COST ACTION FP1303 Meeting
Sofia, Bulgaria
28th February- 1st March 2017

"Designing, Application and Aesthetics of biobased building materials"

Performance of fir-spruce timber houses in North Spain. Examples of wood buildings. The importance of design details in the performance.

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SUMMARY

1.- INTRODUCTION

- **Fir and spruce** have been abundantly used in **exterior structures**: bridges, **houses**, porch, pergolas, etc.) in overall Spain, especially during the last 10-20 years.
- Fir and spruce are from central and northern European countries.
- **Designs** have been copied too from central and northern European countries but without good results in all situations…(early decays)



1.- INTRODUCTION

- **Natural durability** of fir and spruce, "preservative **treatments**" and **designs**, combined with the variability of **climate** and **local climate** conditions (exposure to weathering), have caused serious damage to the wood structures in North Spain.

- In several cases in less than **10 years** have appeared early decays

- Major problems are related to **decays** (brown rot an white rot) and wood destroying insects in lesser extent (wood boring insects and termites).

PERFORMANCE OF WOOD EXTERIOR STRUCTURES

- **Uses classes:** 1, 2, 3, 4 and 5
- **Wood species:** Durability and treatability
- **Climatic conditions:** Climate and local climate
- **Position** and **thickness**: Horizontal/vertical
- **Design details:** Distance from ground, sheltering,…
- **Maintenance:** Coatings

- **Fir** and **spruce** are **not durable (4)** regard to **fungi** (EN 350).
- **Fir** and **spruce** are classified as **very difficult to treat** (EN 350-2).

