Time-Geographic Methods for Analyzing GPS Data

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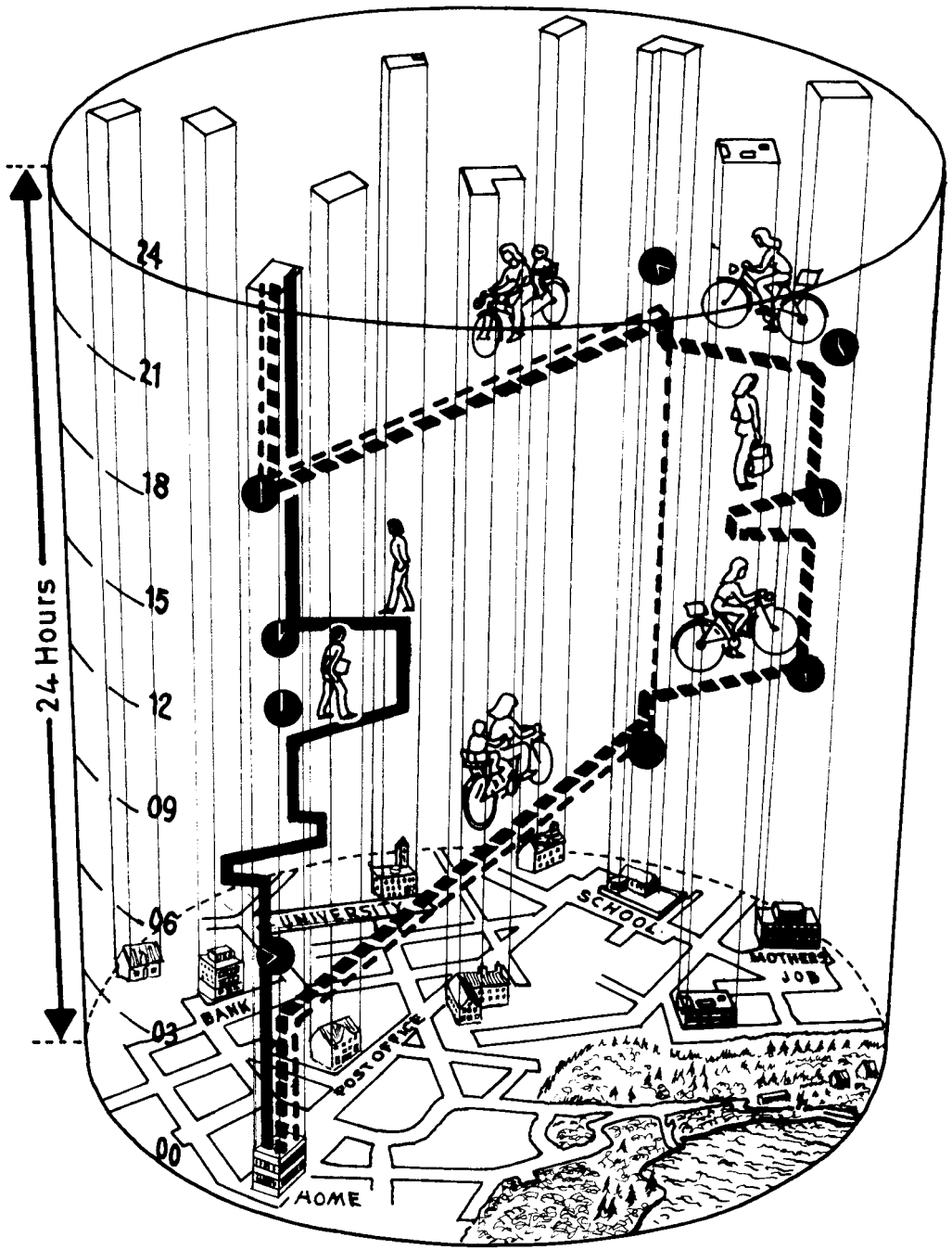
Time Geography

- Developed by geographers at the University of Lund, Sweden: Hägerstrand, Carlstein, Lenntorp
- Map individual movements through time and space within a set of constraints - **space-time paths**
- These constraints limit people's daily mobility to a set of three dimensional 'prisms' - **space-time prisms**
- Individuals can only occupy the area within these prisms
- Area outside prisms requires mobility beyond that available to them


24 Hours
24
21
18
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HOME
BANK
POST OFFICE
UNIVERSITY
SCHOOL
MOTHER'S JOB

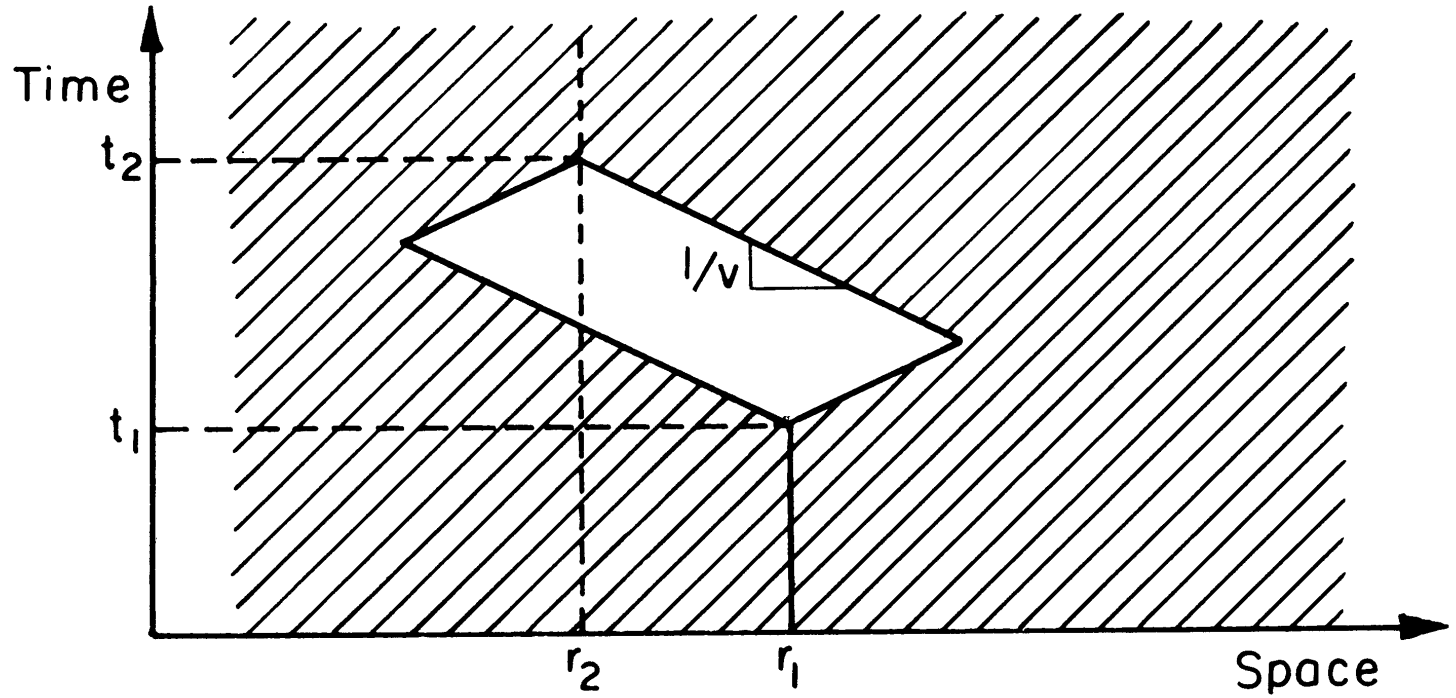
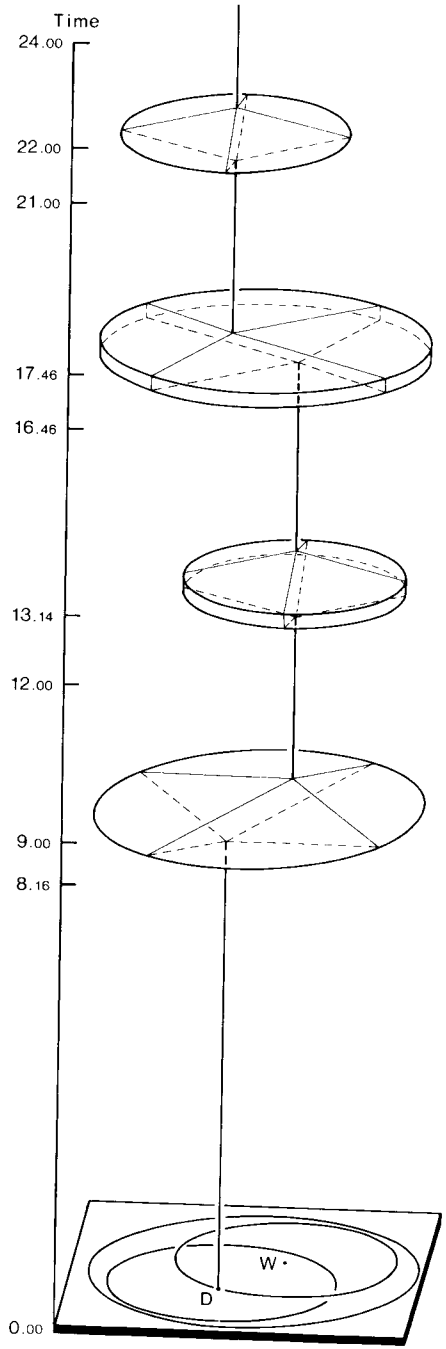
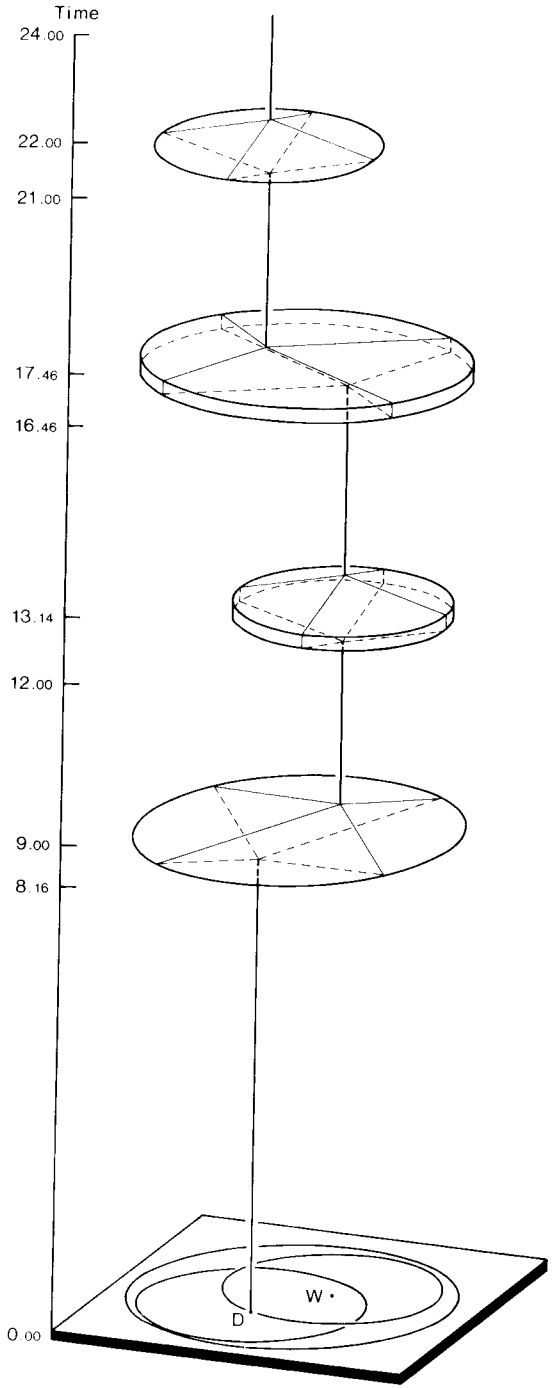


