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Maximizing Bidirectional Green Waves for Major Road Axes

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Abstract : Both from an environmental perspective and with respect to road traffic flow quality, planning so-called green waves along major road axes is a well-established target for traffic engineers. For one-way road axes (e.g. the Avenues in Manhattan), this is a trivial downstream task. For bidirectional arterials, the well-known necessary condition for establishing a green wave in both directions is that the driving times between two subsequent crossings must be an integer multiple of half of the cycle time of the signal programs at the nodes. In this paper, we propose an integer linear optimization model to establish fixed-time green waves in both directions that are as long and as wide as possible, even in the situation where the driving time condition is not fulfilled. In particular, we are considering an arterial along whose nodes separate left-turn signal groups are realized. In our computational results, we show that scheduling left-turn phases before or after the straight phases can reduce waiting times along the arterial. Moreover, we show that there is always a solution with green waves in both directions that are as long and as wide as possible, where absolute priority is put on just one direction. Compared to optimizing both directions together, establishing an ideal green wave into one direction can only provide suboptimal quality when considering prioritized parts of a green band (e.g., first few seconds).

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