Sacramento Testbed for Land Use Transport Modeling

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Backgound

- Project to compare different land use transport models in single context
  - consistent database
  - realistic alternative scenarios
  - US situation: Sacramento, CA Area, with 4 Counties
- Spearheaded by R Johnston
- Supported by
  - US EPA, US DOT, Caltrans
  - Mineta Institute
  - California Energy Commission
  - University of California Transportation Center
  - NSERC of Canada

Motivation and Objectives

- Examine how model form influences model performance
- Inform further model development
- Inform policy development
- For this presentation in particular:
  - show results so far
  - indicate some observations, offer some conclusions; not trying to pick ‘winners’
  - engender reaction and further discussion among participants
  - encourage more participation

Authorship

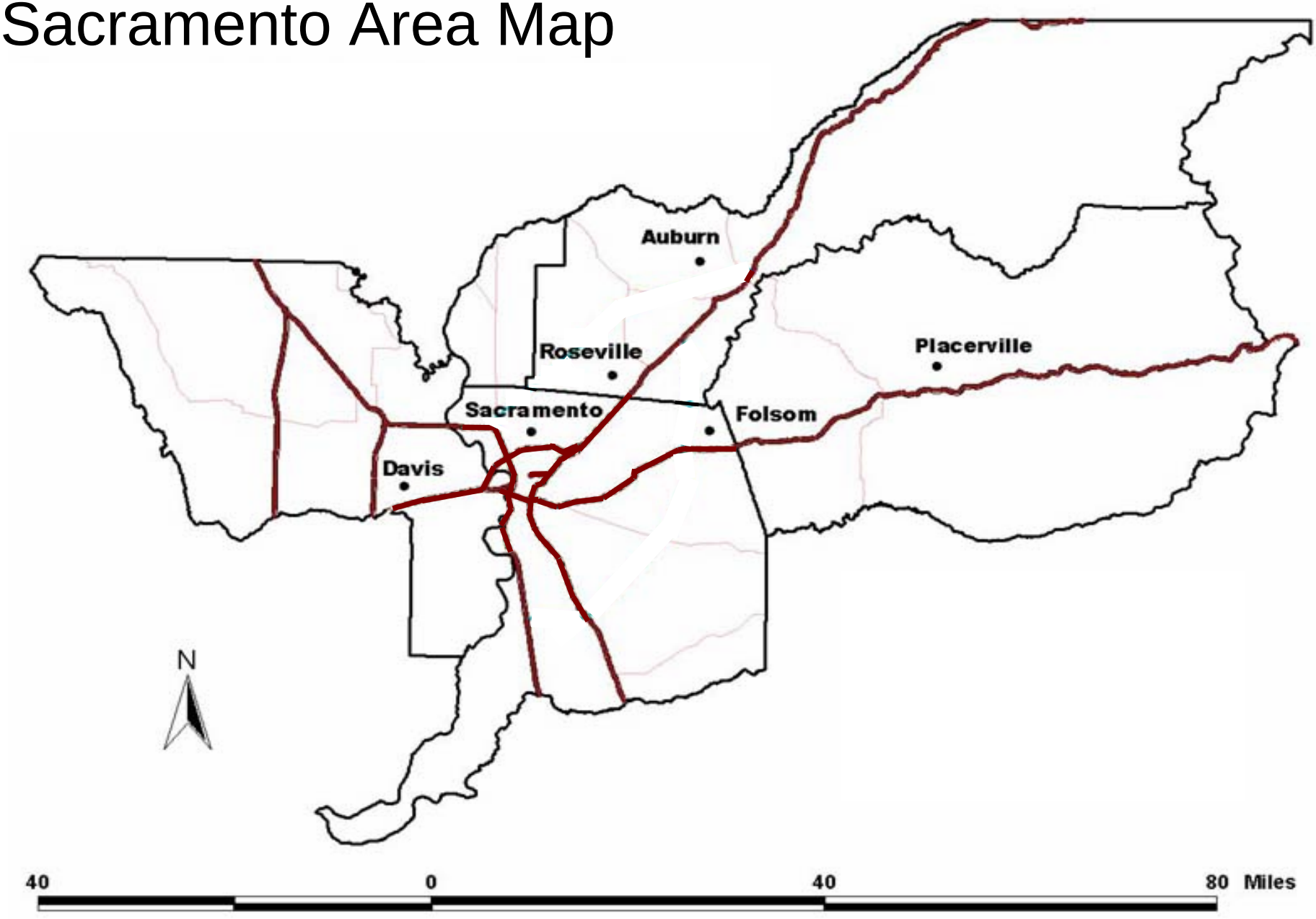
- Large and distributed team contributing
- Several groups of model developers, covered below
- This presentation helped by
  - Caroline Rodier, University of California at Davis
  - John Abraham, University of Calgary
  - Gordon Garry, SACOG
- Pending review by some of the other model developers

Outline

- Sacramento Area
- Model Frameworks
- Models of Sacramento as Developed and Calibrated
- Scenarios Considered
- Model Results for Changes Over Time
- Model Results for Differences Among Scenarios
- Conclusions

Sacramento Area

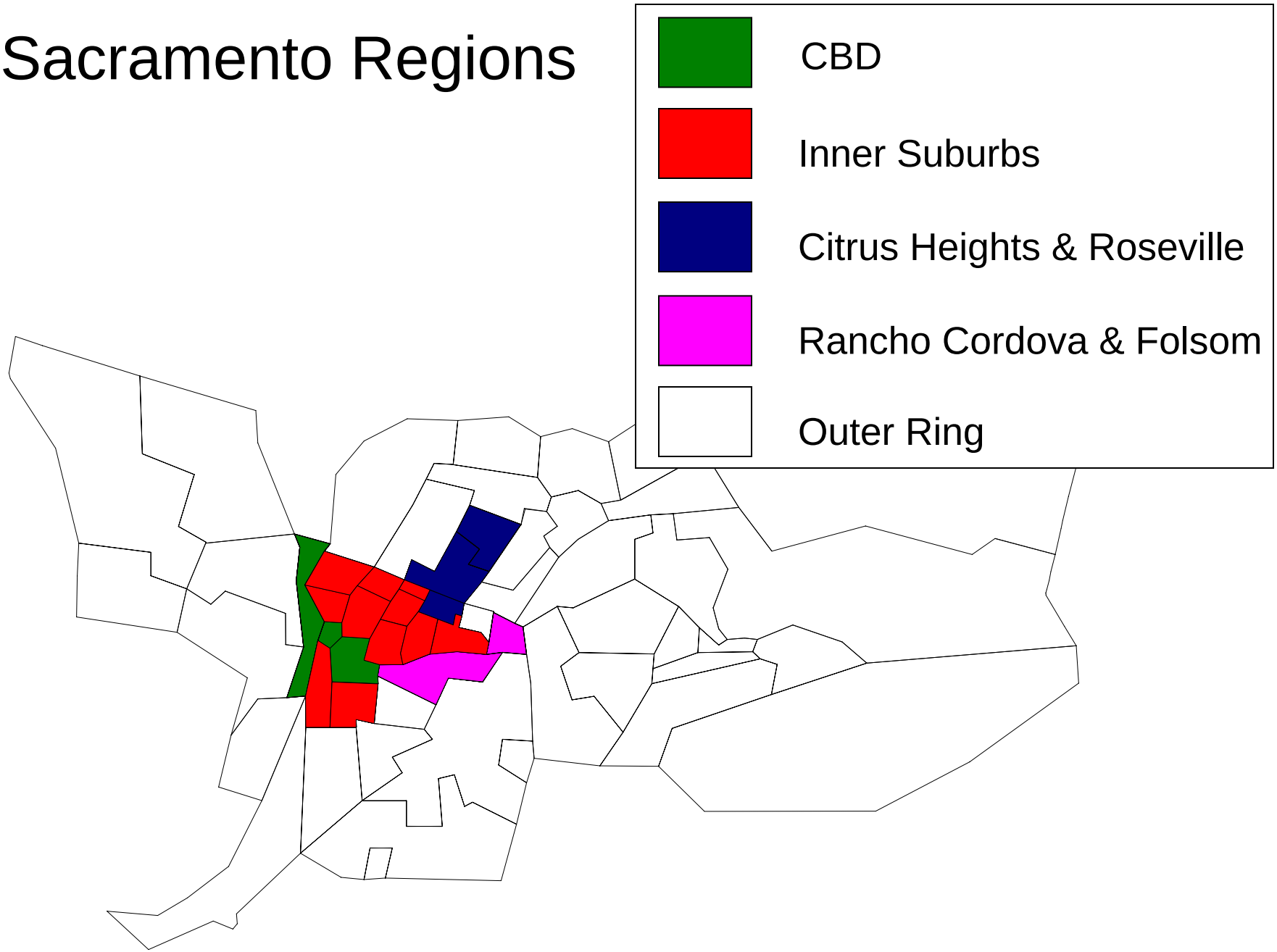
Sacramento Area Map



Sacramento Area

- Lots of empty space with developable land, not necessarily released for development
- low density development
- a CBD, with a patchwork of development spreading outwards; not a set of uniform concentric rings
- auto-based
- auto travel comparatively inexpensive; extensive freeways system with some congestion resulting in time penalties

Sacramento Regions



Model Frameworks

Model Frameworks Considered

- TRANUS
  - author: Modelistica (T delaBarra)
  - developer for Sacramento: J Anez and T delaBarra
- MEPLAN
  - author: ME&P (M Echenique)
  - developer for Sacramento: J Abraham and JD Hunt
- SACMET 96
  - author/developer: SACOG (G Garry) and DKS
- DRAM/EMPAL
  - author: S Putman
  - developer for Sacramento: S Putman & his students

MEPLAN

- Aggregate, quasi-dynamic framework; 5-year steps for Sacramento
- Spatially-disaggregated I/O matrix; households included as sector providing labor; 11 economic and 3 household sectors for Sacramento
- Production activity leads to further production activity which is allocated among zones according to utility values that include input costs, space costs, transport costs and ASCs

MEPLAN

- Space quantities constrained, price feedback to clear space markets
- Standard nested logit for allocations
- Dial’s algorithm for network loading

TRANUS

- Very similar to MEPLAN - with focus on ease of application rather than flexibility
- Aggregate, quasi-dynamic framework; 5-year steps for Sacramento
- Spatially-disaggregated I/O matrix; households included as sector providing labor; 6 economic and 3 household sectors for Sacramento
- Production activity leads to further production activity which is allocated among zones according to utility values that include input costs, space costs, transport costs and ASCs

TRANUS

- Space quantities constrained, price feedback to clear space markets
- Form of scaled logit for allocations
- Path enumeration for network loading
- Mode split and assignment on network

