

## Minutes – Start meeting for the project “Dyna-TTB”

**When:** Start 12:00 the 28<sup>th</sup> of March 2019 and ending at 13:30 the 29<sup>th</sup> of March 2019

**Where:** Wood Hotel by Frich’s Hotel & Spiseri Brumunddal AS

### Aim of the meeting

Presentation of the partners, previous experience and interests in the project. Discussions about the project plan and work for the first part of the project. Discussion about PhD student work and co-operation. Administrative routines and reporting.

### Agenda

#### Day 1

- 13:00-13:15 Welcome and presentation of project
- 13:15-13:30 Presentation of Forest Value
- 13:30-16:00 Presentation of each of the partners – motivations for being in the project and expectations on the project, previous experience, testing and modelling possibilities.
- 16:00-17:30 Discussion on the project plan -setting aims, activities and a timeplan for each WP and how to share results.  
WP 2 – Laboratory-based experimental determination of dynamic response of components, connections and sub-assemblies  
WP 3 – In-situ measurements  
WP 4 – Numerical modelling of dynamic response
- 17:30-18:30 Presentation of Mjøstårnet and tour of the building

#### Day 2

- 08:00-09:30 Cont. Discussion on the project plan -setting aims, activities and a timeplan for each WP and how to share results.
- 09:30-10:00 Discussion regarding PhD projects within the project
- 10:30-12:30 Other questions:  
Discussion on communication within the project and externally  
Project management, reporting and consortium agreement

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# Day 1 – Thursday 28<sup>th</sup> of March

## Project presentation

Marie gave a short presentation of the objectives and the plans for the project Dyna-TTB according to the application: identify experimentally a number of full-scale TTB structures within Europe and based on these results, develop representative FE models for predicting the vibration response of TTBs exposed to wind-induced dynamic loading. The detailed objectives are:

- Quantify structural damping in TTB
- Identify and quantify effects of connections and non-structural elements
- Bottom up numerical FE model
- Validate predicted response
- TTB Design guidelines

## Forest Value

Petter Nilsen from Research Council of Norway is the national representative in the Forest Value program and is together with Anders Holmgren designated as observers of the Dyna-TTB project. Petter gave a short presentation of the Forest Value programme. The programme has 13 national funding bodies and is part of the European Research Arena (ERA-net). The aim is to link national research projects through cooperation. The Forest Value program is one part of Horizon 2020 programme and supports the programme with some funding from the Commission. The total funding of the ForestValue programme is 15M euros with the EU contributing 5M euros.

## Presentation of each of the partners

Most of the ppt-presentations from the partners can be found in the drop-box under the folder “meetings”. Short notations from the presentations can be found in the Appendix to the meeting.

## Discussion on the project plan and the Work Packages (WP)

The WP leaders started of the discussion by showing some ppt-pages about the content of each WP as stated in the project plan.

### **WP2 – Laboratory-based experimental determination of dynamic response of components, connections and sub-assemblies (RISE)**

The first point in the work is to do a survey of types of connections used in the buildings that will be tested in-situ. This survey will show what type of data is missing at the moment and is necessary to establish within the Dyna-TTB project. There are data on several types of connections among the partners, InnoRenew CoE for example have data on several types of CLT connections.

The next step will be to set up laboratory evaluations. There is then a necessity to establish which type of data is necessary and in what format the data is needed.

### **WP3 – In-situ measurements (University of Exeter):**

In the project team there are two teams with experimental equipment (shakers, accelerometers etc) for in-situ testing: University of Exeter (Alex) and CSTB (Olivier). In Slovenia, the team from InnoRenew CoE will perform the measurement by themselves with support from Uni Exeter.

Supports by other partners are necessary for the in-situ testing, supporting team etc. Learning from ambient testing would be helpful for planning the testing. There is also a need for best engineering models of the structures before testing to determine best positions for shakers, accelerometers and the mass needed for the shaker. Some partners have access to models that might be useful.

