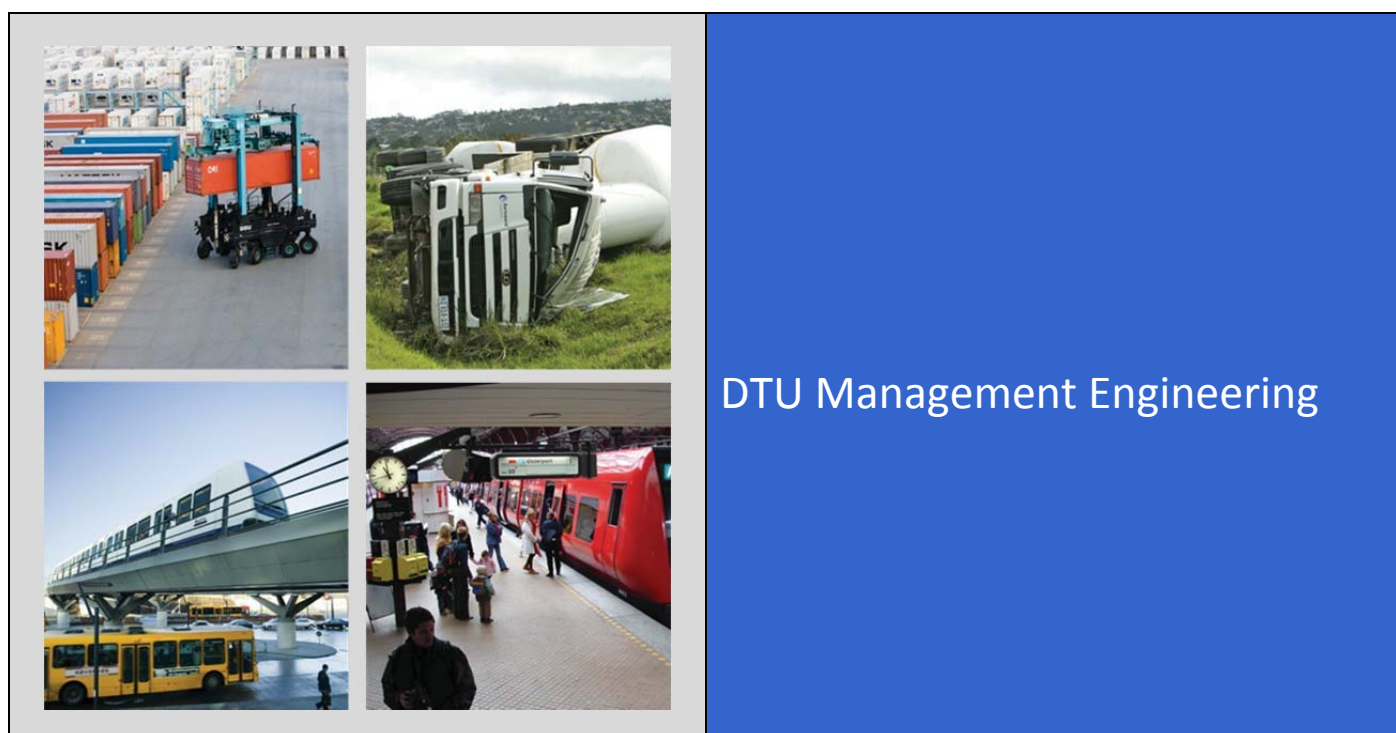


Thesis proposals in Transport and Logistics 2016-2017



DTU Management Engineering

Last update: October 31st 2016

DTU Management – MSc in Transport and Logistics

Writing your thesis within Transport and Logistics

The majority of the theses written within the MSc in Transport and Logistics are oriented towards development, analysis, and application of quantitative or qualitative methods for optimization, planning or modelling problems within traffic, transport and logistics. For theses based on quantitative methods, deep understanding of subjects within statistics and/or operations research is usually an important prerequisite.

In this booklet a number of subjects for thesis projects are offered. The booklet is divided into chapters covering the main areas of research within the field of study. Some projects are carried out internally here at DTU whereas others are performed in close collaboration with external organisations. In addition to the proposals listed in this booklet you are welcome to suggest your own ideas for a thesis subject. If you do so you need to consult a supervisor in order to scope the project so that it is academically sound, relevant and ambitious but also realistic to achieve within the project period.

The descriptions of the subjects are primarily written in English. However, some project proposals have been written in Danish as these have been scoped by external Danish organisations. In case you would like more information on some of the subjects written in Danish you will have to contact the advisor or contact person listed.

Further information on transport and logistics activities at DTU Management can be found at the homepage: www.transport.dtu.dk

We hope to meet you as a thesis writing student!

Best regards,

Stefan L. Mabit
Head of Study

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SUSTAINABLE TRANSPORT



Supporting Copenhagen Green Mobility initiatives with state-of-the-art decision support tools (MSc)

PROJECT SUPERVISOR: Associate professor Michael Bruhn Barfod (mbba@dtu.dk)

PROJECT ADVISOR: Research Assistant Yannick Cornet (yancor@dtu.dk)

EXTERNAL ADVISOR: Annette Kayser, Project Manager, City of Copenhagen, Technical and Environmental Department

BACKGROUND: Sustainable transport appraisal and planning is a complex socio-technical challenge. Copenhagen's 2012 "Action Plan for Green Mobility" includes 25 initiatives as part of its green mobility package. The selection and prioritization of these measures was complex and difficult to operationalize in practice. A set of criteria for the selection of the initiatives was defined, including green mobility, environment, safety, city life and health. However the qualitative nature of the judgments and the different priorities between stakeholders made it difficult to provide a fact-based approach with clear results to bring to decision-makers. There is thus a need for revisiting this case by applying a decision-support tools to prioritize the proposed measures and review the plan according to a more systematic and transparent process. Such tools can help highlight differences but also potential overlaps in preferences between stakeholders – and thus provide maneuver for negotiation and improve the decision-making process. Finally, the approach allows for comparing priorities and decisions with a potential sustainability 'benchmark': that of future generations.

PROJECT DESCRIPTION: In this project you will review and assess the current initiatives as described in the "Action Plan for Green Mobility". With input from the Technical and Environmental Department, the criteria for success will be reviewed and defined based on sustainability principles and applicable sustainable mobility goals for the municipality. Using AHP (Analytic hierarchy process, or similar complex decision-support tool), the judgments for the prioritization of the criteria for each type of stakeholders will be collected through various means (past data, survey, interviews etc). The expected performance of each initiative will also be assessed through expert evaluations. Finally, the perspective of future generations as a 'virtual' stakeholder may also be defined to provide a stronger sustainability perspective. The project concludes with an improved, systematic and transparent decision-support process and impact assessment for Copenhagen's "Action Plan for Green Mobility".

PROJECT PURPOSE: The purpose of this project is to provide the Technical and Environmental Department of Copenhagen Municipality with a state-of-the-art decision-support tool for complex, multi-stakeholder, 'ex-ante' assessment of sustainable mobility initiatives.

The project also evaluates the usefulness in creating a 'future generations' stakeholder as a potential benchmark for backcasting from a vision of sustainability as part of this process.

PREREQUISITES: 13236 Sustainable Transport Assessment, 13235 Planning Theory or similar

NUMBER OF STUDENTS: 1-2 master students (2 projects of 30-35 ECTS Credits).

Green Mobility Index for Copenhagen Municipality (MSc)

PROJECT SUPERVISOR: Associate professor Michael Bruhn Barfod (mbba@dtu.dk)

PROJECT ADVISOR: Research Assistant Yannick Cornet (yancor@dtu.dk)

EXTERNAL ADVISOR: Annette Kayser, Project Manager, City of Copenhagen, Technical and Environmental Department

BACKGROUND: As part of an ongoing initiative to improve green mobility and reduce external costs associated with transport, the European Union is encouraging cities to create and adopt Sustainable Urban Mobility Plans (SUMP, see www.mobilityplans.eu). Copenhagen Municipality has a long tradition in producing such plans. In 2012, a new integrated “Action Plan for Green Mobility” was adopted based around five themes and 25 initiatives. The overarching vision is to improve quality of life and green growth.

Both the SUMP process and Copenhagen Municipality highlight the current lack of performance measures and key sustainability indicators for reporting and benchmarking progress in terms of sustainable urban mobility. There is a need for communicating accessibility & sustainable mobility to stakeholders and decision-makers, as well as to compare progress with other European cities proposing their own SUMP.

PROJECT DESCRIPTION: In this project you will develop an ‘accessibility & mobility index’ for the Municipality of Copenhagen. This includes conducting a full iteration of indicator selection process, which includes: connecting indicators to applicable sustainable mobility goals and priorities at various levels of governance (e.g. as per the Green Mobility plan); evaluating cause-and-effect relationships based on best practices; reviewing past and present data availability in order to enable the monitoring of trends; and finally, evaluating acceptability and usefulness from stakeholders and decision-makers’ perspective. The project concludes with the elaboration of a single index (if deemed possible) and recommendations concerning its use and applicability.

PROJECT PURPOSE: The purpose of this project is to provide the Technical and Environmental Department of Copenhagen Municipality with a simplified and easy-to-understand way to report progress on green mobility. The project will define indicators for accessibility and sustainable mobility at the scale of a large municipality with consideration for comparing with other European cities.

PREREQUISITES: 13236 Sustainable Transport Assessment, 13235 Planning Theory or similar

NUMBER OF STUDENTS: 1-2 master students (2 projects of 30-35 ECTS Credits).

Innovations in transport: enablers and barriers of transition (MSc)

PROJECT SUPERVISOR: Associate professor Michael Bruhn Barfod (mbba@dtu.dk)

PROJECT ADVISOR: Research Assistant Yannick Cornet (yancor@dtu.dk)

EXTERNAL ADVISOR: Annette Kayser for Copenhagen, Naja Hansen for Åbenrå.

BACKGROUND: It has become increasingly evident that a transition towards a vision of sustainable mobility is not hindered by a gap in knowledge, but rather by an implementation deficit. Successful examples of such transition do exist. For example, the 2009 Nørrebrogade experiment includes widened footpaths and bikepaths, bus-only through zones, improved lighting and street furniture, low speed limits and other traffic calming measures in the Nørrebro district. These measures succeeded to reduce traffic by more than 50 % on Nørrebrogade proper, accompanied by significant reductions within the district, and no evidence of increased traffic elsewhere (as was otherwise expected from modelling). The experiment brought other benefits such as reduced local air pollution and noise, increased mobility by non-motorized modes and public transport, improvement in quality of life, and local business profitability. The experiment has become permanent and variations of it are now being trialed on various other thoroughfares in the city.

In Åbenrå, a small city in the West of Denmark, the city centre is being redesigned following similar principles: a main city centre parking lot is being turned into a public space and playground, and a historic square will be returned to its original function as a marketplace. Successful experiments where best practices and innovations in sustainable transport are implemented can serve as useful cases for analyzing the enablers and barriers of transition from a governance perspective.

PROJECT DESCRIPTION: In this project you will select a case (such as Nørrebrogade or Åbenrå) and using constructionist investigative methods (such as actor-network theory) you will unpack their story, with a particular eye on chronology, key turning points, actors and champions, context, and controversies. Based on transition theory, you will analyse the case from a technical innovation systems perspective (or MLP, multi-level perspective), where measures adopted collectively represent an innovation which challenges the incumbent regime of car-based transportation. You will look for evidence of key change enablers, such as willingness to experiment with the new, creation of coalitions among stakeholders, or legitimization with decision-makers. The research is largely qualitative and will rely on conducting a number of interviews. Your analysis will present success criteria in the governance of transition in transportation as a basis for monitoring future projects.

PROJECT PURPOSE: The purpose of this project is to shed light on innovation adoption and implementation success factors in a process of governance towards sustainable transport.

PREREQUISITES: 13236 Sustainable Transport Assessment, 13235 Planning Theory or similar

NUMBER OF STUDENTS: 1-2 master students (2 projects of 30-35 ECTS Credits).

Sustainable Transport Assessment of DTU Campuses (MSc)

PROJECT SUPERVISOR: Associate professor Michael Bruhn Barfod (mbba@dtu.dk)

PROJECT ADVISOR: Research Assistant Yannick Cornet (yancor@dtu.dk)

EXTERNAL ADVISORS: Sustainability coordinator Lisbet Michaelsen (limi@dtu.dk) (Campus Services), Sustainability project manager Anders Gerhard Jørgensen (Campus Services) (andej@dtu.dk)

BACKGROUND: As part of its yearly environmental reporting (Grønt Regnskab), DTU monitors, identifies and visualizes energy consumption and environmental impacts of its activities on its campuses. However, transportation activities so far are not yet included in the reporting. Transportation in Denmark accounts for a quarter of all energy-related greenhouse gas emissions.

Therefore transportation impacts from business travels, staff and student commutes, transportation of goods and waste, as well as on-campus activities may represent a significant share of DTU's overall footprint. Integrating land-use impacts related to transportation infrastructure (for e.g. roads, parking, etc) may also be relevant to the assessment.

It is a prerequisite for a qualified sustainability effort to establish the current baseline in a transportation impact assessment before defining possible reduction measures.

PROJECT DESCRIPTION: In this project you will produce an Environmental Impact Assessment (EIA) baseline for DTU from a transportation perspective. This includes identifying transportation impacts that are likely to be important from a sustainability perspective, selecting measures and producing an evaluation of these impacts. The commuting component of staff and students will likely require the elaboration of a travel survey to gather empirical data. The project concludes with recommendations for avoidance, mitigation or compensation of the impacts.

PROJECT PURPOSE: The purpose of this project is to develop a sustainable transport assessment for DTU campuses. This will include defining necessary indicators of sustainability for transportation at the scale of a university campus, as well as defining proper methods to evaluate them on a continuous basis.

PREREQUISITES: 13236 Sustainable Transport Assessment, 13235 Planning Theory or similar

NUMBER OF STUDENTS: 1-2 master students (2 projects of 30-35 ECTS Credits).

Sustainable highway rating systems – a comparative analysis (MSc)

PROJECT SUPERVISOR: Associate professor Michael Bruhn Barfod (mbba@dtu.dk)

PROJECT ADVISOR: Research Assistant Yannick Cornet (yancor@dtu.dk)

BACKGROUND: There is increased interest in assessment frameworks and tools that can support an evidence-based transition towards a sustainable transport paradigm. In the US, frameworks such as the Federal Highway Administration Infrastructure Voluntary Evaluation Sustainability Tool (INVEST) or The Sustainable Transportation Analysis and Rating System (STARS) are increasingly being used to assess transportation projects. Although one may challenge the concept of a 'sustainable highway', departments of transport (DOTs) in the US have been particularly keen to use such systems for highway and bridge projects. In the UK, the sustainability assessment, rating and awards scheme for civil engineering (CEEQUAL) serves a similar purpose. A previous DTU Transport research project for the EU National Road Administration also proposed a Sustainability Rating System Framework (SUNRA).

The increasing number of such tools raises the question: how do they compare, and how strong is the level of sustainability they are likely to provide?

PROJECT DESCRIPTION: You will analyse existing sustainable transport assessment frameworks (minimum 2 of your choice) with regards to their strength and weaknesses. Your analytical framework will cover the conceptualisation, operationalization, and utilization of indicators. How does the framework connect to principles of sustainability? How were these principles translated into indicators? How is this evidence utilized in their context? Depending on the chosen focus between the three themes above, this comparative study will consist of mixed methods (desktop analysis, interviews with practitioners in targeted countries). You will use real cases to illustrate your analysis (e.g. Harbor Bridge Project in Corpus Christi for INVEST).

PROJECT PURPOSE: The purpose of this project is to analyse the strengths and weaknesses of existing sustainable transport rating systems with regards to their design and application in real life.

PREREQUISITES: 13236 Sustainable Transport Assessment, 13235 Planning Theory or similar

NUMBER OF STUDENTS: 1-2 master students (2 projects of 30-35 ECTS Credits). Due to the comparative nature of the thesis, a team of 2 students is recommended but not required.

Accessibility in rural municipalities (MSc)

PROJECT SUPERVISOR: Associate professor Michael Bruhn Barfod (mbba@dtu.dk)

PROJECT ADVISOR: Research Assistant Yannick Cornet (yancor@dtu.dk)

EXTERNAL ADVISORS: The project requires establishing contact with an interested suburban or rural municipality.

BACKGROUND: While larger cities are seeing dramatic changes towards more sustainable patterns of transportation in recent years, cardependency and its associated environmental costs remain largely unaddressed outside city centres, in suburbs and within rural municipalities. Geographic information systems (GIS) have been used in many settings to more accurately present accessibility measures. These include 30-min isochrones, walkability, bikability, but also housing & transportation affordability depending on location (see for e.g. <http://htaindex.cnt.org/>).

There is a need for systems of indicators to assess current situations, to guide decision-making, and to monitor progress towards a paradigm of sustainable transportation at rural level in Denmark. As transportation demand is tightly coupled to land-use planning, this project proposes a set of spatially disaggregated indicators of accessibility using (GIS), with a view on enabling a transition towards a sustainable transport paradigm.

PROJECT DESCRIPTION: You will demonstrate the feasibility of producing spatial indicators of accessibility and sustainable transportation at the required scales with data available publicly or at DTU. You will do this by performing a full iteration in the process of defining and selecting indicators, including testing acceptability with a test municipality (at minimum 1). Selected indicators should support existing sustainability goals (at municipal, regional, national or EU level).

PROJECT PURPOSE: To propose GIS-based indicators to represent and communicate accessibility and sustainable transportation for Danish municipalities based on existing goals and data.

PREREQUISITES: 13236 Sustainable Transport Assessment, 13235 Planning Theory or similar, GIS course.

NUMBER OF STUDENTS: 1-2 master students (2 projects of 30-35 ECTS Credits).

Enabling cycling in London (MSc)

PROJECT SUPERVISOR: Associate professor Michael Bruhn Barfod (mbba@dtu.dk)

PROJECT ADVISOR: Research Assistant Yannick Cornet (yancor@dtu.dk)

BACKGROUND: In 2014, Copenhagen achieved 45 % mode share for all trips to work or education, with a 50% goal for 2015. Part of this success is an explicit strategy to make cycling the preferred mode of transport for its residents. This is partly enabled by the provision of a network of 'cycle tracks' (protected cycle lanes) where automobile traffic speeds or volumes require it. This allows for a safe and pleasant cycling experience, thus attracting a wider range of users.

In comparison, London has set a 5% cycling mode share goal by 2026. Decisions to reprioritise the use of space to favour cycling is in fact a very difficult proposition in cities where car (or bus) use is deeply entrenched and supported by cultural habits, infrastructure and vested interests. "This won't work here" is a common barrier to implementing high levels of cycling provision as in Copenhagen.

There is a gap in decision-making support systems to unlock cycling investments on a large scale.

PROJECT DESCRIPTION: Can a cycling mode share of 50% be reached in a city like London? You will analyse current travel patterns and the potential for cycling in London, both quantitatively and qualitatively. This can include a survey-based approach, with one outcome being the categorisation of cyclists 'types' (e.g. Portland's study of 'Interested but concerned' cyclists). What are the main cultural barriers and path dependencies working against experimenting with high level of cycling provision in London? You will focus on analyzing recent debates and carry interviews with selected stakeholders to understand enablers and barriers for cycling in London.

PROJECT PURPOSE: To apply mixed quantitative and qualitative methods to understand in depth the contextual enablers and barriers for a major transition towards cycling in London.

PREREQUISITES: 13236 Sustainable Transport Assessment, 13235 Planning Theory or similar

NUMBER OF STUDENTS: 1-2 master students (2 projects of 30-35 ECTS Credits). Due to the mixed methods approach of the thesis, a team of 2 students is recommended but not required.

Mobility patterns in changing family forms (MSC)

ADVISOR: Senior Researcher Sonja Haustein (sonh@dtu.dk)

CO-ADVISOR: Senior Researcher Thomas Alexander Sick Nielsen (thnie@transport.dtu.dk)

BACKGROUND:

Since the middle of the 60's, Denmark and other European countries have experienced substantial changes in family forms. The middle-class ideal of the traditional family consisting of married parents and their own children have become less important. Alternative family forms, such as patchwork families, unmarried and same-sex partnerships with children, and single parent families are increasing. Today, every second 16-year old child in Copenhagen does not live together with both biological parents.

What consequences does this have for transport and what will be required from transport policies? The growing group of single parents are generally less likely to travel by car than parents in couples. But if they have a car they travel more than others. This indicates that single parents have mobility needs that are often not fulfilled – and the topic calls for further attention.

PROJECT DESCRIPTION:

The objective of the project is to study the mobility needs of single parents, in how far they manage their everyday without a car, and in how far some of their mobility needs remain unfulfilled. Singles are an important group of urban transport users and the results may give direction to urban policies aiming to support less car dependent lifestyles and sustainable mobility.

You will design and implement a study among 200 single parents and 200 “traditional” families. The questionnaire will include questions regarding the frequency of different fulfilled and unfulfilled activities, mode choice, and reasons for unfulfilled mobility wishes. In addition, car access, car attitudes, and perceived mobility needs resulting from children and work will be assessed as well as relevant background variables, esp. related to urban form and accessibility. The study will help to answer the question to what extent the mobility needs of single parents can be met satisfactorily without a car and whether they could serve as a role model for less car dependent lifestyles/car-free living based on their coping strategies.

PREREQUISITES:

- Basic knowledge of statistics, regression models, transport models.
- Interest in the sociological / psychological background of the topic.

NUMBER OF STUDENTS:

1 or 2 master students (30-35 ECTS).

TRANSPORT ECONOMICS



The households' location decisions

ADVISOR: Assistant Professor Ismir Mulalic (ismu@dtu.dk)

BACKGROUND:

Local wages, housing costs, and the cost of commuting (accessibility to employment and transport facilities) arguably represent the three most important economic determinants of the households' location decisions. Nevertheless, a recent literature has emphasized that household location choices are also affected by urban amenities. In this project the focus is on a housing market, i.e. the main objective is to identify determinants of the households' location decisions and to compute the marginal willingness to pay for them.

PROJECT DESCRIPTION:

The project should reveal the marginal willingness to pay for housing attributes (e.g. number of rooms, access to transport facilities) using a hedonic-model. Rosen (1974) pioneered the analysis of hedonic markets in a perfectly competitive setting and showed that the first derivative of the hedonic price function with respect to the individual attribute equals the marginal willingness to pay for this attribute. This project focuses on basic housing attributes.

PREREQUISITES:

Knowledge about statistics. Knowledge about microeconomics or urban economics or transportation economics, e.g. as in course 13150 Transport Economics.

LANGUAGE:

Danish or English.

NUMBER OF STUDENTS:

1-2 students.