Figure 2–3. Space–Time Diagram for Individual Confronted with Origin and Destination Coupling Constraints.

Space-Time Measures: Concept

- Fixed activities are ‘pegs’ around which an individual’s daily mobility is structured
- The area an individual can reach between fixed activities is the **Potential Path Area** (PPA)


Time
24.00
22.00
21.00
17.46
16.46
13.14
12.00
9.00
8.16
0.00
W
D


Time
24.00
22.00
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8.16
0.00
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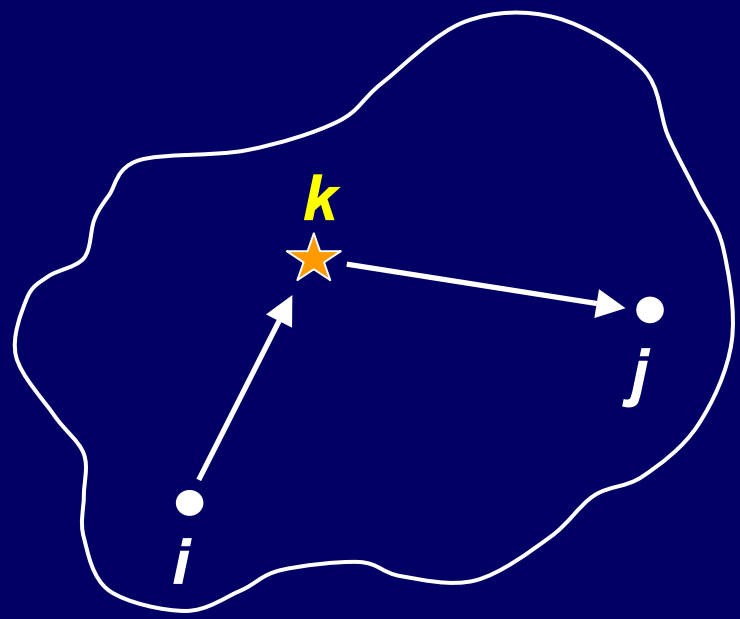
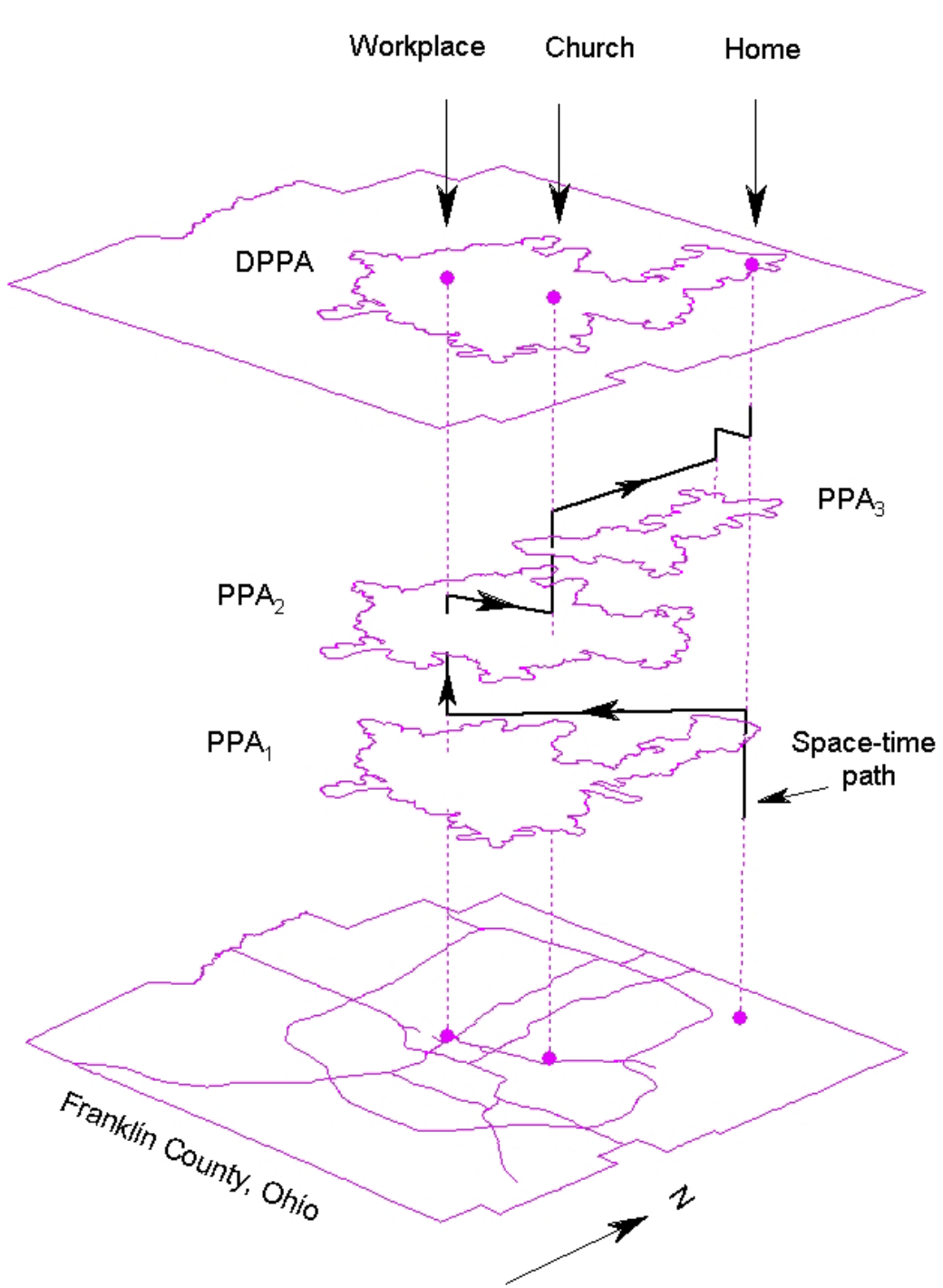
D

