



## Minutes – Meeting 2 Ljubljana

**When:** Start 10:00 the 16th of September 2019 and ending at 13:30 the 17th of September 2019.

**Where:** University of Ljubljana, Rector's office, Kongresni trg 12. The meeting took place in the room called »Hribarjeva dvorana (Hribar's hall).

### Aim of the meeting

Discussions about the project plan and updating the time schedule, especially modelling and measurement of complete buildings. Discussion about PhD student work and co-operation. Administrative routines and reporting.

## Agenda

### Day 1

10:00-10:10	Welcome and start of the meeting
10:10-10:20	Presentation of University of Ljubljana and InnoRenew (Bostjan/Iztok)
10:20-11:00	Update what has happened since the last meeting
11:00-11:30	Presentation of buildings used for in-situ measurement
11:30-13:00	Workpackage 4 - Models
13:00-14:00	Lunch
14:00-15:30	Workpackage 3 – In-situ measurements
15:30-16:00	Coffee break
16:00-17:00	Workpackage 2 – Details and assemblies
17:00-17:25	Presentation of the InnoCrossLam project
17:25-17:45	Presentation of CLT building in Ljubljana
17:45-19:00	Site visit
20:00-	Dinner in the city center

### Day 2

09:00-10:30	Cont. Discussion on the project plan -setting aims, activities and a timeplan for each WP and how to share results. Coffee at a suitable time during the discussions
11:00-12:00	Dissemination and administration
12:00-13:30	Lunch and end of meeting



## Day 1 – Monday 16<sup>th</sup> of September

### 1. Welcome and start of the meeting

Marie gave a short presentation about the aim of the meeting, the agenda, the time plan and milestones for the project. Bostjan welcomed us to Ljubljana and the University and gave a short presentation about the university and the research and education of the faculty of Civil and Geodetic Engineering. Iztok presented the InnoRenew CoE organization and their work. Presentation for both organizations can be found in the presentation for the meeting.

Vincent, Saule, Manuel and Blaž were welcomed as new members in the project team.

### 2. Update what has happened since the last meeting

NTNU	Saule Tulebekova has started as PhD student, working at the moment with a literature review regarding damping. Antonio Totaro left NTNU and the project will in part be run with Master's students instead. Eventually the road bridge will be skipped as measurement object for in-situ measurements due to problems with closing the road for a sufficient amount of time.
Uni Exeter	Vincent Ao has started working in the project as a PostDoc student and will be responsible for the measurements performed by Uni Exeter. The work at the moment mainly concerns preparing equipment for in-situ measurements and running the shakers wire-less.
Smith & Wallwork	The main part of the work at the moment is to talk to the owners of the building in Glasgow regarding permission to perform measurements.
CSTB	Manuel Manthey has joined the team working with structural engineering and modelling, in replacement of Sadiq Sadiq. There was one meeting with the building owners to plan the measurement campaigns. The Galeo building is still uncertain as the building plans has come to a halt at the moment. Galeo is still in the project, however, interested in taking part in the results.
InnoRenew	The webpage is up and running, there is still a need for a discussion about which material we want to publish there. A linked-in page and a page on Research gate <sup>1</sup> has also been set up. InnoRenew has started measurements on a 4-storey building in Ljubljana that is under construction. The measurements have so far been ambient vibration tests.
Uni Ljubljana	Blaž Kurent has started his PhD studies within the project. He has also performed his Masters project regarding model updating using a test data set of measurement on a floor system performed by Uni Exeter. Uni Ljubljana will have a visiting Professor from the University of Braunschweig to help with a training course regarding model up-dating during the autumn.
Lnu	Meeting has been held with the building owner in Mariestad regarding measurements. Measurements will be performed on the finished building in this case. Moelven has also sent drawings for the model. Discussion has started with

<sup>1</sup> <https://www.researchgate.net/project/DynaTTB-Dynamic-Response-of-Tall-Timber-Buildings-under-Service-Load>



	Moelven regarding a lab-truss to be used for measurements. Work is on-going regarding modelling together with RISE on the lab-truss.
RISE	See LNU above. Work has also been on-going regarding administration, with preparing consortium agreement, project reporting, poster, kick-of meeting for ForestValue and Data management plan.