Firm's relocating decision in Denmark

ADVISOR: Associate Professor Ismir Mulalic (ismu@dtu.dk)

BACKGROUND:

The Danish labour market is highly dynamic. Job mobility is the highest in Europe, i.e. average job duration is only 4.7 years (compared to an EU average of 8.2 years). At the same time, residential mobility rates are moderate and substantially less than for example in the UK and the US. The combination of an extremely high level of car taxation (the ad-valorem tax on new cars is 180 per cent), excellent access to the public transport (40 per cent of the population lives in the Copenhagen metropolitan area), the mild climate, and the flat country, implies that many workers commute relatively short distances predominantly using a bicycle or public transport (less than one third of the workers commute by car). For these workers, even small increases in distance (e.g. 1 kilometer) may increase commuting time non-negligibly. This suggests that change in commuting distance due to the firm relocation might be relevant for workers job mobility, transportation and finally for general welfare. Moreover, the set of relocating firms may not be random as firms differ in relocation propensities.

PROJECT DESCRIPTION:

We can only speculate why firms usually relocate. The objective of this project is to analyse this phenomenon. The central company register (CVR) will provide evidence on company locations and movements over time. Understanding relocation patterns is important because it can potentially reveal why many firms prefer to (agglomerate) locate near the larger urban areas and why some peripheral areas shrink.

The future location pattern of population and jobs is partly affected by infrastructure investments, but will also be one of the main determinants of future infrastructure and travel demand. The dynamics are complex but of highly important and thus a topic worthy of elaboration.

PREREQUISITES:

Knowledge about statistics. Knowledge about microeconomics or urban economics or transportation economics, e.g. as in course 13150 Transport Economics.

LANGUAGE:

Danish or English.

NUMBER OF STUDENTS:

1-2 students.

Car-ownership and residential location

ADVISOR: Associate Professor Ismir Mulalic (ismu@dtu.dk)

CO-ADVISOR: Associate Professor Stefan Mabit (smab@dtu.dk)

BACKGROUND:

European transport policies have focused on multimodality and the reduction or avoidance of car-dependent lifestyle as a means to make transport more effective and sustainable. This is difficult to achieve and requires additional knowledge on the drivers of car ownership decisions and car use.

It is well-known that high property prices force the households with lower incomes to settle in the suburbs where the supply of public transport is scarcer than in the Central Business District (CBD). This absence of an alternative to the car transport involves transport expenditures that increases with the distance from the CBD. Consequently, the least wealthy of car-dependent households living in rural areas would be more affected by an increase in car operating costs, e.g. Road User Charge (RUC). On the other hand, the relatively wealthier households may be affected more by an increase in car operating costs (e.g. RUC) because these (high income) households tend to own vehicles that are less energy efficient (i.e. larger vehicles with relatively more powerful engines). This project analyses household's car-ownership decision across households that differ by residential location.

PROJECT DESCRIPTION:

This project analyses car ownership decision focusing on similarities and difference between households in dense urban areas and households in rural areas. This is of interest because the effects of changes in the excise tax on car ownership, the fuel tax, and the tax imposed on public transport can have significantly different effects on the households' car ownership in rural and urban areas.

PREREQUISITES:

Knowledge about statistics. Knowledge about transportation economics, e.g. as in course 13150 Transport Economics.

LANGUAGE:

Danish or English.

NUMBER OF STUDENTS:

1-2 students.

CBA and the Wider Economic Benefits (MSc)

ADVISOR: Senior Researcher Ninette Pilegaard (nipi@dtu.dk)

BACKGROUND:

Cost-Benefit Analysis (CBA) is a policy assessment method that quantifies the value of policy consequences (usually called impacts) in monetary terms to all members of society. It is the standard method used for welfare economic assessment of public projects in Denmark and many other countries and it is performed on most large infrastructure project proposals in Denmark. There is a widespread debate about if and how the CBA ignores important economic benefits related to e.g. growth and location (wider economic benefits) caused by the improved transport infrastructure (e.g. the agglomeration economies).

PROJECT DESCRIPTION:

The objective of this project is to discuss the wider economic benefits related to a CBA. The project will seek to answer following questions. What are the wider economic benefits? Does a conventional CBA in Denmark account for these impacts? If not, how should they be included? Does it affect the overall conclusions of the conducted CBAs in Denmark?

PREREQUISITES:

Knowledge about microeconomics or/and transportation economics.

LANGUAGE:

Danish or English.

NUMBER OF STUDENTS:

1-2 students.

NB! A smaller version of the project can be aligned to suit both BSc and BEng student theses.

Transport Project Assessment in Denmark: CBA (MSc)

ADVISOR: Senior Researcher Ninette Pilegaard (nipp@dtu.dk)

BACKGROUND:

Cost-Benefit Analysis (CBA) is a policy assessment method that quantifies the value of policy consequences (usually called impacts) in monetary terms to all members of society. A CBA calculates net social benefits (NSB) for each policy alternative. The objective of the CBA is to help effective social decision making through efficient allocation of society's resources.

PROJECT DESCRIPTION:

The objective of this project is to discuss and/or apply CBA on a transport project. This can be done through scenario analyses of a transport project using existing Danish CBA practice. It is also possible to focus on the discussion of the accepted CBA practice in Denmark.

PREREQUISITES:

Knowledge about statistics and basic algebra. Knowledge about microeconomics or/and transportation economics can be useful.

LANGUAGE:

Danish or English.

NUMBER OF STUDENTS:

1-2 students.

NB! A smaller version of the project can be aligned to suit both BSc and BEng student theses.

TRAVEL BEHAVIOUR



Separate baner for offentlig transport: Optimering af sikkerhed, fremkommelighed og tilgængelighed (Diplomafgangsprojekt)

ADVISOR: Seniorforsker Mette Møller (mette@dtu.dk)

CO-ADVISOR: Lektor Jacob Kronbak (jakro@dtu.dk)

BACKGROUND:

Siden efteråret 2014 har der på udvalgte vejstrækninger i København været separate busbaner. Formålet med busbanerne er at sikre god fremkommelighed for offentlig transport uafhængigt af eventuel trængsel for den øvrige trafik. Separate busbaner er en vejteknisk løsning, der medfører ændringer i gadebilledet og trafikafviklingen og derfor stiller ændrede krav til trafikanternes adfærd, orientering osv. Foruden separate busbaner må det forventes at forekomsten af separate baner til offentlig trafik vil stige i fremtiden blandt andet i forbindelse med etablering af letbaner. På baggrund af udenlandske erfaringer (fx fra Holland og Tyskland) tyder det på, at optimering af sikkerhed, fremkommelighed og tilgængelighed for forskellige trafikanttyper er en fundamental udfordring i forbindelse med etablering af separate baner for offentlig transport i gadebilledet. Med henblik på at forbedre forudsætningerne for at optimere disse forhold i en dansk kontekst er der brug for større viden om trafikafviklingen i forbindelse med de eksisterende busbaner for forskellige trafikantgrupper ikke mindst potentielle (og eventuelt utilsigtede) konfliktpunkter og udfordringer med hensyn til tilgængelighed.

PROJECT DESCRIPTION:

Du vil i projektet arbejde i dybden med den vejtekniske udformning af busbaner, passagernes adfærd i forbindelse med benyttelse af de aktuelle busser, samt samspillet mellem busser, passagerer og den øvrige trafik. Endvidere vil det være relevant at inddrage internationale erfaringer i projektet. Projektet vil blive gennemført i samarbejde med relevante myndigheder. Dit mål vil være at kvalitetsvurdere de eksisterende busbaner som udgangspunkt for udarbejdelse af anbefalinger for kommende etablering af separate baner for offentlig trafik.

PREREQUISITES:

- Basic knowledge of statistics and surveys
- Interest in traffic and observation studies
- Interest in collaboration with stakeholders

NUMBER OF STUDENTS:

1 or 2 students.

Holiday travel behaviour

MAIN ADVISOR: Senior Researcher Linda Christensen, lich@dtu.dk

CO-ADVISOR: Associate Professor Stefan Mabit (smab@dtu.dk) and/or a teacher in statistical methods

BACKGROUND:

Long distance travel is a type of travelling which is much less investigated than the daily transport. However, mileage at long distance travel is comparable with daily travel and the growth rate has over a long year-span been much higher and - at least for Denmark - the pace does not seem to slow down. From both a transport and an environmental point of view the need for better knowledge is therefore substantial. DTU Transport has started to study long distance travel in the Drivers & Limits research project which was finished in spring 2014. This project pointed to several subjects which could be relevant to study more in depth.

The first descriptive analyses of long distance travel show that holiday travel is more uneven distributed in the population than daily travel. Some Danes travel for holiday several times a year while others are only travelling less than once a year. At the other hand nearly all adults have been at a holiday journey abroad for a week or more at least once during the last 10 years.

One of the questions which is important to gain more knowledge about is who are those who travel much and who are those who travel only little. From simple descriptive analyses of the data we know that people with higher income, people with long education, adults at the age of 55-75, and residents in the Copenhagen Region and especially in Central Copenhagen travel more than others. In the further research at the institute it is planned to analyse if there is a relation between the explaining factors, for instance if the higher travel level in Copenhagen is a result of higher income more than of geography.

From analyses of the daily travel activities according to the National Travel Survey (Transportvaneundersøgelsen, TU) we furthermore know, that residents in the central areas of the big cities travel less than residents in the suburbs and in smaller cities. An interesting question to ask is if those who travel only little in their daily activity travel more on holidays and for long weekend stays. In other words, if there is at the individual level a relation between high holiday travel activity and a low daily travel activity.

PROJECT DESCRIPTION:

In the project the student(s) should analyse the relation between daily and long distance travel when considering other explaining socio-economic variables.

DTU Transport carried out a survey about Dane's daily and long distance travel during one or two weeks in 2010 (the TU two-week survey) as part of the Drivers & Limits project. These data can be used to analyse the relation between daily and long distance travelling.

In 1998-2000 an older version of the TU questionnaire about daily travel was supplemented by a survey about trips longer than 100 km during the last month. These data could also be used.

PREREQUISITES:

A good knowledge of statistical methods, especially regression analyses is a prerequisite.

NUMBER OF STUDENTS:

1-2 students.

Electric vehicle ownership and use in Denmark

ADVISOR: Associate Professor Stefan Mabit (smab@dtu.dk)

CO-ADVISOR: Assistant Professor Anders Fjendbo (afjie@dtu.dk)

BACKGROUND:

Traffic growth makes the transport sector the main contributor to the growth in greenhouse gas (GHG) emissions in Europe. One approach to diminish GHG emissions is to induce consumers to buy climate- friendly alternative-fuel vehicles more frequently, for instance electric vehicles. But the electric vehicle has faced extreme difficulties in developing into a mass market product. This makes understanding the reasons why people do not buy electric vehicles important as it can clarify some of the barriers and help in defining the best policy to be applied. Another important aspect is to make reliable forecasting tools for the future demand for electric vehicles.

PROJECT DESCRIPTION:

The objective of this project is to analyse the demand for electric vehicles. This can be done through scenario analyses using existing models for car ownership and use or through development of a specific model for the demand for electric vehicles.

PREREQUISITES:

Knowledge about statistics. Knowledge about demand modelling, e.g. as in course 13135 Discrete Choice Models.

LANGUAGE:

English.

NUMBER OF STUDENTS:

1-2 students.

Car sharing in urban transport

ADVISOR: Senior researcher Sonja Haustein (sonh@dtu.dk)

CO-ADVISOR: Thomas Alexander Sick Nielsen (thnie@transport.dtu.dk)

BACKGROUND:

Car sharing provides membership or subscription based access to cars and thus supports car based mobility without ownership. Car sharing has been growing around the western world in the recent decades and is increasingly receiving the attention of car manufacturers as a means to approach new generations of consumers that are more urbanized and less likely to need or want to own their own car. In the Danish context car sharing providers like 'Letsgo' has been around for decades, but so called 'free floating' car sharing services (Car2go and DriveNow) are now also provided in Copenhagen. Car sharing may be a way to reduce the dependency on cars – while maintaining mobility – and freeing urban space from its occupancy with parked cars. However, little is known on how or to whom to offer car sharing to achieve these desirable outcomes – nor to what part of the urban population car sharing could be an attractive and viable option.

PROJECT DESCRIPTION:

You will collaborate with Letsgo or DriveNow to study the current uses of cars sharing and its outcomes. The research may include a survey to Car sharing members/users to get knowledge on the users profile and differences from other travellers, as well as their use patterns. You will advise the development of policy for Danish cities with respect to how and where car sharing should be supported by their policies.

PREREQUISITES:

- Basic knowledge of statistics and surveys
- Interest in governance and evaluations
- Interest in collaboration with stakeholders

NUMBER OF STUDENTS:

1 or 2 students.

Carpooling/ridesharing in Denmark

ADVISOR: Senior researcher Sonja Haustein (sonh@dtu.dk)

CO-ADVISOR: Thomas Alexander Sick Nielsen (thnie@transport.dtu.dk)

BACKGROUND:

Ridesharing has been one of the obvious solutions to the energy/sustainability crisis suggested for transport. Increasing the occupancy of vehicles increases the energy/environmental efficiency of transport. Principally the potential is enormous, but it has also proven very difficult to achieve. Increased emphasis on employer based mobility management has however increased its relevance as ridesharing is more obvious and accessible in this context – simultaneously web- and smartphone based communication has paved the way for an increasing coordination of ridesharing options- at least over longer travel distances. There is also a wide spread interest in the potentials of the ‘sharing economy’ of which ridesharing is a part. However, specifically how ridesharing is currently used in the Danish population – and which role the growing ridesharing platforms play is currently not known.

PROJECT DESCRIPTION:

You will collaborate with GoMore to study the users and the use of their ridesharing platform – and you will dig into available datasources such as the TU (Transportvaneundersøgelsen) to detail the current used of ridesharing in the Danish population as much as possible. The aim will be to answer the question of the role of ridesharing and whether ‘ridesharers’ are special people. How promising is ridesharing from the perspective of congestion or sustainable mobility – and how it should be treated in transport policy?

PREREQUISITES:

- Basic knowledge of statistics and surveys
- Interest in governance and evaluations
- Interest in collaboration with stakeholders

NUMBER OF STUDENTS:

1 or 2 students.

Car sharing vs. car ownership

ADVISOR: Associate professor Stefan Mabit (smab@dtu.dk)

BACKGROUND:

Car sharing poses an alternative to car ownership especially for households without private parking access or with low frequency of car use. Therefore car sharing could have a potential to dampen the future increase in car ownership. This makes it interesting to study the mechanisms that govern the choice between conventional car ownership and car sharing to answer why some households choose to participate in car sharing and how car sharing could become more suitable to a larger group of households.

PROJECT DESCRIPTION:

The objective of this project is to analyse the demand for car sharing and the potential of car sharing. Various methodologies could be applied to address these questions, e.g. a specific survey to consumers, demand modelling based on TU data, or other data sources collected from car sharing organisations.

PREREQUISITES:

Knowledge about statistics. Knowledge about demand modelling, e.g. as in course 13150 Transport Economics, 13135 Discrete Choice Models, or 13134 Advanced Transport Models.

LANGUAGE:

Danish or English

NUMBER OF STUDENTS:

1-2 students.

TRANSPORT PLANNING



Sustainable Decision Support: Sustainable transport and infrastructure planning (MSc)

PROJECT SUPERVISOR: Associate professor Michael Bruhn Barfod (mbba@dtu.dk)

PROJECT ADVISORS: (Depending on form and scope of the project): Research Assistant Yannick Cornet (yancor@dtu.dk), or Professor Steen Leleur (stle@dtu.dk)

BACKGROUND: There is a growing focus on sustainable transport planning in order to reduce CO2 emissions as well as congestion. This is a global focus which has to be dealt with locally, thus implying challenges in defining the main planning objectives.

PROJECT DESCRIPTION: The project can either take its starting point in a specific case of transport or infrastructural planning or in the development and testing of an assessment methodology. It should consider the different structural and sectorial frameworks related to the planning process and thereby approach the problem of defining and assessing sustainability within infrastructural planning, which so far remains unsolved.

PROJECT PURPOSE: The purposes of this (these) suggested project(s) are to clarify potential obstacles for the implementation and realization of a sustainable transport network as well as to present a possible assessment and evaluation method for advancing and encouraging sustainable development within transport and infrastructural planning.

PREREQUISITES: 13233/13833 Risk Analysis and Decision support, 13236 Sustainable Transport Assessment, 13235 Planning Theory or similar.

NUMBER OF STUDENTS: 1-2 master student s (2 projects of 30-35 ECTS Credits).

NB! A smaller version of the project can be aligned to suit both BSc and BEng student theses.

Transport Planning: Decision Support and Planning workshops (MSc)

PROJECT SUPERVISOR: Associate professor Michael Bruhn Barfod (mbba@dtu.dk)

PROJECT ADVISORS: (Depending on form and scope of the project): Professor Steen Leleur (stle@dtu.dk)

BACKGROUND: Tendencies in the transport sector has revealed a growing need for involving stakeholders more in the decision support process in order to capture all aspects of the of very complex decision problems. Planning workshops has been suggested to deal with this issue by gathering relevant stakeholders and decision makers with the purpose of generating a fruitful discussion to improve the final decision making.

PROJECT DESCRIPTION: Planning workshops consist of three main elements: group processes, decision analysis and information technology. The purpose is to link these three elements and use the best from each of them in the decision support process. The composition of such a workshop will, however, depend on the decision context, the participants' affiliations, the participants' level of power, and many other issues.

PROJECT PURPOSE: The purpose of this project is to test how the planning workshop concept can be used for real decision support. The implementation of the concept can be tested through a current running decision problem, where workshops e.g. can be held on different levels (citizens, municipality, regional, or organizational) to improve the actual decision support in form of more diverse and detailed information to the final decision makers.

PREREQUISITES: 13233/13833 Risk Analysis and Decision support, 13236 Sustainable Transport Assessment and 13235 Planning Theory.

NUMBER OF STUDENTS: 1-2 master students (2 projects of 30-35 ECTS Credits).

NB! A smaller version of the project can be aligned to suit both BSc and BEng student theses.

Transport Project Evaluation: Decision Support and Multi-Criteria Decision analysis (MSc)

PROJECT SUPERVISOR: Associate professor Michael Bruhn Barfod (mbba@dtu.dk)

PROJECT ADVISORS: Professor Steen Leleur (stle@dtu.dk)

BACKGROUND: Recent research has shown that conventional cost-benefit analysis is inadequate as a decision support tool for appraising transport infrastructure projects as it fails to capture criteria of a more strategic and qualitative character. Multi-criteria decision analysis (MCDA) can be applied to the appraisal scheme to deal with this issue.

PROJECT DESCRIPTION: Current research deals with the difficult task of identifying the most suitable decision aids for supplementing the cost-benefit analysis. Several MCDA techniques have been suggested suitable for decision making in the transport sector when dealing with selections among a limited number of alternatives. However, these techniques become inappropriate when dealing with large a number of alternatives and criteria such as in a screening phase.

PROJECT PURPOSE: The purpose of this project is to look into the possibilities of using outranking methods belonging to the so-called constructive MCDA approach. These methods are able to handle a large number of alternatives and criteria simultaneously using a sort of voting mechanism. The different methods can be applied to a suitable case study and the results can be benchmarked against the outcome of a conventional analysis.

PREREQUISITES: 13233/13833 Risk Analysis and Decision support or similar

NUMBER OF STUDENTS: 1-2 master students (2 projects of 30-35 ECTS Credits).

Integrating life-cycle assessment into transport cost-benefit analysis (MSc)

PROJECT SUPERVISOR: Associate professor Michael Bruhn Barfod (mbba@dtu.dk)

PROJECT ADVISORS: Post Doc Stefano Manzo (stman@dtu.dk)

BACKGROUND: Traditional transport cost-benefit analysis commonly ignores the indirect environmental impacts of a project deriving from the overall life-cycle of the different project components. Such indirect impacts are instead of key importance in order to assess the long-term sustainability of a transport project. In the present study we suggest to overcome this limit by combining life-cycle assessment approach with standard transport cost-benefit analysis.

PROJECT DESCRIPTION: Based on the outcome from the Brundtland report (UN, 1987), Holden et al. (2013) derived four main dimensions of sustainable development: satisfaction of human needs, intra- and intergenerational equity and long-term ecological sustainability. Having the latter dimension in mind, it can be argued that traditional transport project evaluation frameworks commonly fail to provide decision makers and stakeholders with a complete picture of the full environmental costs deriving from the implementation of transport projects. In fact, while direct environmental costs, such as air pollution from vehicles operation, are normally included in the project evaluations, indirect environmental costs, such as the energy and emissions associated with vehicle manufacturing, are usually not. The indirect environmental costs derive from the entire life-cycle of the project components and are commonly quantified in studies on sustainability through Life-Cycle Assessment (LCA) techniques.

PROJECT PURPOSE: The aim of the present study is to fill this gap by, first, outlining a framework combining LCA and CBA and, second, implementing a case study to compare the results from a standard CBA and the suggested framework. As first step, a tool developed to implement transport projects CBA will be applied and tested. Then, a case study e.g. referring to the planned construction in Frederikssund (Denmark) of a new road bridge across the Roskilde Fjord can be analysed.

The effects of the new infrastructure on the overall Danish transport system are then estimated by using the Danish National Transport Model (NTM), an activity-based model meant to establish a unified reference model for transport policy analyses and project evaluations in Denmark.

PREREQUISITES: 13233/13833 Risk Analysis and Decision support, Interest in Statistics and Stochastic simulation/Processes

NUMBER OF STUDENTS: 1-2 master students (2 projects of 30-35 ECTS Credits).

Cykelgader: hvad bidrager de med og hvornår kan de bruges?

ADVISOR: Lektor Jacob Kronbak (jakro@dtu.dk)

CO-ADVISOR: Seniorforsker Mette Møller (mette@dtu.dk) / Thomas Sick Nielsen

BACKGROUND:

I Danmark er såkaldte cykelgader etableret som forsøgsprojekter i Århus (Mejlgade), København (Vestergade), og Næstved (Jernbanegade). Cykelgader er forbeholdt cykler, men motorkøretøjer kan tillades – de skal så køre under særlig hensyntagen til cyklisterne. Det forventes at cykelgader fremover kommer til at indgå i vejregel bekendtgørelsen så muligheden for at etablere cykelgader generelt vil være til stede fremover. Århus Kommune satser i øjeblikket stort med omdannelse af bl.a. ringgaden til cykelgade. Dermed kommer cykelgader til at udgøre en væsentlig del af Århus cykelinfrastruktur. Forbilledet for de danske cykelgader er især brug af cykelgader i Holland og Belgien: Fietsstraat, samt Tyskland: Fahrradstraße. Endvidere er der lighedspunkter i forhold til de amerikanske 'Bicycle Boulevards' og Engelske 'Quietways'. Cykelgader kan være en billig måde at prioritere cykler på – eller en måde at prioritere på når der ikke er plads til egentlige cykelstier. Der mangler imidlertid viden om hvordan cyklisterne oplever cykelgader, hvordan trafikken fungerer i gaderne, samt hvor/hvornår cykelgader er en fornuftig løsning.