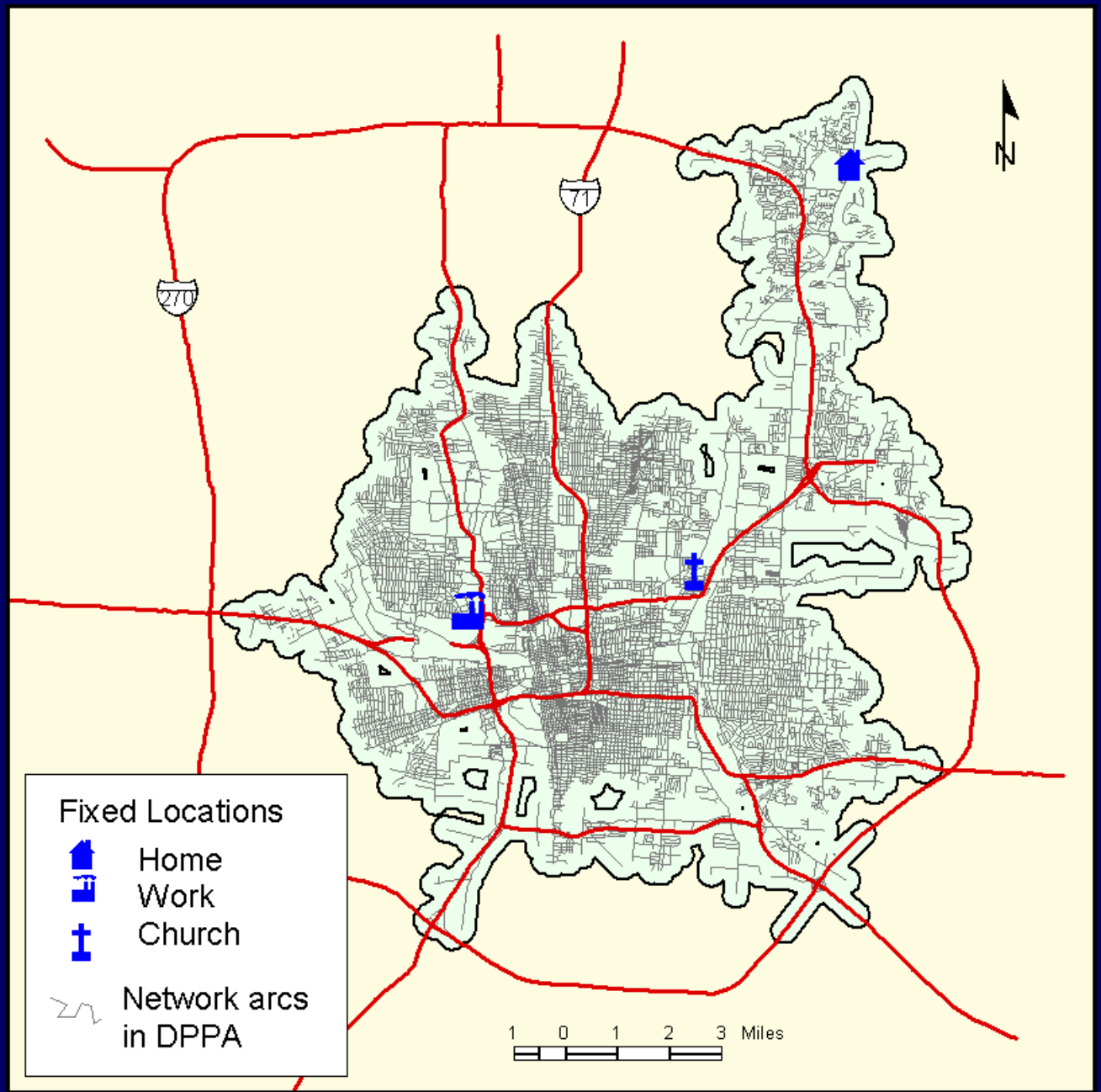
- for any pair of consecutive fixed activities *Fi* at location *i* and *Fj* at location *j* and
- a given time constraints t_j-t_i for activity and travel between these two activities, location ***k*** is reachable if it is within the space-time prism or potential path space (***PPS***)



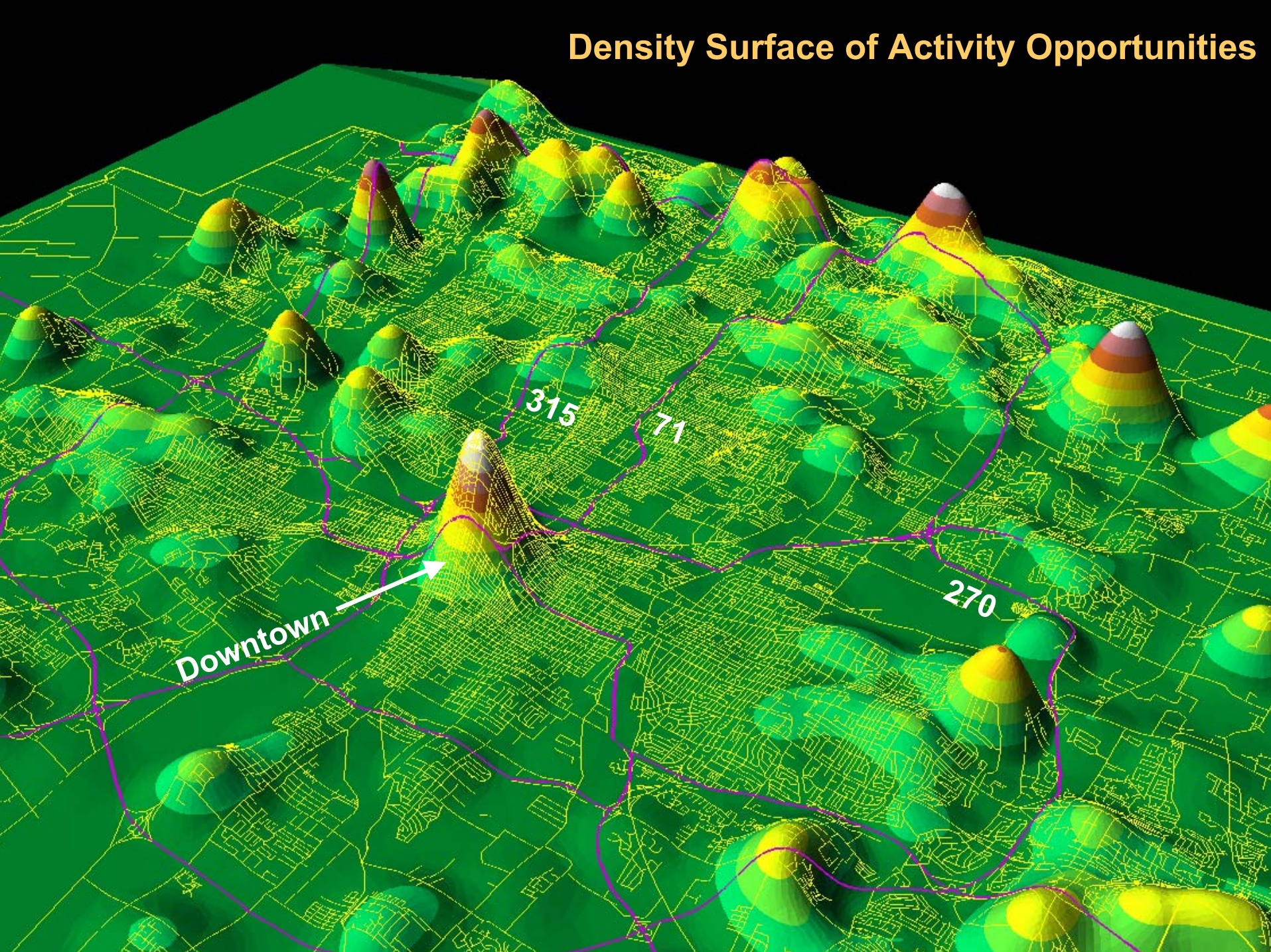
Derivation of Daily Potential Path Area (DPPA)



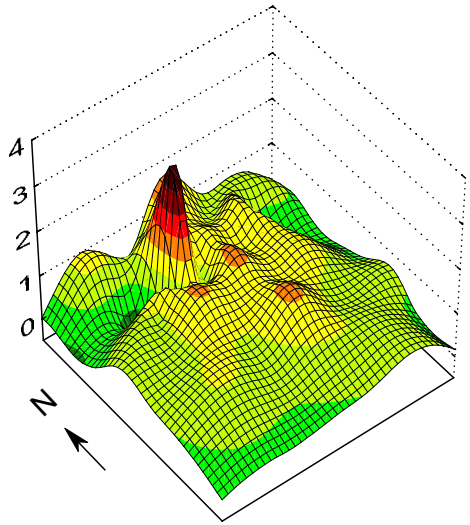
Daily Potential Path Area (DPPA)



