors)**

Title: **Essays on Transport Economics**

Publisher: Physica-Verlag (A Springer Company)

Year: 2007

ISBN: 13 978-3-7908-1764-5 Physica-Verlag Heidelberg New York

[Note: Chapters 1, 4, 13, 17]

(2) Authors: Sinha, Kumeras C. and Labi, Samuel

Title: Transportation Decision Making , Principles of Project Evaluation and Programming

Publisher: John Wiley & Sons, Inc.

Year: 2007

ISBN: 0471747327

[Note: Chapters 1 to 11, 15, 16, 18, 20, relevant material in Appendixes]

(3) Authors: Meyer, Michael D. and Miller, Eric J.

Title: Urban Transportation Planning: A Decision Oriented Approach

Publisher: McGraw-Hill.

Year: 2001

ISBN: 0-07-242332-3

[Note: Chapters 5, 7, 8, 9]

(4) Authors: Khisty, Jotin C. and Lall, Kent B.

Title: Transportation Engineering: An Introduction, Third Edition

Publisher: Prentice Hall

Year: 2003

ISBN: 0-13-033560-6

[Note: Chapters 2, 15 and Appendix A]

07-Tra-B9 "Traffic Safety"

Listed below are several web sites, from which the material can be freely downloaded to assist you to prepare to write this exam that you can download.

http://www.tars.unsw.edu.au/downloads/Fleet_safety_final_for_web_with_cover.pdf

http://www.everestre.com/Portals/0/Documents/Everest_Model_Fleet_Safety_Program.pdf

<http://www.drivingforbetterbusiness.com/pool/benchmarking-workshop-report-jan-08-final.pdf>

<http://www.monash.edu.au/miri/research/reports/muarc166.html>

<http://www.oshatrain.org/courses/studyguides/719studyguide.pdf>

<https://www.fleetsafety.govt.nz/>

<http://eprints.qut.edu.au/7952/1/7952.pdf?referer=www.clickfind.com.au>

https://www.worksafe.vic.gov.au/_data/assets/pdf_file/0015/9510/safe_driving_web.pdf

<http://www.fleetsafetyinternational.com/sites/default/files/documents/Road%20Safety%20Challenge.pdf>

<http://www.jaspersnetwork.org/jaspersnetwork/download/attachments/5439709/Road+Safety+Audits+-+JASPERS.pdf?version=1&modificationDate=1387450051000>

http://www.lags.corep.it/doc/ICorsoSpec/Supporti%20tecnici/au_roadsafetysaudit-2ndedition.pdf

http://ec.europa.eu/transport/road_safety/topics/infrastructure/national-guidelines/pdf/malta-national-guidelines.pdf

<http://www.ite.org/technical/IntersectionSafety/RSA.pdf>

[http://www.rms.nsw.gov.au/roadsafety/downloads/guidelines for road safety audit practices full.pdf](http://www.rms.nsw.gov.au/roadsafety/downloads/guidelines%20for%20road%20safety%20audit%20practices%20full.pdf)

[http://safety.fhwa.dot.gov/tools/data tools/fhwasa1140/](http://safety.fhwa.dot.gov/tools/data_tools/fhwasa1140/)

[http://safety.fhwa.dot.gov/tools/data tools/fhwasa1139/fhwasa1139.pdf](http://safety.fhwa.dot.gov/tools/data_tools/fhwasa1139/fhwasa1139.pdf)

<http://www.fhwa.dot.gov/publications/publicroads/13mayjun/03.cfm>

<http://www.unb.ca/research/transportation-group/road-safety/guidelines.html>

<https://www.onlinepublications.austroroads.com.au/items/AP-R420-13>

<http://casr.adelaide.edu.au/staff/?pid=1165>

[http://www.fiafoundation.org/publications/Documents/road safety in france.pdf](http://www.fiafoundation.org/publications/Documents/road%20safety%20in%20france.pdf)

[https://cbrcc.curtin.edu.au/reports journal articles/aap%2031%20243-252.pdf](https://cbrcc.curtin.edu.au/reports_journal_articles/aap%2031%20243-252.pdf)

<http://www.ors.wa.gov.au/Documents/Strategies/ors-towards-zero-strategy.aspx>

<http://www.ors.wa.gov.au/Documents/Strategies/ors-towards-zero-strategy.aspx>

[http://c-marc.curtin.edu.au/local/docs/CMARC Fact Sheet1.pdf](http://c-marc.curtin.edu.au/local/docs/CMARC_Fact_Sheet1.pdf)

<http://www.ors.wa.gov.au/Documents/Strategies/ors-towards-zero-strategy-development.aspx>

<http://www.ors.wa.gov.au/Documents/Strategies/ors-towards-zero-discussion-paper.aspx>