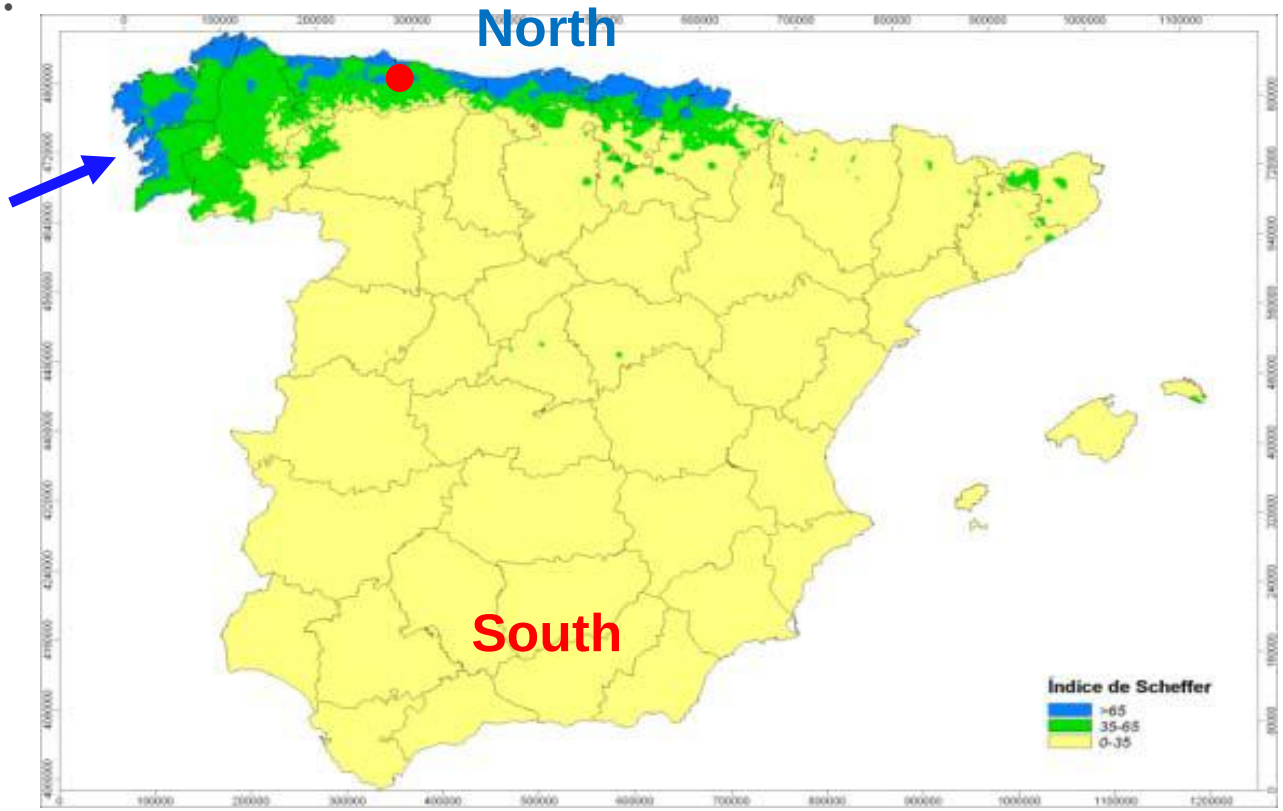
GEOGRAPHICAL LOCATION: CLIMATE

• **Climate conditions** (rain, sun, wind, Rh, etc.) is a key factor in the performance of exterior wooden estructures, afecting strongly the durability and susceptibility to decay of wooden elements.

• There is a high variability of the **climate conditions in Spain** due to different **rainfall and temperatures.**

North climate:

• Rainy: Wet, high RH.
• Warm:
• Winds: South-West



LOCAL CLIMATE CONDITIONS

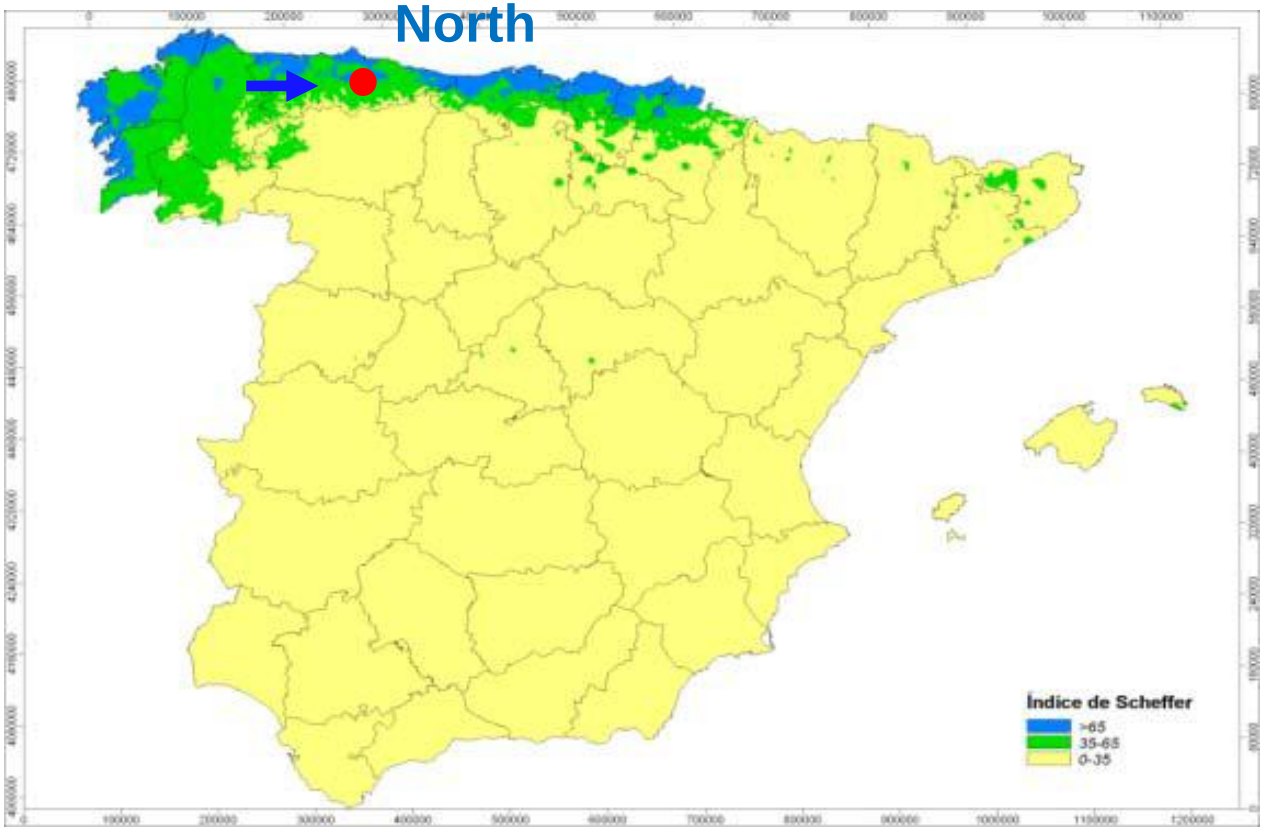
• The **local climate** is also very important key factor in the performance of exterior wooden estructures.