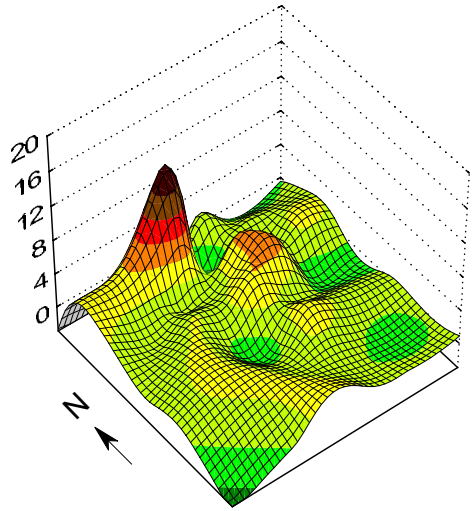
Density Surface of Activity Opportunities



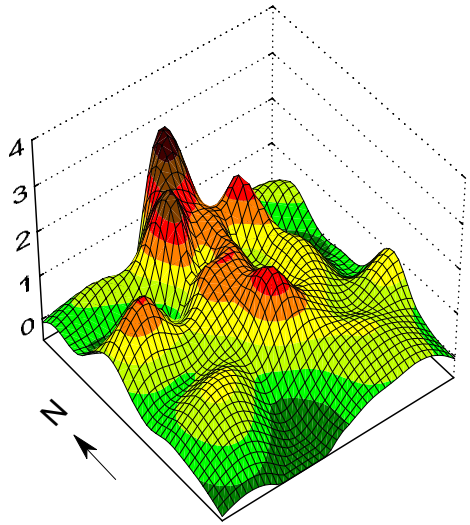
POW1.5



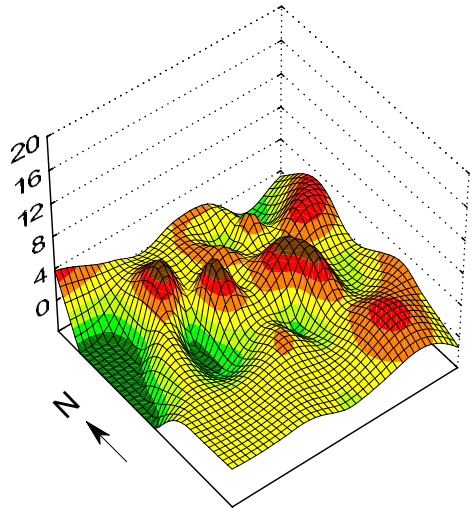
MHWA



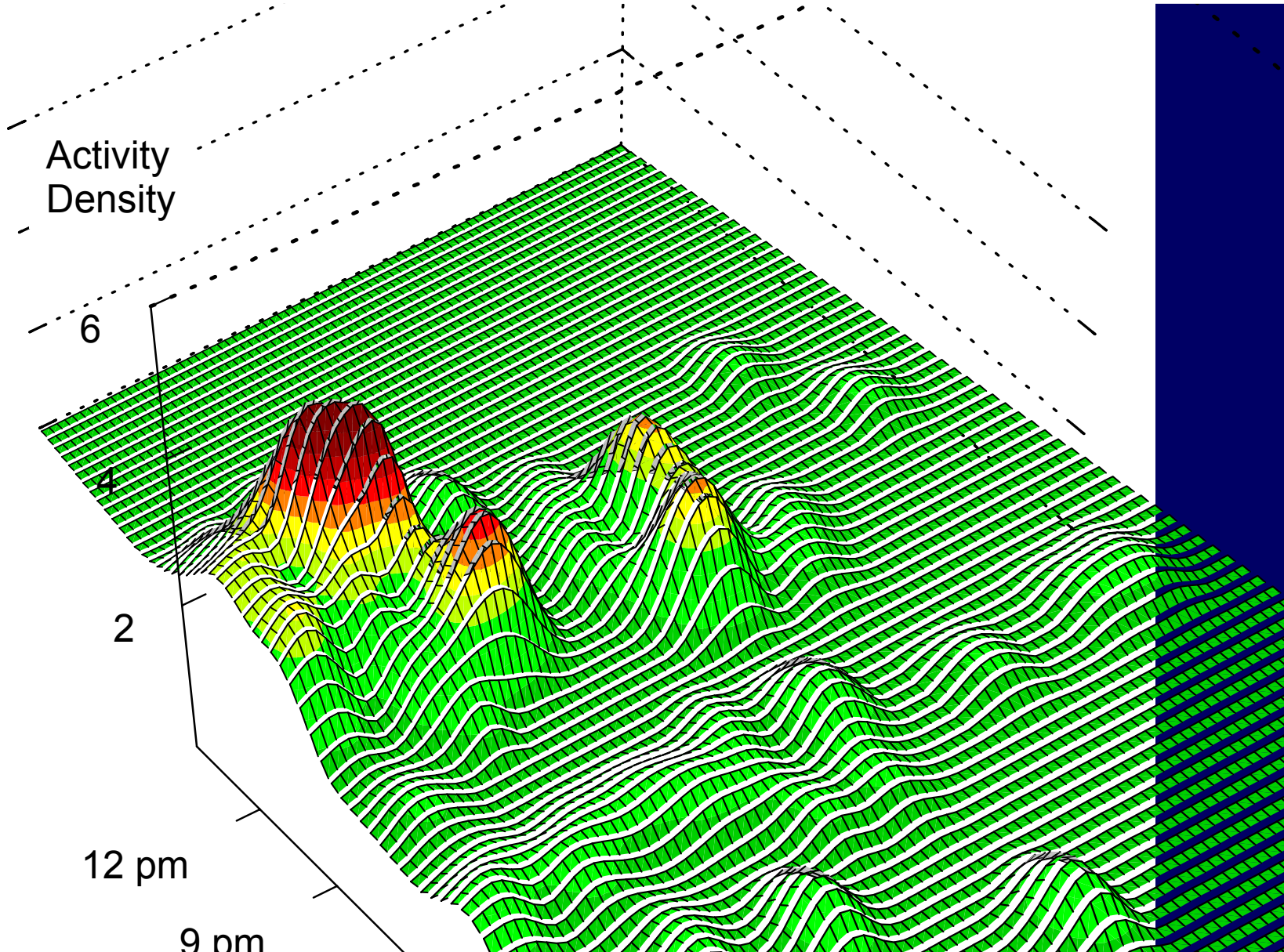
EXP0.45



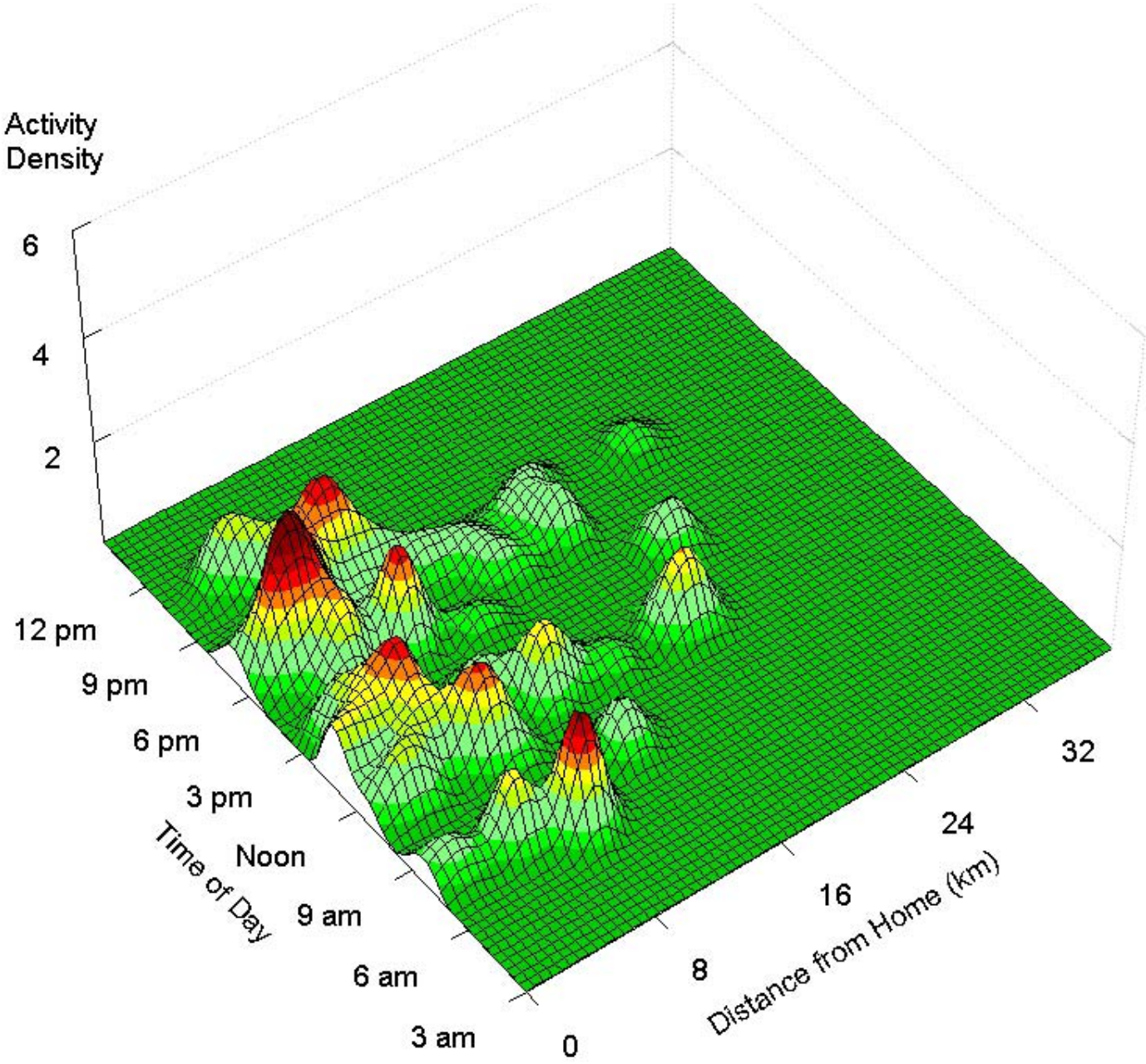
FHWA

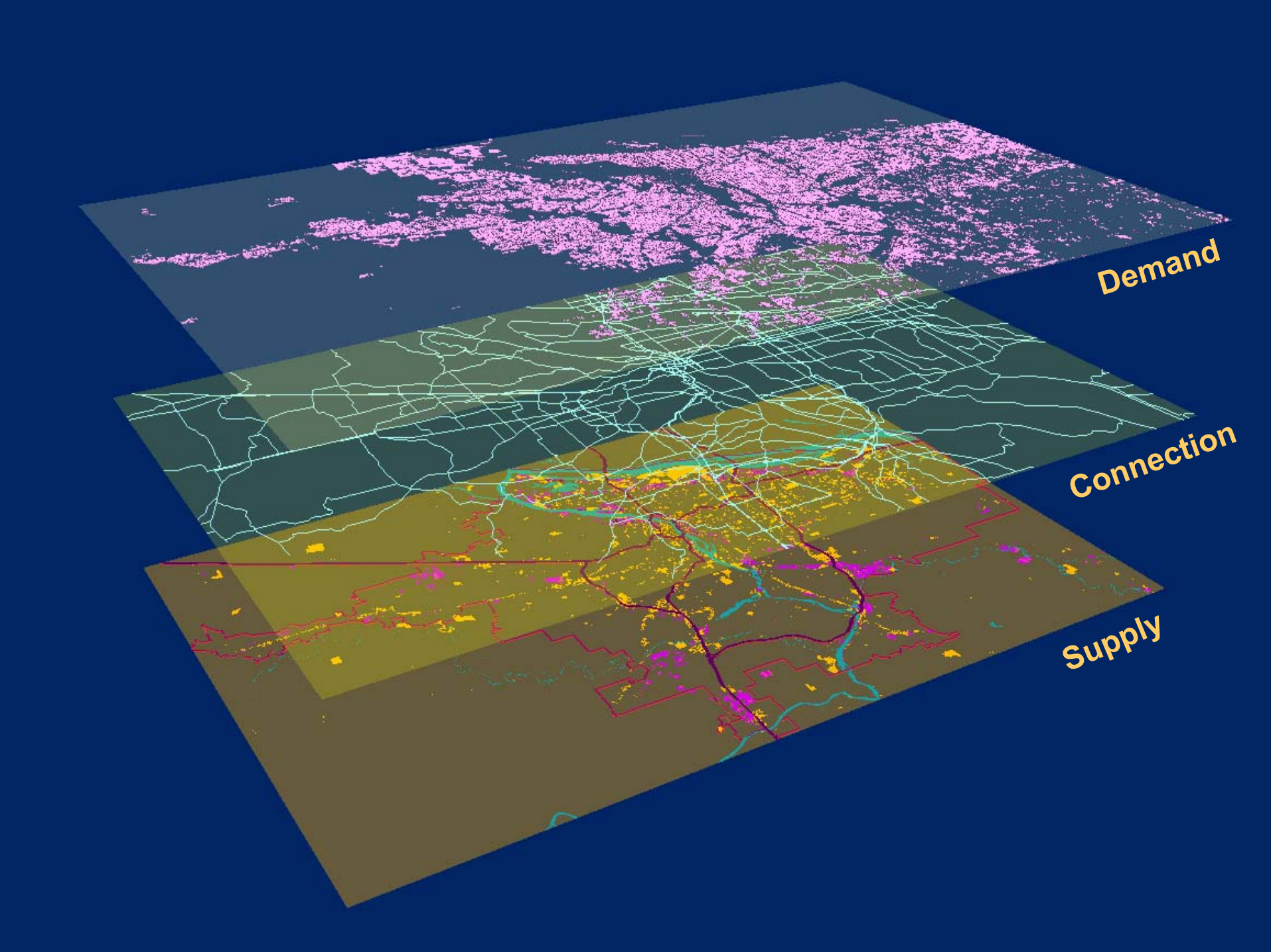


Space-time activity density surface of nonem
activities for women employed full tim



Space-time activity density surface of nonemployment activities for men employed full time