- Sacramento development materials passed from TRANUS team to MEPLAN team

SACMET 96

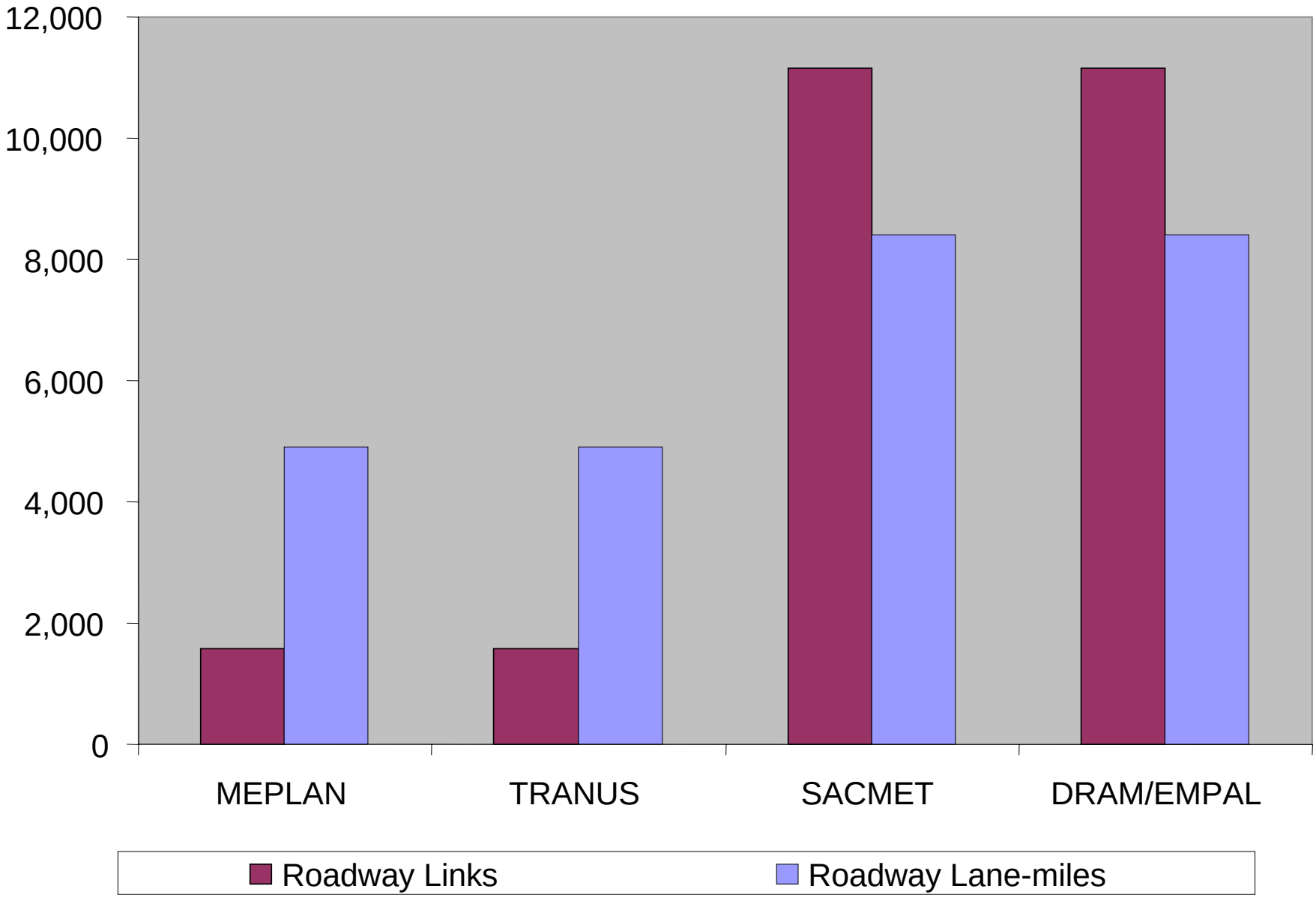
- Latest in a series
- Fairly standard 4-step transport planning model with auto ownership added
- Land use exogenous, no feedback of transport conditions to influence land use
- Explicit trucks component
- Run directly for horizon year, with full feedback to an equilibrium

DRAM/EMPAL

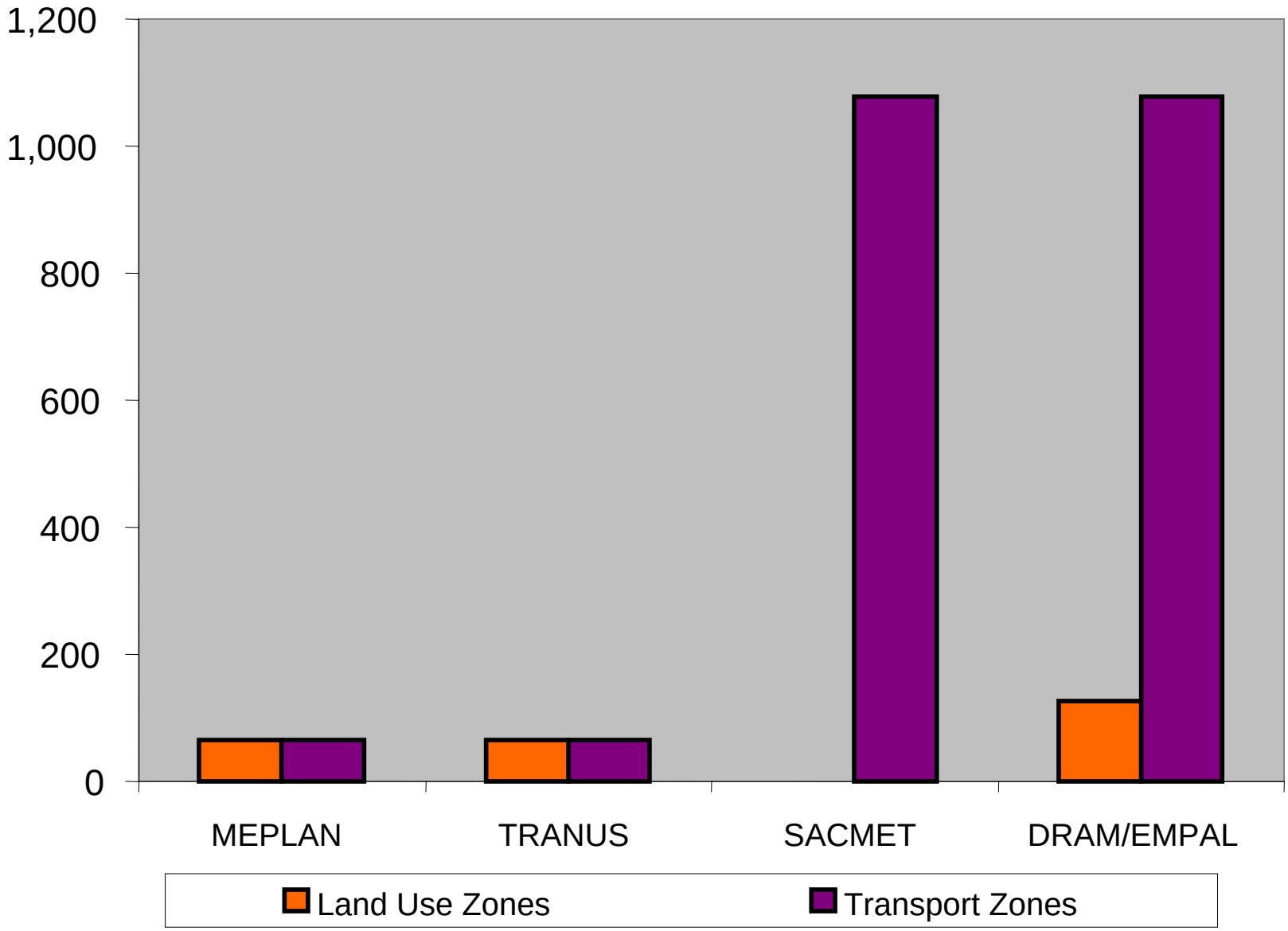
- Aggregate allocation of model-area-wide population and employment by sector to zones; 6 employment and 5 household categories
- Standard logit for allocations, with relatively large number of utility function attributes, including travel conditions (composite utilities) from transport model and results from other allocations
- no explicit treatment of space development or space prices
- allocations of population and employment feed into SACMET 96 model in ‘connected’ format