• Dominant winds (driven rain), high relative humidity (river banks, coast, fogs), local temperature, orientation, building protection, etc.

Local climate :

Coast, valley, river bank

• Rainy: > 150 days (wet)
• High RH.
• Warm
• Winds: West
• No protection (Buildings)



2.- PERFORMANCE OF FIR-SPRUCE TIMBER HOUSES IN NORTH SPAIN.

- **Timber houses:** Timber frame houses
- **Construction year:** 2009 (8 years)
- **Wood species:** *Abies alba* (fir) and *Picea abies* (spruce)
- **Treatment:** "Preservative treatment"
- **Coating:**
- **Wood type:** sawn wood
- **Use classes:** 1, 2, 3.1and 3.2
- **Place:** North coast of Spain
- **Details design:** Sheltering, distance from ground, etc.
- **Performance:** "Early decays before 8 years"

2.- PERFORMANCE OF FIR-SPRUCE TIMBER HOUSES IN NORTH SPAIN.

North Facade

- Foundation (distance from ground), no driven rain, sheltering (eaves) and coating
- Timber walls: Good performance (without decays).

HOUSE 1

- Foundation (distance from ground), no driven rain, sheltering (eaves) and coating
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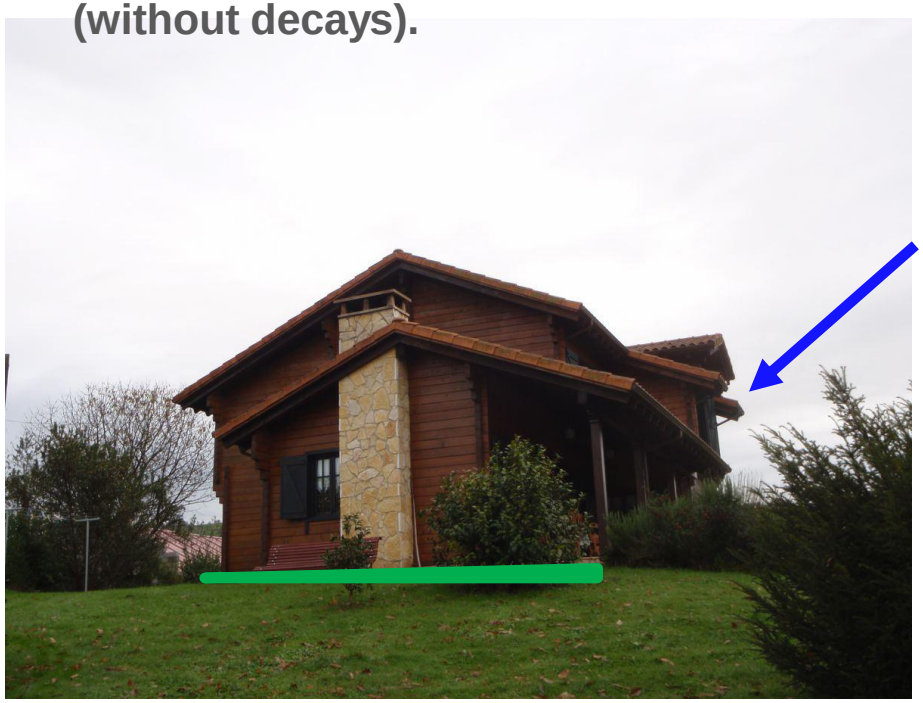


HOUSE 2

2.- PERFORMANCE OF FIR-SPRUCE TIMBER HOUSES IN NORTH SPAIN.