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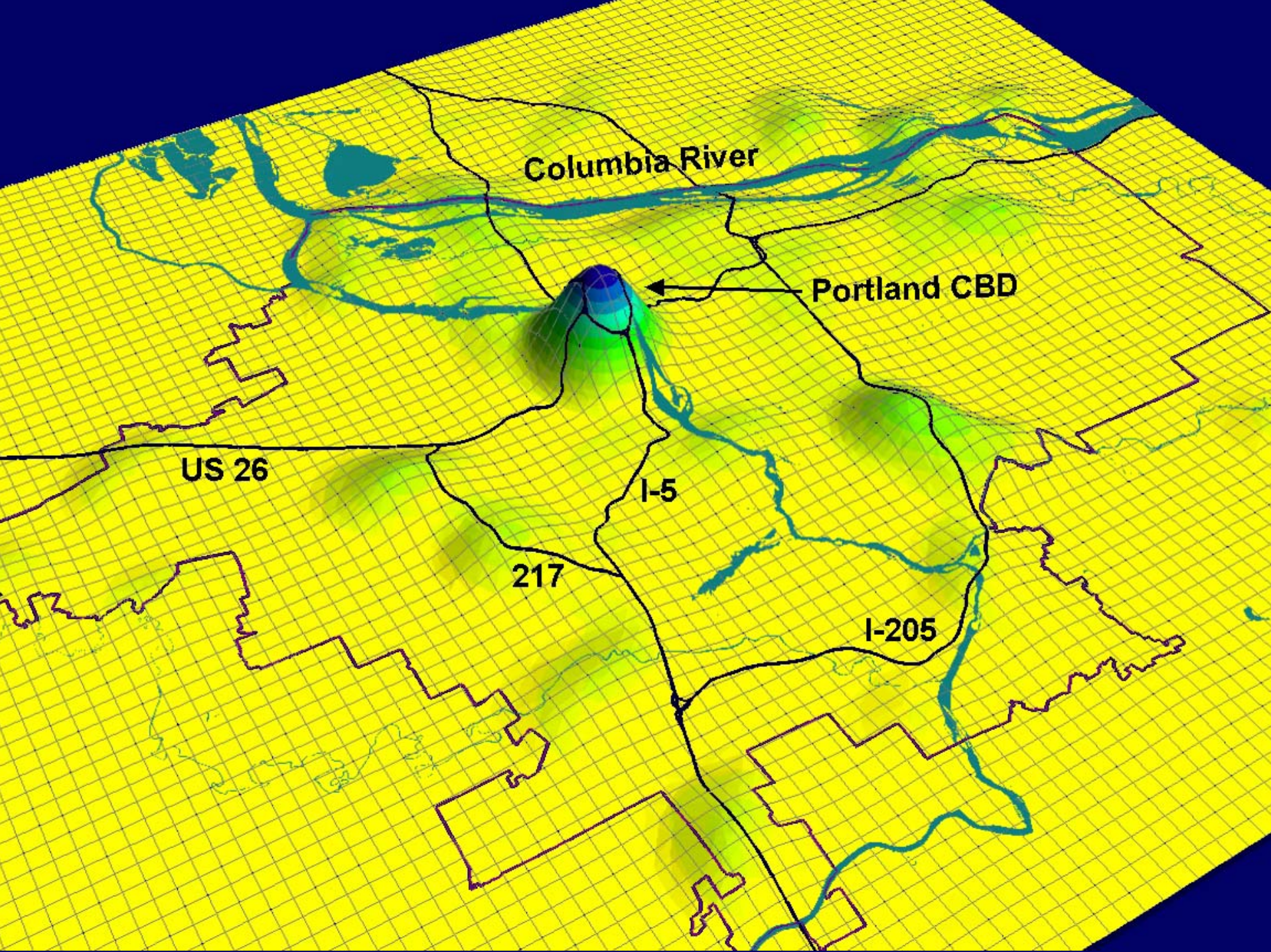
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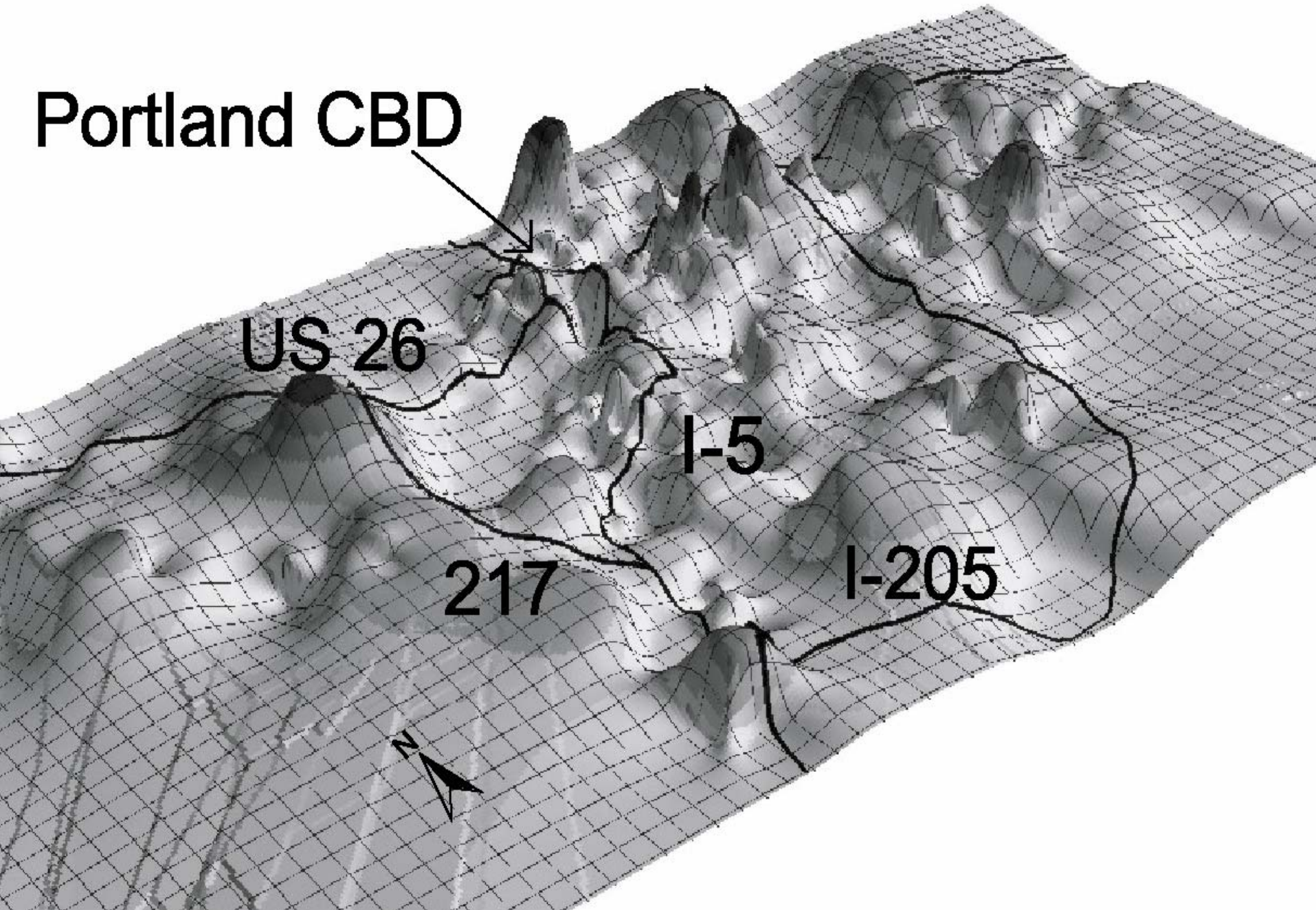