Points needed to be discussed:

- Assessment of feasibility of testing e.g. possibilities to access the buildings with the equipment, check the stiffness of the floor/deck to carry the equipment and transmit the excitations and access to the structure for measurements.
- Sequencing of testing vs modelling.
- Data handling and format and storage.
- Test protocols.

Propose to move Milestone nr. 8 from the month 12 to month 18.

### **WP4 – Numerical modelling of dynamic response (NTNU)**

A MSc thesis on dynamical modelling and Ambient Vibration testing of Treet in Bergen was presented shortly. NTNU also pointed out the importance of understanding the timber structure to be tested so that the measurements are done on the actual building system and not on non-load bearing structures (some parts might be loose).

Points to be discussed:

- Identify all the building to be tested
- Engineering models
- Model updating tools and techniques
- Identify parameters (size effects?)

The models should help us to understand the physic behind the wind-induced vibrations: predict structural stiffness, predict energy dissipation and validate for different choice of structural components and connection techniques.

The planned outcome: Guidelines for structural modelling based on simplifications and documented input for European standardization.

### **Presentation of Mjøstårnet**

Magne and Rune gave a presentation on the construction and the structure of the building before the group did a tour of the building.

# Day 2 – Friday 29<sup>th</sup> of March

## Discussions on the WPs and the project plan

### Discussion point 1 – final aim

The final aim of the project can be described in terms of results disseminated to partners outside the project. Produce a guide for how to design using "Engineering softwares" that includes: stiffness and damping for material, connections and assemblies. Updated regulations for Eurocode 0, 1, 5 (and 8?) and rules of thumb for early stage design.

Comments:

Alex: It might be easier to measure the energy dissipation within the all dynamical tested system than the dissipation within a single material.

Kjell: WP2 and WP3 will measure energy dissipation in structures of different scales and WP4 will aim to combine or merge the results from both scales.

Olivier: Propose to add some sensors to measure strains during the Forced Vibration Tests (FVTs) to see displacement amplitudes effects on the damping.

### Discussion point 2 – structures for testing

The list of buildings ready for the in-situ measurements was discussed. The buildings that were mentioned more or less definite:

- France:
  - o La Tour Hyperion in Bordeaux (Eiffage),
  - o Treed IT near Paris (Arbonis),
  - o and a project near Nantes (Galeo).
- Norway:
  - o Treet in Bergen (Moelven, Sweco),
  - o Mjøstårnet in Brumunddal (Moelven, Sweco),
  - o and one timber bridge (Moelven).
- Slovenia:
  - o Karantanika, two 4-storey CLT-buildings, one built and one under construction near Ljubljana (InnoRenew CoE).
- Sweden:
  - o Kv. Eken in Mariestad (Moelven, Sweco),
- UK:
  - o (a 4-storey CLT in Oxford (SaW))
  - o 7-storey CLT building in Glasgow (SaW)
  - o and maybe Murray Groove in London (SaW).

For all of the buildings it is necessary to:

- Describe the structure incl. building system and connections. For this a template with necessary data needs to be formed.
- One team should be settled as soon as possible for each building. The team should have a team leader coordinating the contacts with the building actors, planning the different activities and establishing testing protocol. The team should also have a member from the WP3 for the in-situ vibration test and a member from the WP4 for the pre-/post-modelling.

- The team lead for each building needs to contact owners, contractors or material producers to secure the availability of buildings to be tested.

Comments:

Alex: Mjøstårnet could serve as a reference to establish templates for planning and for the testing protocols. For buildings under construction the measurements should be done a day without any on-going activities, no problem for residential buildings with occupants.

Olivier: A detailed survey on the status of the structure must be done just prior to the testing to have a good knowledge on the materials giving mass and stiffness to the structure. Especially for building under construction.

### Discussion point 3 – programmes and data handling

The different types of software used by the partners in the project was discussed. The partners works with several different programmes that they are familiar with and needs to continue with these programmes. There is then a need for finding a data format for exchanging model and test data. There are several possible methods for transferring results such as via Matlab or ASCII.