<http://conf.tac-atc.ca/english/annualconference/tac2013/session5/rempel.pdf>

<http://alk.tiehallinto.fi/julkaisut/pdf/4000423e-veffectsofroadside.pdf>

http://www.worldbank.org/transport/roads/saf_docs/campaign.pdf

[http://www.carrsq.qut.edu.au/publications/corporate/road safety advertising fs.pdf](http://www.carrsq.qut.edu.au/publications/corporate/road%20safety%20advertising%20fs.pdf)

http://www.google.ca/url?sa=t&rct=j&q=&esrc=s&frm=1&source=web&cd=1&ved=0CCKQFjAA&url=http%3A%2F%2Fwww.nhtsa.gov%2Fstaticfiles%2Fnti%2Fpdf%2F811727.pdf&ei=hDcKU-eeHI_0ATEXIKgAg&usg=AFQjCNHbqpoHXfbfgZvFYi0iPqgoYegnHw&sig2=reecU5u191Jd9e8OhGt2CA&bvm=bv.61725948,d.cGU

<http://www.ieg-america.com/pdf/Automated%20Traffic%20Enforcement%20Technology%20Guidelines.pdf>

<http://www.assembly.ab.ca/lao/library/egovdocs/2006/alsg/153430.pdf>

[https://www.solgps.alberta.ca/programs and services/public security/peace officers/Publications/Automated%20Traffic%20Enforcement%20Guidelines%20-%202008.pdf](https://www.solgps.alberta.ca/programs_and_services/public_security/peace_officers/Publications/Automated%20Traffic%20Enforcement%20Guidelines%20-%202008.pdf)

<http://www.assembly.ab.ca/lao/library/egovdocs/2006/alsg/153430.pdf>

<http://www.iowadot.gov/traffic/pdfs/automatetrafficenforcementguidelines.pdf>

<https://www.ma.utexas.edu/users/blumberg/automated-enforcement.pdf>

http://www.google.ca/url?sa=t&rct=i&q=&esrc=s&frm=1&source=web&cd=34&ved=0CDgQFjADOB4&url=http%3A%2F%2Froad-network-operations.piarc.org%2Findex.php%3Foption%3Dcom_docman%26task%3Ddoc_download%26gid%3D547%26lang%3Den&ei=VzsKU5OOFNLEoASq1oCADA&usg=AFQjCNGLmi5J1M5tvdNiUclb1Dy6CLUotQ&sig2=ZFdxduZlrx1TG-jKDaJxg

http://www.balticroads.org/downloads/28BRC/104_T06.pdf

http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_729.pdf

http://ftp.dot.state.tx.us/pub/txdot-info/trf/red_light/auto_traffic.pdf

<http://itd.idaho.gov/ohs/HSP/FFY2014HSP.pdf>

http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_746.pdf

<https://www.thunderbaypolice.ca/sites/default/files/pdfs/Traffic%20Enforcement%20and%20Safety%20Plan%202013.pdf>

http://www.piarc.org/ressources/documents/actes-seminaires06/c31-togo06/8712,togo_2006_Hollo.pdf

http://www.crash-network.com/Download/Crash_Analysis_Criteria_1.6.2.pdf

<http://www.ctre.iastate.edu/pubs/traffichandbook/5CrashAnalysis.pdf>

<http://ntl.bts.gov/lib/25000/25000/25079/AZ537.pdf>

<http://web.pdx.edu/~bertini/papers/crash.pdf>

https://www.google.ca/?gfe_rd=cr&ei=X0QKU_oNuiBmAKyv4C4Cg#q=University+of+Maryland+-+Vehicle+Accident+Analysis+-+BUDT+733

<http://www.ktc.uky.edu/projects/analysis-of-traffic-crash-data-in-kentucky/>

<https://connect.ncdot.gov/resources/safety/Documents/TEAAS/Chapter%2015%20Analysis%20Techniques.pdf>

<http://library.oregonmetro.gov/files/safetyplan/2006CodeManualVersion1.0.pdf>

<http://www-nrd.nhtsa.dot.gov/Pubs/811754AR.pdf>

<https://osha.europa.eu/en/publications/e-facts/efact02/view>

http://www.etsc.eu/documents/PRAISE_ROAD_SAFETY_MANAGEMENT.pdf

http://www.dot.ca.gov/dist4/nilescanyon/docs/sr84_va_study_final.pdf

http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_492.pdf

http://www.isprs.org/proceedings/XXXVIII/4-W13/ID_54.pdf

http://www.intrans.iastate.edu/reports/souleyrette_low_vol_report_w_cvr.pdf

http://safety.fhwa.dot.gov/local_rural/training/fhwasaxx1210/lrro_data.pdf

<http://casr.adelaide.edu.au/rsr/RSR2009/RS094023.pdf>

<http://www.cph.org.uk/wp-content/uploads/2012/08/road-traffic-accidents-a-review-of-evidence-for-prevention.pdf>

[http://www.ghdcanada.com/pdf/Enhancing Road Safety Management with GIS Mapping and Geospatial Database.pdf](http://www.ghdcanada.com/pdf/Enhancing_Road_Safety_Management_with_GIS_Mapping_and_Geospacial_Database.pdf)

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