Identifying Optimum Lane Configuration Using CMA

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Identifying Optimum Lane Configuration Using CMA

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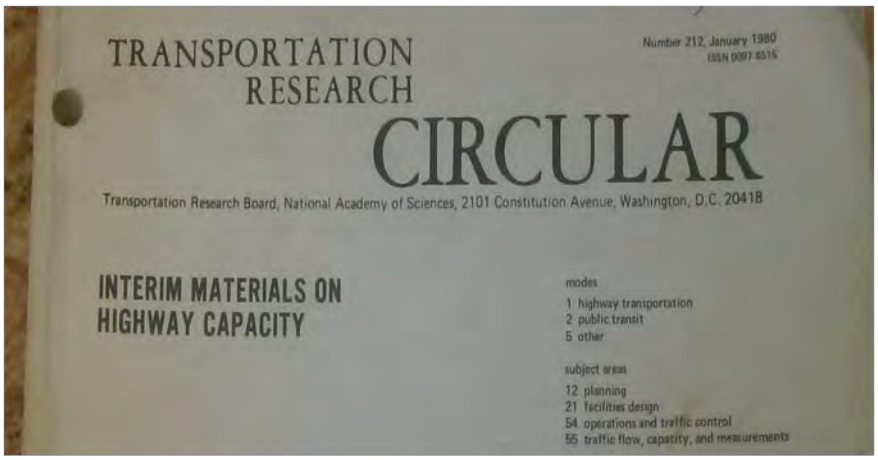
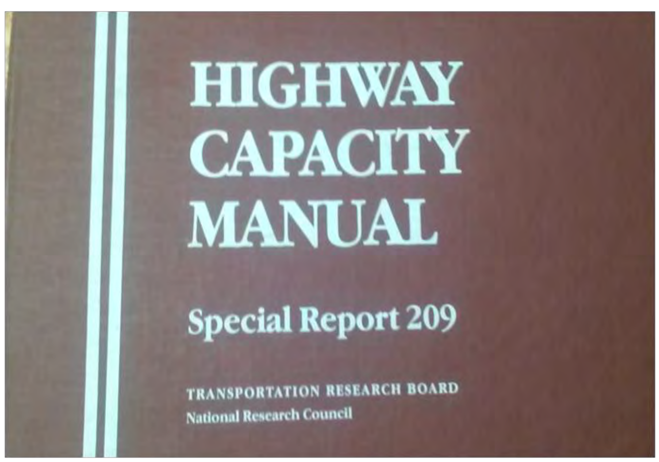
An excellent way to identify the optimum lane configuration and associated signal phasing at a signalized intersection is through the use of simplified Critical Movement Analysis (CMA). CMA is a planning-level analysis methodology that first appeared in the Transportation Research Board's Circular 212 back in 1980.

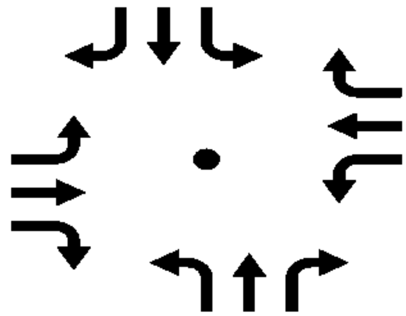


The technique was brought into the transportation engineering mainstream with publication of the 1985 Highway Capacity Manual.