A common protocol for data storage will need to be formed and circulated among the partners.

### Discussion point 4 – other aspects

Pierre: FPInnovations from Canada is an external partner to Dyna-TTB. Sylvain Gagnon and Samuel Cuerrier-Auclair have experience in ambient vibration test of several TTBs e.g. the 18-storey hybrid UBC Brock Common in Vancouver and the 12-storey CLT Origine near Québec City. These two buildings are continuously monitored and FPInnovations is eager to share data, results and out-comes with us. How could we involve them in the project?

The discussions on WP2-4 lead to the following decisions:

(1)	RISE will suggest a format for a survey on a connection types and circulate among the partners.
(2)	RISE will suggest a format for a list of buildings for in-situ testing and circulate among the partners. The list shall at least include name, location, building system and contact person.
(3)	NTNU starts to make a protocol for data storage and circulate among the partners.
(4)	Milestone nr. 8 (in-situ tests performed) will be moved from month 12 to month 18 to facilitating for first step modelling.

## PhD-candidates in the project

### Uni. Exeter:

- One PhD-candidate should start soon and should work on Mjøstårnet on the relation between in-situ measurements (WP3) and model updating (WP4).

### LNU:

- Pierre Landel, started in May 2017, focus on connection design for wind-induced vibrations in tall timber buildings. Pierre presented some results from experiments on

and models of a large glulam truss. He will continue with more lab-experiments (WP2) and model updating (WP4). He will also look in to the part of the building codes dealing with wind structural engineering, specifically the Swedish one.

#### NTNU:

- Saule Tulebekova from Kazakhstan, should start within one month and will work on complete timber structure in relation with WP3 and WP4.
- Antonio Totaro is starting now and will work on lab-experiments in relation with WP2 and WP4.

#### UL:

- Blaž Kurent will start now first with his MSc Thesis and then with his PhD after summer 2019. He should work on different scale of model updating (WP4) of one or two buildings, e.g. one Slovenian CLT-building and one French hybrid building.

Cooperation between the PhD-candidates should be stimulated and encouraged by:

- Creating a Dyna-TTB-PhD meeting forum
- Identifying courses, seminars or workshop within our universities or outside

The discussions on PhD projects lead to the following decision:

(5)	Information on available courses suitable for the PhD candidates will be shared among the partners. RISE will create a drop-box folder where this information can be stored.
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## WP5 – Communication within the project and externally (InnoRenew CoE)

Iztok presented the plans for WP5 - dissemination and opened the discussion on different points:

- Dissemination is in the proposal set to be presented in approximately 8 peer-reviewed journal papers, with at least 15 conference papers presented at international research conferences. Olivier proposed that we shall produce a paper to present the aims and objectives of the project in a paper.
- Several of the funding organisations requires publications with open access.
- Communication can be done at specific events e.g. WoodRise, IHF in Innsbruck, CTBUH and with a special session at WCTE 2020 and/or 2022.
- The project will include thesis works at both PhD and Master's level in the different countries – there will be at least five different PhD students engaged in the project and probably several Master students.
- The project will set-up a web-page for internal data sharing and external information about the project results. InnoRenew CoE will handle this together with proposing a logo for the Dyna-TTB project and circulate for comments among the partners.
- Social-network canals that could be used on a regular matter: LinkedIn, Twitter, ResearchGate.
- InnoRenew CoE suggested different programmes for internal communication within the project: Webpage, Slack or Google Wiki. InnoRenew CoE will continue to investigate which system is possible to use for the different organisations.
- A Data Management Plan has to be implemented for the project. InnoRenew CoE will share their template and RISE will update it with data for this project.