Models of Sacramento as Developed and Calibrated

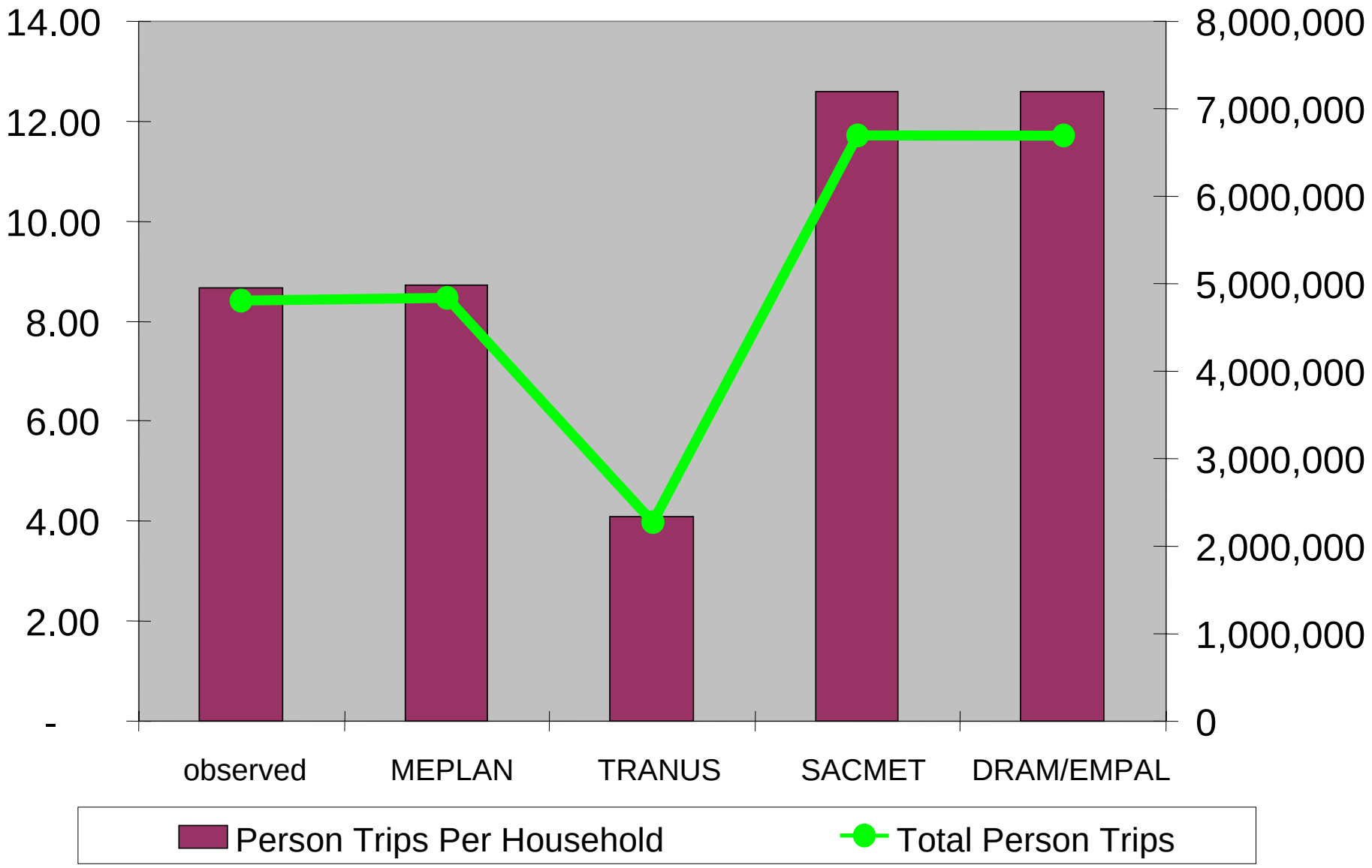
Modeled 1990 Roadway Supply



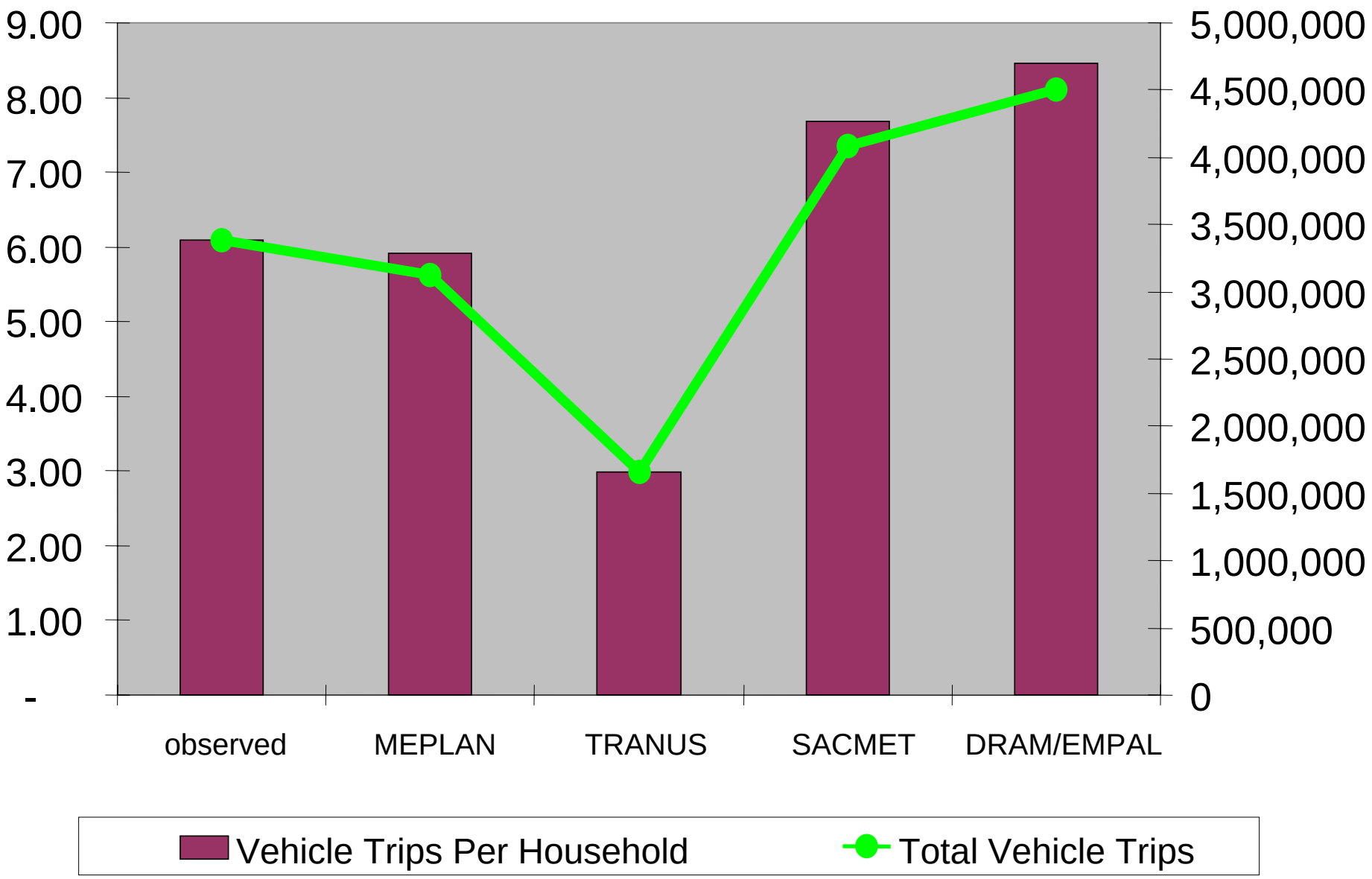
Modeled Zones



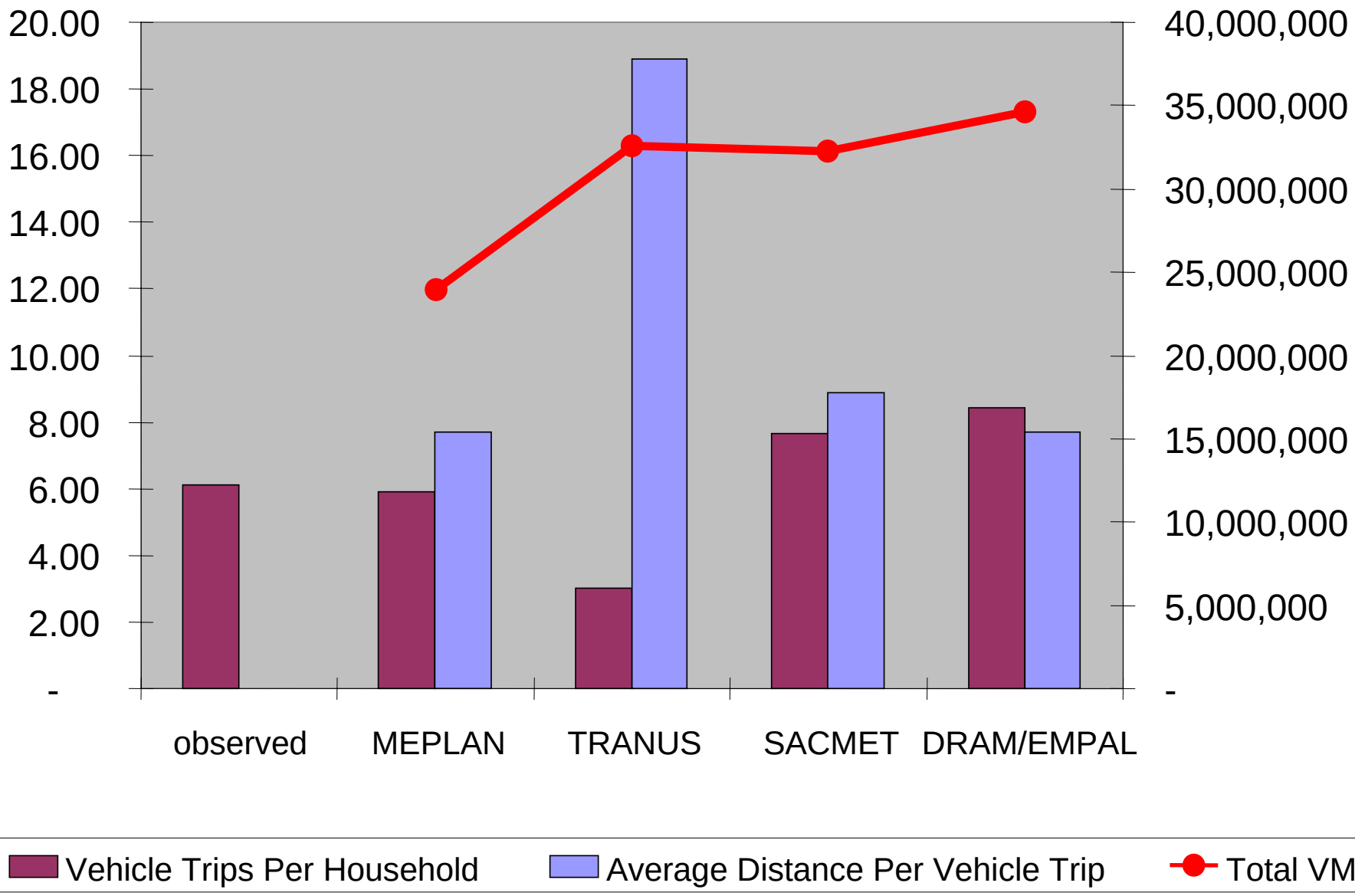
Observed & Modeled 1990 Person Trips



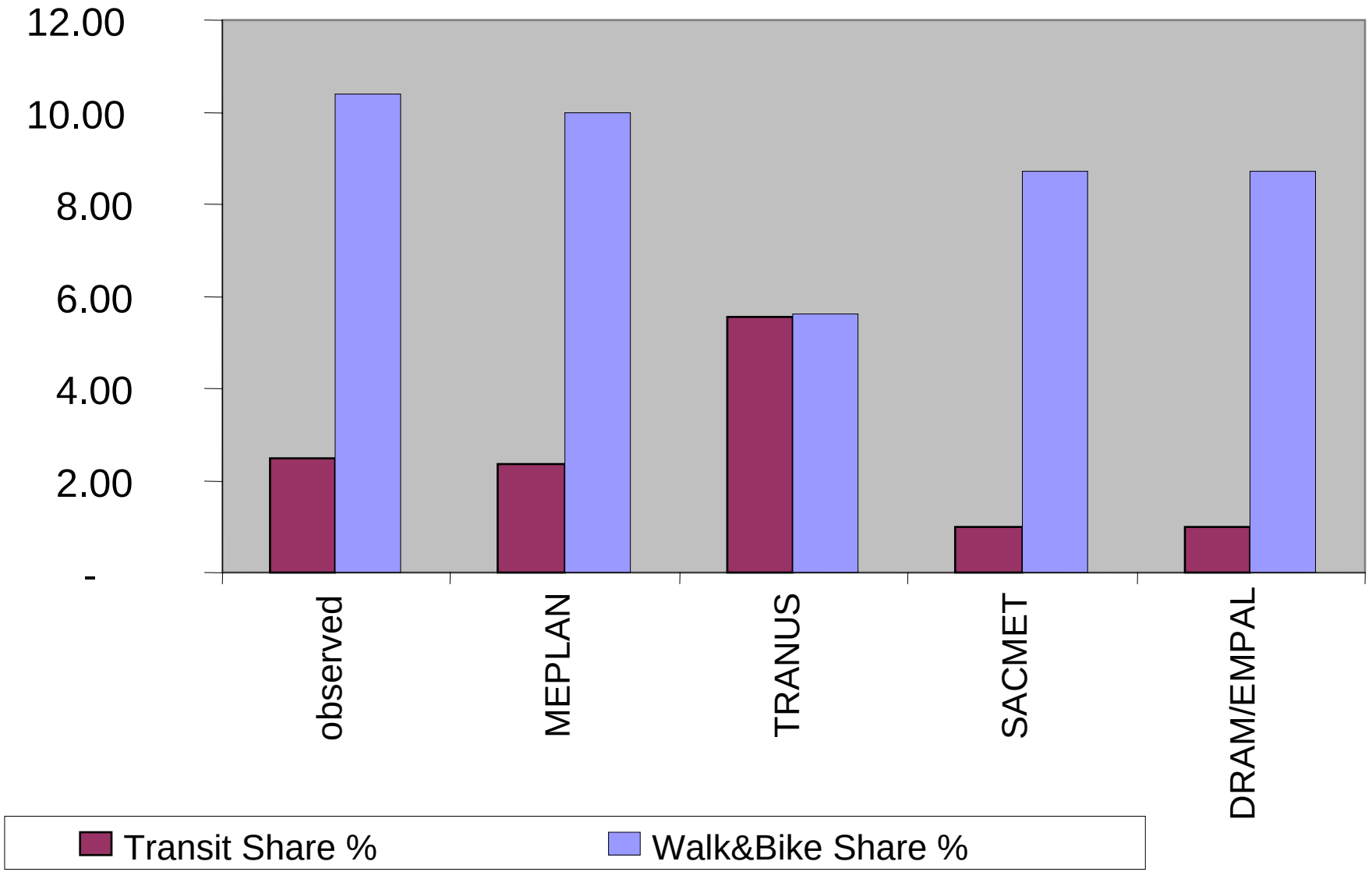
Observed & Modeled 1990 Vehicle Trips



Modeled 1990 VMT & Related Values



Observed & Modeled 1990 Transit & Walk+Bike Shares



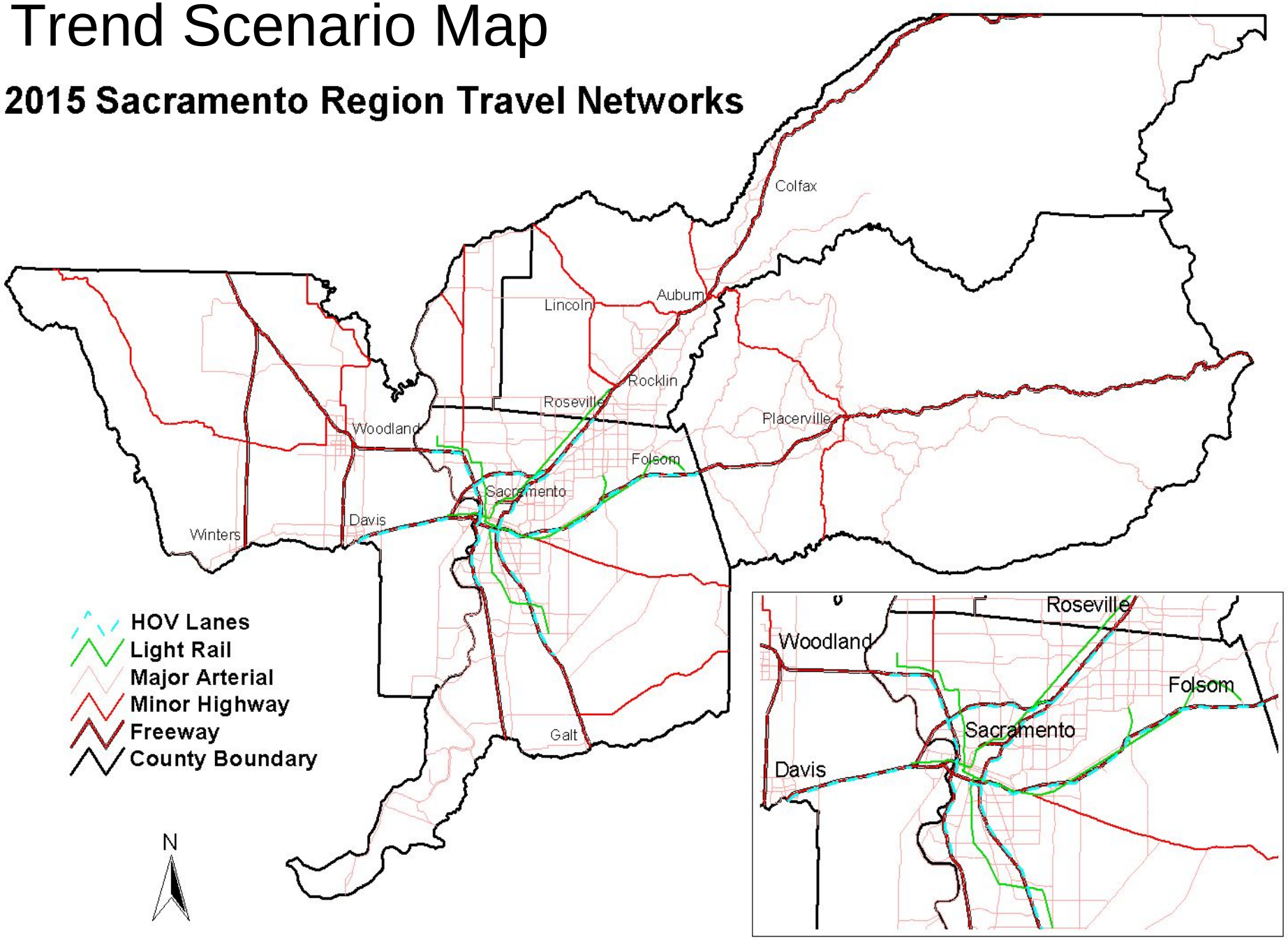
Scenarios Considered

Trend Scenario

- Expected growth in population and employment for entire model area
- Expected ‘financially constrained’ trends in roadway infrastructure and transit service development (the latest TIP)
