

DESIGN OF FRP STRENGTHENED RC BEAM-COLUMN JOINTS USING STRENGTH HIERARCHY ASSESSMENT METHOD

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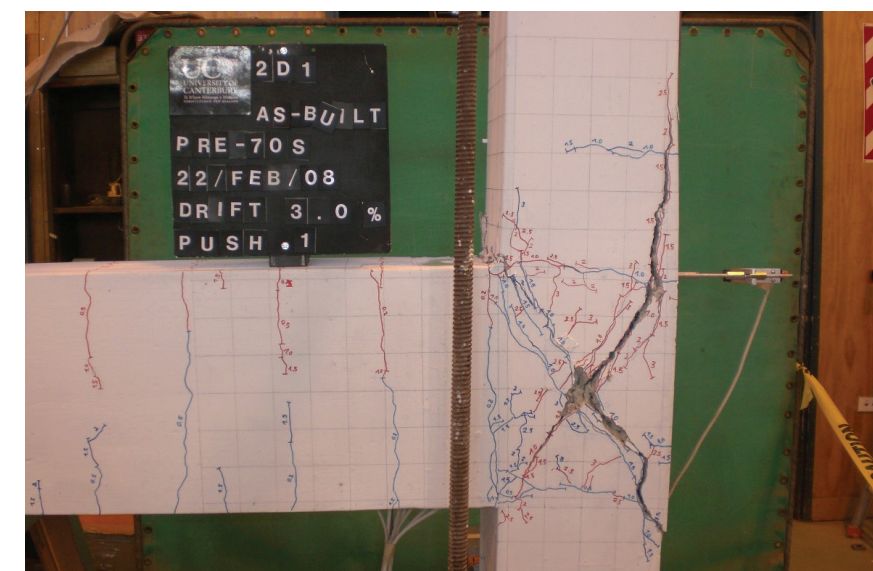
Introduction and statement of the problem

In practice, there are not many options to strengthen vulnerable reinforced concrete beam column joints. Moreover, their design is usually time consuming and complicated. In this work, the Fiber Reinforced Polymer (FRP) beam-column joint strengthening layout adopted by the researchers at the University of Canterbury (UC) has been studied and improved for practical adoption by structural engineers.

A simplified analysis and design procedure is proposed that can be used to quantify the provided capacity. This work aims to provide the New Zealand Structural Engineering community with a practical and accurate FRP strengthening design approach. The proposed procedure can facilitate the use of this strengthening scheme in real life engineering applications. The developed methods are based on the utilization of strength hierarchy assessment, which was improved previously within the scope of this project.

