



Defining “Railway Education” for the Next Generation of University Students

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Defining “Railway Education” for the Next Generation of University Students

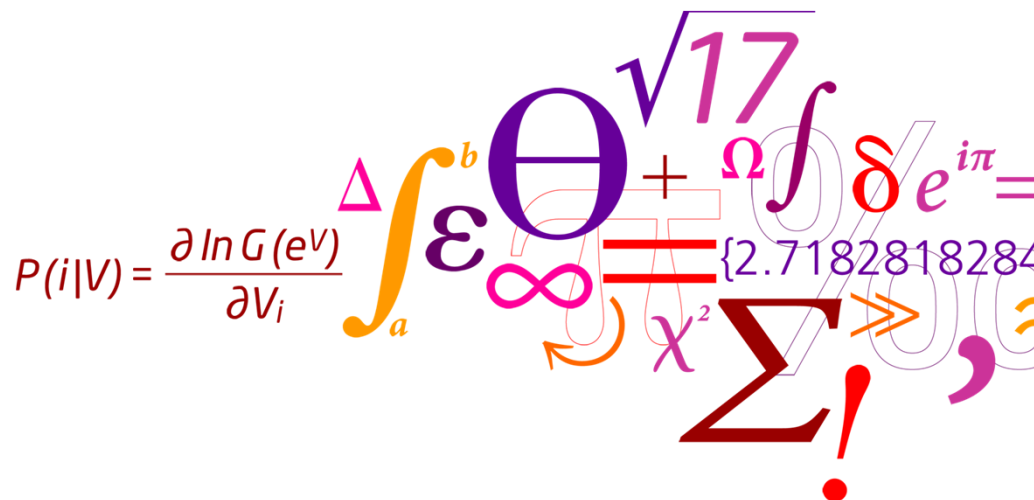
ISRET 2018, Birmingham

Steven Harrod

Associate Professor

DTU Management Engineering

RAILTECH DTU



Railway Careers and Education

- Career Trends
 - More professional management
 - More value in data analysis across job titles
- Results of ISRET Survey
- Education Programs
- DTU Program in Detail



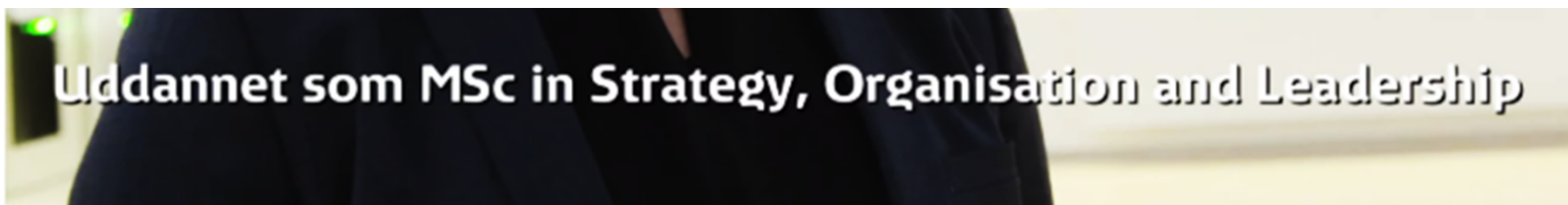
Traditional Railway Career

- Start in train service (brakeman, station operator)
- Promotion by experience
 - Engineer, then foreman, then superintendent
 - Dispatcher, then traffic manager, then director
- Top executives frequently filled from legal and finance
 - Regulated environment
 - Operations not a source of innovation

21st Century Shift in Career Preparation



“Educated with a Master of Science in Strategy, Organization, and Leadership”