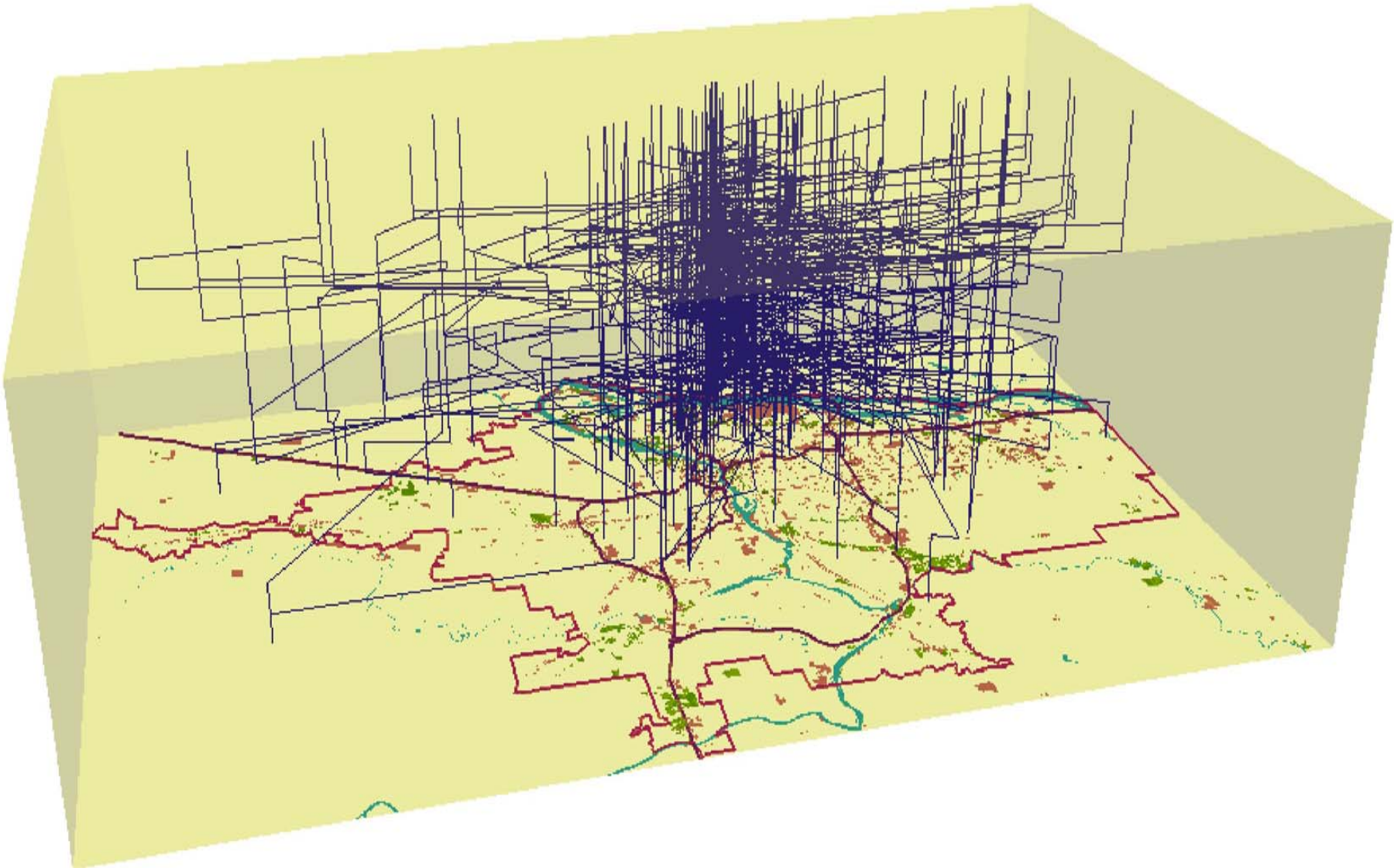
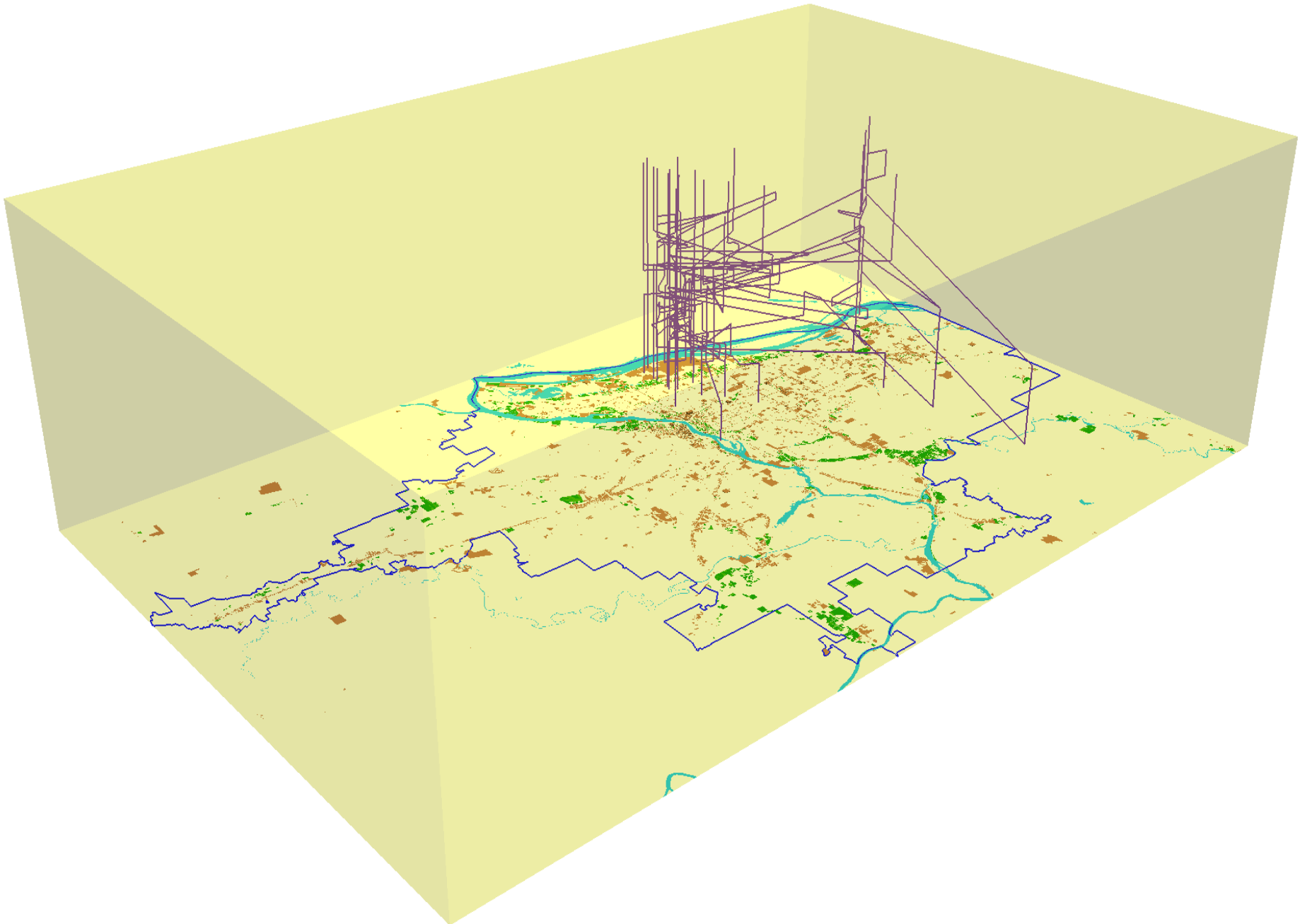
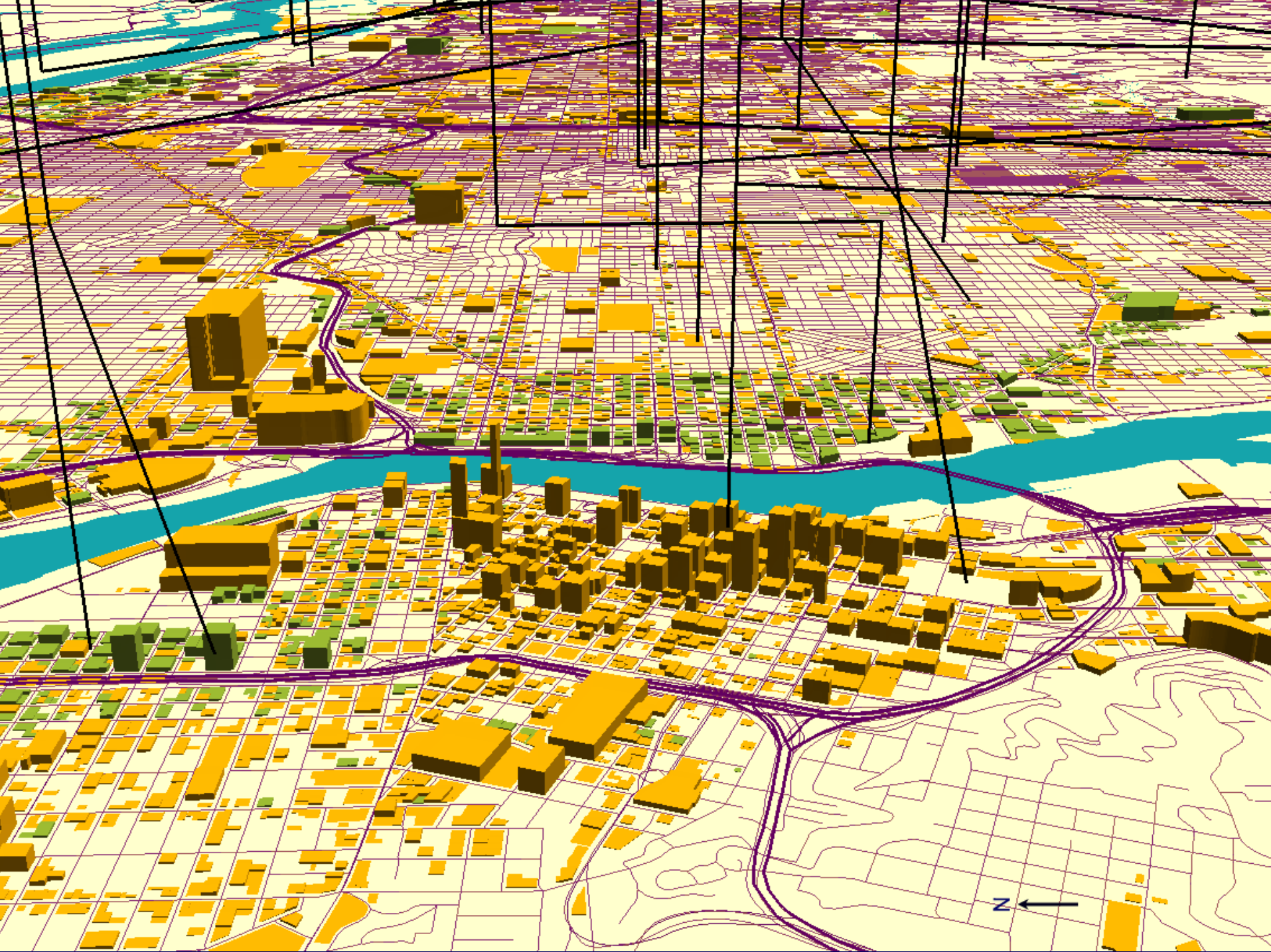
Portland CBD
US 26
I-5
217
I-205