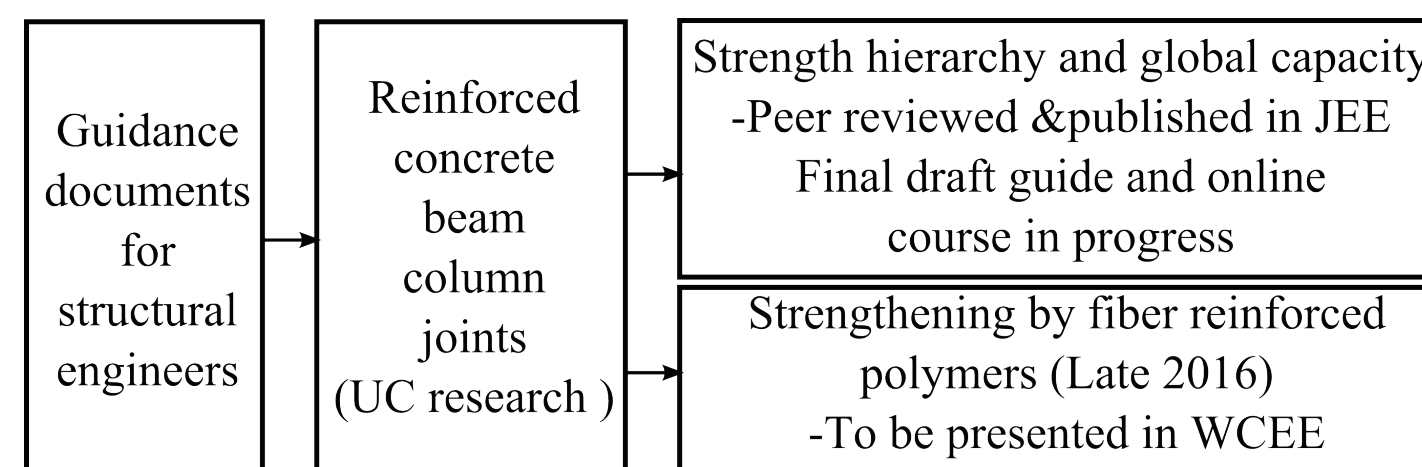


Joint shear failure (Amuri Courts, Christchurch Earthquake February 2011)



Joint shear failure of vulnerable reinforced concrete beam column joints (courtesy of Dr. Umut Akguzel)

