Geog 464 Learning Objective Outline

LOO 19 Integrated, Transportation Improvement Programming Analysis

19.1 What is important for integrating functional themes for GIS data analysis in improvement programming?
19.2 How does one formulate a Transportation Adequacy Measure?
19.3 How is a Transportation Adequacy Measure used in the King County Concurrency Management Program?

19.1 What is important for integrating functional themes for GIS data analysis in improvement programming?

In land use and transportation decision problems, the goal is to support growth where land use permits will have the least impact on degradation of transportation movement. Because of the diversity of development in King County (KC), a major focus of the County's transportation planning process is determining the adequacy of transportation facilities in meeting projected auto and transit travel for activity centers and suburban-rural areas of the County.

- King County makes use of a “priority process” for transportation planning which is very much like an overall transportation improvement programming process. Each project is ranked. At the WA State DOT level they call it the transportation project “priority array”, which is where the counties borrow the terminology. This involves a ten-year improvement horizon for characterizing need, in other words a cross between a plan and a program. This time length seems to work. In recent years the Puget Sound Regional Council (PSRC) has adopted a similar ten-year priority plan perspective as well.

- To establish consistency between PSRC’s and KC’s transportation planning processes, KC makes use of the transportation analysis zones (TAZ) coverage provided by the PSRC as the basis of its transportation modeling.

- A TAZ is a combination of US Census block groups – smaller than census tracks, that approximate small zones of possible “origin” (where commuters potentially might come from, e.g., like residences) and “destination” (where they potentially might go, e.g., places of work and shopping). This is accomplished on the basis of area, network density, and total population of residents and employees.

- Using GIS, King County splits or aggregates TAZs where necessary into small area zones (SAZs) to reflect the character of subareas requiring more refined attention than at the PSRC four-county scale. This is accomplished on the basis of area, network density, and total population in a manner similar to the creation of TAZs, more refined in resolution because of smaller geographic scale than PSRC.

- SAZs have been used by the County's transportation modeling group to forecast travel demand for vehicle trips, focusing on autos and transit trips, but now use travel sheds.

A GIS is used to characterize corridors and transportation service areas (based on travel sheds) in terms of auto and transit service, whether they are inside or outside the urban growth boundary (i.e., urban or rural), and whether they are in an incorporated or unincorporated area. *This check is one of the best examples of an integrated management of land use and transportation in a growth management context.* Together these characteristics help direct strategy for transportation improvement program projects as part of the capital improvement program for KC.

- A transportation adequacy measure (TAM) **establishes an operational monitoring link between land use development and transportation improvements. A TAM** was used for each SAZ as well as for monitored corridors up until 2008, and then KC adopted the idea of "travelsheds" composed of SAZ's to aggregate the measure, simplifying policy implementation, but at the same time make TAM more effective in its application.

19.2 How does one formulate a Transportation Adequacy Measure?

Many of the numbers to implement a TAM are computed using transportation modeling (e.g., EMME/2) software, with data managed in GIS. The TAM is computed using trips, vehicle miles traveled (VMT), and volume to capacity ratio (V/C).

The number of trips on a segment is computed for each zone relative to the total number of trips across the entire county. Computed trips depend on how close or far vehicles are from a zone. The proportion of trips grows smaller as distance from a zone increases (inverse distance relationship).

Trips are used to compute VMT as follows (King County, 2002c).
VMT = segment length (miles) multiplied by the number of trips on a segment.

A capacity for a highway is based on the number of lanes, speed, and composition (although speed and lanes are usually sufficient). The volume is the actual number of vehicles at PM peak load time on the segment. Thus, volume to capacity ratio (V/C) is computed as:

V/C = volume on a segment divided by capacity on a segment.
Thus, the TAM for a SAZ is computed as a relationship between VMT and V/C.
TAM = sum (VMT*V/C) across all links divided by the sum of VMT across all links.

A threshold TAM is used as a policy constraint, such that SAZ's and monitored corridors should not exceed a certain amount of traffic congestion. Exceeding the threshold amount means that there is congestion (lower mobility) in the area because of the level of land use development or the absence of transportation improvements.

The threshold TAM is based on a level of service (LOS) recommended by the Federal Highway Administration for urban highways. LOS is commonly stated as a letter ranked A through F given to segments, routes, corridors as compiled over time as in Table below. It is not something assigned for any specific day.

Traffic Levels of Service (LOS)
(Washington State Department of Transportation 2006)

> LOS is reported on a scale of "A" through "F". The general definition of each LOS is as follows:
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> LOS "A" – This is a very high service level in which the roadway and associated features are in excellent condition. All systems are operational and users experience no delays.
>
> LOS "B" – This is a high maintenance service level in which the roadway and associated features are in good condition. All systems are operational. Users may experience occasional delays.