PROJECT DESCRIPTION:

Du vil i projektet arbejde med cykelgadernes funktion i byer hvor der er etableret cykelgader, samt brugernes oplevelse af trafik og service-niveau. Det vil være oplagt at samarbejde med kommuner der har cykelgader. Det kan også være oplagt at se på tyske erfaringer med cykelgader fordi mange tyske byer bruger cykelgader som en vigtig del af deres cykelstrategier/cykelnetværk. Dit mål vil være at kvalitetsvurdere cykelgader – evt. i forhold til andre typer af cykelinfrastruktur, samt rådgive om cykelgadernes fremtidige brug i Danmark.

PREREQUISITES:

- Basic knowledge of statistics and surveys
- Interest in traffic and observation studies
- Interest in collaboration with stakeholders

NUMBER OF STUDENTS:

1 or 2 students.

Bicycle parking – a hot topic in cycling promotion

ADVISOR: Associate Professor Michael Barfod (mbba@dtu.dk)

CO-ADVISOR: Thomas Sick Nielsen, Road Directorat

BACKGROUND:

Bicycle parking is currently in focus in the Danish cycling promotion efforts. There are several reasons for this:

First, given the objective to maintain and further promote cycling in Denmark considerations of service level and access conditions should include parking. Bicycle parking has been appointed as one of the main problems by the citizens of Amsterdam, but has received less attention in the Danish context. Poor parking conditions may deteriorate accessibility and accelerate conflicts with other road-users e.g. pedestrians, and retailers in city centers.

Second, if adequately managed cycling may increase the catchment of public transport services – while improved conditions for multimodal journeys may make cycling more frequent and attractive. One very practical way to achieve this may be improve parking (and access) conditions for bicycles at train stations.

PROJECT DESCRIPTION:

You will study the provision and use of bicycle parking in a city center context. A project can include benchmarking or assessment of the turnover and productivity of bicycle parking vs car parking. The objective will be to advice on the provision of parking facilities and how this may contribute to the fulfillment of societal and commercial objectives in a given area.

OR

You will study the provision and use of bicycle parking in train stations. A project may include observations of the users behavior, parking and un-parking detours and time use, as well as users perception of service levels and problems. The objective will be to advice on the provision of parking facilities in train stations.

PREREQUISITES:

- Basic knowledge of statistics and surveys
- Interest in traffic and observation studies
- Interest in collaboration with stakeholders

NUMBER OF STUDENTS:

1 or 2 students.

e-bike incident detection (MSc)

ADVISOR: Prof. Francisco Camara Pereira (camara@dtu.dk)

CO-ADVISOR: Senior Researcher Sonja Haustein (sonh@dtu.dk) and Senior Researcher Mette Møller (mette@dtu.dk)

BACKGROUND:

Electrically assisted bicycles (e-bikes) are becoming more common in many western countries. In Germany and Austria, every tenth new bike is an e-bike. In Denmark, e-bikes sales rose from 2% of new bikes sales in 2010 to 6% in 2014 and e-bikes were responsible for 2% of all bike trips made in 2014/2015 (TU, 2015). As e-bike use has increased the number of accidents involving them has also increased. Although the number of recorded e-bike accidents is still small, several studies based on accident statistics, emergency department data, naturalistic cycling data and surveys have also been conducted to study e-bikers' safety-relevant behaviour and accident involvement. Most studies conclude that riding on an e-bike is not related to a higher accident risk than riding on a conventional bike. It is though not clear if these results can be transferred to Denmark and more knowledge is required about the nature and frequency of (near) accidents on e-bikes in Denmark. Understanding this problem demands, in the first place, a systematic process to detect incidents related to e-bike usage. This process involves data collection of high resolution movement from bicycle trips, and an algorithm that detects, in this data, when those incidents have occurred. The results will support a future detailed study of the risk factors in e-bike and regular bikes.

PROJECT DESCRIPTION:

This project will consist of three stages:

- Development/configuration of an app to collect accelerometer and GPS data. In principle, this shall rely on currently available software;
- Run a small scale survey, possibly with a convenient sample based on the student's social network, to collect (e-)bicycle trip data. In this data, cyclist will label where and at what time a dangerous situation appeared;
- Apply data mining techniques to train and evaluate an automated "dangerous situation" detector from the data. Depending on the student skills and interest, these data mining techniques may rely on available software (e.g. Weka, STATA, SPSS) or be implemented from scratch.

PREREQUISITES:

We accept two different student profiles:

Profile 1:

- Non-proficient in programming skills (only basic experience in Java, Python, R or Matlab) or data mining
- Good knowledge of statistics
- Good knowledge of survey design
- Interest in interdisciplinary cooperation

Profile 2:

- Non-proficient in survey design
- Good knowledge in programming skills and data mining or machine learning
- Interest in interdisciplinary cooperation

NUMBER OF STUDENTS:

1 or 2 master students.

TRANSPORT OPTIMISATION AND TRANSPORT LOGISTICS



Using (Commercial) Solvers for a Large Scale Neighbourhood search

ADVISOR: Professor Allan Larsen, alar@dtu.dk

CO-ADVISOR: Assistant Professor Rune Larsen, ruar@dtu.dk

BACKGROUND:

Some engineers insist on trying to solve transport problems to optimality while others focus on using heuristics to solve the problems that still cannot be solved to optimality. Large scale neighbourhood search is a vibrant research field where the practitioners of the second approach use methods developed by the former to their advantage.

THE PROJECT:

A transport problem is agreed upon with the supervisor. Some of the best projects come from students that have themselves found a proposal for a problem from a company, though this is by no means mandatory.

A model/method is developed for solving parts of the overall problem using a (commercial) solver. Then code is designed to extract these subproblems from a solution to the problem, and the subproblem reoptimization is applied iteratively, each time potentially improving the solution to the overall problem.

Results are then analysed and if possible compared to existing methods for solving the problem.

LEVEL:

Best for MSc, but could be adapted for good students

PREREQUISITES:

Any programming course using Java, c++ or similar.

A relevant supporting course (Heuristics etc.) is preferred.

NUMBER OF STUDENTS:

1 preferred, potentially 2 if agreed upon.

Routing and Locating Problems for Electrical Vehicles

ADVISOR: Professor Allan Larsen (alar@dtu.dk)

BACKGROUND:

Have you noticed a recently growing market of electrical vehicle? Have you seen how popular Tesla cars are worldwide? Yes, the electrical vehicle is approaching to us. The environmental concerns have generated a renewed interest in electrical vehicles.

Electrical vehicles are more environment-friendly than traditional vehicles and emit much less CO₂ and almost no air pollutants, but they do have an obvious drawback: limited driving range due to the low density of their batteries. It is therefore important to take this into consideration and overcome this barrier when the electrical vehicles are put into use in practice. A project regarding this topic is ongoing in the department with real-life data and scenarios.

PROJECT DESCRIPTION: A selection of student projects can be considered within the field, including:

- a) Location of recharging stations. Given a traffic flow, where should recharge stations be located in order to maximize the flow covered by a prefixed number of stations, or to minimize the number of stations needed to cover the entire traffic flows?
- b) Routing of electric vehicles. Given the locations of replenishment stations and a number of customers to be served, how do we route vehicles, and when and where should the vehicles be recharged such that the entire transportation cost is minimized?
- c) Scheduling of electric busses. Given a timetable, how shall we schedule electric and conventional busses to maximize use of electric busses or minimize cost?
- d) Combined routing and location problem. Given a number of trip chains and potential locations for the stations, how shall we locate the stations and how to refuel the trip chains such that the amount of traffic flow covered is maximized?
- e) Other transport optimization considering characteristics of electric vehicles.

The goal of the project is to develop algorithms for solving one of these problems, to test the algorithms on the TU (The Danish Transportation Behavior Study) data and to analyze the results. Possible solution methods include: a) formulating the MIP model and solving it in OPL; and b) developing a metaheuristic or exact method (e.g. branch-and-price) and implementing it in C++, Java or C#.

PREREQUISITES:

Mathematical modelling; programming experience in C++, Java or C# could be useful.

NUMBER OF STUDENTS:

1-2 students.

Matheuristics for the Capacitated Vehicle Routing Problem

ADVISORS: Professor Allan Larsen (alar@dtu.dk)

BACKGROUND:

Matheuristics are optimization algorithms made by interoperation of metaheuristics and mathematical programming (MP) techniques. It has been successfully applied on solving several types of combinatorial optimization problems, and has become more and more popular in recent years.

PROJECT DESCRIPTION:

This goal of this project is to develop a matheuristic for solving the capacitated vehicle routing problem. In this method, the neighborhood search is guided by metaheuristic, such as simulated annealing and large neighborhood search. The search of a good neighboring solution can be formulated as a mixed integer programming model and solved by optimization software such as OPL/CPLEX.

PREREQUISITES:

Course 13442, Vehicle Routing and Distribution Planning.

Mathematical modelling skills; programming experience in C++, Java or C# could be useful.

NUMBER OF STUDENTS:

1-2 students.

Optimization of city logistics (MSc)

ADVISOR: Professor Allan Larsen, alar@dtu.dk

CO-ADVISOR: Assistant Professor Rune Larsen, rular@dtu.dk

PROJECT BACKGROUND

In the recent years city logistics has become a popular area of research. The idea is to consolidate goods outside the city center, and having them delivered by a single operator. By consolidating, the traffic in the city center can be minimized thus mitigating the congestion, the environment, saving expenses. To make this viable the city logistics company ultimately needs to provide a better service. The Netherlands and Denmark have both had pilot projects running and DTU Transport is heavily involved, but research is needed to accommodate the special requirements such services will have to fulfil.

PROJECT DESCRIPTION

You will be working with a vehicle routing problem with special side constraints and possibly stochastic elements added. The exact specification of the problem will be done in collaboration with the student in order to take advantage of the student's interests as well as competences.

The task will be to create a local search algorithm that accommodates the special requirements of the problem.

Feel free to suggest spin-offs on this project proposal.

PREREQUISITES:

Any programming course using Java, c++ or similar.

Experience with local search heuristics.

If you want to include stochasticity or dynamism you will benefit heavily from 13436/13437 Optimisation of operational transport systems.

NUMBER OF STUDENTS

1-2 students.

NB! A smaller version of the project can be aligned to suit both BSc and BEng Student theses.

Dynamic transport problems with simulated lookahead (MSc)

ADVISOR: Professor Allan Larsen, alar@dtu.dk

CO-ADVISOR: Assistant Professor Rune Larsen, rular@dtu.dk

PROJECT BACKGROUND

Solving a static vehicle routing problem for a real life company is often just the first step towards having a commercially viable product. During the execution of a solution, disruptions and delays will happen. Incorporating these into the solution is a hard problem that needs to be solved in a very short time frame. Furthermore any re-optimisation is subject to constraints on what can be re-optimised based on what events have already occurred.

By using simulations, some of these problems can be detected ahead of time while more remedial measures are available.

PROJECT DESCRIPTION

You will use simulation tools to predict potential problems, and heuristically evaluate remedial measures ahead of time. The simulation can either be done using tools provided by the co-advisor or by using Rockwell Arena.

An example of this could be: You detect that simulations indicate that your solution will miss a time window in 50% of your simulations => You re-optimize your solution specifically to make that visit be served earlier.

The exact project task will be decided in collaboration with the student.

Feel free to suggest spin-offs on this project proposal.

PREREQUISITES

Any programming course using Java, c++ or similar.

If Arena is going to be used, you need to have taken 13400 Simulation in Transportation and Logistics.
13436/13437 Optimisation of operational transport systems.

NUMBER OF STUDENTS

1-2 master students.

NB! A smaller version of the project can be aligned to suit both BSc and BEng Student theses.

Optimization of Offshore Wind Farm Maintenance & Operations Planning (MSc)

PROJECT SUPERVISOR: Associate Professor Dario Pacino (darpa@dtu.dk)

PROJECT ADVISOR: Assistant Professor Rune Larsen (rular@dtu.dk)

BACKGROUND:

Wind energy is a growing industry that plays an important role in the search for sustainable energy sources. The industry is currently focusing on offshore installations, which are more flexible and have better throughputs. The energy market is, however, highly competitive and there is a need for reducing the costs in order to provide a competitive product.

PROJECT DESCRIPTION:

Maintenance at offshore wind farms is done via vessels. The transport costs are high and therefore present a clear opportunity for the application of optimization techniques. Costs are, however, not the only concern. CO2 emissions from the maintenance vessels also need to be reduced and the same goes for the risk of accidents due to rough sea conditions.

The project(s) can go in different directions:

- Dynamic routing or scheduling of the vessel taking into account disruptions.
- Long term planning with/without stochastic considerations of predicted disruptions and/or weather conditions.
- Risk assessment and route planning for better safety.

POSSIBLE SPIN-OFFS:

A new optimization area is the coordination and logistic planning between the factories building windmills parts and the ports storing and shipping them. Interested students will be asked to do a preliminary study in collaboration with relevant companies and Dansk Industri (DI). The thesis will then be based on the concrete case study found during the preliminary research.

PREREQUISITES:

Independent on the project variant courses on Linear and Integer Programming are a must (e.g. 13432, 13442, 42114).

NUMBER OF STUDENTS:

1-2 master students (projects of 30-35 ECTS Credits).

NB! A smaller version of the project can be aligned to suit both BSc and BEng student theses.

Consistency in Vehicle Routing (MSc)

MAIN-ADVISOR: Professor Stefan Røpke (ropke@dtu.dk)

BACKGROUND:

The algorithms used to plan the distribution of goods are usually aimed at minimizing the total transportation costs. Nonetheless, competitive industries (e.g., small package delivery industries) need more customer-oriented distribution plans, where the primary goal is still to minimize the distribution costs but while satisfying specific customer needs, such as being always visited at the same time or by the same driver. Such distribution plans are defined consistent. In the literature and in commercial packages, few algorithms tailored for Consistent Vehicle Routing Problems (ConVRPs) have been developed.

PROJECT DESCRIPTION:

The goal of this thesis is to develop algorithms to solve ConVRPs. Possible solutions methods can be Iterated Local Search, Tabu Search, Variable Neighborhood Search, Large Neighborhood Search, or Genetic Algorithms. The developed algorithms should be tested on real-life instances, instances from the literature, and new instances.

PREREQUISITES:

13442 Vehicle Routing and Distribution Planning; Programming experience in C++ or similar language.

NUMBER OF STUDENTS:

1-2 students.

Real-Life Arc Routing Problems (MSc)

MAIN-ADVISORS: Professor Allan Larsen (alar@dtu.dk)

BACKGROUND:

Arc Routing Problems (ARPs) differ from well-known Vehicle Routing Problems (VRPs) because the focus is on traversing edges/arcs instead of visiting nodes. The importance of ARPs comes from the wide variety of real-life applications that they model, such as Street Sweeping, Snow Plowing, Garbage Collection, Mail Delivery, Salt Spreading, etc. Many ARPs could be in principle transformed into VRPs and solved with some of the many exact or heuristic algorithms proposed in the literature for the VRPs. Nonetheless, such an approach does not lead to high-quality solutions in most of the cases, so specialized algorithms are necessary to address ARPs.

PROJECT DESCRIPTION:

The Municipality of Copenhagen is to solve complex ARPs on a daily basis. The goal of this thesis is to model one of these problems and implement a proper solution method. Possible solutions methods can be Iterated Local Search, Tabu Search, Variable Neighborhood Search, Large Neighborhood Search, or Genetic Algorithms. The developed algorithms will be tested on real-life instances provided by the Municipality and on well-known instances from the literature.

PREREQUISITES:

Programming experience in C/C++/C#/Java.

NUMBER OF STUDENTS:

1-2 students.

Open Problems in Dynamic Vehicle Routing (MSc)

ADVISOR: Professor Harilaos N. Psaraftis (hnpсар@dtu.dk)

BACKGROUND:

Dynamic vehicle routing problems (DVPRs) are defined as vehicle routing problems in which problem inputs are received and updated concurrently with the execution of the route. Such problems find applications in many transport contexts, such as city logistics, dial-a-ride systems, courier services and others. DVPRs may or may not involve stochasticity in the input data. Research in this area has grown strongly over the years and many methods and techniques have been developed. A recent survey paper has surveyed more than 100 papers and developed a taxonomy for this class of problems according to 11 criteria. Numerous open problems that merit investigation have been identified.

PROJECT DESCRIPTION:

A thesis in this area will investigate one or more of the open problems in this area. These include further analyzing the “Dynamic Travelling Salesman Problem”, analyzing of the worst case or average performance of heuristic algorithms, including vehicle speed as a decision variable, looking at environmental criteria, exploring alternative objective functions, better exploiting ICT technologies and modifying known approaches so as to obtain better solutions.

PREREQUISITES:

Knowledge of a programming language (C++, Java, or other).

TEN-Ts: Assessment of shipper needs in relation to multimodal transport services in Scandinavia (MSc)

ADVISORS: Professor Harilaos N. Psaraftis (hnpasar@dtu.dk); PostDoc George Panagakos (geopan@dtu.dk)

BACKGROUND:

Rising environmental awareness and increasing transport demand render the search for alternatives to road freight transport even more important. One main option is intermodal transport that involves the environmentally friendlier rail and waterborne transport modes for long-hauling. The use of standardized load units, such as standard shipping containers, swap-bodies or trailers that can be easily transshipped between transport modes is the key enabler of intermodal transportation.

However, although this concept is not new, its market penetration has been slower than expected. A number of obstacles preventing the use of intermodal transport have been identified, including: the need for cargo consolidation imposed by the train and ship sizes, the lower than truck flexibility in terms of areal coverage, the longer transport time requirements of combined transport arrangements, their lower reliability especially when crossing national borders, and the lack of knowledge in intermodal transport solutions from the side of the freight forwarders.

The emphasis placed by the new EU transport policy on TEN-T Core Network Corridors, Rail Freight Corridors and Motorways of the Sea creates the need to revisit this issue and try to acquire a better understanding of the shippers' decision making when selecting transport solutions.

PROJECT DESCRIPTION:

The main objective of this project is to identify and assess the shipper needs in relation to multimodal transport services in Scandinavia, and propose solutions and practical measures that address these issues. More specifically, it will include the following activities:

- Search for existing publications on shippers' requirements in the Scandinavian countries but also elsewhere;
- Identification of major shippers and relevant associations in this region;
- Solicitation of their views in relation to multimodal transport solutions through a questionnaire and direct interviews if needed;
- Suggestion of practical measures that address the identified problems; and
- Drafting of a report summarizing the output of the thesis.

PREREQUISITES:

Permission of advisor, or 42884 Green transport logistics.

A cost benefit analysis of green ports agendas (MSc)

ADVISORS: Professor Harilaos N. Psaraftis (hnpсар@dtu.dk); PostDoc Thalís Zís (tzis@dtu.dk)

BACKGROUND:

Regulatory bodies and port authorities have been developing green agendas that seek to reduce shipping emissions in areas near ports. This can be achieved through the use of clean fuel and technologies, as well as through changing the operating patterns of the vessels near the port and specifically reducing sailing speed. While emissions per vessel call are reduced through compliance to such programs, there may be time penalties and increased operating costs for ships.

PROJECT DESCRIPTION:

This project considers the emissions reduction potential of various policies deployed in green agendas of port authorities. The implications of a complying decision to the ship costs need to be identified (e.g. costs due to delays, technological investments, increased fuel consumption) and compared with the emissions reduced at the port. The option of a convincing monetary incentive provided by the port authority to the ship operator will be considered. It is expected that the value of the incentive will influence the ship operator's decision to participate or not in the proposed emissions reduction measure.

The objective of this project are to enhance an existing model that predicts emissions savings from port authority programs with a cost benefit analysis that minimizes the cost per abated ton of pollutant emissions near the port. The decision variables in the proposed optimization problem will depend on the examined policies during the project.

PREREQUISITES:

At least one of the following:

42885 Maritime logistics, 42884 Green transport logistics.

Programming experience in C#, VBA or similar language.

Traffic signal optimisation

ADVISORS: Professor Allan Larsen (alar@dtu.dk)

BACKGROUND:

In busy cities, traffic signal plays an important role to regulate the traffic and make sure of travel safety, but can also cause traffic jam and lengthen the travel time significantly if it is not designed properly. Traffic signal optimisation can reduce in town travel time by 30%.

Green wave is one of popular ideas to optimise the traffic signal and is currently in parts of Denmark for emergency vehicles. It can be understood as a continuous traffic flow passing several intersections without being stopped by the red lights.

PROJECT DESCRIPTION:

In this project, the student(s) should learn how to use TRANSYT and VISSIM to optimise traffic signals. Traffic signal control is a very complicated topic. The student(s) in this project is required to use the simulation software to optimise the traffic lights for a small but busy area in the city. The data can be either generated to approximate the statistics or recorded from real life. Different optimisation objectives will be considered, e.g. travel time and fuel cost. It is also expected that the student(s) does a literature survey of traffic signal optimization to get a good overview of topic.

PREREQUISITES:

Experience in using simulation tool could be useful but not necessary.

Course 13450, Intelligent Transport systems—Modelling and Analysis, could be useful but not necessary.

NUMBER OF STUDENTS:

1-2 students.

THEME

PUBLIC TRANSPORT



Effekt af anvendelse af algoritmer i interaktiv planlægning og disponering af ressourcer (Busser og chauffører)

ADVISOR: Professor Allan Larsen alar@dtu.dk

CO-ADVISOR: Jens Bisballe jens@bisballe.dk

BACKGROUND:

Et af Movias nyeste operatørselskaber er Anchersen ApS, der kører knapt 60 busser med ca. 200 chauffører i det sydlige Københavnsområde. Planlægningen og den daglige disponering udføres af erfarne medarbejdere, under anvendelse af et IT-værktøj, BusPlan, der i det væsentlige er et grafisk og i nogen grad konsekvensberegneende administrativt system.

PROJECT DESCRIPTION:

Det ønskes undersøgt ved studier af de gældende planer, hvilke fordele (økonomiske og andre), der kunne have været, ved at anvende algoritmer i tilknytning til den interaktive planlægning. Vil man fremover kunne opnå bedre resultater og i givet fald hvor meget bedre, ved at introducere algoritmer? Hvilke planlægnings- og disponeringsprocesser med tilhørende typer af værktøjer bør der anvendes?

LANGUAGE:

Dansk p.gr. af samarbejdet med Anchersen A/S.