Project Outputs for Structural Engineers

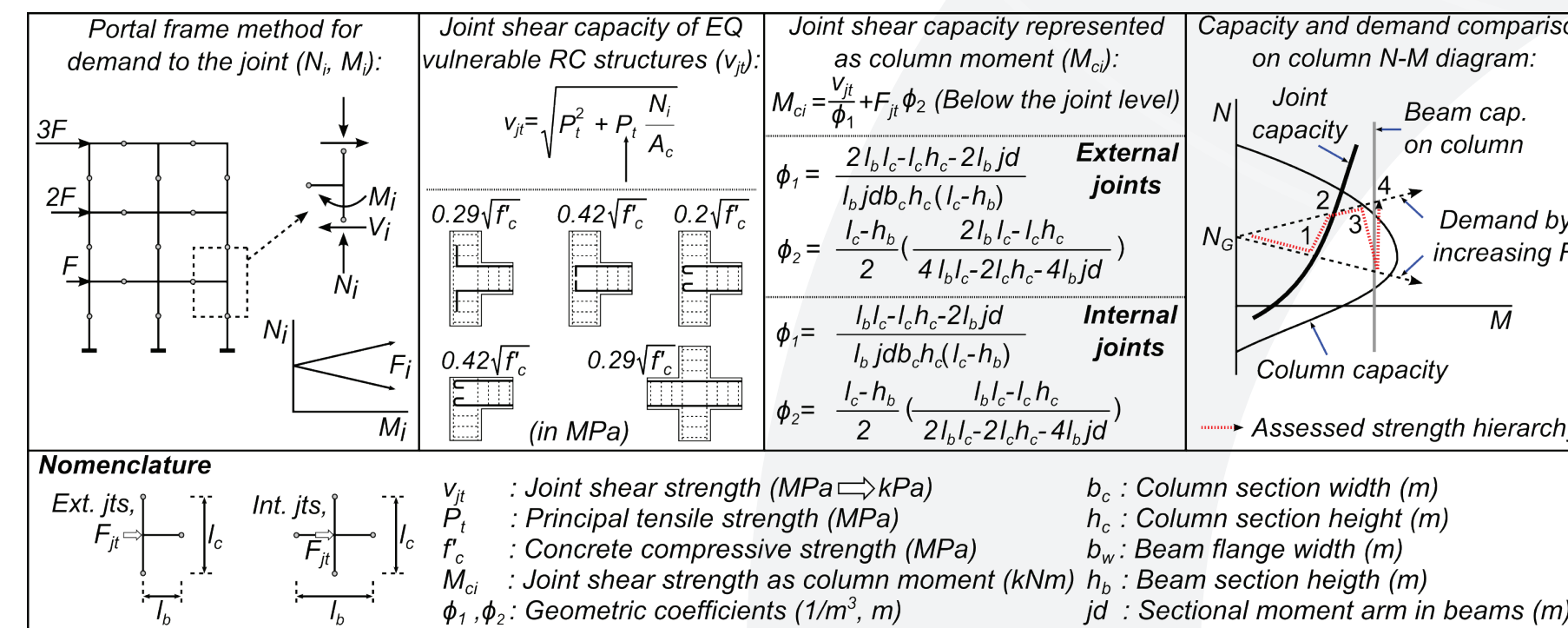


Benefits of the method

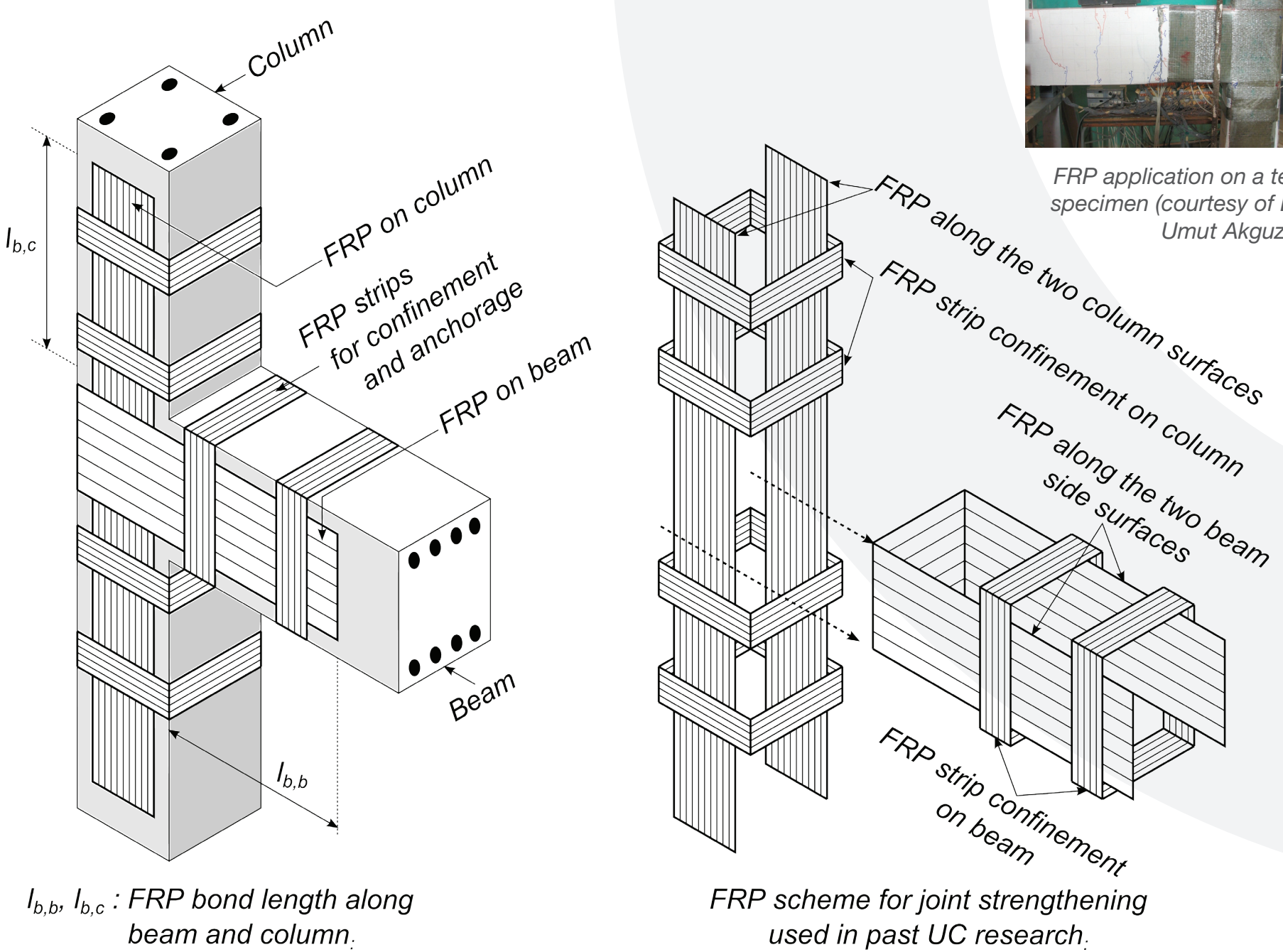
- Application can be done in a matter of hours.
- The engineer understands the structural behaviour and its parameters unlike computer analyses (black box).
- Manual calculations, a spread sheet software and basic reinforced concrete knowledge is required.
- After the application of the strength hierarchy assessment method, FRP design of a vulnerable beam column joint can be immediately carried out.
- An immediate observation can be made to determine if FRP strengthening is the most effective option for a given RC beam column joint, making the retrofit decision faster.

