1. MOTIVATION & INTRODUCTION

- In recent years, massive amounts of data generated by mobile phone activity have been increasingly used to help understand human mobility patterns, trajectories, and travel behavior.
- Mobile phones are becoming devices to track movement with no cost added to their usage and are greatly distributed worldwide.
- These capabilities provide a new source of information that can be used to improve model estimation and validation for traditional metropolitan accessibility systems.

2. AN INTEGRATED LAND USE-TRAVEL DEMAND MODEL FOR LISBON

- In this study, we use mobile phone data provided by a local service carrier to justify travel demand and travel times generated from an integrated land use and transportation (LUT) model calibrated for the Lisbon Metropolitan Area, Portugal.
- The mobile phone data used for this study:
  - record the time and tower location of on-going calls
  - more than 0.3 million users for an entire month in 2009. (w.r.t. 2.8 million population in 2009)
  - a total of 601 towers were identified in the Lisbon Metropolitan Area.
- A time frame was determined in order to identify two most frequently used towers, assuming that they were the residential and employment locations for a mobile phone user.
- A tower routing a signal from a mobile phone user during evenings was inferred as home location, and during daytime as the employment location.
- These locations were used to estimate a 601 by 601 seed OD matrix.

3. MODEL COMPARISON RESULTS

- We are aiming at comparing the base year (2001) road network performance estimated from the integrated LMA LUT model and that from mobile phone data.
- OD pairs generated by LUT model are not directly comparable to those in the mobile phone model, since the basic spatial analysis units for our LUT model and the mobile phone model are quite different.
  - the LUT uses units generated from census boundaries (freguesias)
  - while the mobile phone model uses the Voronoi Lattice of the mobile phone towers.
- We created the same road network (consisting of both centroids of "freguesias" and towers as nodes in the network) and used the mobile phone data to validate the LUT model's road network performance instead of comparing the OD matrices from the two models.

4. MOBILE PHONE DATA TO ESTIMATE OD AND TRAFFIC FLOW

- The mobile phone data used for this study:
  - record the time and tower location of on-going calls
  - more than 0.3 million users for an entire month in 2009.
- A total of 601 towers were identified in the Lisbon Metropolitan Area.
- A time frame was determined in order to identify two most frequently used towers, assuming that they were the residential and employment locations for a mobile phone user.
- A tower routing a signal from a mobile phone user during evenings was inferred as home location, and during daytime as the employment location.
- These locations were used to estimate a 601 by 601 seed OD matrix.

5. CONCLUSION

- External sources are important for validating increasingly complicated LUT model
- Mobile phone data mining & statistical techniques present a rich validation opportunity
- We demonstrate new methods for validation of integrated urban LUT models by using mobile phone data, which:
  - can be scaled in a proper way to capture journey-to-work flows in the road network.
  - represents a very low cost alternative to traditional data collection that are expensive and with small sample
  - can be used as a daily detector of travel demand in the future.

6. ACKNOWLEDGEMENT

- The generous support of the Government of Portugal through the Portuguese Foundation for International Cooperation in Science, Technology and Higher Education and was undertaken as part of the MIT-Portugal Program.
- We acknowledge the contributions of Dr. Pu Wang, Weifeng Li, Yi Zhu, and Jie Sun Lee at MIT.

7. CONCLUSION

- External sources are important for validating increasingly complicated LUT model
- Mobile phone data mining & statistical techniques present a rich validation opportunity
- We demonstrate new methods for validation of integrated urban LUT models by using mobile phone data, which:
  - can be scaled in a proper way to capture journey-to-work flows in the road network.
  - represents a very low cost alternative to traditional data collection that are expensive and with small sample
  - can be used as a daily detector of travel demand in the future.

8. ACKNOWLEDGEMENT

- The generous support of the Government of Portugal through the Portuguese Foundation for International Cooperation in Science, Technology and Higher Education and was undertaken as part of the MIT-Portugal Program.
- We acknowledge the contributions of Dr. Pu Wang, Weifeng Li, Yi Zhu, and Jie Sun Lee at MIT.