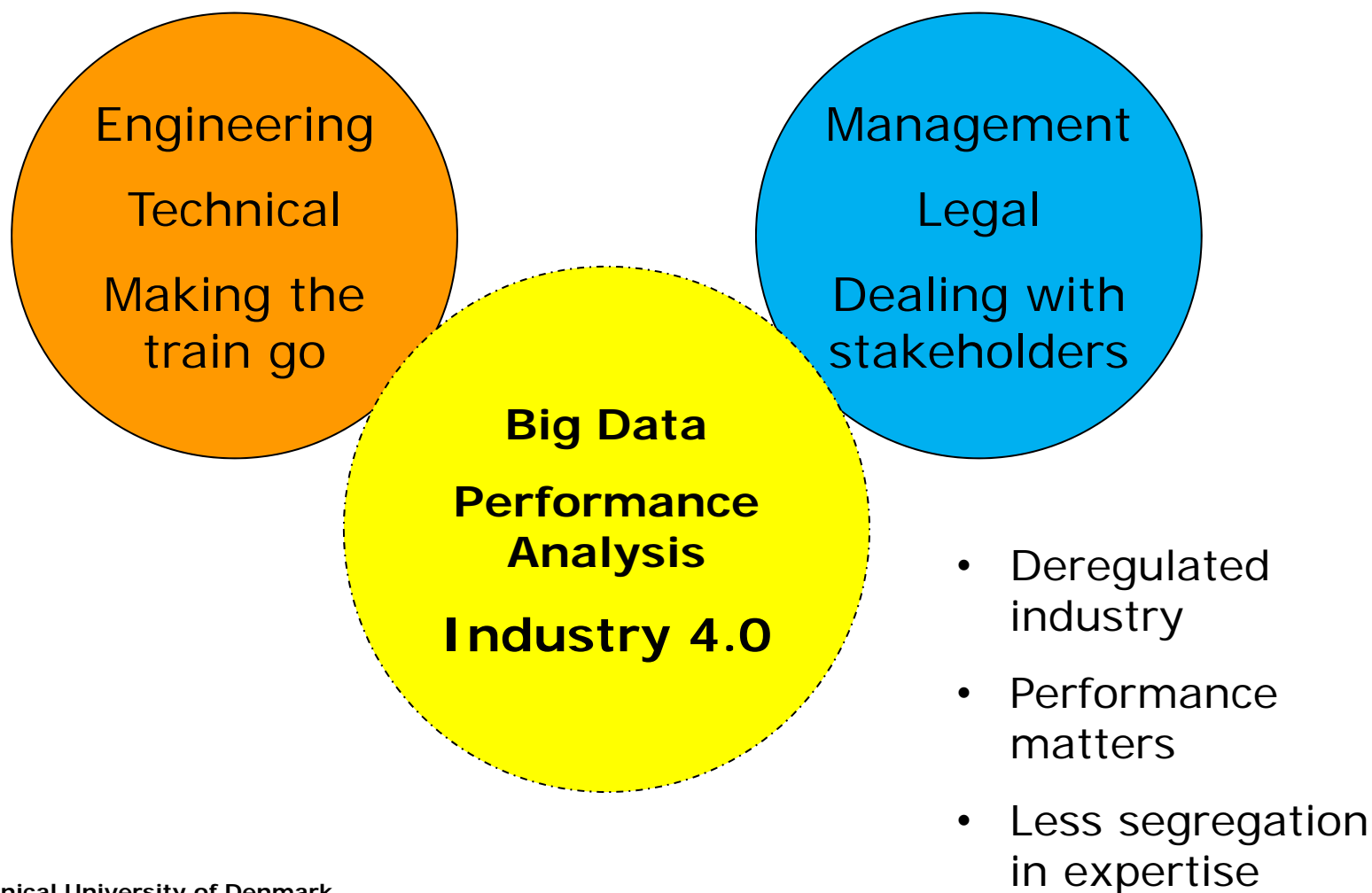
Education/Career Matches at Norfolk Southern

Note

- “Operations” vs. “non-operations”
- Multiple listing and importance of INFORMS skills

		NS OPERATIONS DEPARTMENTS													
		PREFERRED MAJORS													
		Electrical Engineering	Civil Engineering	Computer Engineering	Mechanical Engineering	Industrial Engineering	Metallurgical Engineering	Construction Engineering	Materials Science	Construction Management	Geographic Information Sciences (GIS)	Supply Chain	Logistics	Business	Management
Communication	Creation, distribution, and maintenance of information														
Design & Construction	Designs and constructs complex business infrastructure														
Maintenance	Ensures the safe and efficient operation of positions and equipment														
Network & Service	Ensures the safe and efficient operation of the railroad														
Research	Conducts research to improve operations														
Transportation	Manages the safe and efficient movement of freight														
		NS NON-OPERATIONS DEPARTMENTS													
		PREFERRED MAJORS													
		Business	Accounting	Civil Engineering	Industrial Engineering	Computer Science	Information Technology	Marketing	MBA	Economics	Supply Chain	Logistics			
Accounting Operations		✓	✓												
Industrial Development					✓										
Industrial Engineering					✓										
Information Technology						✓	✓								
Audit & Compliance		✓	✓												
Marketing		✓						✓	✓	✓	✓	✓	✓	✓	✓
Revenue Accounting & Customer Service (RACS)		✓	✓					✓	✓	✓	✓	✓	✓	✓	✓
Sourcing		✓										✓	✓		
Operations Research					✓	✓									
Labor Relations		✓						✓	✓	✓	✓	✓	✓	✓	✓