The discussions on dissemination lead to the following decision:

(6)	InnoRenew CoE will set up a project web-page and propose a logo for the Dyna-TTB project and circulate for comments among the partners.
(7)	InnoRenew CoE will set up social-network canals such as: LinkedIn, Twitter, ResearchGate for the project.
(8)	InnoRenew CoE will continue to investigate system for internal project communication possible to use for the different organisations.
(9)	InnoRenew CoE will share their template for a data management plan and RISE will update it with data for this project.

## WP1 – Administration (RISE)

Management meetings will be held between the main partners on a bi-monthly basis via web-meetings. The first meeting will be scheduled when the minutes of this meeting is sent out.

The Consortium Agreement is accepted by all partners and ready for signing. The signing will be done by each partner signing their respective page in the agreement and send by mail to Marie. A signed copy of the agreement will then be sent by mail to each partner.

Some important issues to emphasize on the consortium agreement is:

- Results (foreground) generated by a partner is also owned by that partner.
- Prior to paper publication, other partners should be informed.
- It is also important to explain clearly to industrial partners how models, results and data will be used.
- The national reporting required is handle by the university or institute in each country to its specific national funding organisation.

The Forest Value also requires some reporting that will mainly be handled by the coordinator:

- Brief annual reports and a final report
- Data on the impact of the research project – *input necessary from each partner necessary.*
- Brief project updates suitable for immediate publication (annually)
- A minimum of 3 stakeholder-oriented articles

ForestValue also arranges an annual seminar which requires presence from at least one representative from the project. Marie will represent Dyna-TTB at the Forest Value kick-off to be held in Helsinki, Finland, the 23<sup>rd</sup> and 24<sup>th</sup> of May 2019.

The following dates and venues for the coming meetings have been chosen, please book your calendars now:

- Dyna-TTB Meeting 2 will be held in Ljubljana, Slovenia, the 16<sup>th</sup> and 17<sup>th</sup> of September 2019. InnoRenew CoE and UL are in charge of the organisation.
- Dyna-TTB Meeting 3 will be held in Paris, France, the 24<sup>th</sup> and 25<sup>th</sup> of Mars 2020. CSTB are in charge of the organisation.

Minutes of the meeting will be written by RISE and distributed within twenty days after the meeting, there will then be fifteen days for comments. The presentations from the meeting will

also be made available to all partners. It is, however, important to remember that the presentations are working material for the project and not for sharing outside the Dyna-TTB group.

The discussions on this point in the agenda lead to the following decisions:

(10)	Management meetings will be held on a bi-monthly basis in a web-based format between the lead partners. A doodle link will be sent out for finding dates.
(11)	Consortium Agreement is accepted and will be signed by each partner and sent to RISE.
(12)	A drop-box account will be started and shared with all partners as a preliminary storage for material until a more permanent solution can be found.
(13)	A file for noting publications, presentations etc will be placed in the drop-box for facilitating reporting of impact.
(14)	Next two meetings for the project will be held: <ul style="list-style-type: none"> <li>- 16<sup>th</sup> and 17<sup>th</sup> of September 2019, in Ljubljana, Slovenia</li> <li>- 24<sup>th</sup> and 25<sup>th</sup> of Mars 2020, in Paris, France</li> </ul>
(15)	Minutes of the meeting will be written by RISE distributed within twenty days after the meeting, there will then be fifteen days for comments.

## End of the meeting

Marie concluded the meeting and thanked every participant for a good meeting and fruitful discussions.

**RISE Research Institutes of Sweden AB**  
**Building Technology - Wood Building Technology**



## Attendance list

Aleksandar Pavic	Uni Exeter
Anders Rønnquist	NTNU
Andreas Linderholt	LNU
Boštjan Brank	Uni Ljubjana
Haris Stamatopoulos	NTNU
Igor Gavrić	Innorennew CoE
Iztok Šušteršič	Innorennew CoE
Julie Lewis-Thompson	Uni Exeter
Marie Johansson	RISE
Pierre Landel	RISE
Antonio Totaro	NTNU
Fernando Perez	Smith&Wallwork
Kjell Arne Malo	NTNU
Magne A Bjertnæs	Sweco
Olivier Flamand	CSTB
Petter Røe Nåvik	NTNU/Sweco
Roberto Crocetti	Moelven
Rune Abrahamsen	Moelven
Seddik Sakji	CSTB
Stephane Hameury	CSTB
Petter Nilsen	Forest Value
Ludwig Hahusseau	Eiffage