Portland CBD
US 26
I-5
217
I-205
N



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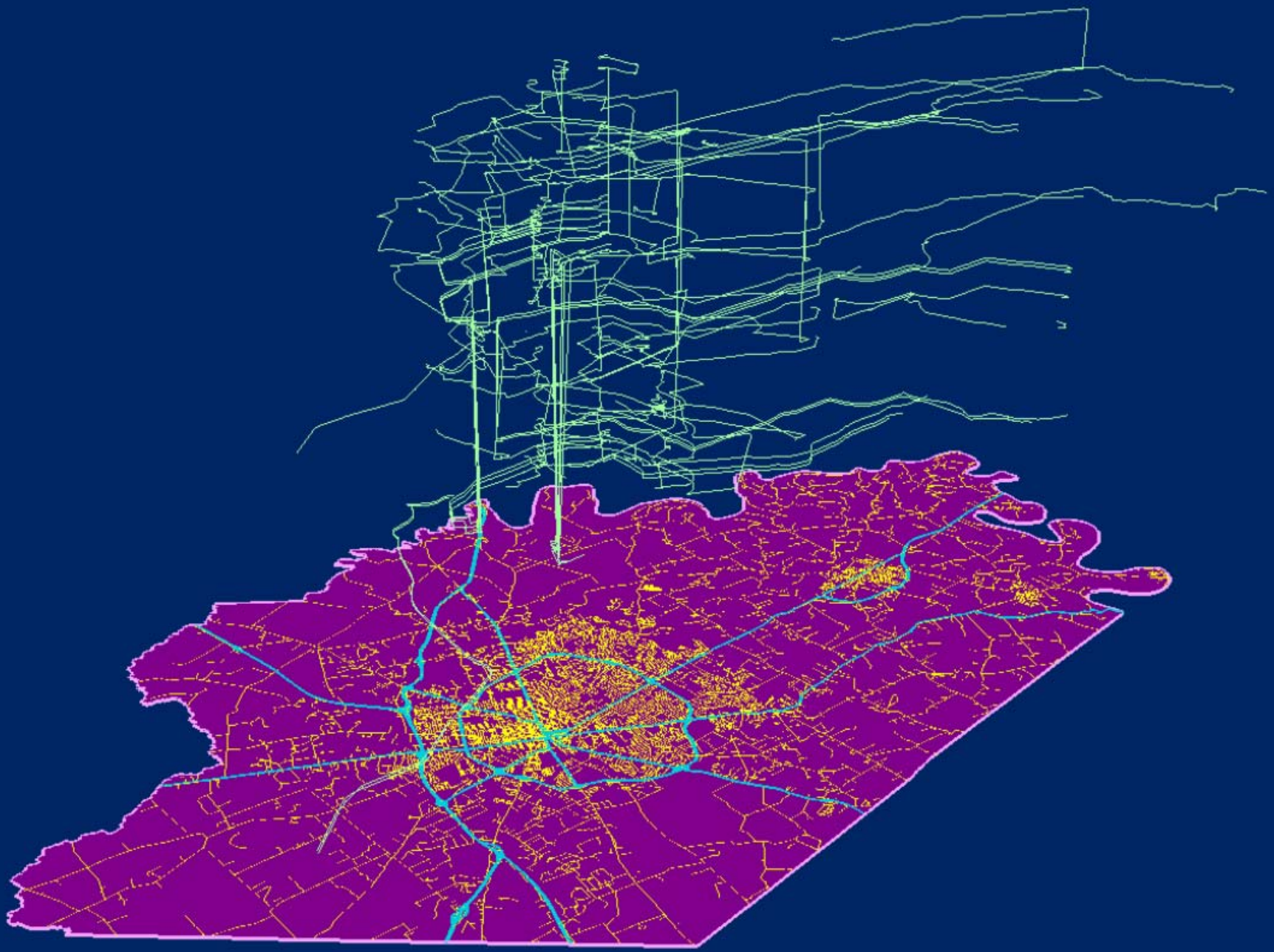