Transportation Bodies of Knowledge



Railway Education Programs



Subject Coverage from “Railway” Schools



University Name	Mechanical Eng.	Electrical Eng.	Civil Eng.	General Eng.	Operations Res.	Operations Mgt.	Transport Models	Marketing and Service	Strategy and Leadership
Beijing Jiaotong University					X	X	X	X	X
Colorado State University - Pueblo				X					
Delft University of Technology			X		X		X		
KTH Royal Institute of Technology	X	X	X	X					
Michigan Technological University	X	X	X	X		X			X
Norwegian University of Science and Technology			X						
University of Belgrade	X	X	X		X		X	X	X
University of Birmingham	X	X	X	X		X	X		X
University of Illinois at Urbana-Champaign			X	X	X		X		
University of Leeds							X	X	
Penn State Altoona			X				X		X
Technical University of Denmark			X		X	X	X		
Sapienza, University of Rome			X		X		X		
University of South Carolina	X	X	X	X		X			X
University of Southampton	X		X				X		

ISRET 2018 Survey

Please Join In

https://dtumanagement.eu.qualtrics.com/jfe/form/SV_0TBKN3eW5HSuNDv

Results as of Monday AM

Consulting	2
Government or Regulatory Agency	3
Infrastructure Manager	3
Research Institution without Teaching	3
Train Operating Company	3
University Faculty	1

Q2 - Please move the slider to match your agreement with the statements



	Mean	Std Dev
There are many opportunities for employment in my organization, related to railways	69	27
Young people today are not interested in railway careers	56	29
I have difficulty attracting applicants to jobs in my area	50	34

100= Full Agreement

What is your experience in recruiting persons to your organization?



	Mean	Std Dev
Prospective job seekers are not sufficiently qualified for our opportunities	58	25
Candidates do not have sufficient railway knowledge for our opportunities	65	25
Candidates do not have sufficient management skills (project management, strategy, organization)	55	21
Candidates do not have sufficient technical and engineering skills	58	19
We have difficulty competing with other organizations or industries in the labor market	55	29

100= Full Agreement

Q4 - As an employer, express your agreement with the following statements about what you think students and prospective employees think about your workplace



	Mean	Std Dev
Railways are uninteresting workplaces	33	31
Railway jobs are harder than other jobs	39	28
It is important to know the difference between a train and a trainset	39	32
It is pretty quick and easy to transition from other industries to railways	44	27
Staff should have practical experience in the field	59	20
We only promote from within	32	31
Seniority is highly valued	59	23
I can't imagine working anywhere else	48	37
The future in this job is great	71	20
Railways are addictive	69	32

Q5 - As an employer, express your desire for the following skills



	Mean	Std Dev
Material strengths, rail wheel interface	45	33
Electrical power supply and catenary	61	36
Civil engineering, concrete, bridges, earthworks	57	36
Customer service, hospitality, service design	75	23
Quality management, measurement and reporting	68	20
Project planning, supervision, and forecasting	75	15
Strategic business and product planning	75	21
Mathematical optimization, timetabling, crew scheduling	57	31
Public policy, social welfare, government relations	70	14
Environment, sustainability, CO2 initiatives	73	21

Q7 - Enter any statements that you feel are missing from the previous questions



Enter any statements that you feel are missing from the previous questions

More emphasis on soft skills and behaviours

People management
Career development
Health and wellbeing
Occupational health, safety and welfare

- a) This feedback is provided from the perspective of (1) a middle manager (retired); (2) in an organisation that has recently downsized.
- b) Should 'Financial Management' (as distinct from 'Accountancy' be included?