East Facade

- Foundation (distance from ground), no driven rain, sheltering (eaves and porch) and coating.
- Timber walls: Good performance (without decays).

HOUSE 1

- Foundation (distance from ground), no driven rain, sheltering (eaves) and coating
- Timber walls: Good performance (without decays).

HOUSE 2

2.- PERFORMANCE OF FIR-SPRUCE TIMBER HOUSES IN NORTH SPAIN.

South Facade

- Foundation (distance from ground), no driven rain, sheltering (eaves and porch) and coating.
- Timber walls: Good performance (without decays).

HOUSE 1

- Foundation and garage (distance from ground), no driven rain, sheltering (eaves) and coating
- Timber walls: Good performance (without decays).

HOUSE 2

2.- PERFORMANCE OF FIR-SPRUCE TIMBER HOUSES IN NORTH SPAIN.

West Facade (Severely exposed)

- **Foundation (distance from ground), sheltering (eaves) and coating.**
- **Driven rain (early decays in water traps in timber walls). Insufficient design protection.**
- **Timber walls: Bad performance (early decays in < 8 years).**

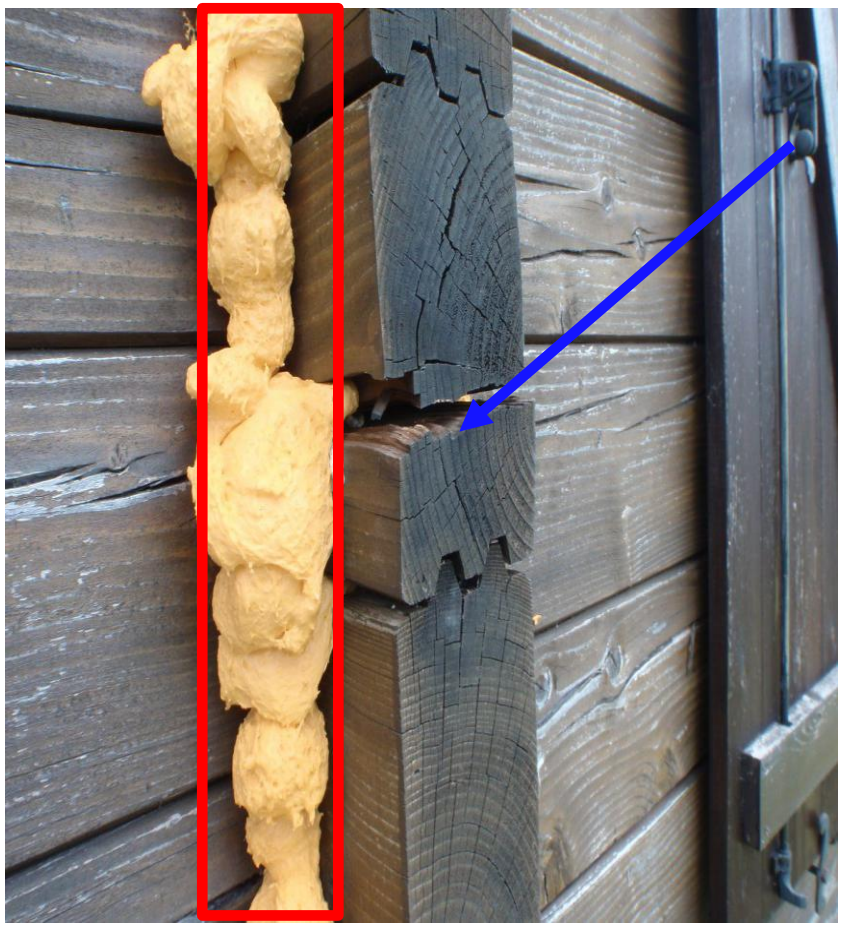
HOUSE 1

- **Foundation (distance from ground), sheltering (Porch and eaves) and coating (maintenance).**
- **Driven rain (early decays in water traps in base pillars). Insufficient design protection.**
- **Timber walls: Bad performance (early decays in < 8 years).**