Separate baner for offentlig transport: Optimering af sikkerhed, fremkommelighed og tilgængelighed

ADVISOR: Seniorforsker Mette Møller (mette@dtu.dk)

CO-ADVISOR: Thomas Sick Nielsen/Lektor Jacob Kronbak (jakro@dtu.dk)

BACKGROUND:

Siden efteråret 2014 har der på udvalgte vejstrækninger i København været separate busbaner. Formålet med busbanerne er at sikre god fremkommelighed for offentlig transport uafhængigt af eventuel trængsel for den øvrige trafik. Separate busbaner er en vejteknisk løsning, der medfører ændringer i gadebilledet og trafikafviklingen og derfor stiller ændrede krav til trafikanternes adfærd, orientering osv. Foruden separate busbaner må det forventes at forekomsten af separate baner til offentlig trafik vil stige i fremtiden blandt andet i forbindelse med etablering af letbaner. På baggrund af udenlandske erfaringer (fx fra Holland og Tyskland) tyder det på, at optimering af sikkerhed, fremkommelighed og tilgængelighed for forskellige trafikanttyper er en fundamental udfordring i forbindelse med etablering af separate baner for offentlig transport i gadebilledet. Med henblik på at forbedre forudsætningerne for at optimere disse forhold i en dansk kontekst er der brug for større viden om trafikafviklingen i forbindelse med de eksisterende busbaner for forskellige trafikantgrupper ikke mindst potentielle (og eventuelt utilsigtede) konfliktpunkter og udfordringer med hensyn til tilgængelighed.

PROJECT DESCRIPTION:

Du vil i projektet arbejde i dybden med den vejtekniske udformning af busbaner, passagernes adfærd i forbindelse med benyttelse af de aktuelle busser, samt samspillet mellem busser, passagerer og den øvrige trafik. Endvidere vil det være relevant at inddrage internationale erfaringer i projektet. Projektet vil blive gennemført i samarbejde med relevante myndigheder. Dit mål vil være at kvalitetsvurdere de eksisterende busbaner som udgangspunkt for udarbejdelse af anbefalinger for kommende etablering af separate baner for offentlig trafik.

PREREQUISITES:

- Basic knowledge of statistics and surveys
- Interest in traffic and observation studies
- Interest in collaboration with stakeholders

NUMBER OF STUDENTS:

1 or 2 students.

How has the new BRT line from Nørreport to Ryparken “Den kvikke vej” been received by the users?

ADVISOR: Senior Researcher Sonja Haustein (sonh@dtu.dk)

CO-ADVISOR: Thomas Alexander Sick Nielsen (thnie@transport.dtu.dk)

BACKGROUND:

The route Nørre Alle-Tagensvej is a main corridor carrying traffic from the suburbs north of Copenhagen towards the city center. Managing congestion in the corridor, while sustaining attractive accessibility for public transport, bicycles and pedestrians is a key challenge. Prioritization of busses by bus-lanes has been in place since the 1970s but not always effective due to congestion and the lack of separation from other vehicle lanes. In connection with the plans for redevelopment of the University of Copenhagen's northern campus into a university city the city of Copenhagen and MOVIA have developed the route into a full BRT corridor with curb separated bus lanes in the middle of the road and significant bus stations on the route. The new BRT line opened in September 2014. Objectives have been to improve services (reliability and travel speeds) and influence mode choice to/from the university city: Northern campus of the university of Copenhagen and the national hospital – by providing a new high grade 'leg' in the public transport system.

PROJECT DESCRIPTION:

You will collaborate with the City of Copenhagen and MOVIA to develop an evaluation of the user experiences of the service offered by the new BRT line. The evaluation may be based on either students and staff in the northern university campus - or bus passengers in the corridor. Important topics will be to what a degree the service changes are acknowledged and appreciated by customers and to what a degree the BRT has been able to attract new passengers. Has the project been successful in these respects, what elements are most important/critical, and what lessons can be drawn for future applications of the BRT concept in the Danish context?

PREREQUISITES:

- Basic knowledge of statistics, regression models
- Interest in governance and evaluations
- Interest in collaboration with cities

NUMBER OF STUDENTS:

1 or 2 students.

Model Structures for Transport Service Mode Choice (MSc)

ADVISORS: Associate Professor Steven Harrod (stehar@dtu.dk)

BACKGROUND:

Transport services are most often determined by history and legacy decisions, but occasionally major urban and property developments present opportunities for “zero based” planning of transport systems. Further, for long term policy planning, it would be informative to have a benchmark “ideal” transport system for reference to the existing transport system. Very often, after the decision is made to provide public transport, a debate begins over what mode should be used to provide transport: rail (and multiple types of rail), bus, and sometimes even water or bicycle. The debate is clouded by conflicting claims of cost and quality or form of transport service, and by advances in technology that make prior assumptions of mode choice obsolete.

PROJECT DESCRIPTION:

In this project, students will compose, validate, and demonstrate planning and cost calculation methods for a transport service between two or more stations or stops. The thesis deliverable will be a planning guide for transport system construction and operation cost, and measures of service quality, for a given mode choice. The reader of this planning guide should be able to select a transport mode, and calculate construction cost, annual operating cost, and describe transport service characteristics (travel time, ride quality, punctuality), for a given set of destinations and traffic demands. The planning guide should provide general cost information for the current year.

The project tasks should include:

- 1) Literature survey on transport system selection, design, and pricing.
- 2) Documentation and reference data for multiple transport modes in the current year, covering:
 - a. Intercity rail, suburban rail (S-tog), “heavy rail”, “light rail”, bus rapid transit, common bus, and “people mover”.
 - b. Cost and time frame for system construction, per stop and per kilometre of route.
 - c. Operating costs, expressed separately as fixed overhead and per departure cost.
 - d. Service quality, expressed as trip time, ride quality (vibration, acceleration), and punctuality.
- 3) Provide a case study example of application of the planning tool on a real or hypothetical service.

PREREQUISITES:

Knowledge of design and construction of transport systems is highly desirable. Experience with transport pricing and finance is useful but not necessary.

NUMBER OF STUDENTS:

1-2 students.

Operational and Economic Impact of Free Cycle Policy on S-Tog

ADVISOR: Associate Professor Steven Harrod (stehar@dtu.dk)

BACKGROUND:

Bicycles have been allowed free carriage on the DSB S-Tog (the Copenhagen suburban train system) since January, 2010. The policy has been immensely popular, resulting in crowding, and in 2014, significant investment in capacity expansion for bicycles. The policy is clearly not free. Bicycles occupy more space than a passenger alone. Also, bicycle traffic is more variable, as bicyclists change their train habits according to the weather.

PROJECT DESCRIPTION:

In this project, students will evaluate the historical and economic record of the S-Tog cycle policy. The students should create a detailed report that considers the following questions: What is the direct financial cost of offering free bicycle carriage? What is the cost of configuring trains to offer the service? What is the operating cost per passenger-kilometre? What are the indirect costs, such as additional train delays, and lost revenue from non-cycle passengers? Has the policy generated additional revenue proportional to the service cost?

How has the policy changed passenger travel patterns in the Copenhagen area? Have riders changed from auto to bike-train? Has the policy made some residential areas more attractive (increased property values)?

The project tasks should include:

- 1) Survey on cycle policy on rail transit in Copenhagen, and at least three other major cities.
- 2) Documentation of operating, financial, and passenger statistics since 2000 (before and after the change).
- 3) Impact analysis of the policy.
- 4) Recommendations on what conditions make a free train cycle policy appropriate for a transit network.

PREREQUISITES:

General knowledge of the cost structure and operations of rail transit is desirable. Experience with passenger transport demand and route choice is useful but may be learned during the project.

NUMBER OF STUDENTS:

1-2 students.

Line planning of Intercity and regional trains (in collaboration with DSB) (MSC)

PROJECT SUPERVISOR: Associate Professor Steven Harrod (stehar@dtu.dk)

PROJECT ADVISOR: Professor Stefan Røpke (røpke@dtu.dk)

EXTERNAL ADVISOR: Analyst Esben Linde, DSB (esli@dsb.dk)

or

PROJECT SUPERVISOR: Professor Jesper Larsen (jesla@dtu.dk)

EXTERNAL ADVISOR: Richard Lusby, DSB

BACKGROUND:

Planning of train operations is a complex task. The aim is generally to deliver the best possible service to passengers while abiding infrastructure and rolling stock constraints, as well as minimizing operational costs. Traditionally the planning process of train operations are divided into several sub-problems, whereas the line planning problem consists of choosing a set of lines with a given set of stops and determining the frequency. This is not a trivial task, as objectives are contradicting and the problem is highly constrained, especially when seeking to solve realistic size problems. Hence planning of train operations today rely heavily on improving existing plans and experience of planners.

PROJECT DESCRIPTION:

The aim of this Thesis is to analyze the literature within line planning and apply the theory to the real-life case of intercity and regional trains in Denmark or a subset hereof. DSB has experience with exact solution approaches from an operations oriented angle as well as passengers; however, heuristics could prove very suitable, especially when taking a passenger oriented approach.

Please feel free to contact DSB with your own ideas within planning of train operations.

Distribution of running time supplement for long distance trains (in collaboration with DSB) (MSC)

PROJECT SUPERVISOR: Associate Professor Steven Harrod (stehar@dtu.dk)

PROJECT ADVISOR: Professor Stefan Røpke (røpke@dtu.dk)

EXTERNAL ADVISOR: Analyst Esben Linde, DSB (esli@dsb.dk)

or

PROJECT SUPERVISOR: Professor Jesper Larsen (jeslar@dtu.dk)

EXTERNAL ADVISOR: Richard Lusby, DSB

BACKGROUND:

Robustness of railway operations is a very complex matter and a wide variety of causes can lead to disruptions. Punctuality is the most widely used measure of robustness, which is the percentage of trains on time. A timetable is commonly made robust by adding time supplements to the minimal train running time. Hence, there is a trade-off between timetable robustness and efficiency, which is referred to as the 'price of robustness'. The right amount of running time supplement can be a very difficult task to determine and in practice, a percentage of the running time is added as supplement. However, the literature suggests that this might be far from the best approach.

PROJECT DESCRIPTION:

The aim of this Thesis is to analyze the literature within robustness and running time supplement and apply the theory to the real-life case of intercity and regional trains in Denmark or a subset hereof. Several solution approaches might be undertaken, whereas heuristics and simulation could be considered.

Please feel free to contact DSB with your own ideas within planning of train operations.

Robust Rolling Stock Rescheduling

PROJECT SUPERVISOR: To be decided

CO-ADVISOR: Assistant Professor Evelien van der Hurk (evdh@dtu.dk)

Do you have another idea? You are always welcome to discuss!

BACKGROUND:

Major disruptions happen every day. Defect trains and infrastructure may cause a track section to be closed for several hours. As a result, trains cannot run according to plan anymore. Thus, to provide the best service to passengers, the operator needs to reschedule the rolling stock fast. Doing this well is even more difficult as the duration of the disruption is often uncertain.

THE PROJECT:

In this project you are going to develop, implement, and test, your own model for robust rolling stock rescheduling based on a case study. You are going to define the targets of what a good schedule should be. You select the parameters you find important: e.g. passenger service level, operating costs, number of cancelled trips, end of day balances. Moreover, you decide on the type of 'robustness' you want to measure your model on: e.g. average performance, worst case performance, ability to find feasible solutions, or ability to find solutions fast. Together they will define the success of your model.

First you will start with a (brief) literature study of the previous rolling stock models that have been developed, with a specific focus on robust rolling stock models. Also (if you are not yet) you will familiarize yourself with the basic concepts of robust optimization. Next you can choose to either extend the rolling-horizon approach, extend the two-stage decision approach, or develop a completely new approach.

If you are capable of programming in Java and interested in working based on a set of case studies from Netherlands Railways, some code could be provided to you as a starting point. You are however free to set up your own experiments and code. DSB case studies may also be an option.

PREREQUISITES:

Programming experience, preferably 13436 Optimizing af operationelle transportsystemer and/or 13250 Optimization of Public Transport.

LEVEL:

Best suited to a MSc thesis, but may be tailored for smaller projects.

NUMBER OF STUDENTS:

1 preferred, potentially 2 if agreed upon.

Guiding Passengers during disruptions

PROJECT SUPERVISOR: To be decided

CO-ADVISOR: Assistant Professor Evelien van der Hurk (evdh@dtu.dk)

Do you have another idea? You are always welcome to discuss!

BACKGROUND:

Ever stood on a station, and heard your train was cancelled? During major disruptions, many passengers wonder what to do. Especially in crowded networks, the 'rejseplaner' (journeyplanner) may not provide sufficient information: maybe there is not sufficient space for you to board the next train on the fastest detour route it recommends, and you are better off taking a slightly longer route. Choosing the best route is thus difficult, as it also depends on the route choice of other passengers. Previous research has shown that indeed providing personal route advice to passengers can reduce passenger's delays. But what if passengers don't accept the advice? Or rather wait than reroute?

THE PROJECT:

You will focus on combined passenger advice optimization and rolling stock rescheduling during major disruptions: that is, what route to recommend to passengers (the advice part) so that they get to their destination as fast as possible, while at the same time trying to provide large enough trains to accommodate all passengers on their preferred routes. The focus will be on including realistic passenger behavior in this model.

Your job will be to include (your) new ideas on what realistic passenger behavior in case of disruptions should be. When do passengers accept a recommended route? What could be attractive alternative routes for passengers? Should there be different types of passengers? Should all passengers with the same origin and destination receive the same recommended route? Or: how much better off would all passengers be, if some of them could be convinced to drink coffee for an hour or two, and thus postpone their journey?

Alternatively, you can focus on the fact that the duration of a disruption is often uncertain. Thus, when it starts, the operator does not know yet when it is going to end. You would study what the influence is of this uncertainty, and how an operator can best handle this in the schedule. For example: is it better to be optimistic or pessimistic about the disruption length when planning?

You will be given a set of cases and a code base to start from, containing two optimization modules and a passenger simulation. You can either focus on adding these features to the simulation, adding them to the optimization, or both.

PREREQUISITES:

Programming experience, preferably 13436 Optimizing of operationelle transportsystemer and/or 13250 Optimization of Public Transport and/or a course on (agent based) simulation / object oriented programming / java.

LEVEL: Best suited to a MSc thesis, but may be tailored for smaller projects.

NUMBER OF STUDENTS:

1 preferred, potentially 2 if agreed upon.

Improving DSB's S-tog bus plan

PROJECT SUPERVISOR: To be decided

CO-ADVISOR: Assistant Professor Evelien van der Hurk (evdh@dtu.dk)

Do you have another idea? You are always welcome to discuss!

BACKGROUND:

Due to maintenance, parts of the S-tog track will need to be closed in the coming years. S-tog-busses will be planned to replace this service. Often, these S-tog busses just follow the track of the S-train. Sometimes however, different bus routes might be better: for example, when station Lyngby is closed, many passengers might be better off if the S-tog bus (also) stops at DTU, rather than only at Lyngby (maybe even passing, but not stopping, at DTU).

THE PROJECT:

You will develop methods to improve passenger service during the track closures. This could focus on:

- Generating better S-tog-bus routes
- Looking into how the general bus network could support the closures
- How to plan the closures over time to minimize the passenger inconvenience

These could be optimization models, simulation models, or you could focus on a practical case study. Data from the National Model can be to obtain information on the passenger demand.

PREREQUISITES:

None.

You can always profit from Programming experience, 13436 Optimizing af operationelle transportsystemer and/or 13250 Optimization of Public Transport.

LEVEL:

Best suited to a MSc thesis, but may be tailored for smaller projects.

NUMBER OF STUDENTS:

1 preferred, potentially 2 if agreed upon.

TRANSPORT MODELLING



Construction of bicycle matrices for Copenhagen (MSc)

PROJECT SUPERVISOR: Associate professor Jeppe Rich (rich@dtu.dk)

PROJECT ADVISOR: Assistant professor Thomas Kjær Rasmussen (tkra@dtu.dk)

EXTERNAL ADVISOR: Thomas Sick, Road directorate.

KEYWORDS: Bicycle modelling, GIS, route choice, OD matrix estimation, transport models

BACKGROUND: Bicycle transport has in recent years become more and more important and this has led to a need for better modelling of bicycle transport in Denmark. In certain corridors of Copenhagen the share of bicycle transport exceed 50% of the total traffic and between Copenhagen and Amager there is now more than 70.000 bicycle trips on a daily basis. A central quantity in understanding the overall bicycle pattern is the trip pattern as represented by trip matrices. These matrices can act as input to transport models or can be the basis for analysis of transport patterns.

In relation to the recent development of the National Transport Model new matrices for bike and walk has been constructed. These matrices have been constructed on the basis of a new simulation approach and are based on TU data. However, the matrices are not calibrated to the network in order to verify whether the predicted bicycle flows (as calculated by a bicycle route choice model) corresponds to the observed level at road links.

The aim of the project is to;

- Design and implement a proper route-choice model for the choice of bicycle routes.
 - o Parameters and specification can be based on a recent PhD study
- On the basis of the route-choice, the student should re-calibrate bicycle matrices using MPME so that predicted link-counts correspond to observed link counts. The observed link-counts can be based on publicly available count data (<http://data.kk.dk/dataset/faste-cykeltaellinger>)
- Validation of the route-choice model and the matrices by looking at filters on important corridors and combine model results with TU data and GPD traces.

PREREQUISITES: 42178 Transport models, 42181 route choice models, Interest in Statistics and Stochastic simulation/Processes, GIS course

NUMBER OF STUDENTS: 1-2 master students (2 projects of 30-35 ECTS Credits).

Evaluation of “super-cycle lanes” (MSc)

PROJECT SUPERVISOR: Associate professor Jeppe Rich (rich@dtu.dk)

PROJECT ADVISOR: Assistant professor Thomas Kjær Rasmussen (tkra@dtu.dk)

EXTERNAL ADVISOR: Thomas Sick, Road directorate.

KEYWORDS: Bicycle modelling, project assessment, GIS, route choice, OD matrix estimation

BACKGROUND: This project shares many similarities with the previously posted project “Construction of bicycle matrices for Copenhagen “. However, whereas this project is also supposed to develop matrices and a route-choice model for bicycle transport, this project also involves that we use the transport model for assessment of the introduced “super-bicycle lanes” (<http://supercykelstier.dk/ruter/>). Can we conclude that these have had impact on the transport pattern locally and at a more regional level? Could there be other explanations for a given change in the transport patterns?

In addition to the matrix project, this project involves;

- Develop a GIS map before the super-bicycle lanes were introduced and a corresponding “after map” with all these included.
- Based on count data (<http://data.kk.dk/dataset/faste-cykeltaellinger>), TU and GIS data construct new matrices before and after the introduction of super-bicycle lanes.
- Verify the changes in transport patterns and try to assess how much is due to the changed infrastructure.
- Conclusions on what makes a super-bicycle lane successful.

PREREQUISITES: 42178 Transport models, 42181 route choice models, Interest in Statistics and Stochastic simulation/Processes, GIS course

NUMBER OF STUDENTS: 1-2 master students (2 projects of 30-35 ECTS Credits).

Estimation of autonomous vehicle market shares (MSc)

PROJECT SUPERVISOR: Associate professor Jeppe Rich (rich@dtu.dk)

PROJECT ADVISOR: Associate professor Stefan Mabit (slm@dtu.dk)

EXTERNAL ADVISOR: TBA.

KEYWORDS: Autonomous vehicles, mode choice models, simulation, forecasting

BACKGROUND: There are many different stages of autonomy and also many different visions on how the market will evolve, however, it is likely that autonomous vehicles will be a very important transportation mode in the future which will capture market shares from other transport modes. This in turn, will give rise to a changed congestion pattern and changed mobility pattern in general.

The market share of autonomy is likely to depend on the stage of autonomy and type of market setting we are looking at. The idea in the following is to consider TU data and on the basis of these data develop a model for choice of transport mode. When looking at the modes of today in particular taxis, and also to some extent public transport, these can be used to mimic various interesting future scenarios of autonomous vehicles.

Taxis can be applied to represent a “swarm AV perspective” where AV’s are circulated like today’s taxis and bringing people from A to B. The only main difference is the fact that it will be much cheaper and that there is no driver in the taxis. However, it is possible to adjust and simulate the model with changes in costs and alternative specifications of the alternative-specific dummies to assess the projected market share under different assumptions.

Public transport can be used to represent a “tele-bus” perspective if we adjust the access-egress and also waiting time to that of an expected AV vehicle.

It will be possible to simulate different projections in a Monte-Carlo setting. This can be accomplished by using the estimated parameters and their variance from the mode choice model (e.g., could be estimated in a Mixed Logit Model) and embed this into a Monte-Carlo exercise.

PREREQUISITES: 42178 Transport models, 42181 route choice models, Interest in Statistics and Stochastic simulation/Processes, GIS course

NUMBER OF STUDENTS: 1-2 master students (2 projects of 30-35 ECTS Credits).

Construction of synthetic household travel-surveys (MSc)

PROJECT SUPERVISOR: Associate professor Jeppe Rich (rich@dtu.dk)

PROJECT ADVISOR: Mikkel Thorhauge (mtho@dtu.dk)

EXTERNAL ADVISOR: TBA.

KEYWORDS: Synthetic data construction, trip dairies, big-data, simulation

BACKGROUND: Advanced activity-based transport models can be improved by incorporating the travel pattern for the entire household. In such case it becomes possible to model interactions between household members. It also facilitate a better understanding of families with children, a better understanding of how time is consumed in the household and how the increase in cars (particularly in the cities) influence travel behaviour. However, the collection of household based data is extremely expensive and difficult.

In the following project we suggest using TU, which is a continuing trip diary (since 2004 more than 100.000 interviews has been collected) based on interviews of a single household member, as a basis for constructing a synthetic household travel survey for all members in the household. More specifically, in TU we already have basic socio-economic information about all members in the household and in addition to this we have indirect information about co-travelling. Moreover, there is also valuable information in non-responses, which can be utilised. For example, if the mother is not bringing her 6 year old kid to the kindergarten, then probably the father will do so.

The methodology to be applied is based on a simulation strategy referred to as “sequential hot-deck imputation”, which is essentially a methodology where we identify donors and receptors of travel behaviour, and thereby sample travel and activity patterns from a pool of similar individuals. If receptors are the unobserved individuals we can gradually re-build the entire dataset and take account of linkages.

The challenge is to define a methodology which accounts for interactions among household member in a realistically and consistent way.

Code and data from a previous project is available for the student.

PREREQUISITES: 42178 Transport models, 42181 route choice models, Interest in Statistics and Stochastic simulation/Processes.

NUMBER OF STUDENTS: 1-2 master students (2 projects of 30-35 ECTS Credits).

Charging patterns for EV's and Vehicle to Grid (V2G) strategies

PROJECT SUPERVISOR: Associate professor Stefan Mabit (smab@dtu.dk)

PROJECT ADVISOR: Anders Fjendbo Jensen (afjje@dtu.dk)

EXTERNAL ADVISOR: TBA.