Innovation

Digital, tech development competencies

Q6 - Answer the following as you think a student believes






	Mean	Std Dev
There are many opportunities for employment in railways	46	21
Railways are uninteresting workplaces	56	29
Railway jobs are harder than other jobs	47	26
The future in this job is great	50	26
It never occurred to me to apply for a railway job	75	27
I have loved trains since I was a little child	38	27
I don't think railways are interested in me	47	31
I don't think I have the necessary skills	56	25
There aren't any railways anymore where I live	41	30
I am looking for a higher pay position	72	15

Youth in Railways



Railway Education at DTU

Domestic and International

- Diplomingeniør 
- MSc 
 - Railway study line
 - Other education
 - Flexible master
 - Open education
- PhD 



Railway Courses All in English for 2017



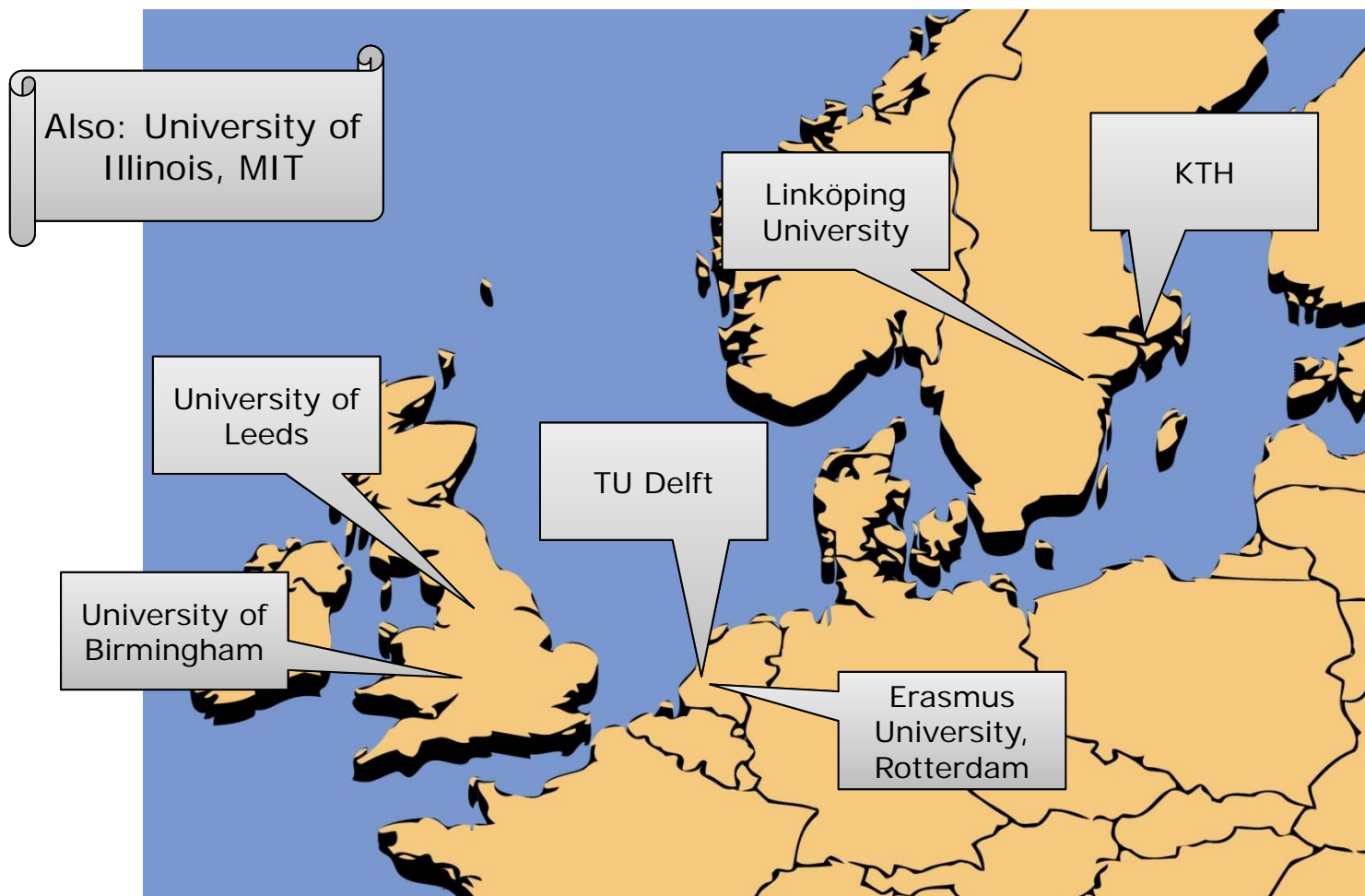
- MSc

- 42880 Railway Operations and Management
- 42878 Future Trains: Railway Fleet Acquisition and Management
- 42877 Railway Design and Maintenance
- 34345 Signaling Systems and Technology for Railways
- 42881 Optimisation in Public Transport

