



UNIVERSITY  
OF BRESCIA

DEPARTMENT OF ECONOMICS AND MANAGEMENT

## SEMINAR

### ***Column Generation for a Multi-Echelon Last-Mile Delivery System Using Public Transport***

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***Aula A6, C.da Santa Chiara 50***



We tackle the problem of coordinating a three-echelon last-mile delivery system. In the first echelon, trucks transport parcels from distribution centres outside the city to public transport stops. In the second echelon, the parcels move on public transport and reach the city centre. In the third echelon, zero-emission vehicles pick up the parcels at public transport stops and deliver them to customers.

We introduce two extended formulations for this problem. The first has two exponential sets of variables, while the second has one. We propose column generation algorithms and compare several methods to solve the pricing problems on specially constructed graphs. We also devise dual bounds, which we can compute even when the graphs are so large that not a single pricing round completes within the time limit. Compared to previous formulations, our models find 16 new best known solutions out of an existing dataset of 24 instances from the literature.

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