KEYWORDS: Electric vehicles, charging patterns, vehicle to grid strategies, CBA, simulation

BACKGROUND: Electric vehicles are expected to become an important part of “Smart City” solutions which focus on better utilization of our available natural resources. With innovative solutions and careful planning, electric transport can contribute to smoothing the electricity consumption over different time periods of the day. Postponing charging of the batteries to off peak hours is an intelligent way of ensuring a higher utilisation of the electric grid and renewable energy production. An even higher potential lies in the possibility of using electric cars as “buffers” where electricity is stored when the production is high and consumption is low and then made available for the grid during consumption peaks.

In this project we suggest utilizing a large and unique dataset consisting of GPS records and information about battery state and charging patterns from electric cars. This data can be used to reveal potential benefits of off peak charging and V2G charging. The data originates from a large demonstration project about EVs conducted in Denmark during the period 2011-2013. Households participating in the trial had an EV available for a period of three months during which all trips were GPS logged. From this data, charging behaviour can be assessed in great detail and it is possible to analyse the demand for charging and compare this to current electricity supply. Several scenarios for a successful implementation of incentives towards off-peak and V2G charging should then be evaluated.

The challenge is to set up and estimate a mathematical model for charging demand, which can then be used for simulation. Geographical variables can be deduced from GIS utilization and data for electricity production and consumption should be obtained.

PREREQUISITES: 42178 Introduction to transport models, 42175 or equivalent GIS course.

NUMBER OF STUDENTS: 1-2 master students (2 projects of 30-35 ECTS Credits).

Vehicle ownership and use in Denmark

MAIN ADVISOR: Associate Professor Stefan Mabit (smab@dtu.dk)

CO ADVISOR: Associate Professor Ismir Mulalic (ismu@dtu.dk)

BACKGROUND:

The relationship between vehicle prices, vehicle ownership, and vehicle use is crucial to the derived effects of vehicle use on the environment and congestion. As both effects are expected to increase in the future due to higher vehicle ownership it is important to investigate how households react to various pricing schemes for vehicle purchase and use, e.g. road pricing.

PROJECT DESCRIPTION:

The objective of this project is to analyse the behavioural reactions to taxation on vehicle ownership or use. This can be done through scenario analyses using existing models for car ownership and use or through development of a specific car model.

PREREQUISITES:

Knowledge about statistics. Knowledge about transportation economics and discrete choice models, e.g. as in the courses 13150 Transport Economics and 13135 Discrete Choice Models.

LANGUAGE:

Danish or English.

NUMBER OF STUDENTS:

1-2 students.

Destination and mode modelling for long distance travel (MSc)

Main advisor: Associate Professor Jeppe Rich (rich@dtu.dk)

Co-Advisor: Senior Researcher Linda Christensen, lich@dtu.dk

BACKGROUND:

Long distance travel is a travel type which is less investigated than the daily transport. However, mileage for long distance travel is comparable with daily travel (for Denmark around 60%). Furthermore, the growth rate has over a long year-span been much higher and the pace is not slowing down. A need for better knowledge is therefore from both a transport and an environmental point of view substantial. DTU Transport has started to study long distance travel in the Drivers & Limits research project which was finished in spring 2014. This project pointed to several subjects which could be relevant to study more in depth.

One of the questions which is important to gain more knowledge about is the travel destinations and the attraction of these. From the literature we know that Danes seem to travel more on holidays abroad than several other nationalities due to lower summer temperatures than in more southern countries. Temperature might therefore be one parameter of attraction for holiday trips. A panel data analyses made on development in long distance travel shows that countries with a relatively cheaper price level than in Denmark seems to attract more travellers. But what else could explain the travel destinations?

DTU transport carried out a survey about Dane's long distance travel in 2010-11 (the TU 3-month overnight survey) as part of the Drivers & Limits project. In this the question about purpose of the journey is more detailed than the normal travel purpose question in the National Travel Survey. The answers to this question might be a help to understand the destination choice.

PROJECT DESCRIPTION:

In the project the student(s) should develop a nested discrete choice model for long distance travel destination and mode choice based on the TU 3-month overnight survey. In the project the focus should be on experiments with including new measures for attraction parameters for the destination choice than what is used traditionally (number of hotel beds, number of inhabitants, and GDP at the destination).

PREREQUISITES:

13133 and 13135. 13134 is recommended but not absolutely necessary.

NUMBER OF STUDENTS:

1-2

Image Recognising as Data Processing Method for Video based Data Collection (MSc)

PROJECT SUPERVISOR: Professor Otto Anker Nielsen (oani@dtu.dk)

PROJECT ADVISOR: Senior Researcher Thomas Martini Jørgensen (tmjq@dtu.dk)

BACKGROUND:

Traffic count data is one of the most important elements in building traffic model. Accuracy of traffic count data is important in developing appropriate traffic model. There are several ways in collecting traffic count which can affect data accuracy due to their properties.

The Danish Road Directorate uses loop detector on some of the main roads in Denmark, however vehicle speed of at least 15 km/h is needed in order to activate the device, this feature will then potentially reduce data accuracy when congestion is formed. Another way is to use manual counting. It is however can also potentially reduce the accuracy due to human error.

Video camera data collection should be able to capture and record the traffic condition data perfectly. It can also be used for extracting different type of data, for example traffic count, vehicle speed, and queue length. However it requires more steps to extract applicable data. Furthermore, extraction method could influence the data accuracy. Therefore method using image recognising and processing to extract applicable data with appropriate accuracy level needs to be developed.

PROJECT DESCRIPTION:

This project develops method and algorithm to extract traffic count data, vehicle speed data and queue length for a given time interval from video based data collection data. The method developed should be able to deal with any condition including among others change in weather condition and also congestion condition where vehicles are closer together and possibly standing still. In addition, the project can also explore the possibility to distinguish between car, van and truck.

PREREQUISITES:

02502 Billedanalysis (Image analysis) or corresponding courses

02506 Videregående billedanalyse (Advanced image analysis) is desirable but not mandatory

NUMBER OF STUDENTS:

1-2 master students.

INTELLIGENT TRANSPORT SYSTEMS (ITS)



Daily grammars (MSc)

PROJECT SUPERVISOR: Professor Francisco Pereira (camara@dtu.dk)

EXTERNAL ADVISORS: Carlos Carrion, University of Maryland

BACKGROUND:

Human travel behavior is known to follow habitual patterns, which is behind plenty of research and practice in Transport. While these are often seen from a spatial-temporal perspective (e.g. time-space prism), the more recent activity-based paradigm also considers activities as a key component. One wonders what key patterns exist in terms of daily activity scheduling, given constraints: we usually start and end the day at home; when we drop-off people (kids), it is also common to pick them up later; we also have occasional different (discretionary) activities such as leisure or shopping, that happen some frequency. And all of these patterns evolve in life depending on personal and household characteristics.

To communicate, we follow a very well defined syntax, usually called a natural language grammar. Such a grammar carries strong structural consistency that governs how we build sentences to communicate. The same happens with programming languages, which commonly follow an even more rigid formal grammar construction, which defines whether a sentence is valid or not.

In this project, we focus on a fundamental research question: is there an underlying grammar behind our daily activity schedules? If yes, what are its rules?

PROJECT DESCRIPTION:

The objective of the project is to apply context free grammars (CFGs) tools to activity diary data in order to extract grammar rules. As an example of such a rule, we could have `S → H W H`, which means that there exist two types of activities (H=home, W=work), and each one could be broken with sub-rules (e.g. `W → w e w`, where “w” is a work period and “e” is an “eating break”).

The student will be guided on how to build such type of grammars from the data, and the end result of the project is one or more grammars that describe human activity-based travel behavior.

PROJECT PURPOSE:

The purpose of this thesis is to make a mechanism (the rules) that can generate potential activity-schedules for activity-based travel models.

PREREQUISITES:

Two student profiles are acceptable:

- Proficiency on demand modelling and behaviour econometrics. The student will develop (potentially simpler) grammars manually and estimate demand models from them, following available well-established literature;
- Proficiency in programming languages. The student will focus on automatically deriving the grammars from the data

NUMBER OF STUDENTS:

2 master students (2 projects of 30-35 ECTS Credits).

Event detective - Detection (MSc)

PROJECT SUPERVISOR: Professor Francisco Pereira (camara@dtu.dk)

EXTERNAL ADVISOR: Erik Damgaard, ImTech; Carlos Lima Azevedo, Massachusetts Institute of Technology (MIT)

BACKGROUND:

Managing traffic in real-time is a well-known challenge, particularly in highly dynamic cities such as Copenhagen. While the transport system may be carefully planned, it is never possible to cater for all eventualities such as traffic incidents, special events, system disruptions (e.g. public transport breakdown), or harsh weather. A first challenge in such situations is detecting these events from the data.

Techniques such as network sciences, time series analysis or simply outlier detection can help detect such situations if designed carefully. They demand some level of transport network knowledge and statistics, and basic machine learning skills.

PROJECT DESCRIPTION:

In this project, we will analyse a dataset with traffic sensing counts from the city of Copenhagen in three major phases:

1. Descriptive statistical analysis – apply common statistical tools (mean, standard deviation, quantiles, histograms, etc.) to understand both the “normal behaviour” and the “extreme behaviour”
2. Network analysis – Estimate transport and network science measures (flow, density, speed, centrality, node degree, etc.) to further characterise normal and extreme behaviour
3. Classification modelling – Using the measures from 1 and 2, train a classification algorithm (e.g. decision tree, logistic regression, neural network, from Weka open source tool) that detects, at each moment, if there is a relevant event in the network.

PROJECT PURPOSE:

The purpose of this thesis is primarily to gain insight into the traffic sensing data from Copenhagen, and its potential for real time event detection. A successful project will eventually be proposed for the traffic management center.

PREREQUISITES:

Statistics, traffic modeling and operations

NUMBER OF STUDENTS:

1 master student (1 project of 30-35 ECTS Credits).

Event detective – Mining from the web (MSc)

PROJECT SUPERVISOR: Professor Francisco Pereira (camara@dtu.dk)

PROJECT ADVISOR: Postdoc Filipe Rodrigues (rodr@dtu.dk)

EXTERNAL ADVISOR: Stanislav Borysov, Singapore-MIT Alliance for Research and Technology (SMART/MIT)

BACKGROUND:

Managing traffic in real-time is a well-known challenge, particularly in highly dynamic cities such as Copenhagen. While the transport system may be carefully planned, it is never possible to cater for all eventualities such as traffic incidents, special events, system disruptions (e.g. public transport breakdown), or harsh weather. A key factor in treating situations is detecting why a specific disruption is happening. A congestion due to special events will require a very different treatment than a traffic incident or flood.

Often, the explanation for such disruptions can be found on the web, in dedicated platforms (e.g. Twitter, Facebook), news websites or querying search engines. The internet has been shown as a very valuable source to understand mobility patterns and problems. The challenge is then how to find the right information, this is known as an Information Retrieval problem.

PROJECT DESCRIPTION:

The objective of this project is to find explanations online about previously detected traffic events, which were observable in traffic sensing data (e.g. vehicle counters) or public transport records (e.g. Rejsekort data). The project will build on earlier work already implemented that automatically queries for event explanations for taxi demand peaks in Singapore.

The project has three general phases:

1. Selection of relevant event case studies from the available datasets
2. Manual information retrieval, where the student needs to understand, for each case, the best possible explanatory content (thus creating a “ground truth” database)
3. Automatic information retrieval, where the student will adapt the previous work to our context

PROJECT PURPOSE:

The purpose of this thesis is primarily to gain insight into the possibilities of using internet data for the Copenhagen context, and its potential for real time event explanation. A successful project will eventually be proposed for the traffic management center.

PREREQUISITES:

Programming languages

NUMBER OF STUDENTS:

1 master student (1 project of 30-35 ECTS Credits).

Post-travel analytics on smartphone activity diaries (MSc)

PROJECT SUPERVISOR: Professor Francisco Pereira (camara@dtu.dk)

PROJECT ADVISORS: Hjalmar Christiansen (hjalcd@dtu.dk), Jesper Wibrand (jwib@dtu.dk)

EXTERNAL SUPERVISOR: Ajinkya Ghorpade, Singapore-MIT Alliance for Research and Technology (SMART)

BACKGROUND:

Travel surveys are key to a vast amount of transport research and application, and their quality and quantity influences heavily how we understand and can improve our transport systems. This explains why there are every year considerable investments on such data collection campaigns all around the world.

A recent trend has been to move from traditional paper and web-based surveys to solutions where we use location sensing devices (e.g. GPS loggers, smartphones), and, although plenty has been said about their potential, they are still far from being a widespread technology. Many reasons exist for this, namely battery consumption, privacy concerns and difficulty in providing the right incentives. Several technologies already exist that claim to have solved the former two problems, but the latter, about incentives, still remains a challenge. How can we motivate people to share their travel behavior data?

A common answer lies on the data itself. It is believed that such data can provide interesting insights that can help understand (and improve) our individual mobility choices. For example, telling which is the best commute path, when is the best departure time, and so on. The goal of this project is to develop a range of such post-travel analytics measures, estimate them with available technology and evaluate their reliability.

PROJECT DESCRIPTION:

The project will comprise three components:

- A small multi-day data collection campaign (potentially based on DTU Transport students and staff, some of which recording a personal log for later ground truth);
- Development of post-travel analytics measures, and estimate them from the available data;
- Evaluate their reliability by comparing with ground truth.

PROJECT PURPOSE:

The purpose of this thesis is to evaluate the data quality of smartphone-based travel diary technology and develop a potential incentive mechanism based on feedback to the user.

PREREQUISITES:

- Basic statistics are necessary
- Interest in survey design and in smartphone-based technologies

NUMBER OF STUDENTS:

1 master student (1 project of 30-35 ECTS Credits).

Sensing happiness (MSc)

PROJECT SUPERVISOR: Professor Francisco Pereira (camara@dtu.dk)

PROJECT CO-SUPERVISORS: Allan Olsen (allo@dtu.dk), Sonja Haustein (sonh@dtu.dk)

BACKGROUND:

Denmark has been often classified as one of the happiest countries in the world and a usual question regards “how do we measure happiness?”. From text mining research, plenty of tools already exist that aim to evaluate the “sentiment” polarity of a given text, for example for distinguishing whether a sentence provides “positive” or “negative” feelings.

This project aims to explore such tools on online data from Copenhagen, including Twitter feeds, news feeds, and popular Facebook pages, in search for insights on how such sentiment analysis tools perform and how dynamic is the city with respect to such happiness measures.

PROJECT DESCRIPTION:

The project will comprise two distinct stages:

- Collection of relevant data from the city, using social network websites and news feeds. This should preferably be done programmatically (through APIs);
- Testing of available open-source/free license sentiment analysis and opinion mining tools.

PROJECT PURPOSE:

The purpose of this thesis is to understand the potential of sentiment analysis and online data to gain a clearer insight on the concepts of happiness and well being, and how to measure them.

PREREQUISITES:

- Basic programming skills are necessary, to program the API data crawlers.
- Interest in the sociological / psychological background of the topic.

NUMBER OF STUDENTS:

1 master student (1 project of 30-35 ECTS Credits).

CENTRE MARITIME DTU



Simulation Analysis for Container Terminal Activities (BSc)

ADVISORS: Professor Allan Larsen (alar@dtu.dk)

BACKGROUND:

Recent statistics shows that large container terminals can process more than 30 million containers a year, and are constantly in search for the better ways to analyze/optimize processing time and deliver high quality, and profitable services. Most of the operational problems in a container terminal are interconnected and the productivity of container terminals heavily relies on the efficiency of quay cranes operations, and the usage of the berthing area. Hence, analysis of operations by means of defined Key Performance Indicators contributes well to the performance of terminal. Proposing new KPIs for operations will be another focus of the study. Simulation as a tool can be used to analyze real-time operations of container terminal operations, and assess performance of different policies in respect to queuing times, utilization of resources (berths, quay cranes, etc.). Simulation software offers a lot of visualization of operations that are modelled. Animation of activities is also in scope of this research.

PROJECT DESCRIPTION:

A selection of student projects can be considered within the field, including:

- a) Improving berth allocation policies in container terminals: Since arrival pattern of vessels to port is stochastic, various policies could be applied and tested to improve the efficiency/utilization of the berth area.
- b) Scheduling of Quay Cranes: Once vessel is berthed, we know how many Quay Cranes are going to process on that given vessel. However due to interference between QCs, operations time, load of vessel, there are a lot of different schedules. Testing these schedules via simulation will help to evaluate the performance of container terminals.
- c) Resource Leveling: Depending arrival pattern of vessels, we can determine how many QCs/Trucks/AGVs to assign given vessel regarding its time window and load of cargo. These operations includes very much variety in data hence doing the analyses with simulation will yield an increased performance to assess operations.
- d) Combined operations: Integrating before-mentioned problems in an combined framework with all animations and real-time operations.
- e) Statistical Input/Output Analysis for container terminals: Markov Chains to represent queuing problems in container terminals, confidence intervals and statistical inferences for container terminals.
- f) Black-box simulation and Simulation meta-modelling: Due to variability in data and in operations, practitioners do not know of the results of the scenarios. However, some computational intelligence techniques such as Artificial Neural Networks can be used to estimate the performance of different policies in parallel to simulation.

PREREQUISITES:

13400 Simulation in freight transport and logistics (or a similar course), i.e. practical experience in modelling in for instance Arena, 02323 Statistics and probability theory OR 02401/02 introduction to statistics (or a similar introductory statistics course).

NUMBER OF STUDENTS:

1-2 students.

Metaheuristics for Quay Side Operations of Container Terminals (MSc)

ADVISORS: Associate Professor Dario Pacino (darpa@dtu.dk)

BACKGROUND:

Nowadays, over 60% of the world's deep-sea cargo is being placed in containers and transported by vessels via container terminals. Due to increasing importance of container terminals in the supply chains, the need for optimization in operations has become quite important in recent years. Container terminal problems are proved to be hard to solve to optimality. Hence, there are a number of metaheuristic algorithms that aim to solve these problems with near-optimum characteristics. This project focuses on one of following quay-side container terminal problems and aims to establish heuristic algorithms for given problem.

PROBLEMS DESCRIPTION:

A selection of student projects can be considered within the field, including:

- a) Berth allocation problem: The problem addresses the problem of finding a berth position and berthing time for a vessel with a number of constraints such as berth configuration, time windows or interference factors.
- b) Quay crane assignment problem: Once the place and time of berthing is defined, container terminal may decide "how many" and "which" quay cranes are going to be assigned to given vessel regarding its load, position, and characteristics.
- c) Scheduling of Quay Cranes: Once vessel is berthed, we know how many Quay Cranes are going to process on that given vessel. However due to interference between QCs, operations time, load of vessel, there are a lot of different schedules. Testing these schedules via simulation will bring.
- d) Combined operations planning: Integrating before-mentioned problems in a combined framework.

PROJECT DESCRIPTION:

The goal of the project is to develop algorithms for solving one of these problems, to test the algorithms with the equivalent literature (data is to be provided by the advisors) and to analyze the results. Possible solution methods include: developing a metaheuristic (Large Neighborhood Search, Ant Colonies, Genetic Algorithms, Local Search etc.) and implementing it in C++, Java.

PREREQUISITES:

Mathematical modelling; programming experience in C++, Java could be useful. The following courses could be useful: 13432 Maritime Logistics & 42137 Optimization using metaheuristics.

NUMBER OF STUDENTS:

1-2 students.

Ship Loading Optimization

PROJECT ADVISOR: Associate Professor Dario Pacino (darpa@dtu.dk)

PROJECT DESCRIPTION:

Container vessels are known to be one of the most CO₂ efficient ways to transport goods. Even though the emissions per ton/mile are minimal the total amount of produced emissions is huge. Since the economic crisis of 2009, the carriers have adopted a sailing policy called "slow steaming". With this policy, vessels are meant to sail at slow speeds thus reducing emissions, bunker consumption and costs. Such a strategy can make economic sense only if the extra transport times do not affect the customers. This can be achieved by reducing the ship's time at port.

PROJECT ASSIGNMENT:

The aim of the project is to exploit the flexibility that type based stowage plans can offer when optimizing port operations. Your task will be to develop a solution method for the optimization of the ship loading operations. This will include the assignment of containers to the vessel and the scheduling of the cranes and terminal vehicles.

PREREQUISITES:

Operations Research methods, both in terms of mathematical programming and heuristic implementation.

NUMBER OF STUDENTS:

1-2

Heuristic or Optimal Container Stowage slot Planning (MSc)

ADVISOR: Associate Professor Dario Pacino (darpa@dtu.dk)

PROJECT DESCRIPTION:

The generation of cost-efficient container stowage plans has become a 'priority for the shipping industry. Current state-of-the-art adopts a hierarchical decomposition to the container stowage problem. The first phase of the decomposition solves a so called master bay plan, where containers are distributed to subsections of the vessel. The next phase, slot planning, finds a final assignment for the containers within those vessel subsections. Due to the solutions characteristics of the first phase, many near-optimal slot planning solution exists. The aim of the project is to either find an optimal approach that can efficiently cut through the sea of near-optimal solutions, or a heuristic approach that can find those solutions efficiently. Students will be challenged by a real industrial problem and will be given access to large amounts of industrial data.

NUMBER OF STUDENTS:

Heuristic Container Stowage Master bay Planning

ADVISOR: Associate Professor Dario Pacino (darpa@dtu.dk)

PROJECT DESCRIPTION:

The generation of cost-efficient container stowage plans has become a priority for the shipping industry. The complexity of the problem and time within which it must be solved, impose a great challenge to the use of optimal mathematical models. Current state-of-the-art adopts an hierarchical decomposition to the container stowage problem. The first phase of the decomposition solves a so called master bay plan using a MIP model. Regardless of the positive results, some instances are still too complex to be solved within the required time limit. The aim of the project is the analysis and implementation of a heuristic solution for the master bay problem of container stowage planning. Students will have a chance to work with real industrial data from one of the largest container shipping companies in the world, and test their abilities against a large scale optimization problem.

NUMBER OF STUDENTS:

Policy measures to reverse and mitigate the negative implications of SECA limits on Short-Sea Shipping (MSc)

ADVISORS: Professor Harilaos N. Psaraftis (hnpсар@dtu.dk); PostDoc Thalís Zís (tzis@dtu.dk)

BACKGROUND:

The new lower sulphur limit on fuel consumed within Sulphur Emission Control Areas (SECAs) constitutes sailing within SECAs more expensive. This in turn can lead to higher freight rates experienced by shippers, and lead into modal shifts to rail and road options. As a result, the viability of certain services is at risk of closure or significant alterations.