- Release of land for development such that land prices grow at about 1% per year in real terms
  - zone-by-zone in TRANUS
  - overall in MEPLAN

- This scenario is used as reference case against which other scenarios are compared

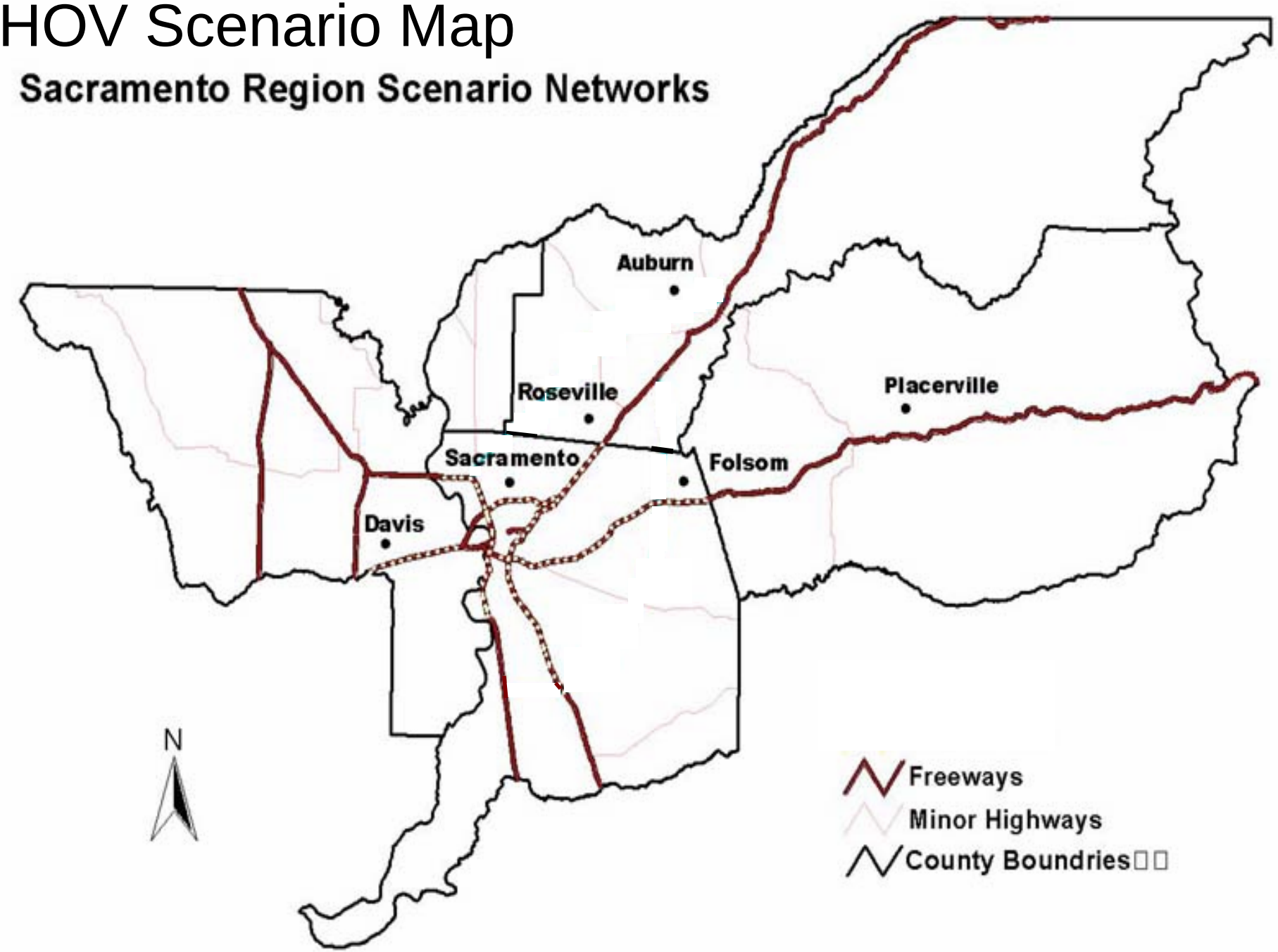
Trend Scenario Map



HOV Scenario

- HOV lanes added to various radial freeways, covering the inner 2/3 of Area

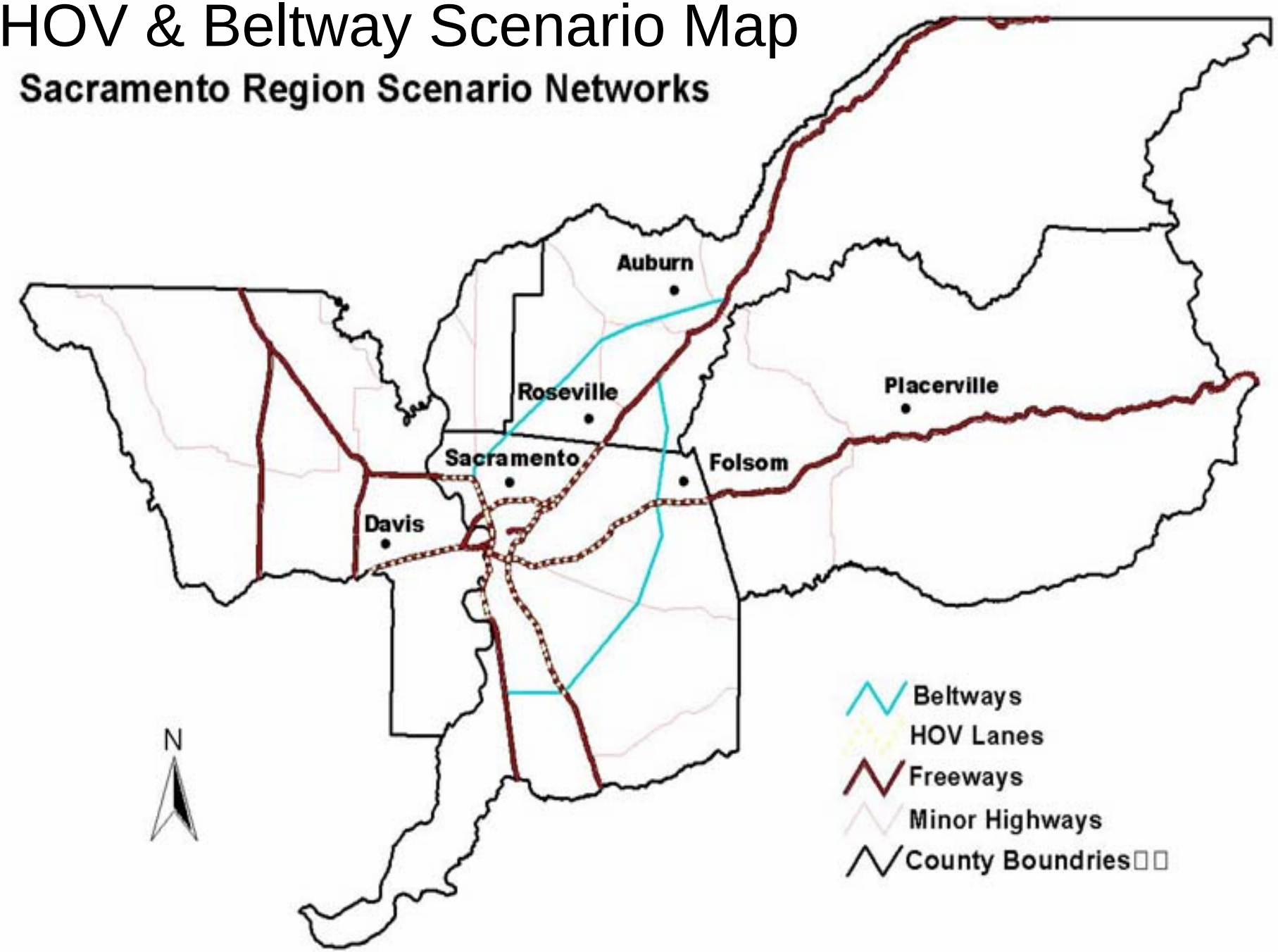
HOV Scenario Map



HOV & Beltway Scenario

- HOV lanes are added to various radial freeways, HOV additions are the same as with HOV scenario
- Further ‘orbital’ beltways are built, omitting the west side of the ‘orbit’