### 3. Presentation of buildings used for in-situ measurement

The buildings that will be used for in-situ measurements were presented. A list with all the buildings and data regarding them are available in an excel-file in the drop-box. Contact persons and some selected data regarding the building projects can also be found there. There is also information regarding some of the buildings in the ppt-presentation from the meeting.

### 4. Workpackage 4 - NTNU

NTNU as work-package leader started the discussion with a presentation by Saule regarding possibilities to model damping in Abaqus. Two types of damping are available: Raleigh damping - includes two parts, mass proportional and stiffness proportional and Structural damping – proportional to internal forces, only for steady state modelling.

Damping can be introduced at three levels, material/element damping, global damping and modal damping. Global damping is introduced in the input file, modal damping can be introduced for each mode.

**Discussion:** How do we include the aerodynamic damping on the structure? NTNU normally takes this into account using a specially designed user element.

The measurements include both aerodynamic and structural damping. The aerodynamic damping can be taken into account by calculating it according to the codes. This can be done for regular structures such as Mjöstornet without problem, structures with irregular shapes is more complicated. Do we need to measure wind speed as well, is it good enough with a nearby weather station?

Kjell-Arne then started a discussion based on the project application. Definition: Total damping – material damping = structural damping. NTNU want to measure damping on all elements and then connect them together and get the difference in damping as the structural damping. The higher damping in timber materials (compared to metals) makes it necessary to consider. Nathalie Labonnote, NTNU, has studied this during her PhD studies and published several papers<sup>2</sup>.

Blaz presented his Master's project performed at Uni Ljubljana. FE-model updating based on a composite concrete - corrugated steel floor measured by Uni Exeter. The updating has been done using two methods; Bayesian approach and maximum likelihood methods. The model of the floor system is simplified using orthotropic material but using effective stiffness factors. The results show

<sup>2</sup> <https://rd.springer.com/article/10.1617%2Fs11527-014-0286-7>



good agreement regarding modes shapes for the hybrid floors. This model was combined with the steel structure around the sheets to model the complete structure.

## 5. Workpackage 3 – Uni Exeter

*The text here also includes discussions from Tuesday the 16<sup>th</sup> regarding In-situ measurements.*

Uni Exeter – Alex as work-package leader started the discussion with a presentation of practical issues regarding in-situ measurements. The presentation can be found in the drop-box file for the meeting. The presentation shows what is necessary for the logistics, moving equipment, electrical currents, acquisition system. Safety issues and protocols must be followed (hard shoes, vest and gloves).

The equipment has a fixed base plate at the bottom with a moving base plate on top. Needs to be dismantled and moved and put together at location. Dimensions are 2000 x 800 mm with a stroke length of 152 mm. It is possible to use up to 64 accelerometers. The shaker can be moved to a new position to make sure enough modes are captured. Data from ambient testing will be used to change the test plan if necessary. Each building takes between 2-3 days for measurements, putting up equipment, ambient vibration tests and shaking tests day 2.

**Discussion:** It is necessary to have FE-models for test planning, i.e. where to place the accelerometers and loading. These must be finished a few months before testing to facilitate planning.

CSTB - Olivier presented the measurement equipment in France, the presentation can be found in the drop-box. The equipment is a rolling mass-shaker, i.e. the mass is rolling on rails driven by a motor and a rotating wheel. The equipment can be run in two modes: Inertia mode – rotating modes – works vertical or horizontally, high frequencies or Mass mode – modes for low frequency measurements. It is possible to change – mass, amplitude (changing wheel size) and frequency (motor speed). The loading will be sinusoidal.

Acceleration is measured using force-balance accelerometers. In total 9 wired accelerometers can be used. The plan is to put 3 at the top level, 3 at the bottom and 3 at an intermediate level of the building. The equipment also includes 2 force sensors on the shaker, 1 anemometer on the roof and 2 LVDT:s that can be used to measure on some detail such as connections in the building.

The logistics includes loading the equipment into a light truck. The crew is composed of 2 or 3 persons. One arranges the shaker when other(s) put sensors in place and wire them. The typical logistical plan includes 5 days:

- 1: loading and travelling,
- 2: Installation of system. Measure with ambient excitation to get modal frequencies.
- 3: Test for mode 1 with two different amplitudes.
- 4: Move shaker test for mode 2 and 3.
- 5: Remove equipment, pack and travel.

First measurement will be made week 47 on the building Treed-it in Paris, during construction. The same building will be measured a second time in March 2020 using both CSTB and Uni Exeter



equipment. The second time it will only be possible to place the shakers on the roof structure using a mobile crane.