PROJECT DESCRIPTION:

This project aims to identify candidate policy measures that can ensure the viability of Short-Sea Shipping (SSS) routes under the new limits, and particularly for fuel price scenarios with increased values. The student will use an existing tool that predicts modal shifts for the various fuel price scenarios, and subsequently test the policy measures to assess the environmental performance and the profitability of the Route. The potential policy measures are summarized below:

- Full or partial internalization of external costs
- Easing of port fees for relevant shipping
- ECO-bonus similar system. Freight haulers are refunded when using SSS modes
- Provision of subsidies to shipowners for environmental investments such as LNG, scrubbers etc.
- Other relevant measures that will be discussed with the supervisors

It is expected that the measures will be applied in a series of case studies for various fuel price scenarios, and for different SSS routes. Data on these routes are available.

PREREQUISITES:

At least one of the following:

42885 Maritime logistics, 42884 Green transport logistics.

Experience in Economics, good data-handling skills. Some knowledge of VBA is preferred.

CENTRE

RailTech DTU



Asset Portfolio Management for the Danish Railways

ADVISOR: Associate Professor Steven Harrod (stehar@dtu.dk)

BACKGROUND:

As part of changing traffic patterns and uses, many Danish rail facilities have been abandoned, sold, and re-developed for other uses. Simultaneously, demand for rail transport is growing in Denmark, and many services are highly congested. For example, in 1950 the railway line from Nærum to Vedbæk was abandoned, and many feel today that a vital east-west link has been lost. Many terminal and service facilities have been reduced or are planned to be abandoned in Hovestaden. Examples include the København workshops, the goods yard at Rungsted Kyst, the goods yard at Helsingør, and many others. Are these properties being discarded prematurely? Should they be held in reserve for future use? Should other assets, not currently part of the railway network, be acquired and held for potential future use?

PROJECT DESCRIPTION:

In this project, students should integrate concepts of transport demand with delivery of transport services and the specific technical requirements of railways to deliver those services. The project should attempt to project forward perhaps 50 years, and balance the cost of retaining transport assets (and not releasing them to alternate economic development) versus the potential cost of re-creating those assets in the future. The thesis deliverable and content for evaluation will be a written report containing a formal problem analysis and recommended actions.

The project tasks should include:

- 1) Literature survey on transport infrastructure asset requirements and management
- 2) Historical account of prior Danish rail asset abandonments
- 3) Review of fifty year projections for economic growth and transport demand
- 4) Estimation of transport assets necessary for future requirements and comparison to existing infrastructure
- 5) Recommendations on asset preservation policies for Danish railways

PREREQUISITES:

Skills in transport demand analysis and planning and specification of infrastructure for railway services is highly desirable.

Experience with large scale geographic or data analysis is useful but not necessary.

NUMBER OF STUDENTS:

1-2 MSc students.

Large Scale Network Models for Pricing and Allocation of Railway Infrastructure

ADVISOR: Associate Professor Steven Harrod (stehar@dtu.dk)

BACKGROUND:

A major challenge to offering true “open access” to the railway network is how to set pricing policy for access. Unlike road, air, or water transport, nearly every train movement involves potential conflicts with other train movements. In a congested network, this means that the insertion of a new train service often necessarily requires the removal or rescheduling of an existing service. Further, if these train services should be from separate, competing train operating companies, the infrastructure manager faces a difficult decision that requires a response that is sensitive to political, social, and legal requirements.

The, sometimes conflicting, objectives for railway access pricing and allocation are set out in the EU “Recast” First Railway Package of 2001 (Directive 2012/34/EU). The directive variously requires that pricing will be transparent, that use of the transport infrastructure will be “optimal”, that railways will make “rational” decisions based on economics, and that charges should be directly related to the specific train service. Each of these objectives individually requires a quite complex decision and set of policies, and taken together this set of objectives has no clear solution with current methods.

PROJECT DESCRIPTION:

In this project, students should balance political and social expectations with mathematical or financial “optimal” solutions. The project should attempt to provide some guidance on the areas where planning methods and social expectations are in alignment, and areas where these methods may in fact be difficult to coordinate. The thesis deliverable and content for evaluation will be a written report containing a technical reference to the topic and case study examples of method application.

The project tasks should include:

- 1) Literature survey on “open access” train path pricing
- 2) Review of Danish path pricing policy in detail
- 3) Model construction for two or more pricing models, and comparison of results for a random sample of pricing scenarios
- 4) Comparison and discussion of results

PREREQUISITES:

Skills in timetabling and train path calculation are highly desirable. Skills in mathematical optimization are highly desirable.

Experience with economics, pricing, and game theory are useful but not necessary.

NUMBER OF STUDENTS:

1-2 MSc students.

Provision of Onboard Services in Passenger Railways

ADVISOR: Associate Professor Steven Harrod (stehar@dtu.dk)

BACKGROUND:

In years past, nearly all long distance passenger train services provided various onboard services, ranging from “bar cars” to restaurant cars and even sleeping cars. However, in recent years, these services have been abandoned or severely reduced. Here in Denmark, the last sleeping car train was discontinued in 2014, and onboard beverage and snack service was discontinued on national trains. What does the discontinuance of these services do to the competitive position of passenger rail transport?

PROJECT DESCRIPTION:

In this project, students should review the particular challenges of service delivery and retail sales onboard the limited facilities of a train. The project should provide some guidance on the best practices for onboard services, a general model for cost estimation, and an analysis of their cost recovery and secondary benefits to the attractiveness of travel by rail. The thesis deliverable and content for evaluation will be a managerial guide and planning tool.

The project tasks should include:

- 1) Literature survey on passenger transport amenities and auxiliary services
- 2) Study of the service delivery process and infrastructure. Summary of best practices.
- 3) Formulation of a pricing model for service delivery cost, revenue, and secondary effects.
- 4) Discussion of results by example on a sample of Danish routes.

PREREQUISITES:

Skills in transport demand analysis and service design are highly desirable. Skills with spreadsheet models is highly desirable.

Experience with accounting and process analysis are useful, but may also be developed in the course of the thesis.

NUMBER OF STUDENTS:

1-2 MSc students.

New Applications for Automation and Remote Control of Trains

ADVISOR: Associate Professor Steven Harrod (stehar@dtu.dk)

BACKGROUND:

Sixty years ago, the New York City subway system experimented with a driverless shuttle train, which promptly triggered a labor strike, and the concept was abandoned. Since then, technology for automation of railways controls has improved and seen greater application, while continuing to create tension in management-labor relations. In recent years, vehicle control automation has become so advanced that automated, driverless road vehicles are widely believed to be feasible.

PROJECT DESCRIPTION:

In this project, students should perform a deep technical analysis of railway automation. All sub-categories should be considered: light rail, heavy rail, commuter rail, and intercity rail (North American classification). The project should review current and projected future capabilities for driver automation of trains, including best practices and likely limitations. Political and labor concerns should also be reviewed. Finally, the project should determine what the potential benefits of automation are, in all measures. The thesis deliverable and content for evaluation will be a technical reference and case study application analysis.

The project tasks should include:

- 1) Literature survey on rail vehicle automation.
- 2) Technical guide to methods and systems for rail vehicle automation.
- 3) Discussion of political and labor concerns due to automation.
- 4) Evaluation of potential benefits: changes to service delivery and cost of service.
- 5) Case study examples of application to two or more Danish routes.

PREREQUISITES:

Skills in intelligent machine controls or railway signaling. Skills in rolling stock design and operation. Skills in railway line operations or service design. Strong aptitude for engineering topics.

Optional: Experience with railway cost of service calculations. Knowledge of railway history and labor relations.

NUMBER OF STUDENTS:

1-2 MSc students.

Best Practices for Application of Condition Based Maintenance

ADVISOR: Associate Professor Steven Harrod (stehar@dtu.dk)

BACKGROUND:

Traditionally, service intervals for vehicles and track have been defined as fixed time intervals based on statistical assumptions of time to failure. Innovations in automated and remote data collection have led to the formulation of the concept of “condition based maintenance”. Instead of replacing components on fixed intervals, intensive data collection allows for components to be replaced closer to their ideal life expectancy, thus obtaining more service life from the component and/or identifying potential failures earlier.

PROJECT DESCRIPTION:

In this project, students examine in detail the processes and methods of rolling stock and-or track maintenance. The project may cover one or both topics. The project should review condition based maintenance theory, and review potential applications in Danish railway practice. Topic coverage should integrate maintenance process design, life cycle cost of components, and change management in processes. The thesis deliverable and content for evaluation will be a technical reference and case study application analysis.

The project tasks should include:

- 1) Literature survey on condition based maintenance.
- 2) Technical guide to maintenance process design for selected components or systems.
- 3) Discussion and estimation of benefits of condition based maintenance.
- 4) Case study examples of implementation including change management procedures.

PREREQUISITES:

Skills in rolling stock or track maintenance and technology. Skills in data analysis and data collection systems.

Optional: Experience with process management. Experience with change management. Experience with quality management and lean systems.

NUMBER OF STUDENTS:

1-2 MSc students.

Thesis Proposals by the Danish Rail Sector Association

The Danish Rail Sector Association (BaneBranchen) (see www.banebranchen.dk) represents the railway industry in Denmark. The association aims at solving today's challenges in training and recruiting engineers specialised in railway engineering. The association offers a wide range of thesis projects for students within engineering. Below examples of possible thesis projects are listed. The projects are by default described in Danish but will also be able to be carried out in English.

Please contact RailTech DTU (railtech@dtu.dk) for further information and links to the companies mentioned below.

RailTech DTU – main point of contact

- Automatisk togdrift på fjernbanen. Rationalisering af togdriften i Danmark. Er lokomotivføreren nødvendig i fremtidens tog? Trafikstyrelsen og RailTech DTU
- Forudsætninger og muligheder for automatisk drift på S-banen med CBTC. Trafikstyrelsen og RailTech DTU
- Principper for sikker integrering af letbaner i bybilledet. Trafikstyrelsen og RailTech DTU
- Pålidelige tog: Metoder til trafikplanlægning, driftsoptimering, overvågning, fejlanalyse. Trafikstyrelsen og RailTech DTU
- Transport System Design Review: How to perform assurance/control processes (what, who, where, why, how, when). Aarhus Letbane og RailTech DTU
- Level Crossings (new, upgraded, modified) design, works and interface control plan. Aarhus Letbane og RailTech DTU
- Transport Priority System - Design, test and commissioning process. Aarhus Letbane og RailTech DTU
- Operation Rules: what can we reuse from SR / Signalling program and input from suppliers. Aarhus Letbane og RailTech DTU
- Data om ulykker i forbindelse med letbaneprojekter. Sammenhæng mellem udformning af projekt og ulykker - f.eks. cyklister der falder i rilleskinner. Venstresvingende biler ind foran bagfrakommende letbane, osv. Aarhus Letbane og RailTech DTU
- Letbanen æstetik i stil med lignende studier, der er lavet om Vejens arkitektur. Aarhus Letbane og RailTech DTU
- Letbane effektivitet. Hvilke(n) variabler påvirker energiforbruget. Længde på tog, m2 pr. tog, antal passagerer, antal stop, antal meterstigninger etc. Aarhus Letbane og RailTech DTU
- Passagerkapacitet - belysning af om den måles i m2, længde på tog etc. Aarhus Letbane og RailTech DTU
- Interoperabilitet og TSI-klassificering af det danske jernbanelnet. COWI og RailTech DTU
- Hastighedsopgradering af jernbaner i Danmark. COWI og RailTech DTU

DTU Civil Engineering

- By og letbane: Om Letbanen som løftestang til områdefornyelse/byfornyelse/byudvikling (Cases i udlandet, implementering i Gellerup). Aarhus Letbane og DTU Byg

DTU Compute

- AVLS / Communications - what shall content look like - screens on stations and trains for optimal user guidance. Aarhus Letbane og DTU Compute
- Datagenereringsværktøj; Design og udvikling af et datagenereringsværktøj, der via en grafisk brugerflade kan repræsentere/manipulere en database. Bombardier Transportation og DTU Compute
- Nye og optimerede teststrategier; Optimering af eksisterende- samt udvikling af nye teststrategier der sikrer at fejl/mangler opdages tidligt i forløbet. Bombardier Transportation og DTU Compute

DTU Electro

- Eltraktion og miljø: Batteridrift, induktiv energiforsyning, genbrug af kinetisk energi, energi kilder og "smart grids", hybrid traktion. Trafikstyrelsen og DTU Elektro
- Vagabonderende strømme i forhold til S-banen 1.500 VDC og/eller letbaner 750 VDC. COWI og DTU Elektro
- Jording og potentialudligning på elektrificerede baner. COWI og DTU Elektro
- Krav til DC immunisering af relæsikringsanlæg, herunder jævnstrømssporisolationer i forbindelse med jævnstrøms køreledningsanlæg. COWI og DTU Elektro
- Simulering af eksterne enheder / interfaces; Softwarebaseret repræsentation af fysisk hardware samt deres interfaces. Bombardier Transportation og DTU Elektro

DTU Management Engineering

- Risikostyring af letbaneprojekter baseret på fælleseuropæiske regler for risikovurdering (CSM RA). Trafikstyrelsen og DTU Management Engineering
- Modeller for risikoaversion (forskelle i acceptabelt risikoniveau for mange små ulykker frem for én stor) i relation til sikkerhedsmål. Trafikstyrelsen og DTU Management Engineering
- Letbanens potentiale som driver for vækst (byudvikling, grøn omstilling, vækst, sociale forhold - holistisk tilgang - mobility planning). Aarhus Letbane og DTU Management Engineering

DTU Mechanical Engineering

- Detektering af skinnerbrud: Årsager, teknologier og metoder. Trafikstyrelsen og DTU Mekanik
- Udbredelse af støj og vibrationer fra letbanesystemer og konventionel jernbane: Trace typer og støjdæmpning. Trafikstyrelsen og DTU Mekanik
- Belastningsfordeling af akseltrykket ned gennem skinne, befæstelse, svelle, skærver og underballast. COWI og DTU Mekanik
- Krav til udlægning og komprimering af ballast. COWI og DTU Mekanik
- Bæreevne af planum ved forskellige akseltryk. COWI og DTU Mekanik
- Beregning af betonsveller. COWI og DTU Mekanik
- Letbanens miljø og klimafordele (i dansk kontekst men baseret på erfaringstal fra udlandet). Aarhus Letbane og DTU Miljø

Automatisk togdrift på fjernbanen

Automatisk togdrift på fjernbanen. Rationalisering af togdriften i Danmark. Er lokomotivføreren nødvendig i fremtidens tog?

Brancheforeningen Banebranchens medlemsvirksomheder tilbyder et antal studieprojekter. Dette projekt tilbydes af Trafikstyrelsen. Kontaktpersonen er vicedirektør Jesper Rasmussen; jer@trafikstyrelsen.dk.

Projektbeskrivelsen er forholdsvis kort og specificeres i samarbejde med den studerende.

Det forventes at de[n] studerende udfører projektet primært på virksomheden.

Tilknyttet institut: DTU Management Engineering

Forudsætninger og muligheder for automatisk drift på S-banen med CBTC

Brancheforeningen Banebranchens medlemsvirksomheder tilbyder et antal studieprojekter. Dette projekt tilbydes af Trafikstyrelsen. Kontaktpersonen er vicedirektør Jesper Rasmussen; jer@trafikstyrelsen.dk.

Projektbeskrivelsen er forholdsvis kort og specificeres i samarbejde med den studerende.

Det forventes at de[n] studerende udfører projektet primært på virksomheden.

Tilknyttet institut: DTU Management Engineering

Principper for sikker integrering af letbaner i bybilledet

Brancheforeningen Banebranchens medlemsvirksomheder tilbyder et antal studieprojekter. Dette projekt tilbydes af Trafikstyrelsen. Kontaktpersonen er vicedirektør Jesper Rasmussen; jer@trafikstyrelsen.dk.

Projektbeskrivelsen er forholdsvis kort og uddybes i samarbejde med den studerende.

Det forventes at de[n] studerende udfører projektet primært på virksomheden.

Tilknyttet institut: DTU Management Engineering

Pålidelige tog

Pålidelige tog: Metoder til trafikplanlægning, driftsoptimering, overvågning, fejlanalyse.

Brancheforeningen Banebranchens medlemsvirksomheder tilbyder et antal studieprojekter. Dette projekt tilbydes af Trafikstyrelsen. Kontaktpersonen er vicedirektør Jesper Rasmussen; jer@trafikstyrelsen.dk.

Projektbeskrivelsen er forholdsvis kort og uddybes i samarbejde med den studerende.

Det forventes at de[n] studerende udfører projektet primært på virksomheden:

Tilknyttet institut: DTU Management Engineering

Transport System Design Review

Transport System Design Review: How to perform assurance/control processes (what, who, where, why, how, when)

Brancheforeningen BaneBranchens medlemsvirksomheder tilbyder et antal studieprojekter. Dette projekt finder sted hos Aarhus Letbane og kontaktpersonen er adm. direktør Claus Rehfeld, crm@aarhusletbane.dk.

Projektbeskrivelsen er forholdsvis kort og uddybes i samarbejde med den studerende.

Det forventes at de[n] studerende udfører projektet primært på DTU.

Tilknyttet institut: DTU Management Engineering

Level Crossings

Level Crossings (new, upgraded, modified) design, works and interface control plan

Brancheforeningen BaneBranchens medlemsvirksomheder tilbyder et antal studieprojekter. Dette projekt finder sted hos Aarhus Letbane og kontaktpersonen er adm. direktør Claus Rehfeld, crm@aarhusletbane.dk.

Projektbeskrivelsen er forholdsvis kort og uddybes i samarbejde med den studerende.

Det forventes at de[n] studerende udfører projektet primært på DTU.

Tilknyttet institut: DTU Management Engineering

Transport Priority System

Transport Priority System - Design, test and commissioning process

Brancheforeningen BaneBranchens medlemsvirksomheder tilbyder et antal studieprojekter. Dette projekt finder sted hos Aarhus Letbane og kontaktpersonen er adm. direktør Claus Rehfeld, crm@aarhusletbane.dk.

Projektbeskrivelsen er forholdsvis kort og uddybes i samarbejde med den studerende.

Det forventes at de[n] studerende udfører projektet primært på DTU.

Tilknyttet institut: DTU Management Engineering

Operation Rules

Operation Rules: What can we reuse from SR / Signalling program and input from suppliers

Brancheforeningen BaneBranchens medlemsvirksomheder tilbyder et antal studieprojekter. Dette projekt finder sted hos Aarhus Letbane og kontaktpersonen er adm. direktør Claus Rehfeld, crm@aarhusletbane.dk.

Projektbeskrivelsen er forholdsvis kort og uddybes i samarbejde med den studerende.

Det forventes at de[n] studerende udfører projektet primært på DTU.

Tilknyttet institut: DTU Management Engineering

Data om ulykker i forbindelse med letbaneprojekter

Data om ulykker i forbindelse med letbaneprojekter. Sammenhæng mellem udformning af projekt og ulykker - f.eks. cyklister der falder i rilleskinner. Venstresvingende biler ind foran bagfrakommende letbane, osv.

Brancheforeningen BaneBranchens medlemsvirksomheder tilbyder et antal studieprojekter. Dette projekt finder sted hos Aarhus Letbane og kontaktpersonen er adm. direktør Claus Rehfeld, crm@aarhusletbane.dk.

Projektbeskrivelsen er forholdsvis kort og uddybes i samarbejde med den studerende.

Det forventes at de[n] studerende udfører projektet primært på DTU.

Tilknyttet institut: DTU Management Engineering

Letbanen æstetik

Letbanen æstetik i stil med lignende studier, der er lavet om Vejens arkitektur

Brancheforeningen BaneBranchens medlemsvirksomheder tilbyder et antal studieprojekter. Dette projekt finder sted hos Aarhus Letbane og kontaktpersonen er adm. direktør Claus Rehfeld, crm@aarhusletbane.dk.

Projektbeskrivelsen er forholdsvis kort og uddybes i samarbejde med den studerende.

Det forventes at de[n] studerende udfører projektet primært på DTU.

Tilknyttet institut: DTU Management Engineering

Letbane effektivitet

Letbane effektivitet. Hvilke(n) variabler påvirker energiforbruget. Længde på tog, m2 pr. tog, antal passagerer, antal stop, antal meterstigninger etc.

Brancheforeningen BaneBranchens medlemsvirksomheder tilbyder et antal studieprojekter. Dette projekt finder sted hos Aarhus Letbane og kontaktpersonen er adm. direktør Claus Rehfeld, crm@aarhusletbane.dk.

Projektbeskrivelsen er forholdsvis kort og uddybes i samarbejde med den studerende.

Det forventes at de[n] studerende udfører projektet primært på DTU.

Tilknyttet institut: DTU Management Engineering

Passagerkapacitet

Passagerkapacitet - belysning af om den måles i m2, længde på tog etc.

Brancheforeningen BaneBranchens medlemsvirksomheder tilbyder et antal studieprojekter. Dette projekt finder sted hos Aarhus Letbane og kontaktpersonen er adm. direktør Claus Rehfeld, crm@aarhusletbane.dk.

Projektbeskrivelsen er forholdsvis kort og uddybes i samarbejde med den studerende.

Det forventes at de[n] studerende udfører projektet primært på DTU.

Tilknyttet institut: DTU Management Engineering

Interoperabilitet og TSI-klassificering af det danske jernbanenet

Brancheforeningen BaneBranchens medlemsvirksomheder tilbyder et antal studieprojekter. Dette projekt tilbydes af COWI. Kontaktpersonen er markedsdirektør Preben Juul Mikkelsen; pjm@cowi.dk.

Projektbeskrivelsen er forholdsvis kort og uddybes i samarbejde med den studerende.

Det forventes at de[n] studerende udfører projektet primært på virksomheden.

Tilknyttet institut: DTU Management Engineering

Hastighedsopgradering af jernbaner i Danmark

Brancheforeningen BaneBranchens medlemsvirksomheder tilbyder et antal studieprojekter. Dette projekt tilbydes af COWI. Kontaktpersonen er markedsdirektør Preben Juul Mikkelsen; pjm@cowi.dk.

Projektbeskrivelsen er forholdsvis kort og uddybes i samarbejde med den studerende.

Det forventes at de[n] studerende udfører projektet primært på virksomheden.

Tilknyttet institut: DTU Management Engineering

Letbanen som løftestang til områdefornyelse/byfornyelse/byudvikling

By og letbane: Om Letbanen som løftestang til områdefornyelse/byfornyelse/byudvikling (Cases i udlandet, implementering i Gellerup)

Brancheforeningen BaneBranchens medlemsvirksomheder tilbyder et antal studieprojekter. Dette projekt finder sted hos Aarhus Letbane og kontaktpersonen er adm. direktør Claus Rehfeld, crm@aarhusletbane.dk.