- Diplom or bachelor

- 42976 Rail Traffic Engineering

Partners and Peer Institutions



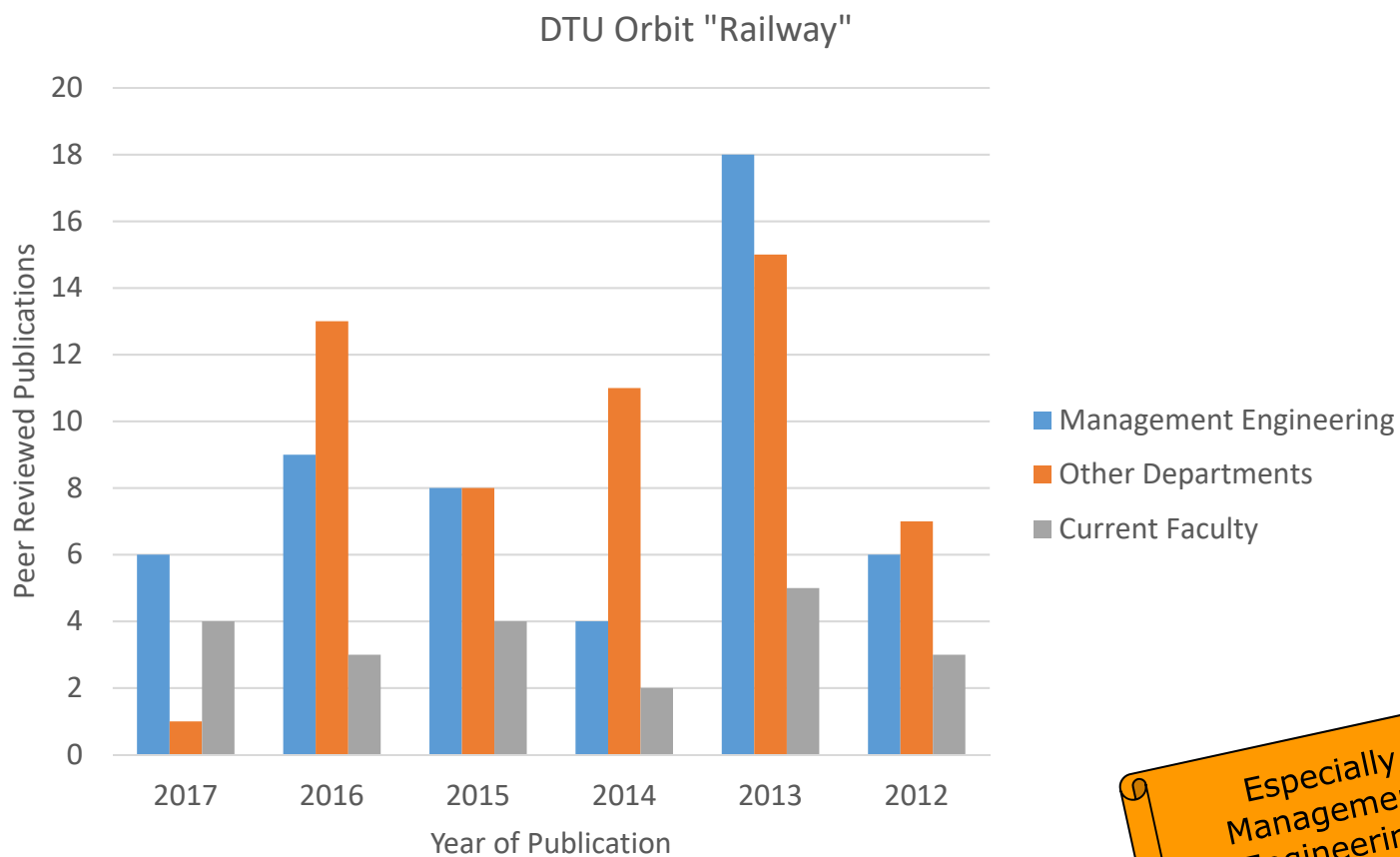
Prospects for Growing Enrollment

- More international recruiting
- Better integration of our research and education
- Present railways as a "fun" career
- Better presentation of career opportunities
- More tours and industry outreach
 - Innotrans
 - Hamburg
 - Danish rail facilities