Summary of the strength hierarchy assessment method

Strength hierarchy assessment was previously improved and presented as the basis of the approaches in this project. It is used in order to quantify the capacity of an existing RC frame structure as well as the design of the joint strengthening. RC beam column joint strengthening by FRPs can be directly implemented in this assessment method.

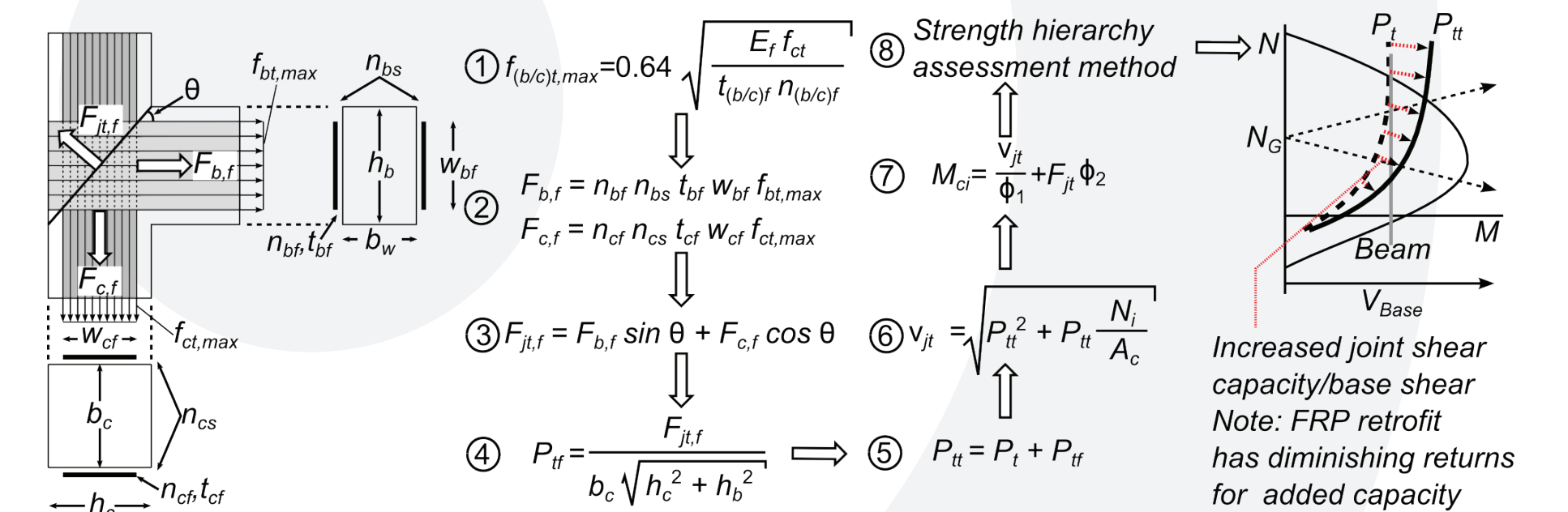
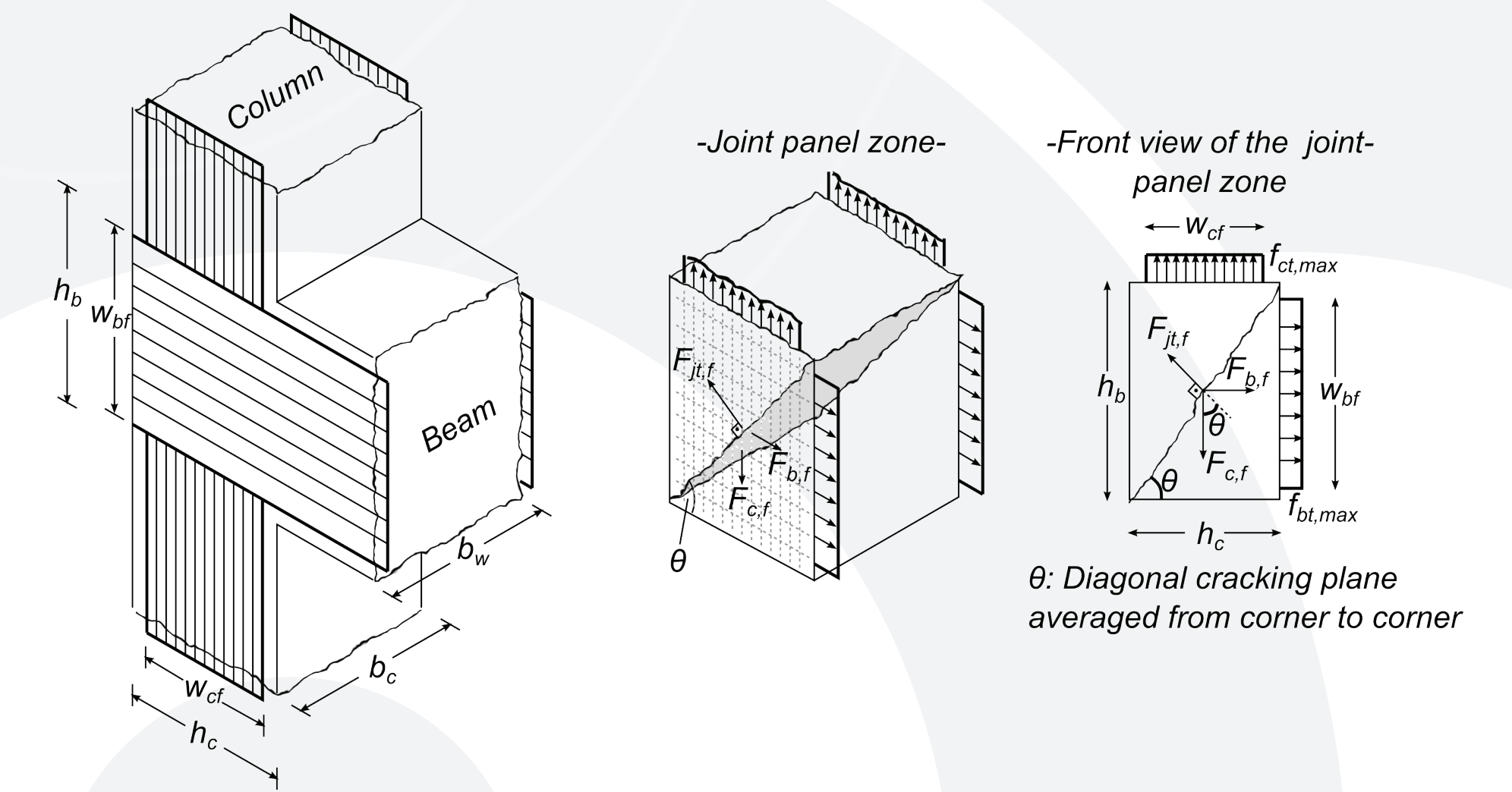


FRP Strengthening Scheme for the RC Beam Column Joints



Capacity of FRP strengthened RC beam column joints

The joint shear capacity provided by the adopted FRP scheme can be approximately quantified for use in strength hierarchy assessment as follows.



Concluding remarks

The procedure is confirmed and reported for the quantification and assessment of the provided capacity as a result of the given FRP joint shear strengthening layout. The procedure does not require complicated computer models and can be conveniently implemented by the practitioner engineers using only a spreadsheet software and fundamental knowledge of reinforced concrete structures with accuracy and efficiency.

Acknowledgements

The author would like to express his gratitude to UC Quake Centre for funding this project. The author is grateful for the background information, sources and comments provided by Umut Akguzel (Ramboll UK Ltd).