HOUSE 2

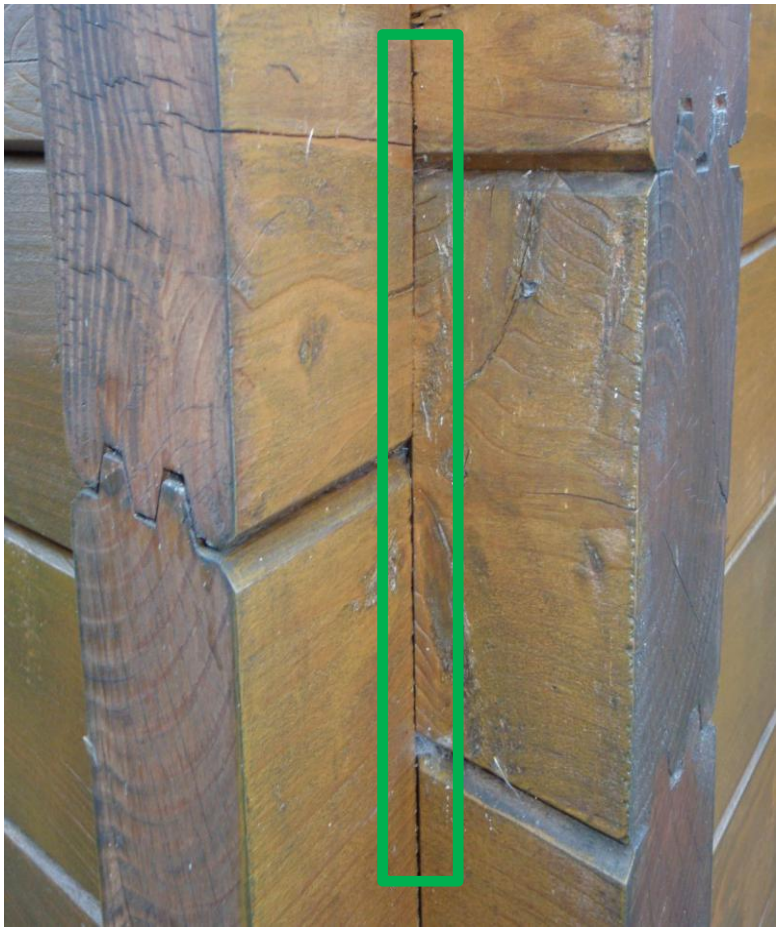
2.- PERFORMANCE OF FIR-SPRUCE TIMBER HOUSES IN NORTH SPAIN.