Projektbeskrivelsen er forholdsvis kort og uddybes i samarbejde med den studerende.

Det forventes at de[n] studerende udfører projektet primært på DTU
Tilknyttet institut: DTU Byg

AVLS / Communications

AVLS / Communications - what shall content look like - screens on stations and trains for optimal user guidance

Brancheforeningen BaneBranchens medlemsvirksomheder tilbyder et antal studieprojekter. Dette projekt finder sted hos Aarhus Letbane og kontaktpersonen er adm. direktør Claus Rehfeld, crm@aarhusletbane.dk.

Projektbeskrivelsen er forholdsvis kort og uddybes i samarbejde med den studerende.

Det forventes at de[n] studerende udfører projektet primært på DTU
Tilknyttet institut: DTU Compute

Datagenereringsværktøj

Datagenereringsværktøj; Design og udvikling af et datagenereringsværktøj, der via en grafisk brugerflade kan repræsentere/manipulere en database.

Brancheforeningen BaneBranchens medlemsvirksomheder tilbyder et antal studieprojekter. Dette projekt tilbydes af Bombardier Transportation. Kontaktpersonen er adm. direktør Peter Sonne; peter.sonne@dk.transport.bombardier.com

Projektbeskrivelsen er forholdsvis kort og uddybes i samarbejde med den studerende.

Det forventes at de[n] studerende udfører projektet primært på virksomheden
Tilknyttet institut: DTU Compute

Nye og optimerede teststrategier

Nye og optimerede teststrategier; Optimering af eksisterende- samt udvikling af nye teststrategier der sikrer at fejl/mangler opdages tidligt i forløbet.

Brancheforeningen BaneBranchens medlemsvirksomheder tilbyder et antal studieprojekter. Dette projekt tilbydes af Bombardier Transportation. Kontaktpersonen er adm. direktør Peter Sonne; peter.sonne@dk.transport.bombardier.com

Projektbeskrivelsen er forholdsvis kort og uddybes i samarbejde med den studerende.

Det forventes at de[n] studerende udfører projektet primært på virksomheden
Tilknyttet institut: DTU Compute

Eltraktion og miljø

Eltraktion og miljø: Batteridrift, induktiv energiforsyning, genbrug af kinetisk energi, energi kilder og "smart grids", hybrid traktion.

Brancheforeningen BaneBranchens medlemsvirksomheder tilbyder et antal studieprojekter. Dette projekt tilbydes af Trafikstyrelsen. Kontaktpersonen er vicedirektør Jesper Rasmussen; jer@trafikstyrelsen.dk.

Projektbeskrivelsen er forholdsvis kort og uddybes i samarbejde med den studerende.

Det forventes at de[n] studerende udfører projektet primært på virksomheden
Tilknyttet institut: DTU Elektro

Vagabondende strømme

Vagabondende strømme i forhold til S-banen 1.500 VDC og/eller letbaner 750 VDC

Brancheforeningen BaneBranchens medlemsvirksomheder tilbyder et antal studieprojekter. Dette projekt tilbydes af COWI. Kontaktpersonen er markedsdirektør Preben Juul Mikkelsen; pj@cowi.dk.

Projektbeskrivelsen er forholdsvis kort og uddybes i samarbejde med den studerende.

Det forventes at de[n] studerende udfører projektet primært på virksomheden
Tilknyttet institut: DTU Elektro

Jording og potentialudligning på elektrificerede baner

Brancheforeningen BaneBranchens medlemsvirksomheder tilbyder et antal studieprojekter. Dette projekt tilbydes af COWI. Kontaktpersonen er markedsdirektør Preben Juul Mikkelsen; pj@cowi.dk.

Projektbeskrivelsen er forholdsvis kort og uddybes i samarbejde med den studerende.

Det forventes at de[n] studerende udfører projektet primært på virksomheden
Tilknyttet institut: DTU Elektro

Krav til DC immunisering af relæsikringsanlæg

Krav til DC immunisering af relæsikringsanlæg, herunder jævnstrømssporisolationer i forbindelse med jævnstrøms køreledningsanlæg.

Brancheforeningen BaneBranchens medlemsvirksomheder tilbyder et antal studieprojekter. Dette projekt tilbydes af COWI. Kontaktpersonen er markedsdirektør Preben Juul Mikkelsen; pj@cowi.dk.

Projektbeskrivelsen er forholdsvis kort og uddybes i samarbejde med den studerende.

Det forventes at de[n] studerende udfører projektet primært på virksomheden
Tilknyttet institut: DTU Elektro

Simulering af eksterne enheder / interfaces

Simulering af eksterne enheder / interfaces; Softwarebaseret repræsentation af fysisk hardware samt deres interfaces.

Brancheforeningen BaneBranchens medlemsvirksomheder tilbyder et antal studieprojekter. Dette projekt tilbydes af Bombardier Transportation. Kontaktpersonen er adm. direktør Peter Sonne; peter.sonne@dk.transport.bombardier.com

Projektbeskrivelsen er forholdsvis kort og uddybes i samarbejde med den studerende.

Det forventes at de[n] studerende udfører projektet primært på virksomheden
Tilknyttet institut: DTU Elektro

Risikostyring af letbaneprojekter baseret på fælleseuropæiske regler for risikovurdering (CSM RA)

Risikostyring af letbaneprojekter baseret på fælleseuropæiske regler for risikovurdering (CSM RA).

Brancheforeningen Banebranchens medlemsvirksomheder tilbyder et antal studieprojekter. Dette projekt tilbydes af Trafikstyrelsen. Kontaktpersonen er vicedirektør Jesper Rasmussen; jer@trafikstyrelsen.dk.

Projektbeskrivelsen er forholdsvis kort og uddybes i samarbejde med den studerende.

Det forventes at de[n] studerende udfører projektet primært på virksomheden
Tilknyttet institut: DTU Management Engineering

Modeller for risikoaversion

Modeller for risikoaversion (forskel i acceptabelt risikoniveau for mange små ulykker frem for én stor) i relation til sikkerhedsmål

Brancheforeningen Banebranchens medlemsvirksomheder tilbyder et antal studieprojekter. Dette projekt tilbydes af Trafikstyrelsen. Kontaktpersonen er vicedirektør Jesper Rasmussen; jer@trafikstyrelsen.dk.

Projektbeskrivelsen er forholdsvis kort og uddybes i samarbejde med den studerende.

Det forventes at de[n] studerende udfører projektet primært på virksomheden
Tilknyttet institut: DTU Management Engineering

Letbanens potentiale som driver for vækst (byudvikling, grøn omstilling, vækst, sociale forhold – hollistisk tilgang - mobility planning).

Brancheforeningen BaneBranchens medlemsvirksomheder tilbyder et antal studieprojekter. Dette projekt finder sted hos Aarhus Letbane og kontaktpersonen er adm. direktør Claus Rehfeld, crm@aarhusletbane.dk.

Projektbeskrivelsen er forholdsvis kort og uddybes i samarbejde med den studerende.

Det forventes at de[n] studerende udfører projektet primært på DTU
Tilknyttet institut: DTU Management Engineering

Detektering af skinnebrud

Detektering af skinnebrud: Årsager, teknologier og metoder.

Brancheforeningen Banebranchens medlemsvirksomheder tilbyder et antal studieprojekter. Dette projekt tilbydes af

Trafikstyrelsen. Kontaktpersonen er vicedirektør Jesper Rasmussen; jer@trafikstyrelsen.dk.

Projektbeskrivelsen er forholdsvis kort og uddybes i samarbejde med den studerende.

Det forventes at de[n] studerende udfører projektet primært på virksomheden.

Tilknyttet institut: DTU Management Engineering

Udbredelse af støj og vibrationer fra letbanesystemer og konventionel jernbane

Udbredelse af støj og vibrationer fra letbanesystemer og konventionel jernbane: Trace typer og støjdemping.

Brancheforeningen Banebranchens medlemsvirksomheder tilbyder et antal studieprojekter. Dette projekt tilbydes af Trafikstyrelsen. Kontaktpersonen er vicedirektør Jesper Rasmussen; jer@trafikstyrelsen.dk.

Projektbeskrivelsen er forholdsvis kort og uddybes i samarbejde med den studerende.

Det forventes at de[n] studerende udfører projektet primært på virksomheden

Tilknyttet institut: DTU Mekanik

Belastningsfordeling af akseltryk

Belastningsfordeling af akseltrykket ned gennem skinne, befæstelse, sveller, skærver og underballast.

Brancheforeningen BaneBranchens medlemsvirksomheder tilbyder et antal studieprojekter. Dette projekt tilbydes af COWI. Kontaktpersonen er markedsdirektør Preben Juul Mikkelsen; pj@cowi.dk.

Projektbeskrivelsen er forholdsvis kort og uddybes i samarbejde med den studerende.

Det forventes at de[n] studerende udfører projektet primært på virksomheden

Tilknyttet institut: DTU Mekanik

Krav til udlægning og komprimering af ballast

Brancheforeningen BaneBranchens medlemsvirksomheder tilbyder et antal studieprojekter. Dette projekt tilbydes af COWI. Kontaktpersonen er markedsdirektør Preben Juul Mikkelsen; pj@cowi.dk.

Projektbeskrivelsen er forholdsvis kort og uddybes i samarbejde med den studerende.

Det forventes at de[n] studerende udfører projektet primært på virksomheden

Tilknyttet institut: DTU Mekanik

Bæreevne af planum ved forskellige akseltryk

Brancheforeningen BaneBranchens medlemsvirksomheder tilbyder et antal studieprojekter. Dette projekt tilbydes af COWI. Kontaktpersonen er markedsdirektør Preben Juul Mikkelsen; pj@cowi.dk.

Projektbeskrivelsen er forholdsvis kort og uddybes i samarbejde med den studerende.

Det forventes at de[n] studerende udfører projektet primært på virksomheden
Tilknyttet institut: DTU Mekanik

Beregning af betonsveller

Brancheforeningen BaneBranchens medlemsvirksomheder tilbyder et antal studieprojekter. Dette projekt tilbydes af COWI. Kontaktpersonen er markedsdirektør Preben Juul Mikkelsen; pjm@cowi.dk.

Projektbeskrivelsen er forholdsvis kort og uddybes i samarbejde med den studerende.

Det forventes at de[n] studerende udfører projektet primært på virksomheden.
Tilknyttet institut: DTU Mekanik

Letbanens miljø og klimafordele

Letbanens miljø og klimafordele (i dansk kontekst men baseret på erfaringstal fra udlandet)

Brancheforeningen BaneBranchens medlemsvirksomheder tilbyder et antal studieprojekter. Dette projekt finder sted hos Aarhus Letbane og kontaktpersonen er adm. direktør Claus Rehfeld, crm@aarhusletbane.dk.

Projektbeskrivelsen er forholdsvis kort og uddybes i samarbejde med den studerende.

Det forventes at de[n] studerende udfører projektet primært på DTU.

Tilknyttet institut: DTU Miljø

THE DANISH ROAD DIRECTORATE (VEJDIREKTORATET)



Thesis suggestions by the Danish Road Directorate

The Danish Road Directorate (In Danish: Vejdirektoratet (VD)) offers a list of thesis proposals within intelligent transport systems (ITS) and traffic engineering. The projects are listed below and described in the following. All theses written in collaboration with VD will have an external advisor from VD and an internal DTU advisor from DTU Transport.

Please contact Professor Allan Larsen (alar@dtu.dk) for further information on these subjects.

- Forældelse af signalprogrammer
- Signalregulerede rudelanlæg
- Busprioritering i signalanlæg
- Optimeringskriterier for samordnede signalanlæg
- PC-modeller for beregning af signalanlæg
- Grønne bølger for cyklister?
- Model for beregning af forsinkelse i trafikstyrede signalanlæg
- Fremkommelighed i kryds med separatregulerede venstresving
- Intelligent styring af signalanlæg
- Intelligent styrelogik ved detektorfejl i trafikstyrede signalanlæg
- Signalregulerede rundkørsler
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- Rampedosering på motorvejsramper
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- Rejsetidsmåling på motorveje
- Trafikantadfærd i signalregulerede kryds
- Kriterier for samordning af signalanlæg
- Evaluering af adaptivt styresystem, DOGS, i Hørsholm
- Signalstyring i nye signalanlæg på Køgevej i Roskilde
- Emissioner og energiforbrug i signalanlæg og rundkørsler
- Evaluering af motorvejsstyringssystemer
- Mere kapacitet på Motorring 3
- Tidlig eller sen fletning ved indsnævring af motorveje
- Trafikantadfærd ved varsling om vejrlig
- Trafikafvikling på vekselstrækninger
- Lastbilers betydning for fremkommeligheden på motorveje
- Troværdighed af visning på variable tavler
- Evaluering af kørsel på nødspor i myldretiden
- Netværksbaseret trafikinformation på motorveje
- Konsekvenser af hændelser

Forældelse af signalprogrammer

Engelske erfaringer siger, at effektiviteten af trafikafviklingen pga. ikke-opdaterede signalplaner bliver forværret med 2-3 % pr. år. Dette afhænger dels af, hvor meget trafikvolumenet er ændret, dels af hvordan størrelsen af de enkelte trafikstrømme (trafikmønstret) har udviklet sig i samme periode.

Signalprogrammer til signalanlæg dimensioneres til et bestemt trafikmønster. I projektet skal det klarlægges hvor meget trafikafviklingen forringes, hvis trafikmønstret ændrer sig, uden at signalprogrammet samtidig justeres til at håndtere de nye trafikmængder. Med andre ord, er det pengene værd at ofre ressourcer på hyppige opdateringer? Eller kan et signalprogram stå uændret i flere år, før det vil være nødvendigt at justere det?

Modellerne TRANSYT og VISSIM anvendes til at beregne forskellige kvantitative parametre om trafikafviklingen, såsom antal stop, forsinkelse og benzinformbrug for forskellige variationer af trafikmængderne. Endelig kan TRANSYT optimere et samordningsmønster ud fra et givet trafikmønster.

Signalregulerede ruderalnæg

I Danmark findes 20-30 signalregulerede ruderalnæg langs motorvejene. Afstanden mellem rampekrydsene er typisk 50-100 m, hvilket medfører korte kømagasiner for indsvingende trafik fra ramperne med risiko for tilbageblokering.

I Københavns Amt anvendes stort set kun rent tidsstyrede og samordnede signaler, mens man i nyere signalanlæg (fx langs Køge Bugt Motorvejen) benytter sig af mere avancerede trafikstyringsteknikker.

I projektet beskrives de forskellige principper for styring af ruderalnæg. Nogle af anlæggene udvælges med henblik på optimering med eksisterende beregningsmodeller. Modeller som kan bringes i anvendelse er PASSER III-88 til beregning af ruderalnæg samt VISSIM og TRANSYT.

Projektet kan udvides til at omfatte tætliggende signalanlæg generelt.

Busprioritering i signalanlæg

Forskellige foranstaltninger, der i dag anvendes ved busprioriteringer i signalregulerede kryds gennemgås og vurderes med hensyn til cost/benefit for vejforvaltningen, trafikselskabet og trafikanterne.

I projektet udvælges et eller flere kryds med megen bustrafik, hvor forvaltningen og trafikselskabet er enige om, at der bør og kan gennemføres tiltag for forbedring af bussers fremkommelighed, f.eks. signalanlæggene ved Østerport station eller et andet relevant sted.

Der udarbejdes et forslag til ændring af ét eller flere signalregulerede kryds, så fleksibiliteten i signalgivning øges. De afviklingsmæssige egenskaber før/efter dokumenteres i form af simulationer med VISSIM og/eller TRANSYT, der begge indeholder faciliteter til modellering af busser. Med VISSIM kan indlægning af aktiv busprioritering vurderes.

Signalerne omstilles herefter som foreslået, og der gennemføres målinger af trafikafviklingen før og efter omstillingen af signalerne.

Optimeringskriterier for samordnede signalanlæg

Signalanlæg kan samordnes på baggrund af vidt forskellige kriterier. Ved manuel udformning af samordning for en kæde af signalanlæg anvendes i Danmark normalt det princip, at et køretøj, der starter i den ene ende af samordningen, så vidt

muligt skal kunne køre igennem de øvrige uden at skulle stoppe, det s.k. grønbølge-princip. Dermed tages der ikke hensyn til forholdene for indsvingende, der med dette princip vil få et stop ved det første signal efter indsvingningen. Af andre kriterier kan nævnes:

- mindst muligt antal stop i systemet
- mindst muligt antal stop på hovedvejen
- mindst mulig forsinkelse i systemet
- mindst mulig forsinkelse på hovedvejen
- mindst mulig benzinforbrug
- mindst mulig luftforurening
- eller en kombination af ovennævnte

Ved en manuel beregning er det praktisk taget umuligt at bestemme disse parametre, og det bliver derfor heller aldrig foretaget. Dvs. man ved en manuel beregning ikke ved om det er en optimal løsning, man er nået frem til. Med det svenske AVT (Användarvänligt TRANSYT) får man beregnet alle trafikanteffekterne på kryds og netniveau, og det er muligt som optimeringskriterium at vælge en vilkårlig linearkombination af de nævnte effekter på systemniveau.

I Sverige benyttes mere og mere "mindst mulig luftforurening" som optimeringskriterium. Spørgsmålet er nu, hvorledes trafikanterne opfatter de forskellige optimeringskriterier. Vil disse give vidt forskellige samordningsmønstre og hvor meget vil disse mønstre afvige fra det sædvanlige danske grønbølgeprincip?

Man kan også forestille sig forskellige optimeringskriterier på forskellige vejtyper. På ringveje omkring byer er det måske et grønbølgekriterium, der skal benyttes, mens det på centrumsgader er mindst mulig luftforurening. I projektet afdækkes disse spørgsmål, og det vurderes hvilke trafikale og økonomiske aspekter, der er forbundet med en optimal edb-indstilling af samordnede signalanlæg frem for manuelt fundne indstillinger.

PC-modeller for beregning af signalanlæg

Der findes i dag en række forskellige pc-programmer for beregning/optimering af signalreguleringer (OSCADY, CAPCAL, SIDRA m.fl.). I dette projekt afprøves/vurderes en række af de forskellige modeller under forskellige former for signalstyring (trafikstyring/tidsstyring) og trafikmængder.

Grønne bølger for cyklister?

Cyklisterne klager over, at samordninger er for bilister, ikke for cyklister. Selv om dette ikke nødvendigvis medfører rød bølge for cyklister, kunne det være interessant at undersøge, om det er muligt - og evt. under hvilke vejnets- og signaltekniske betingelser, det ville være muligt at etablere en grøn bølge for cyklister.

Effekten af samordning er stærkt afhængig af spredningen på køretiden mellem de signalregulerede kryds. I TRANSYT regnes med en bølgespredningsalgoritme, hvorefter køretøjer spredes ved kørsel mellem krydsene. I denne algoritme indgår en faktor kaldet bølgespredningsfaktoren, som er en funktion af afstanden mellem krydsene og hastigheden. I opgaven skal der foretages nogle målinger af cyklisters kørsel mellem kryds, og bølgespredningsfaktoren skal bestemmes. Resultatet kan herefter benyttes til en TRANSYT-beregning, hvor både cyklisters og bilisters forsinkelse og antal stop kan bestemmes samt naturligvis effekten af et forsøg på at skabe grøn bølge for cyklister.

Da TRANSYT beregner benzinforbruget ved en given signalindstilling, vil det også være muligt at bestemme en evt. forværring af luftforureningen, som et øget benzinforbrug vil give anledning til. Vejdatalaboratoriets "Køremønster og luftforurening" kan benyttes ved beregningen af køretøjernes emission.

Model for beregning af forsinkelse i trafikstyrede signalanlæg

Teorien for beregning af forsinkelsen i tidsstyrede signalanlæg blev udviklet af F.V. Webster i 1960'erne. Derimod mang-

ler vi en metode til beregning af forsinkelsen i trafikstyrede signalanlæg. Findes der mon en enkel metode, hvormed forsinkelsen kan bestemmes, når strategien bag trafikstyringen er kendt? (præference, "alt rødt"). I projektet kan VISSIM benyttes til at vurdere forsinkelserne i anlæg med forskellige former for trafikstyring.

Fremkommelighed i kryds med separatregulerede venstresving

I disse år ombygges flere og flere signalregulerede kryds, så venstresvingende kun må svinge på 3-lys pilsignaler. Dette vides at reducere antallet af venstresvingsulykkerne markant. Men hvad med fremkommeligheden?

Flere faser i anlægget giver mere ventetid. Hvordan påvirkes trafikafviklingen (stop, forsinkelse, brændstofforbrug, emission), når denne styringsform introduceres, og hvordan kan man med effektiv trafikstyring imødegå nogle af de negative effekter? Effekterne ønskes undersøgt for en vifte af trafikmængde og svingprocenter i et tænkt 3- og 4-benet kryds.

Projektet gennemføres ved hjælp af simuleringsprogrammet VISSIM.

Intelligent styring af signalanlæg

Over halvdelen af de danske signalanlæg er trafikstyrede. Princippet for langt de fleste er nogenlunde det samme: Når en trafikant venter for rødt, forsøger anlægget at finde et hul i alle de trafikstrømme som har grønt. Dette sker ved at enkeltkøretøjer i disse strømme kan forlænge det grønne lys, dog kun op til et vist maksimum, således at de kan passere stoplinien for grønt lys.

I disse betragtninger indgår dog ikke, hvor mange køretøjer, der venter for rødt lys, hvor lange køerne er, og hvor længe køretøjer har ventet for rødt.

Idéen i dette projekt er med hjælp af VISSIM at udvikle og simulere nye strategier, der overordnet set forbedrer trafikafviklingen, især i situationer, hvor krydset er overbelastet. Dvs. der skal udvikles en styrestrategi, hvori parametre som ventetider, kølængder og kapacitet indgår i styringen af signalerne.

Intelligent styrelogik ved detektorfejl i trafikstyrede signalanlæg

Hvis der forekommer detektorfejl i et trafikstyret signalanlæg vil anlæggets performance blive forringet i form af forøget forsinkelse og brændstofforbrug for trafikanterne. I dag benyttes normalt det princip, at en fejlrant detektor anmelder og forlænger, hvis den ikke virker.

I stedet kunne man forestille sig en mere intelligent styrelogik, hvor styreapparatets logik lader en defekt detektor, enten anmelde eller forlænge, eller lader den gøre begge dele ud fra en vurdering i hvert enkelt tilfælde. En foreløbig vurdering tyder på, at dette kan spare trafikanterne for en del ulemper, indtil detektoren bliver repareret.

Vejdirektoratet mangler mere detaljeret viden om, hvordan den intelligente styring skal foregå ved forskellige styreformer i krydset og ved forskellige trafikmængder.

I projektet benyttes VISSIM til at evaluere eksisterende og mere intelligente former for styring ved forskellige trafikmængder.

