

*NordFoU-seminar
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ETSI – Experiences from Nordic R&D co-operation

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- ETSI history
- Pre-study
- ETSI I + ETSI II
- ETSI III
- After ETSI
- Experiences
- Conclusions

- In Finnish National Road Administration (FINNRA) interest to life-cycle costing due to study "Life-cycle costs of small bridges"
- Project "Livscyklusanalyser til broforvaltning" was proposed to NordFoU project, accepted 22.-23.9.2004, project responsibility FINNRA, project leader TKK
- Pre-study 2004 – 2005 in Finland: FINNRA + TKK + Ramboll Finland
- Agreement on Nordic Research Cooperation 7.12.2005: Finland, Norway and Sweden
 - ETSI I 2005 – 2007, ETSI II 2007 – 2009
- ETSI III, agreement 8.12.2009: Denmark, Finland, Norway and Sweden
- Name ETSI comes from original Finnish project name: Elinkaareltaan Tarkoituksenmukainen Silta (= Life cycle functional bridge)

■ Tasks

- Defining the potential research subjects for larger project
- Preparing the Nordic R&D project

■ First proposal for contents

- Human requirements: Noise barriers on bridges, Traffic and structural safety
- Economy (LCC): Discount rates to be used for bridge life cycle cost, Life cycle cost of concrete, steel, stone and wood bridges, Comparison of different bridge construction materials, Traffic cost during rehabilitation
- Bridge management: Bridge maintenance, Advanced monitoring and inspection of bridges
- Cultural and aesthetical requirements: Multilateral decision-making methods
- Raw material economy: Recycling of bridge components and materials
- Environmental burdens economy: Environmental profiles of concrete, steel, stone and wood bridges

- Negotiations between Danish, Finnish, Norwegian and Swedish road administration
- Industry funding was first planned to begin with larger project, but decision was made by administrations to begin with smaller budget
- Project was divided to two stages I and II with possibilities
 - to define the tasks for stage II after stage I
 - to add new partners for stage I
- Agreement 7.12.2005 Finland, Norway and Sweden
- Total budget 2005 – 2008 for ETSI I + ETSI II 420 000 euro
- Research institutes
 - Helsinki University of Technology (TKK)
 - Norwegian University of Science and Technology (NTNU)
 - Ramboll Finland Ltd.
 - Royal Institute of Technology (KTH)
 - VTT Technical Research centre of Finland (VTT)

- Create appropriate tools of information related to a bridge and its life cycle for designers, constructors and bridge owners. Tools to be developed will be in such a form that they are relevant and directly applicable to practical problems or decision-making.
- Optimise a bridge considering all aspects: functionality, technique, economics and aesthetics in the lifetime of the bridge. For example, on detail level the project will give basis to choose the proper bridge type or material considering long-term effects.
- Produce measuring methods for comparing and evaluation of different items for judging the life cycle of a bridge in a meaningful way.
- Bring the principle of sustainability into practice in bridge engineering.
- Emphasise the importance of cultural values in bridge design, construction and maintenance.
- Create a communication channel between the Nordic countries in bridge life cycle engineering.
For example, a web site will be created for the relevant information.

- Main focus
 - State-of-the-art study of previous investigations related to bridge life cycle cost (LCC) analysis with a proposal for further actions.
 - Data collection for LCC-analysis
 - Methodology for LCC-analysis
 - Programming of the LCC-analysis tools, in the first stage for the use of road administrations.
- Report of stage I, published by TKK
 - State-of-the-art
 - Methodology
 - Description of three LCC programs
 - Suggestions for future research and development
- Closing seminar