West Facade



- Water traps (M.C>20%) driven rain in timber walls

HOUSE 1

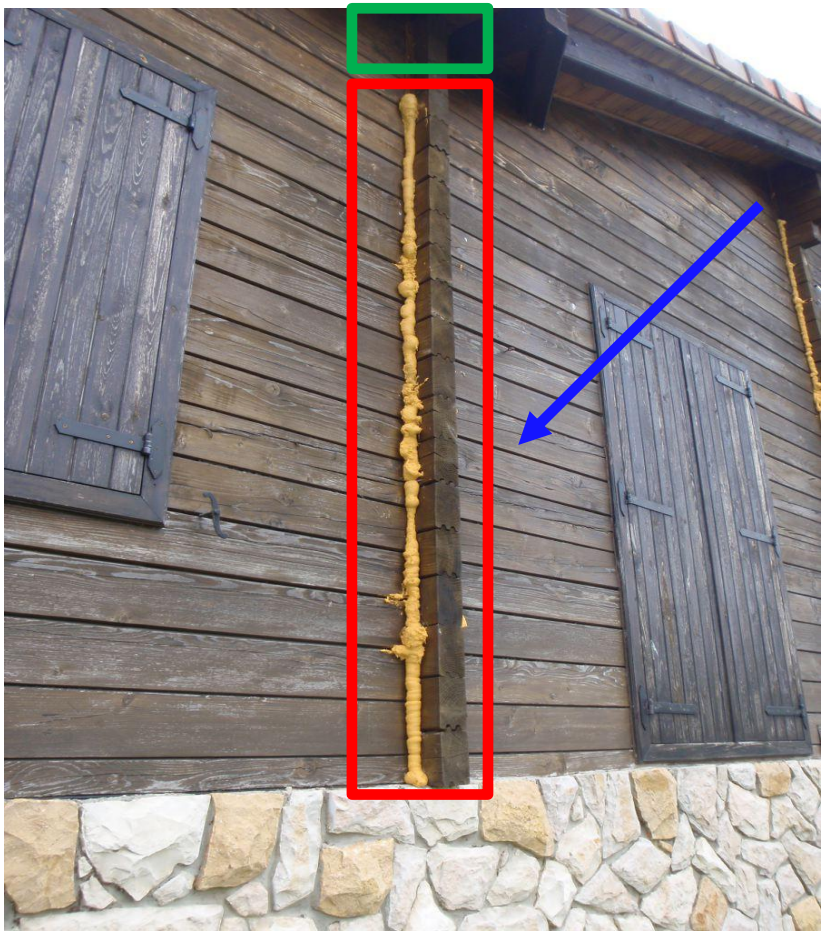


- Water traps (M.C<20%) no driven rain in timber walls (porch)

HOUSE 2

2.- PERFORMANCE OF FIR-SPRUCE TIMBER HOUSES IN NORTH SPAIN.

West Facade



- Water traps (M.C>20%) driven rain in timber walls

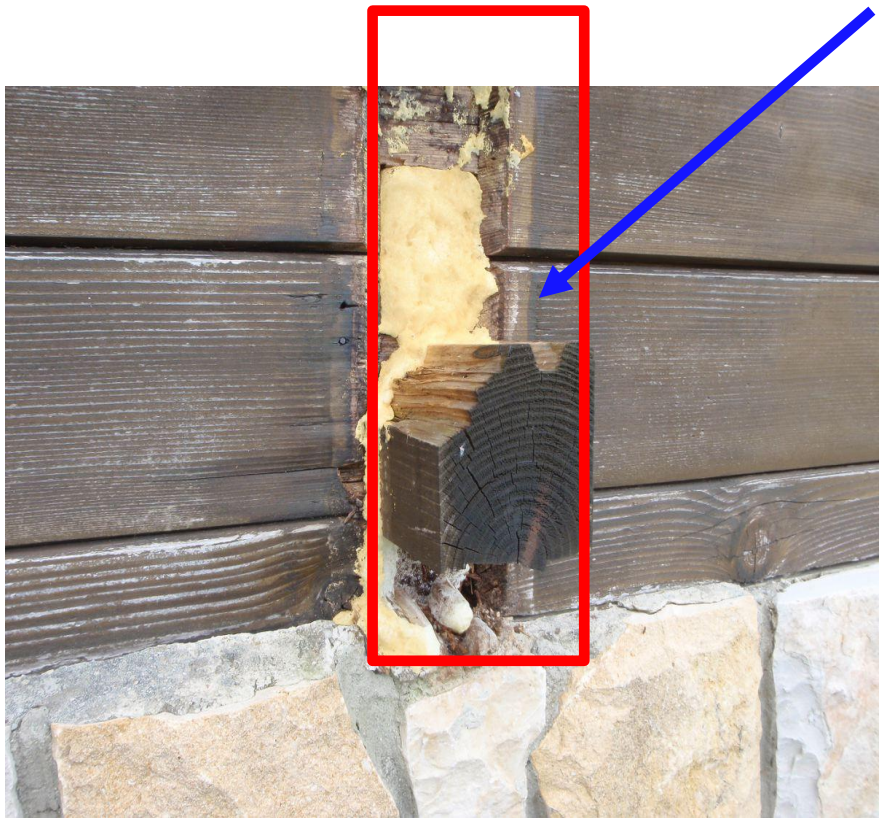
HOUSE 1

- Water traps (M.C<20%) no driven rain in timber walls (porch)

HOUSE 2

2.- PERFORMANCE OF FIR-SPRUCE TIMBER HOUSES IN NORTH SPAIN.