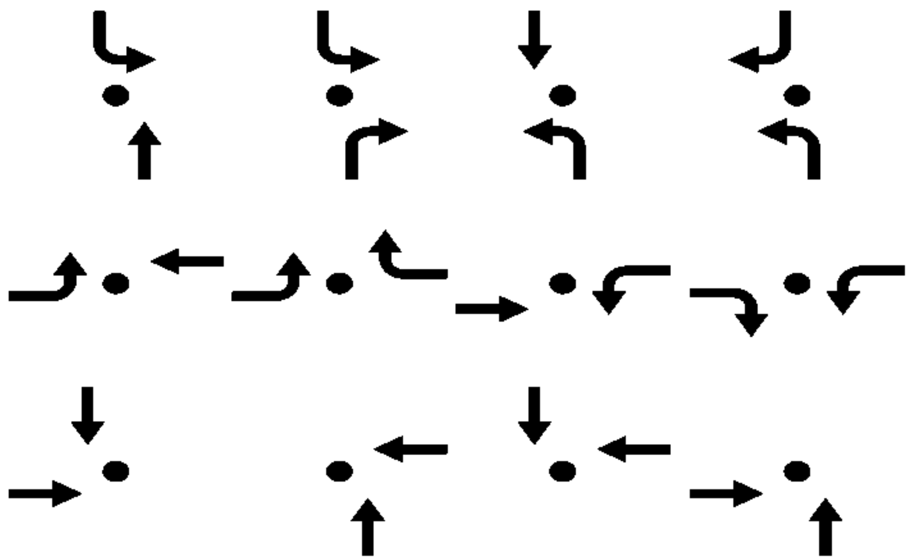


The methodology is simple enough to be performed by hand yet provides the analyst with an excellent feel for how a signalized intersection can be expected to perform under a given set of hourly traffic volumes. It is a great tool for analyzing intersections under future conditions where traffic volumes may be approximate and where detailed signal timing information and traffic stream characteristics (such as percent trucks or the peak hour factor) may be unknown or known with little certainty. While going through the CMA procedure the traffic analyst develops an excellent feel for which lane additions will improve traffic operations and which will not. The procedure is also useful in determining which signal phasing pattern will produce optimum capacity results.

Over the last 30 years Critical Movement Analysis has given way to highly computerized procedures that are much more accurate, but which have a much higher data input need. The use of such automated procedures can result in the analyst getting bogged down in detail and "losing touch" with the operational needs of the intersection. Consequently, when designing intersections, CMA is a great first step in the analysis process that allows one to quickly determine the optimum lane configuration and associated signal phasing. CMA is based on the simple principal that no two streams of conflicting traffic can cross through the intersection at the same time (or we would have the obvious accident). For example, northbound left turns and southbound thru movements cannot proceed at the same time and neither can westbound left turns and northbound thru movements. The complete set of conflicting and non-conflicting volumes at a typical 4-leg intersection can be depicted as follows.

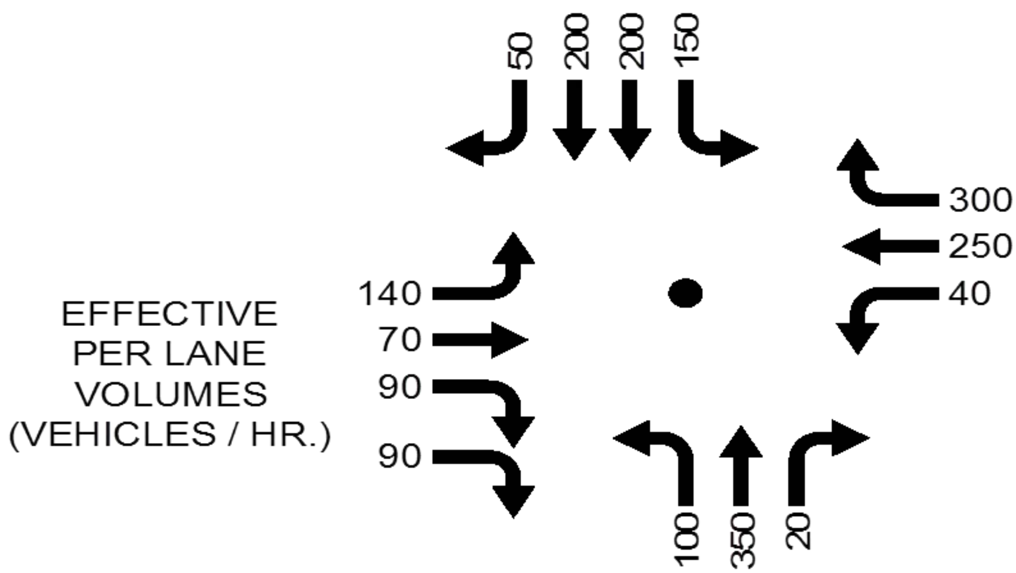


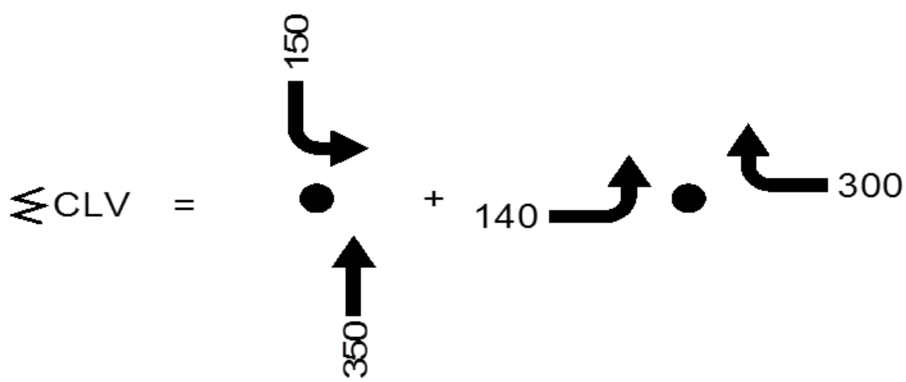
ALL MOVEMENTS



CONFLICTING MOVEMENTS

CMA identifies the set of conflicting movements that require the most time to serve (assuming the intersection were signalized) and then sums up the hourly per-lane volumes associated with this "critical" set of movements. This sum, known as the Sum of the Critical Lane Volumes (SCLV), is then compared to a simple table to determine whether the intersection as designed will operate BELOW capacity, NEAR capacity, AT capacity, or ABOVE capacity.