- Main focus
 - Developing and completing LCC program
=> efficient LCC tool for the use of Road Administrations
 - Methodology for LCC-analysis further developed
 - Creating a system to bring human requirements as well as cultural and aesthetical requirements to Life Cycle Analysis
 - Raw material economy and environmental burdens
=> weight of these issues smaller than of the two other ones
- Report of stage II, published by TKK
 - SP1: Life Cycle Cost Methodology and Computer Tool WebLCC
 - SP2: Environmental Effects – Life Cycle Assessment of Bridges (with BridgeLCA tool)
 - SP3: Bridge Aesthetics and Cultural Effects (with developed evaluation system)
- Intermediate and closing seminars

- Need for further development of created methods and tools
- Need for more qualified input data
- Need for input databases helping data input
- Agreement 8.12.2009: Denmark, Finland, Norway and Sweden
- Total budget 600 000 euroa
- Research institutes and consultants
 - Helsinki University of Technology (TKK)/Aalto University
 - COWI Denmark
 - Extraplan, Finland
 - Norwegian University of Science and Technology (NTNU)
 - Ramboll Finland
 - Royal Institute of Technology (KTH)
 - VR Track, Finland
 - WSP Finland

■ Research areas

- Testing of the developed tools of Stage II; *WebLCC* and *BridgeLCA* - programs for various kind of bridge types. Testing the developed method for evaluation the aesthetical values.
- Establishing the *Material Groups*. Obtaining valid data for LCC-analysis of concrete, steel and timber bridges. Data for other materials (stone, stainless steel, etc.). Developing national material data basis and default values for materials.
- Updating and completing of *WebLCC* and *BridgeLCA* -programs. The final goal is to get integrated tools for the use of all Nordic Road Administrations.
- Dissemination of the *ETSI Project* results will occur constantly by bringing the results to practical application level.

■ Task groups

- TG1: Testing of the developed tools. (All)
- TG2: Data Base and Material Groups. (All)
- TG3: Updating and Completing WebLCC. (KTH)
- TG4: Updating and Completing BridgeLCA. (NTNU)
- TG5: Implementing ETSI systems in bridge design process. (All)

- Project prolonged December 2011 => May 2012
- State now
 - Last testings of program tools still continuing
 - Part of national values for databases still missing
 - Final reporting beginning
- Closing seminar in Malmö 14 – 15 May in Malmö, Luftkastellet vid bron, see <http://etsi.aalto.fi/etsi3>