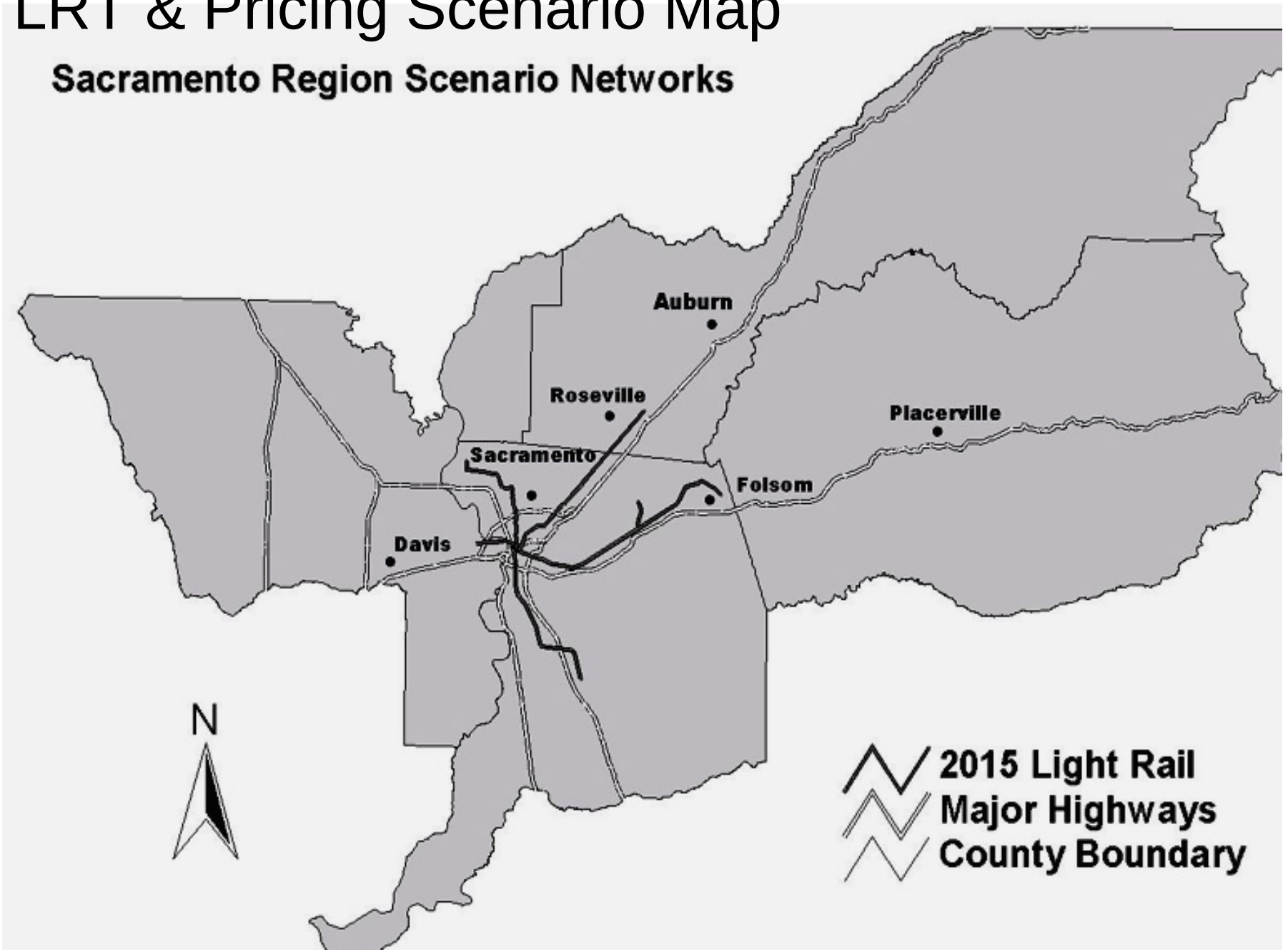
HOV & Beltway Scenario Map



LRT & Pricing Scenario

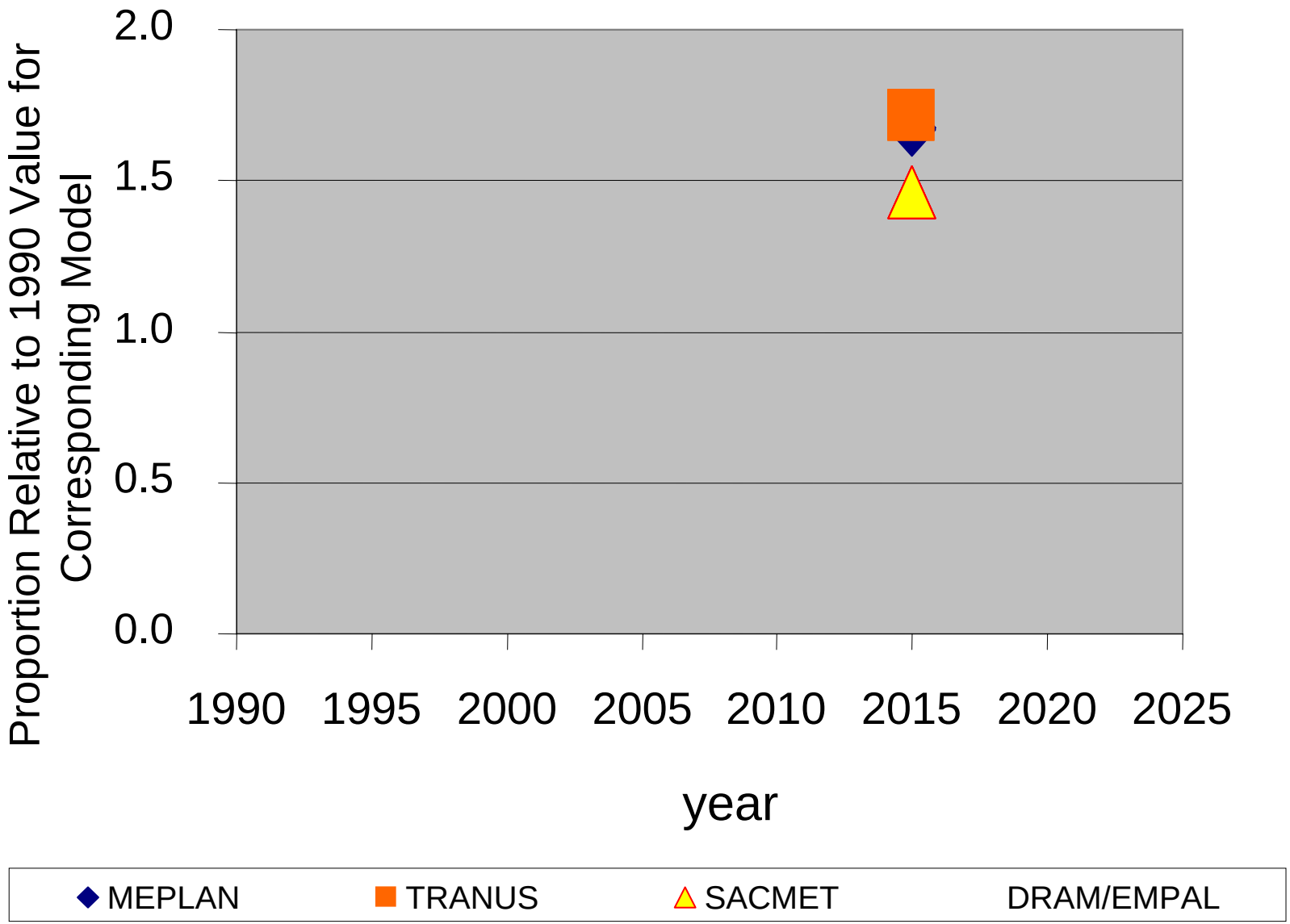
- LRT is extended along various lines
- tax of 30% on operating costs for private vehicles
- parking rates increased in CBD
  - by $4.00 for work trips
  - by $1.00 for other trips