West Facade



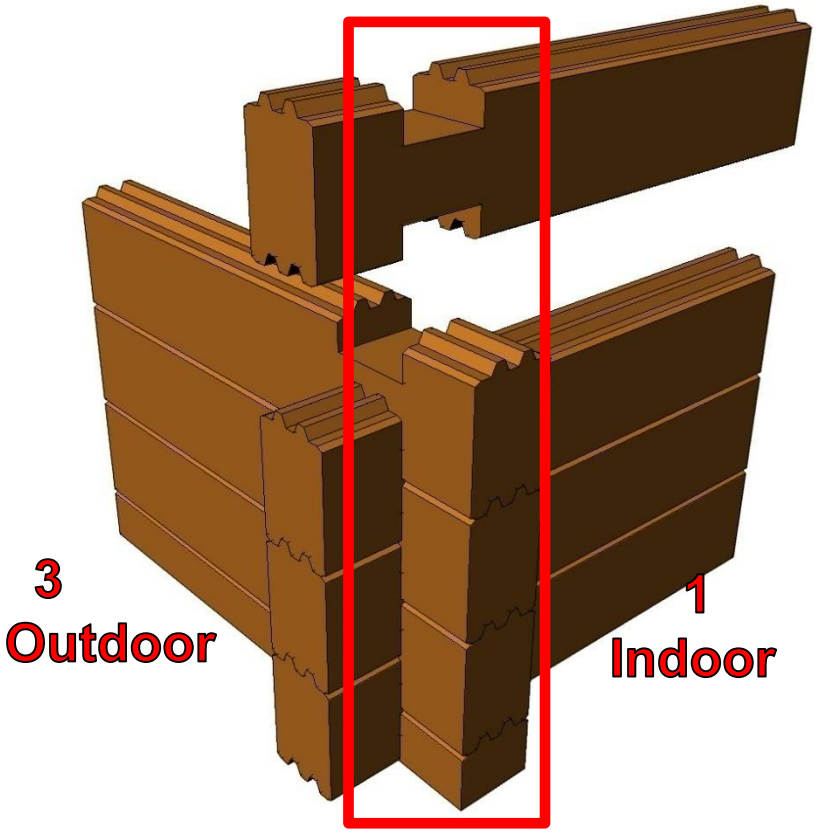
Water traps (M.C>20%) driven rain in timber walls and early decays

Important structural damages

HOUSE 1

2.- PERFORMANCE OF FIR-SPRUCE TIMBER HOUSES IN NORTH SPAIN.

West Facade



WEST TIMBER WALL HOUSE: IMPORTANT STRUCTURAL DAMAGES

HOUSE 1

2.- PERFORMANCE OF FIR-SPRUCE TIMBER HOUSES IN NORTH SPAIN.

West Facade

Interior timber house: stain and moisture problems and early decays in timber walls

HOUSE 1

3.- CONCLUSIONS

HOUSE 1

- *Abies alba* (fir)
- "Treated wood"
- Without maintenance (Coating)
- 8 years

- West facade: **Early and several decays**. Design details protection insufficient (exposed facade) **WATER TRAPS** (C.U: 3.2).
- Other facades: **Good performance**.

HOUSE 2

- *Picea abies* (Spruce)
- "Treated wood"
- With maintenance (Coating)
- 8 years

- West facade: **Early decays in base pillars**. Design details protection (Porch) **NO WATER TRAPS** (C.U: 2 and 3.1)
- Other facades: **Good performance.**

3.- CONCLUSIONS

PERFORMANCE OF EXTERIOR STRUCTURES DEPENDS ON:

- **Wood species: Durability and treatability** *Abies alba and Picea abies*
- **Uses classes: 1, 2, 3.1, 3.2 (West)**
- **Climatic conditions:** Climate and local climate
- **Position** and **thickness**:
- **Design details: Similars** but **different orientations**
- **Maintenance: Yes** and **not**

THANK YOU VERY MUCH FOR YOUR KIND ATTENTION

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