**Discussions:** Where should the accelerometers be placed. It would be very good to place one accelerometer next to the force to be able to scale the modes for comparison with FE-models.

## 6. Workpackage 2 - RISE

*The text here also includes discussions from Tuesday the 16<sup>th</sup> regarding laboratory experiments.*

RISE started the discussion with the question – what type of data do we need and what type of data do we have already? Data is necessary regarding:

- Stiffness of different types of connections and assemblies
- Damping for different types of connections and assemblies

Data will also be needed for the different types of connections used in the building systems used in the project, i.e CLT systems and Glulam beam systems.

InnoRenew – Igor presented what kind of data they have in a data base regarding CLT systems. The data has been produced for the purpose of earth-quake safety, meaning cyclic loading but at a relatively high load level (EN12512 – cyclic tests). The data includes: CLT-connections; Hold-downs, brackets (ground and upper stories), Screwed connections – wall to wall and wall to floor. In total 210 tests. Single wall test – with different type of configuration, with and without openings and with different connections to the floor and between panels. In total there is 49 CLT wall tests with direct access. What can be found – elastic resistance, degradation of strength, equivalent viscous damping [%].

Sweden and Norway – stiffness measurements exist for some types of glulam connections. Measurements will be made on typical connections (slotted-in steel plates) for glulam structures during the project.

**Discussion:** What type of data is necessary for the WP4 models? And in which format? How do we make sure we get comparable data from the experiments? How do the models for damping look in the models? A more in-depth discussion is necessary between WP 2 and 4 to decide what type of data is necessary and in which format the data should be.

What load/deflection levels are we actually having at the SLS level? Are the connections working or is it only friction? The self-weight is also acting as a pre-load, so where on the load-deformation curve are we?

## 7. Presentation of InnoCrossLam

Boris Azinović from ZAG (Slovenian National Building and Civil Engineering Institute) gave a short presentation regarding the ForestValue project InnoCrossLam (Innovative solutions for Cross Laminated timber structures). The aim of the project is to increase the competitiveness of CLT, increase its predictability and develop multi-functional use of CLT in terms of its thermal activation.



The WPs in the project concerns; CLT at in-plane beam load, Adaption of a 3D multisurface failure criterion for clear wood, generation of accurate 3D digital models of CLT plates including knots, 3D simulation of common structural details of CLT-based structures, Seismic response, Asymmetrical buildings, hybrid structures and Innovative multifunctional CLT. There are similarities between the projects especially regarding connections for CLT and for hybrid buildings with concrete connections.

The presentation will be placed in the drop-box and contact information will be shared.

Suggestions are also made to have a final common result presentation. CLT Hub Europe are willing to arrange such a “conference”.

## 8. Building in Ljubljana

Iztok shows the building system and structure of the building in Ljubljana. The building is a CLT building in four floors but with a rather irregular shape. Measurements have been done on the structure and more will be done during the construction time. A presentation of the building is placed in the drop-box.

The day then ended with a visit to the building site in Ljubljana.

## Day 2 – Tuesday 17<sup>th</sup> of September

### 9. Continued discussion

The discussions and presentations regarding WP2 and WP3 are described in conjunction with these WPs in the notes from day 1. The discussions on WP2-4 lead to the following decisions:

(16)	Timeplan for in-situ measurements: <ol style="list-style-type: none"><li>1. First building in France to be measured week 47, 2019 using CSTB Equipment.</li><li>2. Second measurement in France in March 2020 using both CSTB and Uni Exeter equipment.</li><li>3. Measurements in Scandinavia in April-May 2020 using Uni Exeter Equipment.</li></ol>
(17)	Responsible persons for modelling and measurements for each building was assigned and registered in an excel-file in the drop-box.
(18)	Local help will be necessary at each location to complement the team from Uni Exeter. NTNU in Norway and LNU/RISE in Sweden will take part in the measurements.
(19)	NTNU will start to gather what type of data is necessary for connections and assemblies to be put into the global FE-models. A special meeting will be set up between the main partners in WP 2 and 4 to discuss this point further.



## 10. Dissemination and administration

### Data management plan – Mike Burnard InnoRenew

Mike Burnard InnoRenew gave a presentation on data management plans, what they are and what they should include. Data management should be FAIR – Findable, Accessible, Interoperable, Re-usable. Describes how data is: Collected, Processed – used/analyzed, Shared – disseminated/distributed, Accessed, Stored, Deleted.