LRT & Pricing Scenario Map

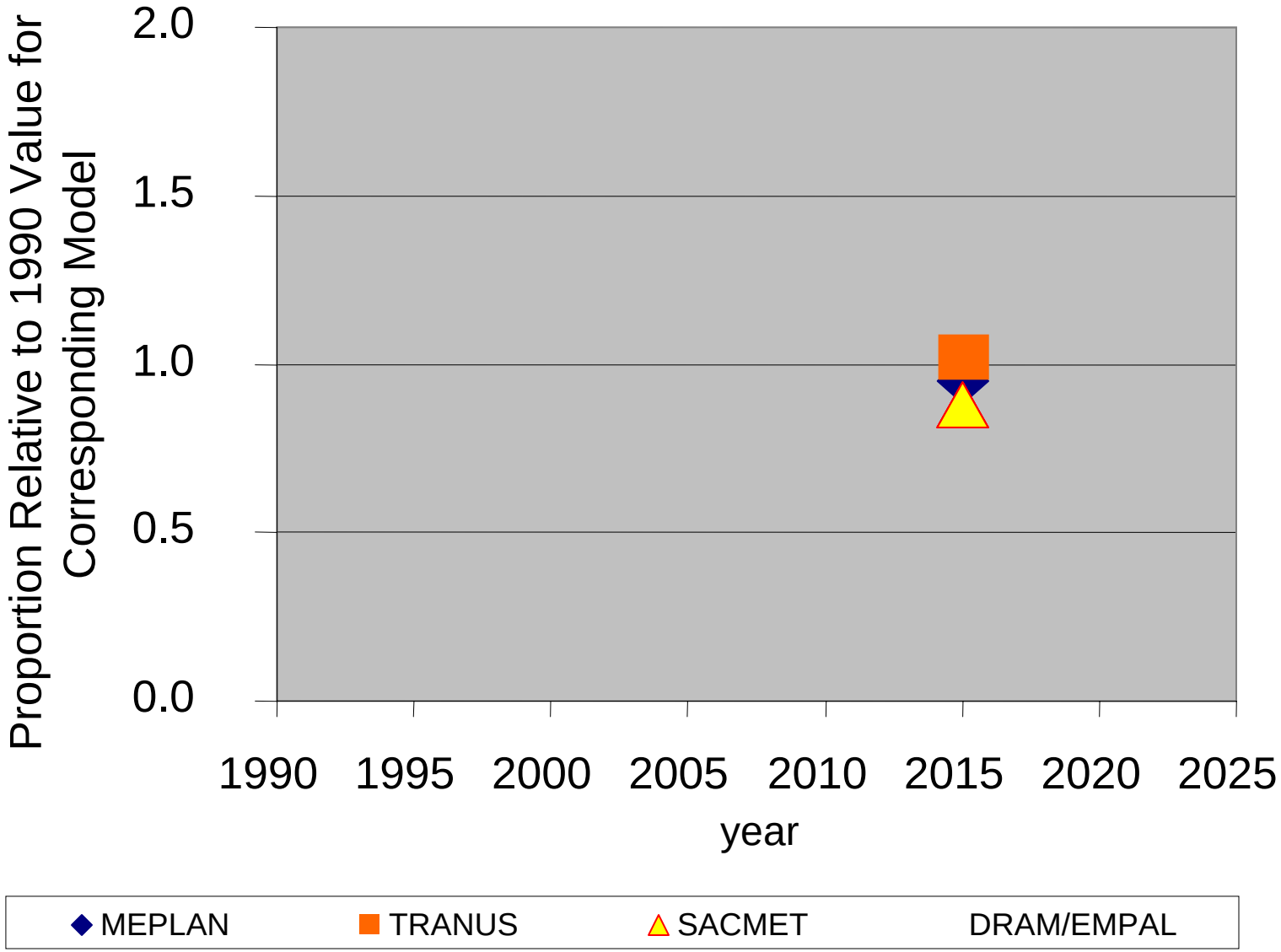


Model Results for Changes Over Time

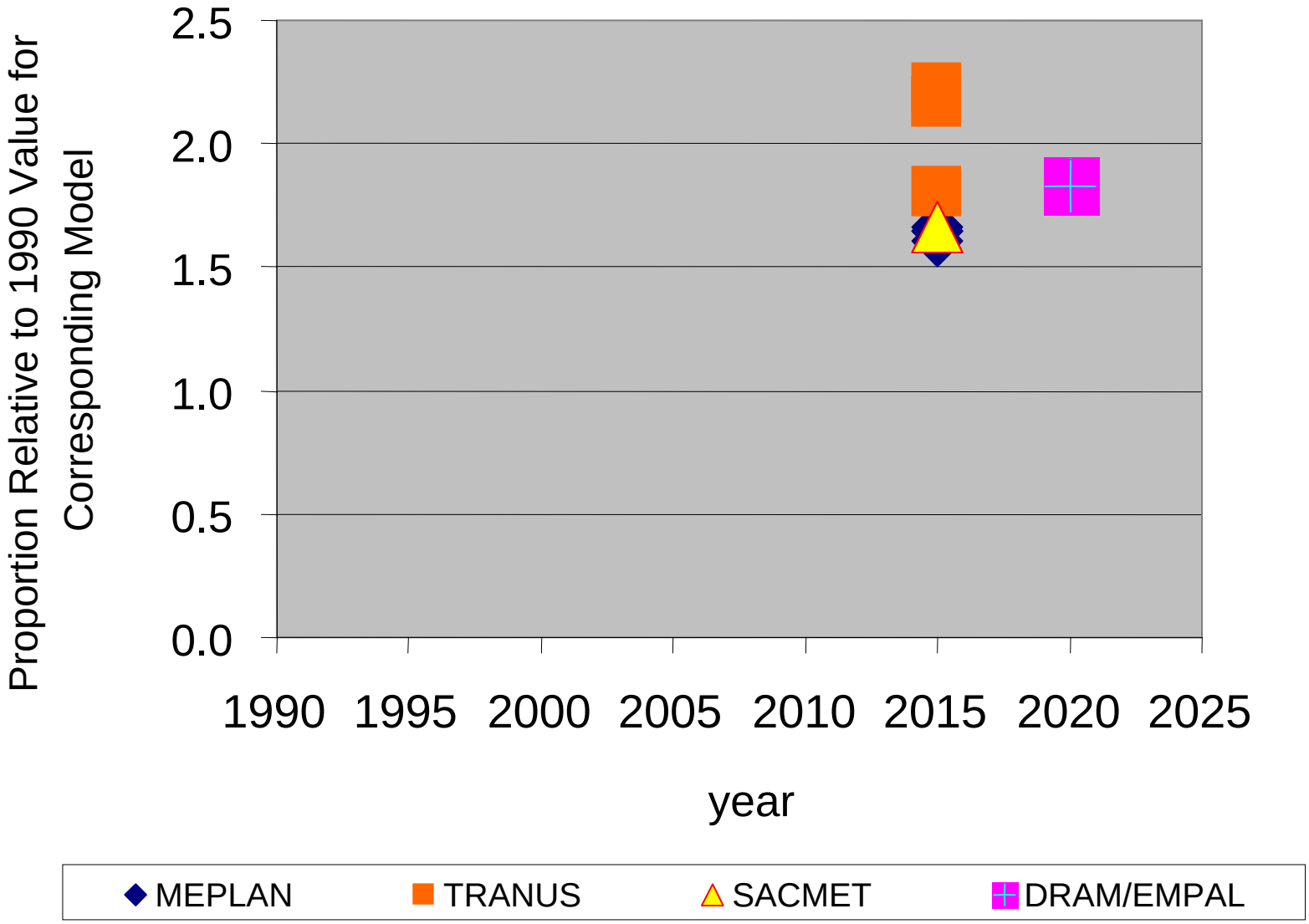
Changes in Total Person Trips



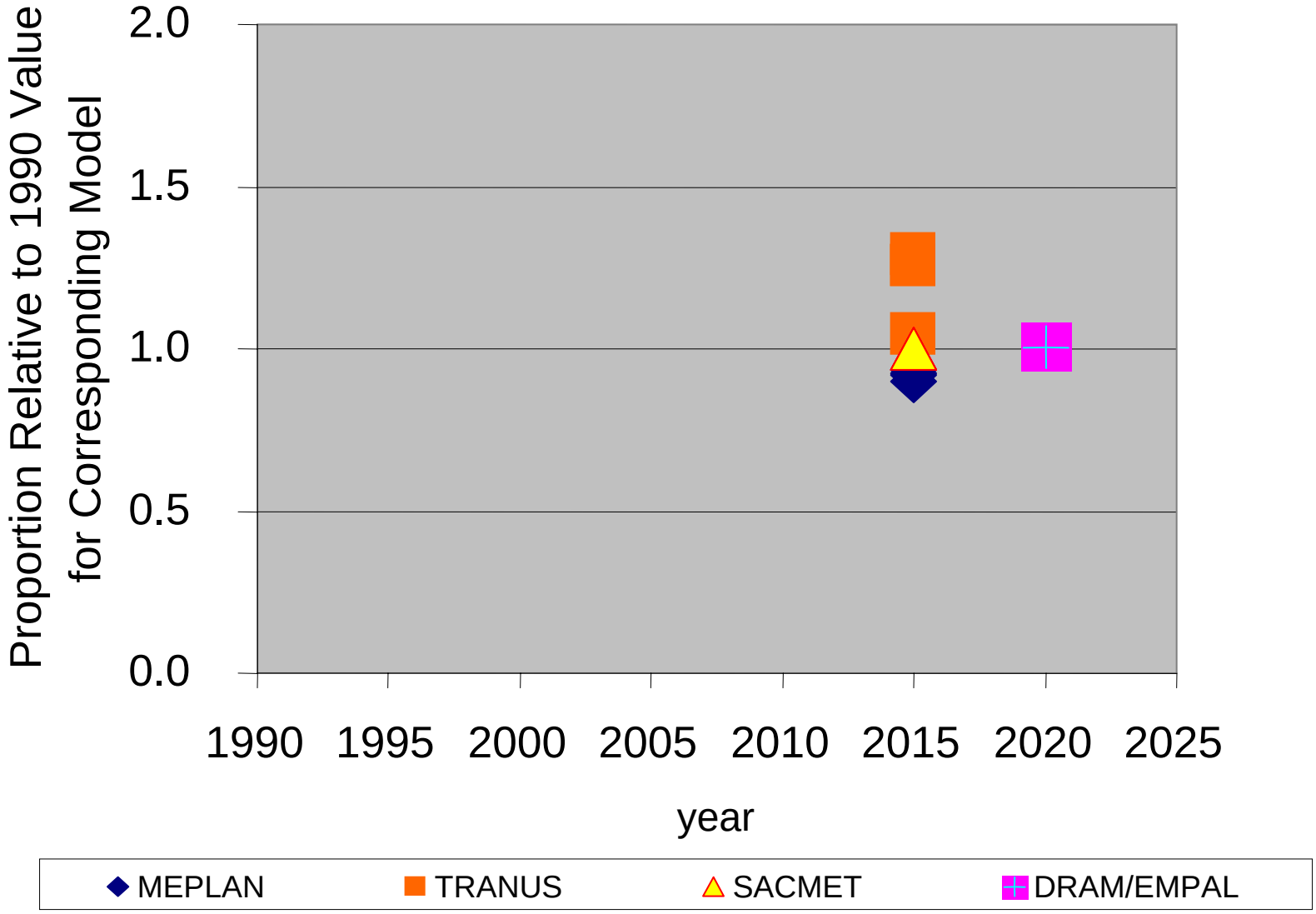
Changes in Person Trips per Household



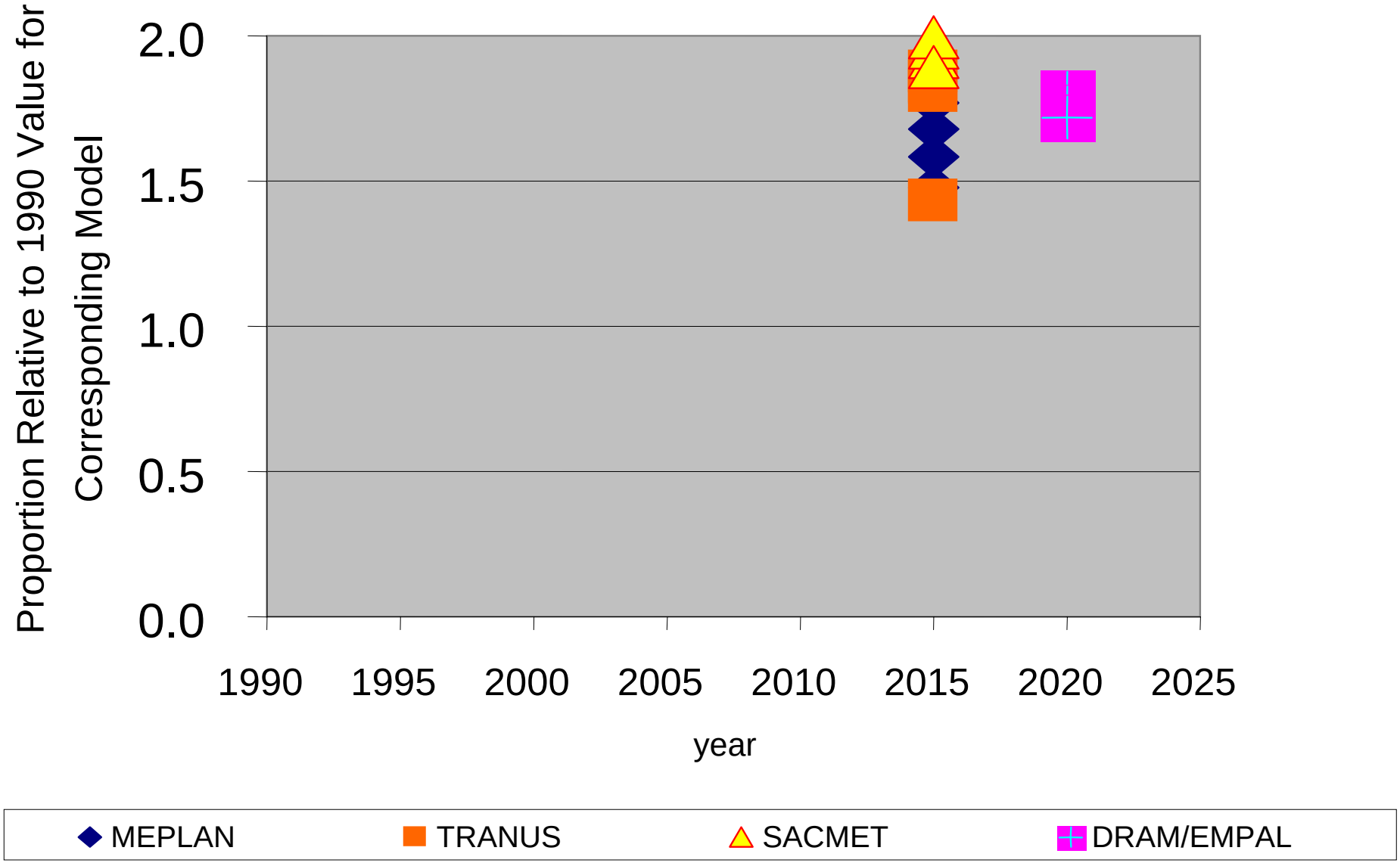