International Recruiting

- MSc program already about half non-Danish
- Danish government aggressively offers integration services
 - Subsidized language training
 - Work permits for Danish program graduates
- Many international students stay in Denmark after graduation

DTU Has a Rich Railway Research Output



Especially Management Engineering

Tour to Innotrans Received High Evaluations from Students



Bombardier



Web Visibility Search “Railway Master of Science”

Denmark

All Images News Videos Maps More

About 17.000.000 results (0,53 seconds)

Transport and Logistics (MSc) - DTU

www.dtu.dk/english/Education/msc/Programmes/transport_and_logistics ▼

The MSc programme in Transport and Logistics is designed to give you all the ... as logistics combined with skills in software technology, data science, planning methods, ... Railway Management and Engineering gives you the opportunity to ...

KTH | Master's programme in Railway Engineering

<https://www.kth.se/.../master/railway.../master-s-programme-in-railway-engineering-1...> ▼

May 17, 2017 - Railway transport is experiencing a worldwide renaissance. It offers substantial economic, energy efficiency, environmental and safety benefits ...

Railway Infrastructure, M.Eng. - Part time online by ... - Masters Portal

www.mastersportal.eu/studies/62949/railway-infrastructure.html ▼

Study a Masters of Engineering Railway Infrastructure, developed exclusively for engineers employed in the rail industry to advance your professional practice. ... Developed as a cooperative project between the rail industry and the Queensland University of Technology, this course ...

Sat, 1 Jul [Railway Infrastructure, M.Eng.](#)

MSc in Rail and Logistics - NewRail - Newcastle University

www.ncl.ac.uk > [NewRail](#) > [Study With Us](#) ▼

Feb 15, 2017 - The objective of the programme is to develop your ability to initiate and carry out advanced performance systems analysis and research ...

Kentucky

Settings To All News Images Maps Videos More ▼ Search tools

About 15,700,000 results (0.50 seconds)

Railway Systems Engineering and Integration Masters/MSc/Diploma ...

www.birmingham.ac.uk > ... > [Postgraduate taught degrees](#) ▼ | [University of Birmingham](#) ▼

The taught postgraduate programme in Railway Systems Engineering and Integration has a strong focus on developing postgraduates' railway engineering knowledge and know-how, their systems integration skills and their understanding of the complex interactions between subsystems.

Advanced Masters in Rail and Urban Transport Systems | École des ...

www.enpc.fr/en/node/8474 ▼ | [École des ponts ParisTech](#) ▼

The rapid growth in the railway sector has prompted constructors and operators to turn to the grandes Ecoles to create a high-level educational programme ...

Delft University of Technology: Road and Railway Engineering - TU Delft

www.tudelft.nl/.../master-of-science/master.../msc.../ro... ▼ | [Delft University of Technology](#) ▼

Read here how international students and alumni have experienced the MSc ... Infrastructural facilities such as roads, airfields, port areas, railways and ...

Official Master's Degree in Railway Systems - 13th Year (7th Year as ...

www.icaui.upcomillas.es/en/master/msf-en ▼ | [ICAI School of Engineering](#) ▼

For information on the Master's Degree in Railway Systems, contact: +34 91 ... in Industrial Engineering or similar, as well those who hold degrees in sciences.

Railway Systems Engineering and Integration Masters/MSc/Diploma ...

<https://www.findamasters.com/.../masters-degree/.../railway-systems-engineering-and-i...> ▼ |

Railway Systems Engineering and Integration Masters/MSc/Diploma/Certificate ... an appropriate

Ideas for Program Promotion

- More outreach to gymnasia students
- More opportunities for exchange students
 - Within Danish universities
 - From international markets
- More alignment with hiring and career opportunities at rail firms
- Better central information source

Summary

- Management topics increasingly relevant to railway careers
- Still a heavy engineering focus in self described “railway” schools
- DTU making a transition to balanced OR/MS and engineering program
- Still needs to grow its program to sustainable numbers

Thank you and “vi ses”