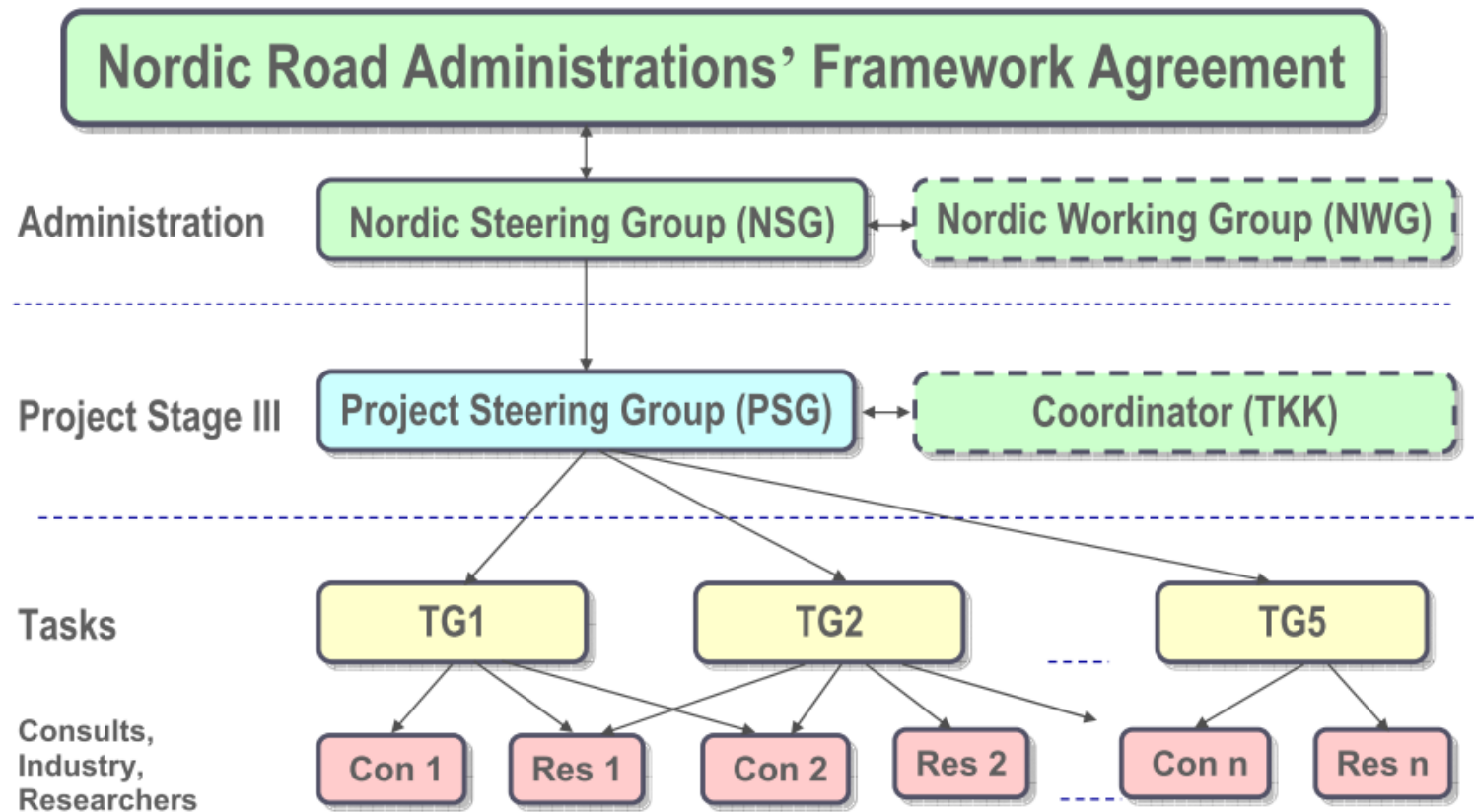


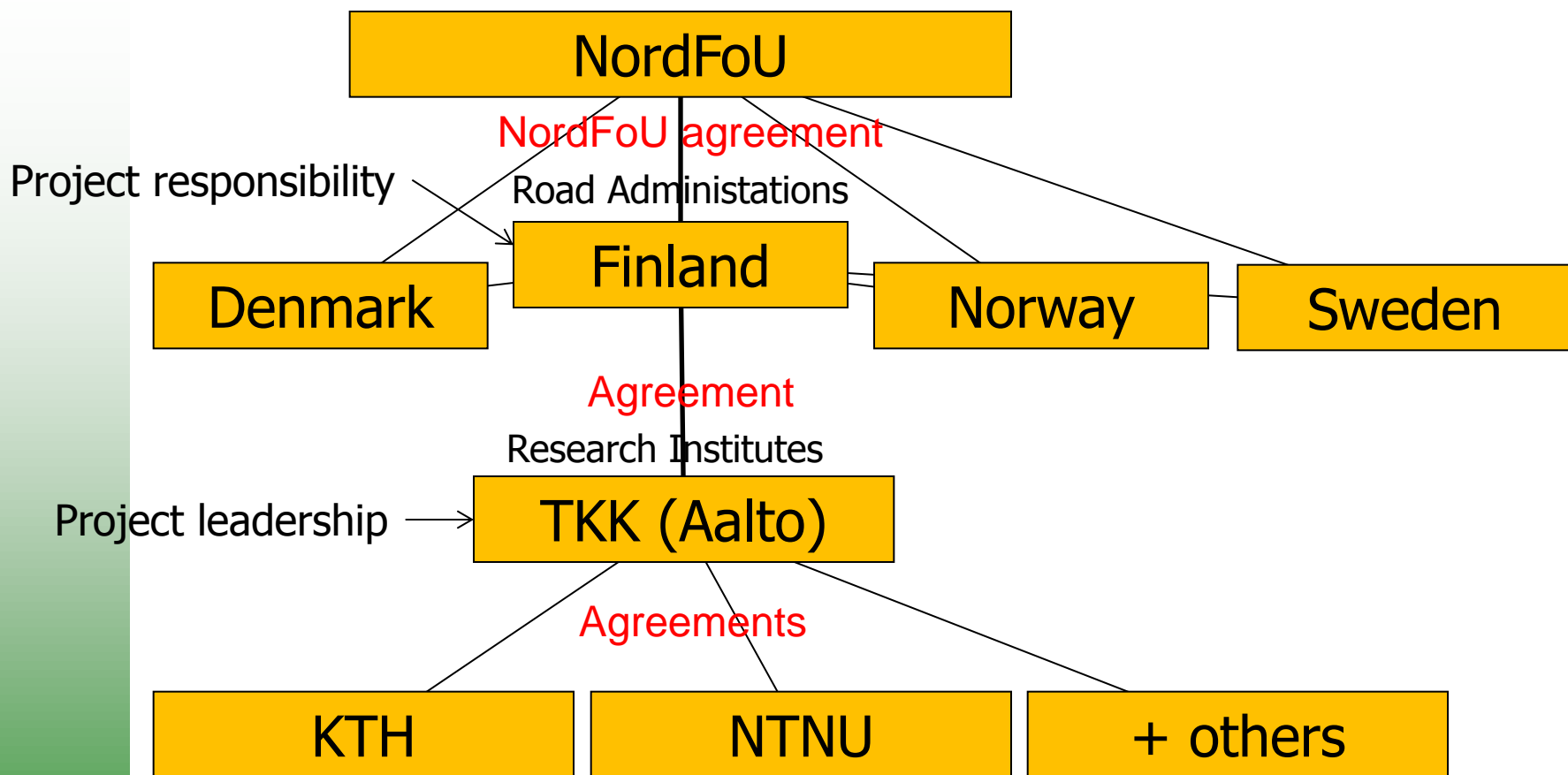
Luftkastellet vid Bron: Den 1800kvm stora byggnaden har en jättepotential för kulturella arrangemang, events, konserter, konferenser, utställningar och stora middagar.

- National implementing: seminars, courses, articles
- Piloting in projects
- Nordic follow-up group with yearly meetings
- Widening methods and tools to calculate other infra structures

- NordFoU bureaucracy
 - Agreement form was good help in the beginning
 - Has become easier: decisions can be made by e-mail
 - Status reporting simple enough
- Organizing of project
 - Responsibilities were quite clear
 - Challenges
 - Three levels of agreements took time
 - Especially agreements between universities were difficult
 - Follow up of the real costs was quite difficult
 - Dividing the project under national responsibilities could be easier
- Co-operation
 - The special know-how of each research institutes could be used
 - There were problems in keeping schedules due to temporary missing resources of partners

ETSI Project III Organization Chart





- Other

- The task to develop program tools is not the best for NordFoU R&D-project: this should be task for private software producers
=> better areas: common R&D and know-how, quality requirements, directions
- Both universities and consultants are needed
 - Universities: to guarantee scientific level and give education
 - Consultants: to guarantee functionality and practicability
- Duration of the project was too long
 - During the project many LCC and LCA tools were developed
 - The need for tools in the end of the project was smaller than in the beginning?

- We could do it!
 - Common ETSI tools developed for LCC, LCA and aesthetical evaluation
 - Know-how of partizipating organisations has increased substantially
 - Workability in projects still have to be tested
 - Implementation under national responsibility
- NordFoU co-operation is needed!
 - To combine forces and increase know-how in common environment and culture
 - To get to know Nordic colleagues and organisations

Thank you for your attention!