LOS "C" – This is a medium maintenance service level in which the roadway and associated features are in fair condition. Systems may occasionally be inoperable and not available to users. Short term delays may be experienced when repairs are being made, but would not be excessive.

LOS "D" – This is a low maintenance service level in which the roadway and associated features are kept in generally poor condition. Systems failures occur because it is impossible to react in a timely manner to all problems. Occasionally delays may be significant.

LOS "E" – This is a marginal service state in which flow becomes irregular and speed varies rapidly, but rarely reaches the posted limit. On highways this is consistent with a road at or approaching its designed capacity. LOS E is a common standard in larger urban areas, where some roadway congestion is inevitable

LOS "F" – This is a very low service level in which the roadway and associated features are kept in poor and failing condition. A backlog of systems failures would occur because it is impossible to react in a timely manner to all problems. Significant delays occur on a regular basis.

In the table, A designates "best" as in freely flowing traffic, F is worst as in almost standing still – fully capacitated (Transportation Research Board 1985). LOS is essentially a recommended flow volume-to-capacity ratio. See the King County level of service in terms of average travel speed for roadways within section 14.70.220 of Title 14 Roads and Bridges of King County law code. NOTE: average travel speed is NOT speed limit, but average speed of vehicles traveling on roadways at peak PM.

Thus, the TAM is to be interpreted as a performance measure threshold; it is an indication of people's mobility on the transportation system (could one create a measure for water or housing performance?).

- **Areas expected to be mobility deficient can be computed based upon changes in land use that generate trips.**
- The TAM (and associated LOS) as computed, are compared to a threshold TAM, thus creating an **operational concurrency link between land use development and transportation development**.
- **This link guides the approval process for land development permits as part of growth management planning.**

18.3 How is a Transportation Adequacy Measure used in the KC Concurrency Management Program?

- The TAM is used to assess the amount of congestion in small areas (rather than just on road segments), as well as in corridors, because land use generates trips. Making the connection operational through policy comes in the form of a **concurrency management program** adopted by King County Council in 1995 and periodically revised since then, with the most recent update in March 2017.

KC Ordinance establishes a **concurrency management system**, which assures that adequate transportation facilities are available to meet the requirements of new development in King County. A concurrency review must be completed by anyone who intends to apply for a land development permit in unincorporated King County.

Applicants (anyone who wants to develop a property) for development permits must obtain a certificate of transportation concurrency (or availability) prior to obtaining a development permit. The certificate confirms and establishes the availability of transportation facilities (or supply) to serve the development and commits the capacity to the development. A certificate is not issued if the development causes a violation of transportation level of service and if no financial commitment is in place to complete the improvements within six years.

The King County Concurrency Management Program updated a GIS map of TAM levels for SAZ's and corridors twice a year (**See RUGIS Figure 12.2 for LOS-based TAM for SAZ's - 2002**).

- Light gray shade (green color in original) indicates that the computed TAM is less than the threshold TAM, and thus developing land is not likely to affect transportation flow very much.
- Medium gray (yellow color in original) indicates a precautionary level of development has been reached.
- Dark gray (red color in original) indicates that land development permits will not likely be issued because the roads are already at, or over, capacity.

The concurrency assessment: see **key elements of the program** on concurrency program web page.

1. travel shed area check
2. corridor routes check

- If a development permit is denied after checking the TAM in the first phase, i.e., against the TAM for a travel shed, then the permit is denied overall.

- If however, the permit passes the first phase TAM travel shed check, then the second phase test is administered, i.e., to check the TAM in the corridor.

- Assuming the test passes this stage, then the permit moves through the regular permitting process for approval/denial consideration.

In 2008, the TAM strategy was refined by applying it to 28 travelsheds rather than SAZ's, but as of March 2017 the check is based on 13 (7 urban and 6 rural) travelsheds.

The following maps are adopted as attachments to the transportation concurrency ordinances:

2016 Transportation Concurrency Map, Attachment A to Concurrency Mgt Ordinance

Travelsheds boundary map - Transportation Concurrency Travel Shed Boundaries, Attachment B to the Ordinance – Note how travel shed areas are symbolized in terms of land use.

In summary, the concurrency management program, and its core concepts of corridor, travelsheds and TAM are among the best examples world-wide of integrated management of land use and transportation for improvement programming assessment. Decisions for land use permitting are based on the adequacy of transportation functional service.

How might this be used for watershed improvement in regards to land use and water flow? Look at total maximum daily load (TMDL) water quality regulations for drinking water (Clean Water Act section 303d).