

Planning a City with Matrices

By Robert Bilinski

Collège Montmorency

The activity introduces students to an application of matrices in urban planning. Indeed, matrices may be used to study possible travel routes between two locations, or to assign one-way traffic to different streets, when planning a city. This can be achieved by representing all street corners and streets in a graph. The graph is then modeled with its incidence matrix and various powers thereof. The items in the matrix list the number of streets (based on their direction) that link two specific street corners. The square of that matrix will indicate the number of possible travel routes between these two street corners via two streets, and its cube will indicate the number of possible travel routes between two street corners via three streets, etc.

Once you determine how easy it is to travel to or from a specific location, you can design it for a particular purpose. For example, a site that is difficult to reach could be used for public works (where few people need to go, and which must be out of the way because of the noise), or serve as a bedroom community (where travel is not as frequent). On the other hand, an easily accessible site could be used to provide an essential service (e.g. store, hospital, etc.).

The many possibilities (often mutually exclusive) make this type of work conducive to discussion and motivate students to get involved in the subject. The teacher can even include current issues (pro-industry vs. pro-nature debate, urban sprawl, etc.) to varying degrees, at his own discretion.