## Partner presentations

### RISE – Sweden

Four Swedish Research Institutes (Swedish ICT, SP, Innventia and Swerea) have now merged to become RISE – Research Institutes of Sweden. Three researchers from the Wood Building Technology department will work in Dyna-TTB: Marie Johannsson (Växjö), Anders Gustafsson (Skellefteå) and Pierre Landel (Borås).

Have experience in Timber engineering - moisture, bridges, life cycle analysis, fire, structural, strength grading of timber floors, restoration, sound and vibrations, smart housing. Recently finished two national projects: TTB - concept studies: RISE + LNU + Industrial companies and consultants and one part of FBBB to identify and study some TTBs specific challenges: i.e. wind-induced vibrations but also fire safety and robustness. One on-going PhD project (Pierre Landel): Connection design for wind induced vibrations in TTB : RISE + LNU.

Expected results: verification of models with experimental data, develop calculation of wind load, develop best practice.

### Norges Teknisk-Naturvitenskapelige Universitet (NTNU) – Norway

From NTNU (42000 students) two departments located in Trondheim are involved.

1. Timber Structure dpt. where Haris Stamatopoulos is an Assoc Professor and Kjell Arne Malo is Professor + 5 other PhD students. Focus on teaching and research at the structural engineering lab-facilities. Have experience in timber bridges, floor systems, project on long threaded screws, modelling with Abaqus and Isight. Interest in serviceability and wind induced acceleration and deflection and how these influence design. Particularly research on connections, stiffness and how stiffness influences dynamic properties.

Expect to better understand the dynamic behaviour, mode shapes, frequencies, energy dissipation, wind-induced accelerations of timber structures.

2. Structural Dynamic dpt. where Anders Rønnquist is professor, the department has 2 other professors, 4 postdocs and 12 PhD students. Have experience in bridges and catenary systems, measurements, monitoring and remaining life of infrastructures.

### University of Exeter (Uni. Exeter) – UK

Uni. Exeter has about 20 000 students and the department of Vibration Engineering is involved in the project through professor Alex Pavic, Julie Lewis-Thompson and 1 or 2 PhD. Has experience in vibration serviceability of floors, footbridges, tall buildings and stadia. Wants to focus on modal testing with FRF measurement to understand the path between excitation source and the receiver. Modelling with Ansys and Matlab. Have a 600 kg horizontal shaker and many sensors.

### University of Ljubljana (UL) – Slovenia

UL have about 40 000 students and professor Boštjan Brank working at the Faculty of Civil and Geotechnical Engineering is participating in the project and a PhD-candidate will start after summer 2019. Have experience in FE-modelling, material fracture and worked on CLT hybrid and timber glass composites. Uses Abaqus and SAP200 and self-developed AceGen&AceFem. Interested to collaborate and learn more about model updating.

### **InnoRenew CoE– Slovenia**

A two-year old Center of Excellence still in development with 47 employees. Iztok Šušteršič leads the Sustainable Building with Renewable Materials group and Igor Gavrić is a researcher in the group. Have experience in CLT buildings, seismic testing and modelling, experiments on connection and wall assembly. Plan to invest in experimental equipment (shaker and sensors). Have access to a completed CLT-building and a similar one under construction.

### **CSTB – France**

The Centre Scientifique et Technique du Bâtiments has 906 employees and is a public organisation for research, certification, assessment and education in the construction sector. Two teams from different departments will be part of the project.

1. From Champs-Sur-Marne near Paris, Stéphane Hameury and Seddik Sakji work on safety of structures and fire research. Have experience on design methods for fire safety and acoustic in TTBs. Model with SAP200, MarcMSC, Ansys and LS-Dyna.