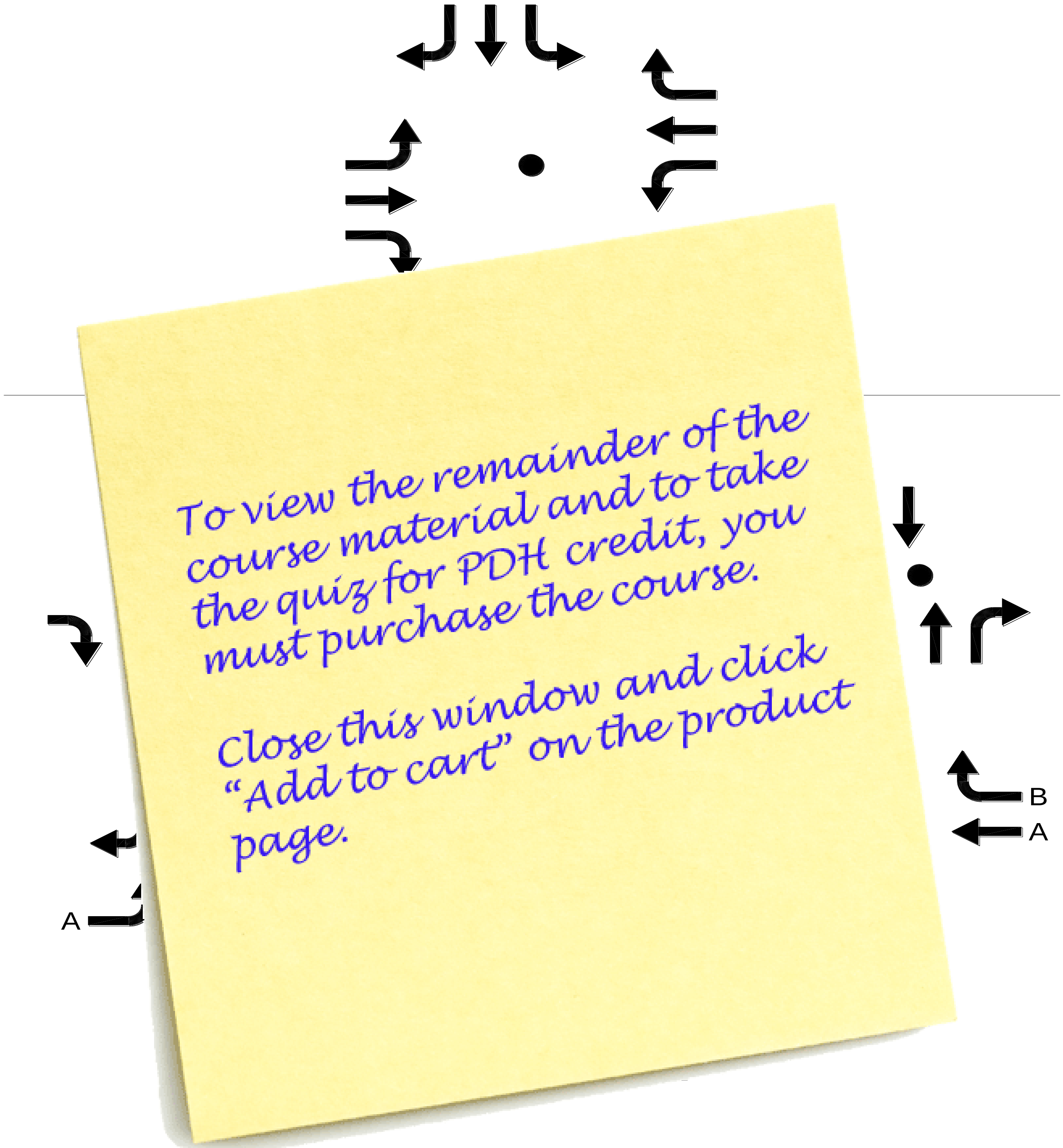




$$\sum CLV = 500 + 440$$

$$\sum CLV = \underline{\underline{940}}$$

Certain movements can proceed at the same time and are, therefore, non-conflicting.



Whenever there are such simultaneous movements, only one of the two movements will contribute to the SCLV. For example, in the above figure either movement A or movement B will contribute to the SCLV, but not both.