A data management plan will be written for the DynaTTB project including these factors.

### Introduction to Slack

Discussions have been on-going regarding which system to use for the project communication. Teams has many functionalities that we need. The problem is that not all partners have Microsoft 365 installed and it will then mean high costs. Slack is an alternative that can be used as a free-ware with some limitations.

### Data storage protocol + systems

Discussions were had regarding data storage. The free version of drop-box does not allow for huge amount of data. Other possible solutions are OneDrive and GoogleDocs.

Due to time limitations NTNUs presentation regarding data storage protocols will have to be done at a separate web-meeting.

### Content on [www.dynattb.com](http://www.dynattb.com)

InnoRenew has set up a webpage for the project. The content of the page now shortly presents the work-packages and partners. It is possible to create a password protected part of the page for internal documents.

Suggestions for content to include on the webpage can be sent to Iztok. Discussions regarding what we to have on the webpage will be held at further meetings within the project.

### Reporting to ForestValue

No more information regarding reporting to ForestValue has been sent out yet.

### Conferences and publications

Two upcoming conferences where the project can be presented is:

- Eurodyn 2020 in Athens, 22-24 June <https://eurodyn2020.org/>. Abstract due 30 October 2019.
- WCTE 2020 in Santiago, 24-27 August <https://wcte2020.com/>. Abstract due 30 October 2019.

Discussions regarding presentations of the project. It is possible to make a presentation of the complete project at both conferences accompanied by other more specific presentations from the different partners.



### Forthcoming meetings

Next IRL meeting will be in Paris 24-25<sup>th</sup> of March 2020, the plan is for two full days. The plan is to have presentations and discussions day 1 and visit the building Treed-It day 2 where in-situ measurements will be performed by CSTB and Uni Exeter. The first day will be at CSTB office in central Paris, the second day will be close to the building site.

Discussion points for the meeting:

- Global models of the buildings
- Structure and format of guide-lines for tall timber buildings that is part of the final dissemination

The meeting thereafter will be held in Exeter, UK the 22-23<sup>rd</sup> of September 2020.

Marie will call to web-meeting with the research partners. The plan is for one-hour meetings once a month, where at least one member from each partner can participate.

The discussions on dissemination and administration lead to the following decision:

(20)	Slack will be used as a platform for the project. Iztok will set up a slack workspace and run a tutorial via internet.
(21)	InnoRenew and RISE will investigate other possible data sharing systems that will not be too costly for different partners but allow large amount of data.
(22)	The idea of a common final dissemination conference was seen as a good idea. InnoRenew and RISE will continue discussions regarding a common final "conference" between ForestValue projects with similar themes.
(23)	Oliver starts an abstract to Eurodyn and Iztok starts an abstract to WCTE presenting the project. In both papers all project participants will be co-authors.
(24)	Project meetings: <ul style="list-style-type: none"><li>- 24-25<sup>th</sup> of March 2020 in Paris, hosted by CSTB</li><li>- 22-23<sup>rd</sup> of September 2020 in Exeter, hosted by Uni Exeter</li></ul>
(25)	Web-meeting will be held each month between the leading partners. Points to be discussed at the next meetings: <ul style="list-style-type: none"><li>- Data storage protocols</li><li>- Slack introduction</li></ul>
(26)	Meeting notes will be written by Marie and placed in the drop-box. Comments on the notes are thereafter possible for three weeks before the notes will be finalised.

### End of the meeting

Marie concluded the meeting and thanked all participants for a good meeting and fruitful discussions.

### Notes:

Marie Johansson, RISE





### Attendance list

Aleksandar Pavic	Uni Exeter
Anders Rønnquist	NTNU
Andreas Linderholt	LNU
Blaž Kurent	Uni Ljubljana
Boštjan Brank	Uni Ljubljana
Fernando Perez	Smith&Wallwork
Igor Gavrić	Innorennew CoE
Iztok Šušteršič	Innorennew CoE
Kjell Arne Malo	NTNU
Manuel Manthey	CSTB
Marie Johansson	RISE
Olivier Flamand	CSTB
Roberto Crocetti	Moelven
Saule Tulebekova	NTNU
Stephane Hameury	CSTB
Vincent Ao	Uni Exeter