2. Olivier Flamand works in Nantes on aerodynamic response of structures to wind loads. Have experience on bridge dynamic testing with 400 kg electromagnetic shaker and of wind tunnel testing (Soufflerie Climatique Jules Verne).

### **Linnaeus University (LNU) – Sweden**

LNU has 35 000 students in Växjö and Kalmar. Andreas Linderholt is professor at the dpt of Mechanical Engineering, teach structural dynamic and supervise PhD students. Has experience in modal experiments and model updating/sub-structuring from airplanes but is now working more on timber buildings. Expects in the project to perform and follow experiments and modelling, to work on wind loads and to continue supervising Pierre Landel's PhD.

### **Moelven – Norway + Sweden**

Moelven is a producer of timber products with 37 productions plants in Norway and Sweden and has 3500 employees. Moelven Limtre and Moelven Töreboda are the two glulam manufacturers of the group and produces together about 60 000 m<sup>3</sup>.

Rune Abrahamsen leads the Moelven Limtre in Norway who delivered the timber structures to many buildings (Mjöstårnet and TREET), bridges and large span roofs.

Roberto Crocetti is based in Stockholm, professor at KTH and manages Research and Development for Moelven Töreboda together with Thomas Johansson. Roberto will coordinate and represent both countries for this project. Have worked at Moelven Töreboda and helped to develop a building system called Moelven Trä8 to optimize material use.

Expectations from Moelven: Guideline to make it easier for engineers to choose timber solutions, increased trust in timber as a construction material for high rise building and simplifications on dynamic design.

Moelven will provide material and buildings/bridge for the experiments in both countries.

### **Sweco – Norway**

Sweco is a Scandinavian consult company in Architectural and Engineering Design. Magne Bjertnaes is the group leader at Sweco Lillehammer for Structural Engineering. Has experience from timber structural design: Treet and Mjöstårnet but also bridges and long span roofs. Sweco have details and FE-models for several projects to be tested.

Expecting: Learn more on damping in timber structures, compare calculated and measured dynamical properties.

### **Smith and Wallwork Engineers (SaW)- UK**

SaW is a structural design firm based in Cambridge with experience in timber structure in general and CLT specifically (school, multi-residential). Fernando Perez is a structural engineer and have collaborated with Cambridge University to test material stiffness, hybrid timber-concrete floors and a concept for a tall timber tower in London.

Expectations: more timber buildings to cope with housing demand, increased efficiency of building performance and reliable/simple tool or guidance for practitioners to advise clients and design team at an early stage of projects on possibilities of timber building based on serviceability criteria.

Resources: design data for timber building completed and possible to be tested, time to review and comment on WP proposals and outcomes to ensure applicability.

### **Eiffage - France**

Eiffage is the third largest French construction group with four different entities. Eiffage Construction is part of the project and has recently started to build a 18 storey timber residential and commercial building in Bordeaux: La Tour Hyperion. It is an hybrid structure with concrete core, CLT floors, Glulam timber columns and steel structure for the balconies. Ludwig Hahusseau from Eiffage Construction Nord Aquitaine was in charge of the design of the tower for three years. Eiffage will provide structural details and the possibility to test this project. Eiffage have also experience in building the tallest CLT building in France: the Sensations with 12 storeys all CLT.

Motivations: instrumentation of Hyperion, increase knowledge on timber structure and use results in future realisations, make parallels between seismic and wind vibrations.

Have questions for on-site measurements in their project Hyperion: analysis of creep in compression in long term, measure of moisture content level in timber structure (and in timber frame wall), concerned about the use of shaker during and after the construction.

### **Galeo - France**

Galeo is a real estate developing and managing building projects and will provide access and information to test an hybrid timber building planned to be built near Nantes by 2020.

### **Arbonis - France**

Arbonis is part of Vinci Construction and design and build timber building projects. They will provide information and access to test an hybrid timber building planned to be built near Paris by 2020.