Changes in Total Vehicle Trips



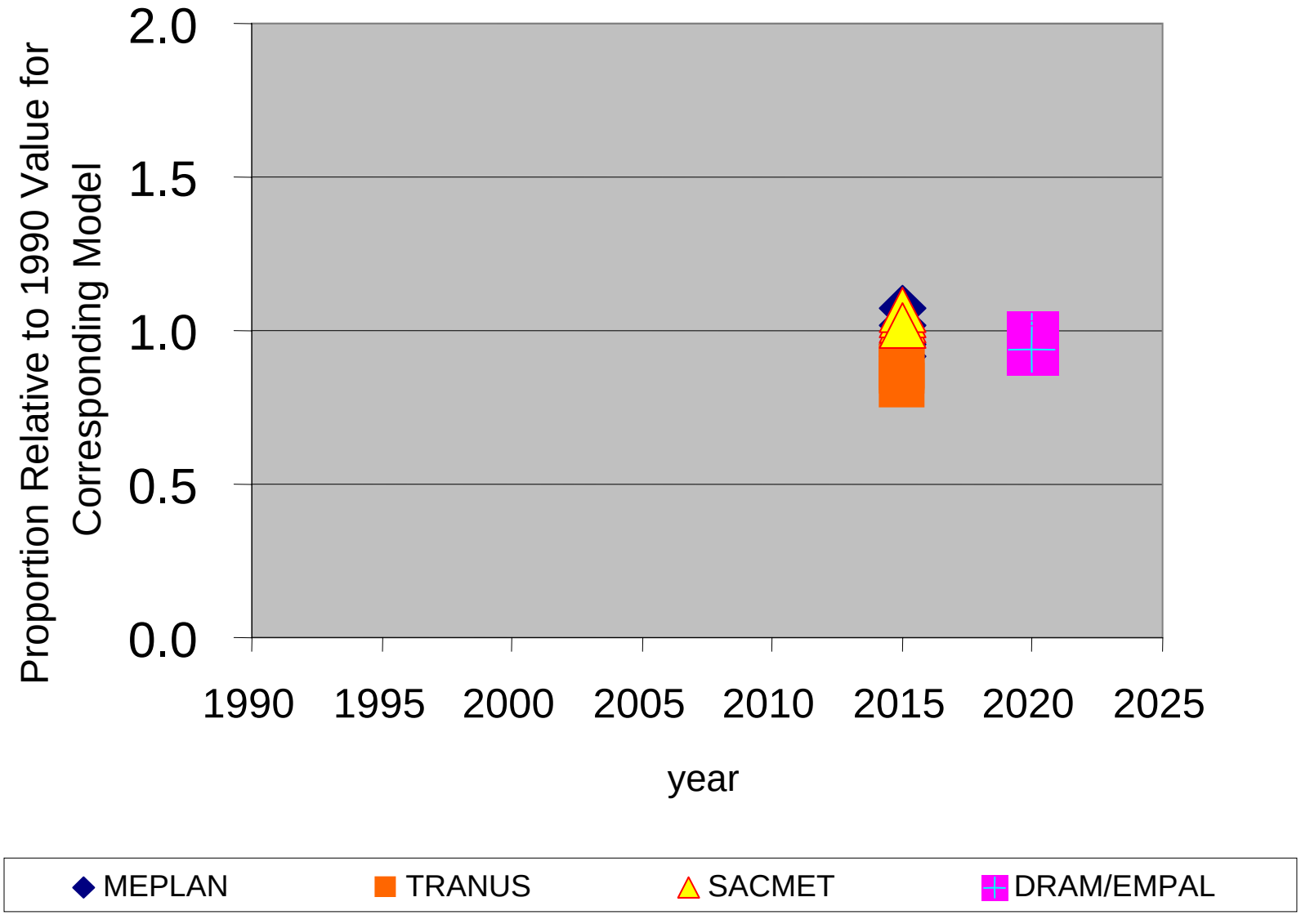
Changes in Vehicle Trips per Household



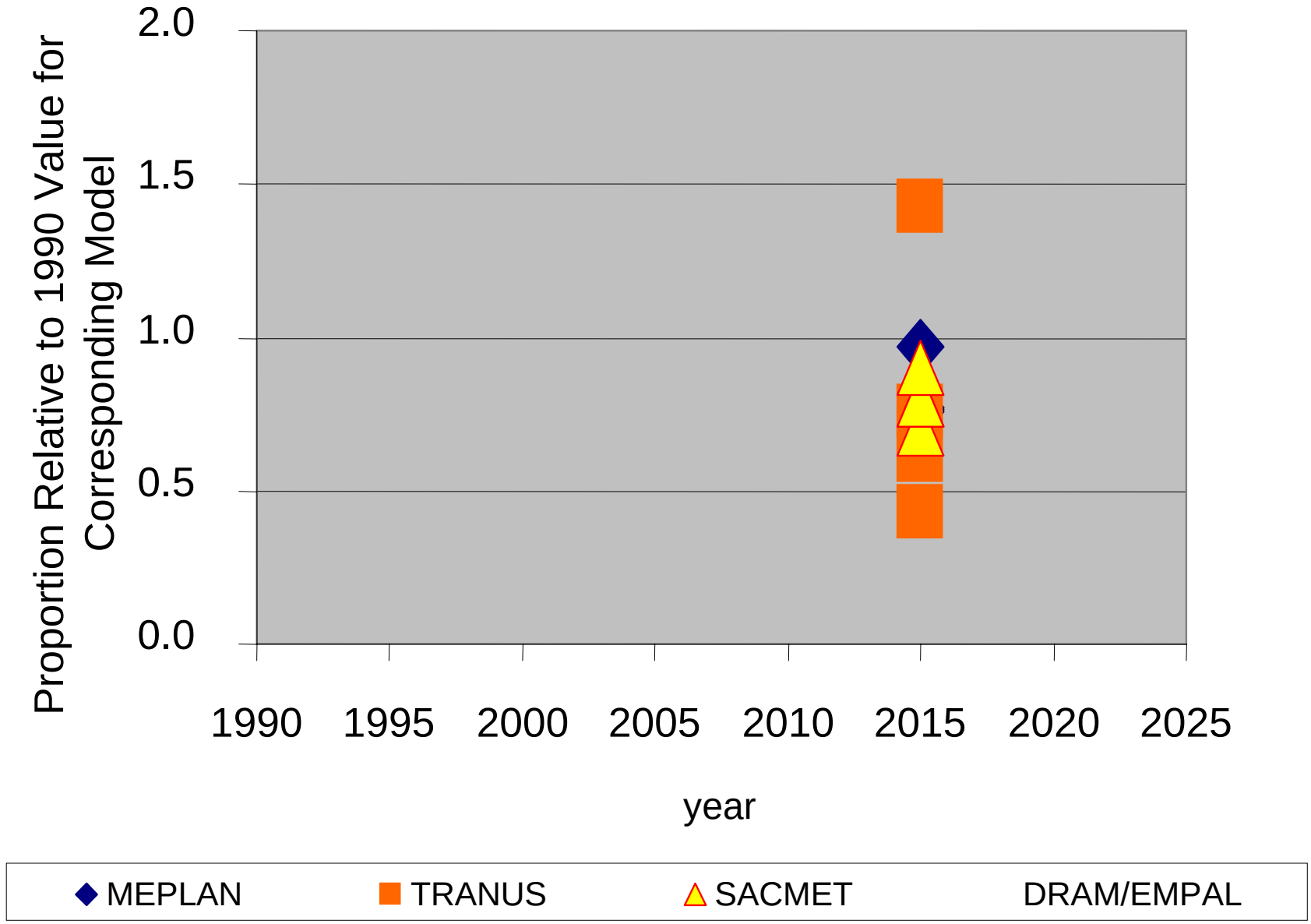
Changes in Total VMT



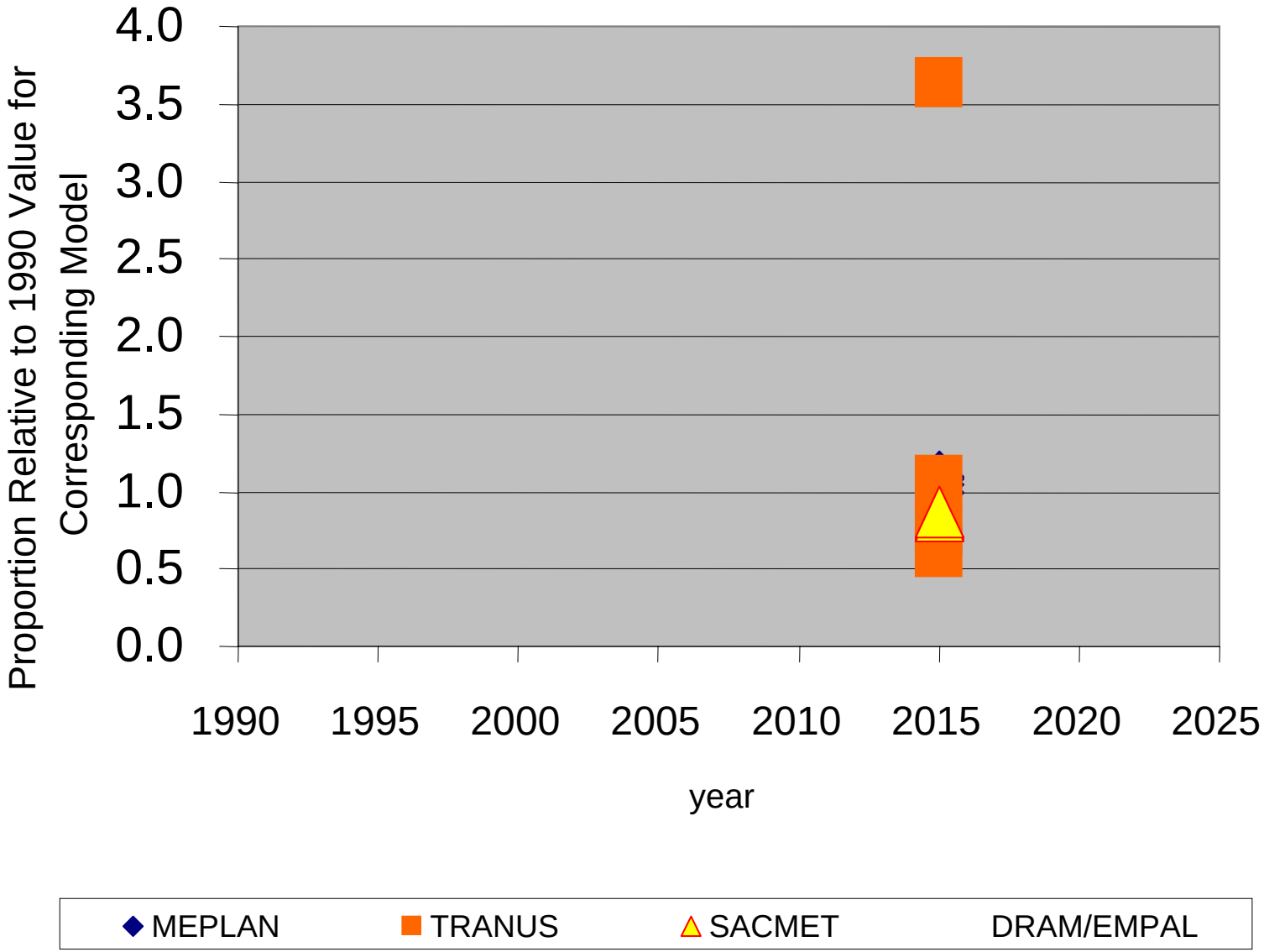
Changes in Average Distance per Vehicle Trip