Signalregulerede rundkørsler

I Danmark findes signalregulerede rundkørsler, der fungerer med tidsstyring 24 timer i døgnet. Ud fra de gældende trafikmængder vurderes den valgte faseopbygning, som sammenlignes med alternativer, der genereres af TRANSYT.

I tynd trafik kan et tidsstyret signalanlæg virke lidt stift. Der udarbejdes derfor et forslag til ombygning fra tidsstyring til trafikstyring.

I VISSIM programmeres forskellige løsninger, som foruden en vurdering af fremkommeligheden (forsinkelse og antal stop) vurderes med hensyn til anlægs- og trafikøkonomi.

Vejrafhængig omløbstid i et samordnet signalsystem

Hastighedsdetektorer til kontinuerlig indsamling af hastighedsdata med henblik på justering af signalers omløbstid i tilfælde af dårligt vejrlig med reducerede kapaciteter og køretøjshastigheder til følge er indlagt i nogle samordnede signalsystemer, fx København/Frederiksberg, Københavns Amt, Frederikshavn, Fredericia (Vejlevej) samt i enkeltanlæg (Kirkeåsvejen).

Formålet med dette projekt er at belyse effekterne af en sådan facilitet, og hvilke virkninger, som ville kunne registreres, hvis systemet ikke indeholdt denne funktion. Herigennem kan vi få en viden om, om det vil være lønsomt at indføre denne facilitet generelt i vore samordnede signalsystemer. Knap halvdelen af landets signalanlæg indgår i samordnede signalsystemer.

Som evalueringsværktøj benyttes TRANSYT-modellen på en konkret samordning. Der foretages målinger af grøntimekapaciteten i en række kryds i såvel tørt som i vådt føre (eller snevejr?). Disse målinger kan gennemføres manuelt, eller maskinelt, hvis der kan træffes aftale med en forvaltning med et overvågningssystem med tælleudstyr. Der laves endvidere målinger af køretiderne mellem krydsene.

Måledata benyttes som indgangsværdier til TRANSYT-beregningerne og effekterne beregnes for følgende scenarier:

1. Tørt føre - nuværende signalplan
2. Tørt føre - TRANSYT-optimeret signalplan
3. Vådt føre - nuværende signalplan
4. Vådt føre - TRANSYT-optimeret signalplan
5. Vådt føre - hastighedsafhængig korrektion af 2).

Ved sammenligning af effekterne for de forskellige scenarier fås et kvantitativt udtryk for virkningerne af såvel TRANSYT-optimering som af en hastighedsafhængig korrektion af omløbstiden.

Energisparepotentialer ved optimering af signalanlæg

Forbedring af signalanlæg kan ske på flere fronter. I signalsamordninger kan man forbedre signalernes indbyrdes stilling, hvorved antallet af stop reduceres og fremkommeligheden forøges.

I Danmark har vi ca. 250 rent tidsstyrede signalanlæg. Disse kan ombygges til fuldt trafikstyrede signalanlæg. Øvrige trafikstyrede signalanlæg kan vedligeholdes bedre, så de i højere grad fungerer uden detektorfejl.

Vejdirektoratet har lavet et vist forarbejde, der indikerer, at der er rigtig meget at hente på brændstofforbrug, hvis man intensiverer indsatsen på ovennævnte områder. I projektet optimeres en række samordninger, fx med brug af TRANSYT, og effektforbedringerne eftervises med simuleringer i VISSIM.

Endvidere undersøges nogle typiske danske fuldt trafikstyrede kryds for fejl og konsekvenserne på trafikafviklingen undersøges i VISSIM. I projektet skal der især holdes fokus på de energimæssige aspekter og dermed CO₂, idet dette er output fra de anvendte modeller.

Rampedosering på motorvejsramper

Regulering af tilfartstrafikken til motorveje gennem etablering af et signalanlæg på rampen har været benyttet på Helsingørmotorvejen ved Nærum i perioden fra 1992-96. På denne måde sendes bilerne ind på motorvejen enkeltvis med 5-10 sekunders mellemrum. På denne måde reduceres sandsynligheden for trafikstop på motorvejen. Effekterne fra Nærum er evalueret i en 3-ugers opgave ved CTT, DTU i 1996 og i Aalborg Trafik-dage i 1997.

Fra Holland, Storbritannien og Frankrig kendes en algoritme benævnt ALINEA, der benytter detektorernes belægningsgrad efter rampen som styringsparameter. En anden algoritme er baseret på FUZZY-logik og har med held været benyttet i Holland.

I projektet simuleres for en konkret lokalitet et doseringsanlæg med forskellige strategier, og det vurderes hvilken effekt en koordineret styring af anlæggene vil have på trafikafviklingen.

Trafikafvikling ved rampetilslutninger

Trafikken på stærkt befærdede motorveje bryder ofte sammen i myldretiden. Især omkring rampetilslutningerne og flettestrækninger kan trafikafviklingen være dårlig med køopstuvning bagud til følge. Kapaciteten af frie motorvejssegmenter er blevet belyst. Derimod er vor viden om trafikafviklingen ved rampetilslutninger beskeden. I projektet skal trafikafviklingen (kapacitet, hastighed, serviceniveau) fastlægges for sådanne vejsegmenter under forskellige belastninger og geometrisk udformning af hhv. motorvej og rampe. Data indsamles p.t. for enkeltkøretøjer via TRIM-spoler på alle motorveje og ramper i Københavnsområdet. Disse data kan indgå i projektet. Data kan suppleres med videooptagelser eller andre trafikmålinger på de relevante steder.

Simulering af motorvejstrafik

Der findes mange simuleringsprogrammer til forskellige formål. Det mest anvendte i Danmark er VISSIM, som har været benyttet til simulering af trafikken på motorveje i forskellige situationer. Et af de ømme punkter i VISSIM synes at være vognbaneskit og flettemanøvrer. I projektet simuleres indfletninger fra ramper og trafikafvikling på vekselstrækninger.

Regularitet for motorvejstrafik

Med Vejdirektoratets analysesystem, ASTRID, ønskes belyst, hvordan regulariteten, rejsetider og forsinkelse er på motorvejene i Københavnsområdet i myldretiden. Samtidig ønskes udviklet et regularitetsbegreb for motorvejstrafik. Hvor stor er fx sandsynligheden for, at man på en given dag kan gennemføre en tur med en forsinkelse under en vis værdi? ASTRID indeholder alle trafiksituationer med hastigheder under 80 km/t på det meste af motorvejsnettet i Københavnsområdet (TRIM-nettet).

Det vil også være interessant at få opstillet en model for sammenhængen mellem trafikmængde og forsinkelse på en række strækninger for at afdække, om der er en forskel i marginalforsinkelsen ved forskellige trafikniveauer.

Nyt serviceniveaubegreb for motorveje med køtrafik

Med det klassiske serviceniveaubegreb for motorveje analyseres trafikafviklingen i en spidstime og klassificeres i én af seks klasser fra A til F. Grænsen mellem serviceniveau E og F ligger ved en hastighed på 80 km/t. Med Vejdirektoratets ASTRID-system opsamles for de motorveje, der indgår i TRIM-systemet, alle perioder med en hastighed mindre end 80 km/t, dvs. serviceniveau F. Der er imidlertid stor forskel på, om man kører 75 km/t, eller om man kører 30 km/t på en

strækning. Begge situationer karakteriseres som serviceniveau F.

Ud fra ASTRID ønskes der opstillet en model for, hvorledes man klassificerer fremkommeligheden på de enkelte strækninger i forhold til hinanden. Med andre ord ønskes udviklet en model for, hvorledes man beregner et årsserviceniveau på TRIM-strækningerne. Det kunne fx være noget med antal timer med hastighed mindre end 80 km/t (eller en anden hastighed) eller noget med sandsynligheden for en hastighed mindre end 80 km/t.

Hastighedsspredning mellem kørespor på motorveje

Praksis viser, at kapaciteten af køresporene på en motorvej er forskellig. Ved kørsel på motorvej i myldretiden virker det som om, at der er en større hastighedsspredning i de(t) hurtige spor, som også har den største kapacitet. Det vil sige, at der er en større tendens til hyppige og hurtige trafikstop, mens trafikken glider mere upåvirket i højre spor. Når man i trafikradioen hører om motorvejsuheld i myldretiden er det næsten altid i venstre spor, at uheldet er sket. Er der en fornuftig forklaring på dette fænomen? I projektet ønskes det belyst, hvorledes hastighedsspredningen er i de forskellige kørespor. Måske kan dette forklare de mange uheld i venstre spor.

Hvis der er stor hastighedsspredning i venstre spor, kan man måske nedbringe uheldstallet ved at indføre hastighedshomogenisering, dvs. at køretøjerne ved hjælp af variable hastighedstavler bringes til at køre med en mere ensartet hastighed og dermed mindre hastighedsspredning. Projektet kan evt. gennemføres sammen med projektet om "Simulering af motorvejstrafik".

Konsekvenser af forstyrrelser i vejtrafikken

Flere gange om ugen sker der større eller mindre trafikuheld på motorvejen omkring København. Det er dog ikke kendt hvor store de samfundsmæssige omkostninger ved sådanne uheld egentlig er. I Sverige har man udført analyser af de samfundsøkonomiske konsekvenser af konkrete situationer, hvor en hændelse har forårsaget trafiksammenbrud i et større område. I projektet analyseres konsekvenserne af en række hændelser på motorvejsnettet mht. ekstra rejsetid, forsinkelser og trafikomlejring til det omkringliggende vejnet. Som datamateriale kan benyttes egne observationer, data fra Vejdirektoratets TRIM-system og oplysninger fra Vejdirektoratets trafikinformationscenters daglige logbog.

Rejsetidsmåling på motorveje

I hovedstadsområdet pakker trafikken mere og mere i myldretiderne, og den aktuelle rejsetid afviger mere og mere fra rejsetiden uden for myldretiderne. I projektet vurderes evt. ud fra egne målinger forskellige algoritmer til beregning af rejsetider. I Vejdirektoratets ASTRID-database baseret på hastigheder fra TRIM-systemet beregnes rejsehastigheden ved at udstrække en punkthastighed over en delstrækning mod det foregående og efterfølgende hastighedsmålepunkt. Denne punkthastighed antages således at gælde for en strækning på op til 2 km. Ved højere hastigheder er dette formentlig en udmærket målemetode. Men ved lave og dermed typisk stærkt varierende hastigheder på strækningen er metoden næppe særlig god. Usikkerheden er p.t. ukendt.

I projektet gennemføres egne målinger på strækninger med fremkommelighedsproblemer, Køge Bugt Motorvejen, Holbækmotorvejen og Hillerødmotorvejen. Aktuelle måledata sammenlignes med data fra ASTRID-systemet, hvor der genereres aktuelle 1 min. og 5 min. databaser.

Trafikantadfærd i signalregulerede kryds

Den eksisterende viden om trafikantadfærden i signalregulerede kryds er ikke særligt stor. Enkelte data findes dog, men den er efterhånden ved at være gammel, og der er en formodning om, at den ændres med tiden. Sådanne data benyttes

ved dimensionering af signalregulerede kryds. Vejreglerne for signalanlæg er under revision, og nye værdier efter danske forhold er ønskelige. I projektet ønskes en række parametre bestemt, som fx kunne være: Fodgængerhastighed ved hhv. grøn og rød mand, hastighed og tidspunkt i forhold til skift til grøn for første køretøj med flyvende start, hastighed og tidspunkt for sidste køretøj efter skift fra grøn til gult.

Nogle vejbestyrelser har automatiske systemer til indsamling af data vedr. biltrafikken. Disse systemer kan sammen med videooptagelser danne grundlag for dataindsamlingen.

Kriterier for samordning af signalanlæg

For 30 år siden blev der lavet nogle tommelfingerregler for hvornår signaler burde samordnes. Vi har en formodning om, at jo højere hastighed og jo flere spor, jo større spredning vil finde sted efter igangsætningen. P.t. findes der dog intet videnskabeligt grundlag for at afgøre, hvornår signaler bør samordnes. I dette projekt gennemføres serier af målinger af køretøjers passage i bestemte afstande fra forskellige signalanlægs stoplinier med henblik på at finde ud af, hvorledes køretøjsbølger spredes efter start.

Denne viden benyttes til at opstille normer for, hvornår signaler bør samordnes på veje med forskelligt antal kørespor og hastighed.

Evaluerings af adaptivt styresystem, DOGS, i Hørsholm

I Hørsholm blev der i 2005 etableret et adaptivt system, DOGS (Dynamisk Optimering af Grøntider og Samordning) for en række signalanlæg. Omløbstid, grøntider og forskydninger beregnes løbende ud fra detektordata.

Gennem projektet ønskes det belyst, om trafikanterne set ud fra en overordnet vurdering har fået bedre forhold i forhold til det tidligere tidsstyrede signalsystem.

Projektet tænkes gennemført med egne målinger af fremkommeligheden med og uden systemet indkoblet samt evt. VISSIM-simuleringer.

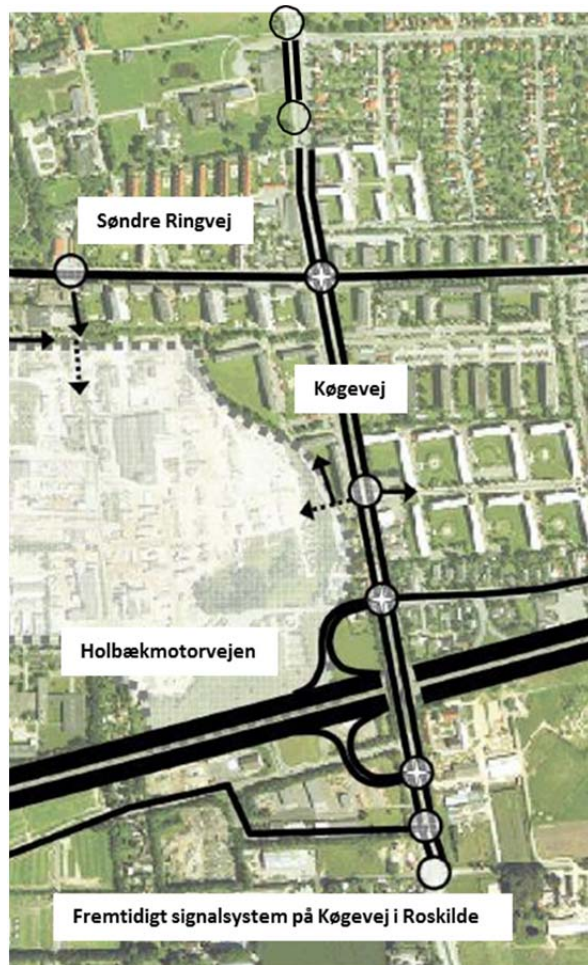
Signalstyring i nye signalanlæg på Køgevej i Roskilde

I forbindelse med udvidelsen af Holbækmotorvejen ved Roskilde er der etableret nye signalreguleringer på Køgevej i Roskilde. Kommunen er ved at planlægge et nyt signalanlæg. Med dette som udgangspunkt er formålet at optimere signalstyringen på en 2 km lang strækning af Køgevej fra Roskilde sygehus til et punkt syd for motorvejen.

Vil det være fordelagtigt at sammenkoble signalanlæggene ved motorvejen med de to øvrige signalanlæg på strækningen?

Hvorledes skal signalanlæggene styres? Og hvordan skal samordningen udformes?

Ved hjælp af TRANSYT kan signalanlæggene optimeres og med VISSIM kan der simuleres trafikstyring og effekterne kan vurderes. Der er allerede opbygget en simpel model i VISSIM for dele af signalsystemet, men virkningerne af trafikstyringen er ukendt.



Emissioner og energiforbrug i signalanlæg og rundkørsler

I disse år er der bygget en del rundkørsler, men hvorledes ligger det egentlig med køretøjernes emissioner og energiforbrug i rundkørsel contra signalanlæg med forskellige former for styring? Det antages normalt, at rundkørsler giver de laveste værdier, men hvorledes forholder det sig ved forskellige trafikmængder og svingprocenter? I projektet gennemføres en række simuleringer til afdækning af dette forhold, fx med brug af VISSIM.

Evaluerings af motorvejsstyringssystemer

Vejdirektoratet etablerer i de kommende år en række systemer for styring af motorvejstrafikken i hovedstadsområdet, fx på Helsingørmotorvejen, Amagermotorvejen og Hillerødmotorvejen.

I projektet ønskes foretaget en evaluering af effekterne af etablering af sådanne systemer. Parametre i en sådan evaluering kan fx være:

- Trafikantforståelse, –accept og –adfærd, –forståelse og brugertilfredshed
- Kapacitet, fremkommelighed, hastighedsvariation
- Trafikanternes vejvalg og rejsetidspunkt

Til projektet stiller Vejdirektoratet data til rådighed i det omfang det er muligt.

Mere kapacitet på Motorring 3

Efter færdiggørelsen af udbygningen af Motorring 3 er trafikken vokset ganske betragteligt. Mange steder kan tilslutningsanlæggene ikke længere klare den forøgede trafik og også på flere delstrækninger er der begyndende afviklingsproblemer.

Nødsporene på strækningen mellem Buddingevej og Holbækmotorvejen er forberedt til kørsel. I projektet skal det analyseres, hvilke muligheder, der er for at forøge kapaciteten på strækningen. Dette vil bl.a. medføre, at ITS-systemet skal udbygges.

Projektet kan tage udgangspunkt i trafikberegninger med vejvalgsmodeller eller mere detaljerede modeller til analyse af trafikafviklingen på de enkelte delstrækninger og ramper, fx EXCEL-modellen FREEVAL.

Tidlig eller sen fletning ved indsnævring af motorveje

Oftest sker der et sporbortfald på motorveje, enten fordi motorvejen permanent indsnævres, eller fordi et anlægs- eller vedligeholdelsesarbejde på strækningen har krævet, at der midlertidigt mangler et spor på strækningen.

Spørgsmålet er nu, om trafikken i god tid skal orienteres/anbefales at køre ind i én række, eller om denne indfletning først skal ske sent, dvs. umiddelbart ved indsnævringen?

Der er skrevet en del litteratur om dette emne (også på dansk), og det har været diskuteret, hvilket af de to koncepter, der er bedst for trafikafviklingen.

I projektet gennemgås litteraturen inden for emnet, og der iværksættes egne målinger, som kan klarlægge, hvilken af de to metoder, der giver den største kapacitet og dermed den bedste fremkommelighed.

Trafikantadfærd ved varsling om vejrlig

Vejdirektoratet giver visse steder udmelding om vejrliget på variable teksttavler. I projektet skal det undersøges, hvilken indflydelse disse udmeldinger har på trafikanternes hastighed og øvrig adfærd. Med andre ord: har sådanne budskaber på variable tavler deres berettigelse?

Trafikafvikling på vekselstrækninger

Vekselstrækninger udgøres af vejsegmenter, hvor to indgående trafikstrømme har en fælles strækning inden trafikstrømmene igen deler sig i to. Vekselstrækninger forekommer primært på motorveje, enten hvor motorvejen udgør køresporene længst til venstre eller ved siden af motorvejens gennemgående spor, hvor en vekselstrækning samler og fordeler trafikken, inden den skiller ud mod to destinationer. Sidstnævnte forekommer især ved kløverbladsanlæg. Vejdirektoratet er interesseret i en analyse af fremkommelighed og kapacitet ved forskelligt forekommende vekselstrækninger under danske forhold.

Lastbilers betydning for fremkommeligheden på motorveje

Det er velkendt, at tunge køretøjer alene ved deres længde og afstand til andre køretøjer påvirker kapaciteten og fremkommeligheden. Det er imidlertid ikke klarlagt, hvorledes lastbilers lavere hastighed influerer på disse forhold. I projektet analyseres sammenhængen mellem hastighed og trafikintensitet for en række motorvejsstrækninger under varierende trafikbelastninger, hvor køretøjssammensætningen er kendt.

Troværdighed af visning på variable tavler

Der er efterhånden kommet mange ITS-systemer i drift langs de danske motorveje, der kan vise en variabel hastighed samt oplysninger om rejsetid eller afstand til en kø længere fremme. I projektet skal troværdigheden af tavlernes visning undersøges. Svarer tavlernes visning til det, som trafikanterne oplever på de tidspunkter tavlerne passeres?

Der kan fx indsamles GPS-data ved gennemkørsler som sammenlignes med aktuel tavlevisning og hastigheder fra snit langs strækningen.

Evaluerer af kørsel på nødspor i myldretiden

På Hillerød-motorvejen mellem Værløse og Bagsværd i retning mod København vil det fra slutningen af 2013 være muligt at køre i nødsporet i morgenmyldretiden. Vejdirektoratet har en forventning om, hvilke trafikale effekter dette vil have (kapacitet, trafikmængde og fremkommelighed). I projektet analyseres alle tilgængelige data i forbindelse med projektet og det vurderes, om tiltaget har den forventede effekt samt hvilke øvrige effekter, der evt. kan registreres.

Netværksbaseret trafikinformation på motorveje

Vejdirektoratet giver på to steder i hovedstadsområdet oplysninger på variable tavler om rejsetiden mod samme destination. Tanken er at udbrede konceptet til en række andre steder på motorvejene i hovedstadsområdet. I projektet skal det vurderes bl.a. ved hjælp af rutene/rutebundter, hvor mange trafikanter man kan forvente har glæde af et sådant system på de steder, hvor tavler informerer om rejsetiderne ad alternative ruter mod samme destination. Ligeledes skal det vurderes, hvilke trafikale og samfundsmæssige effekter en sådan brug af variable tavler vil have.

Konsekvenser af hændelser

Hændelse på vejnettet i form af trafikulykker, nedbrudte biler på kørebanen o.l. har små eller ingen konsekvenser ved små trafikbelastninger. Derimod kan de trafikale konsekvenser være meget store, hvis trafikbelastningen er meget høj eller måske endda over vejens kapacitet. Hændelser kan her give anledning til lange kødannelser, meget store forsinkelser og store trafikomlejring til andre dele af vejnettet.

I projektet skal det for en række konkrete trafikale hændelser i projektperioden analyseres, hvilke konsekvenser den pågældende hændelse giver anledning til. Dette kan fx være køers udstrækning, hastighed, trafikal omlejring. Til brug herfor benyttes data fra Vejdirektoratets fremkommelighedsregistreringssystemer, TomTom/livetraffic, Google/Traffic o.l. samt tilgængelige trafiktællinger fra området. Det kan også være relevant at analysere beredskabsindsatsen (redning, bugsering, politidirigering) og udmeldinger i trafikradioen (DR/P4) samt evt. budskaber på variable tavler alt sammen med henblik på at klarlægge evt. forbedringsmuligheder samt erfaringsindhentninger til fremtidig brug.

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