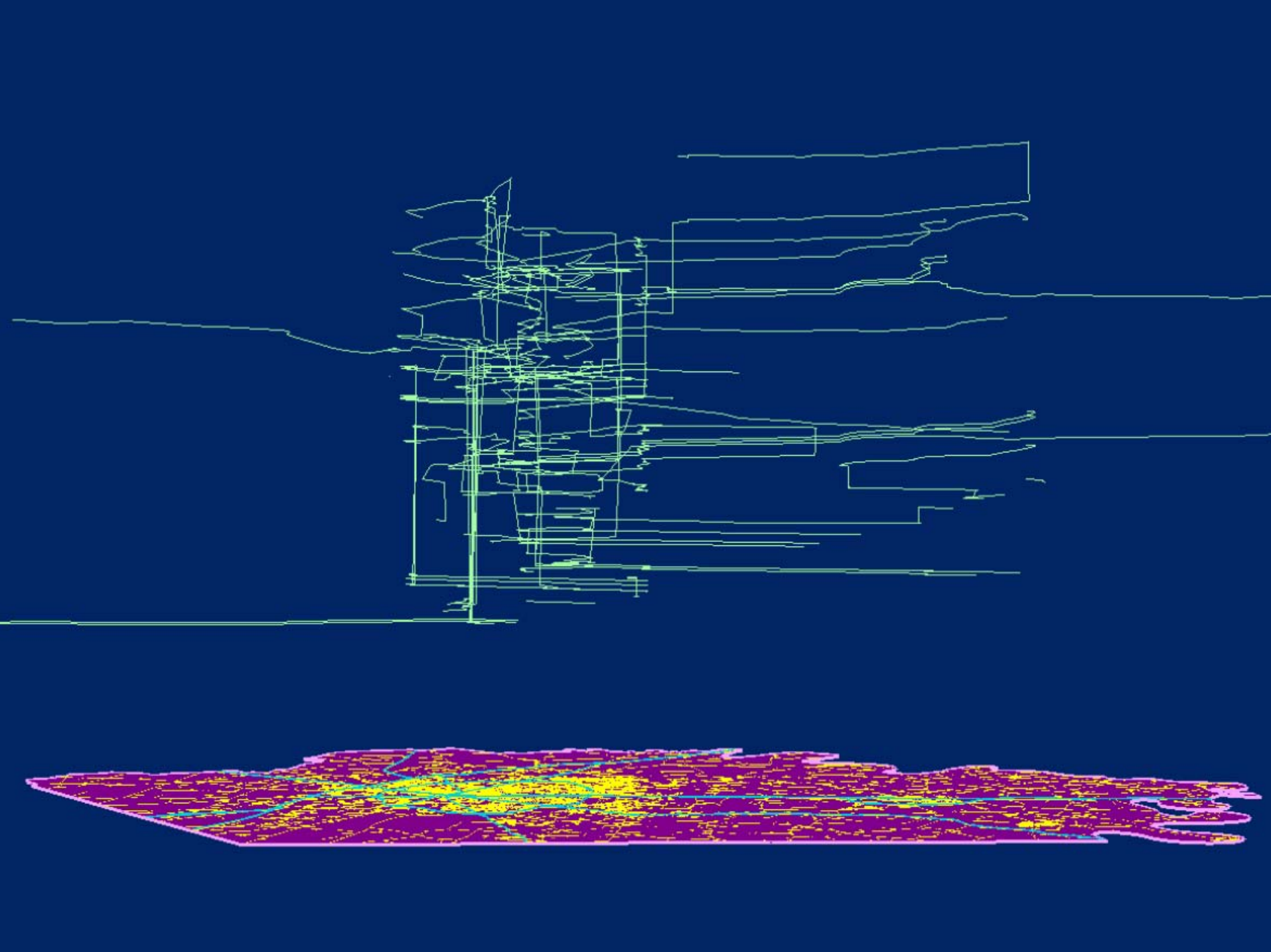

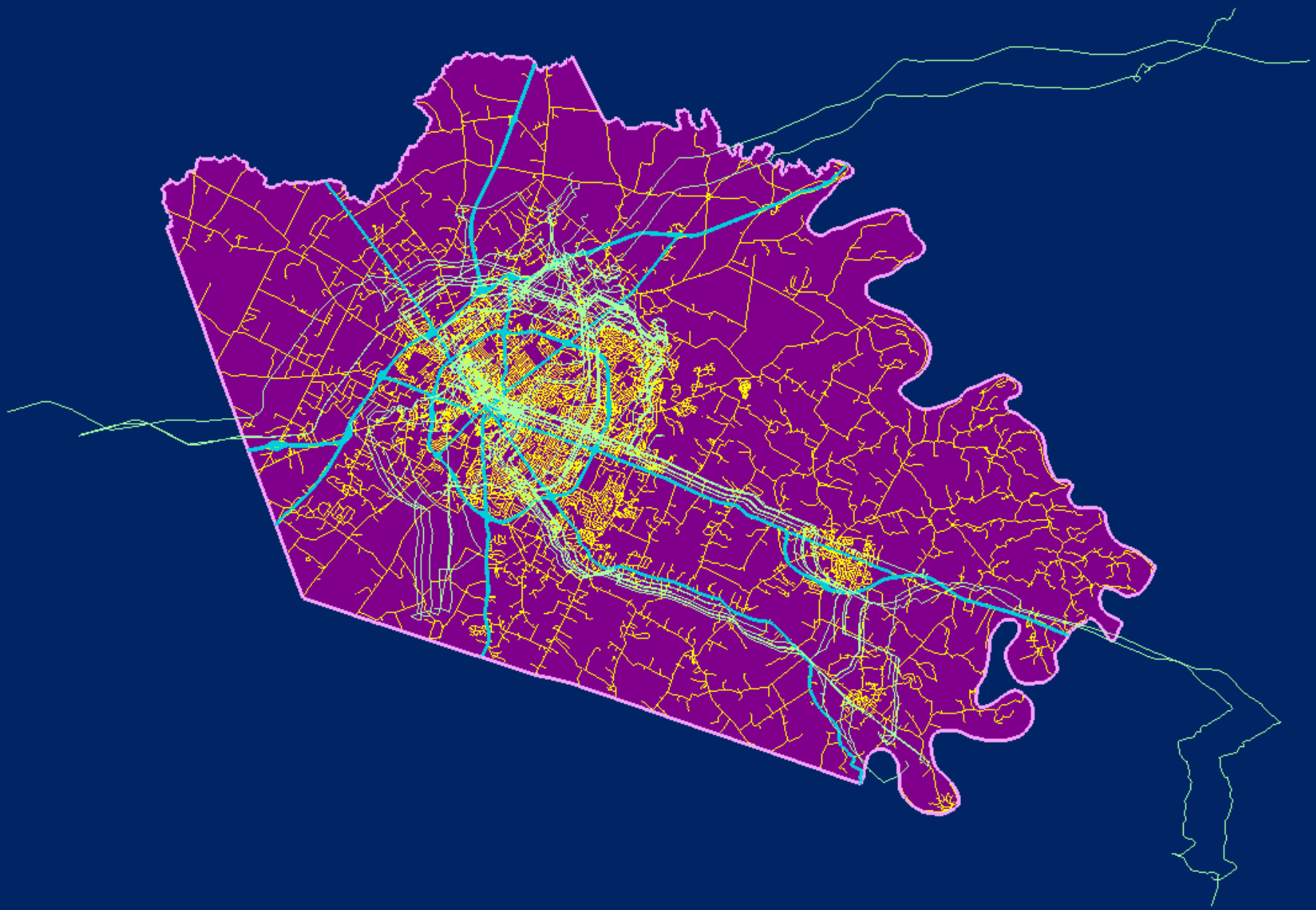

Golledge, Reginald G., Mei-Po Kwan, and Tommy Gärling (1994) "Computational process modeling of household travel decisions using a geographical information system." *Papers in Regional Science,* 73(2): 99-117.