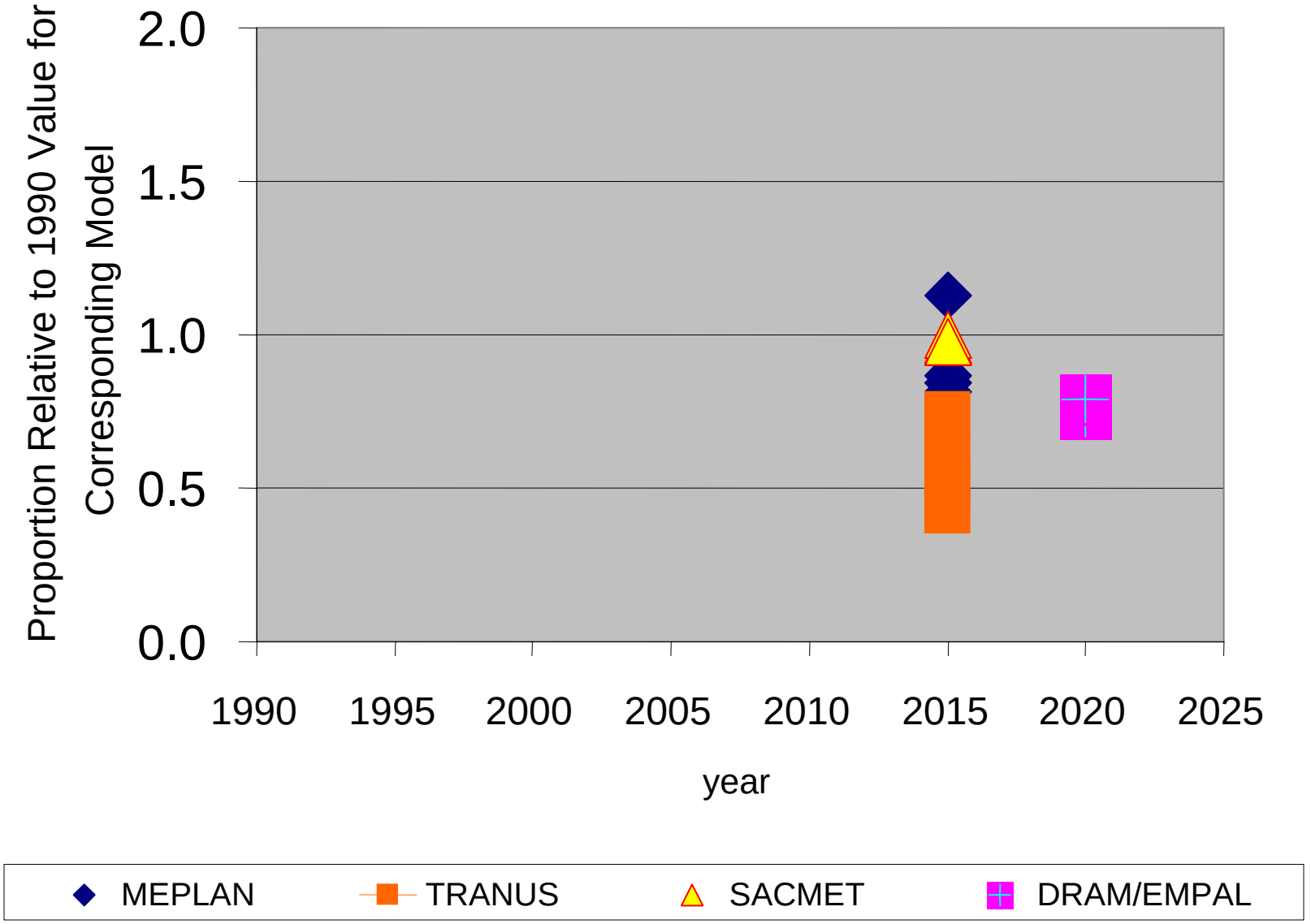
Changes in Transit Share of Person Trips



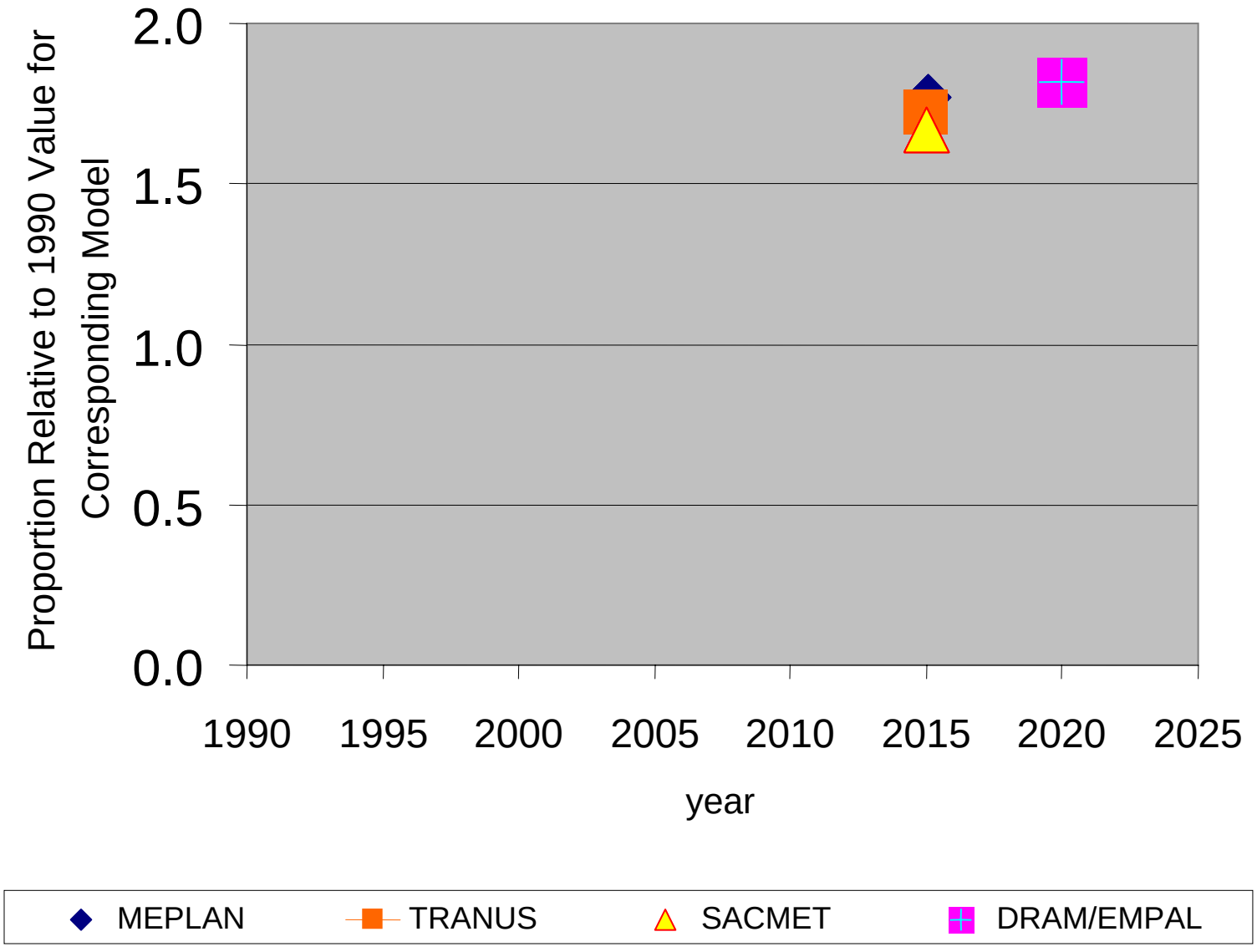
Changes in Walk+Bike Share of Person Trips



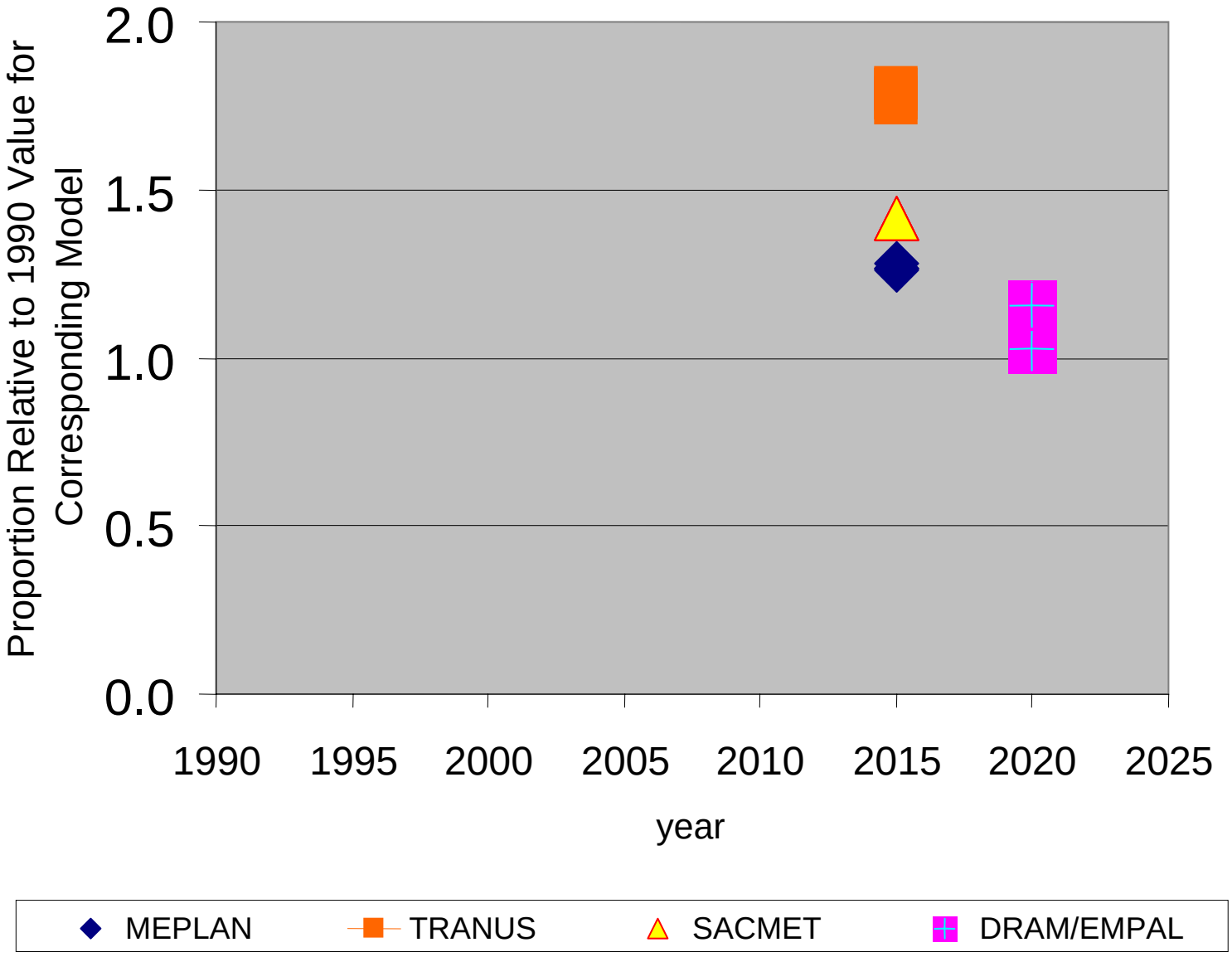
Changes in Average Speeds



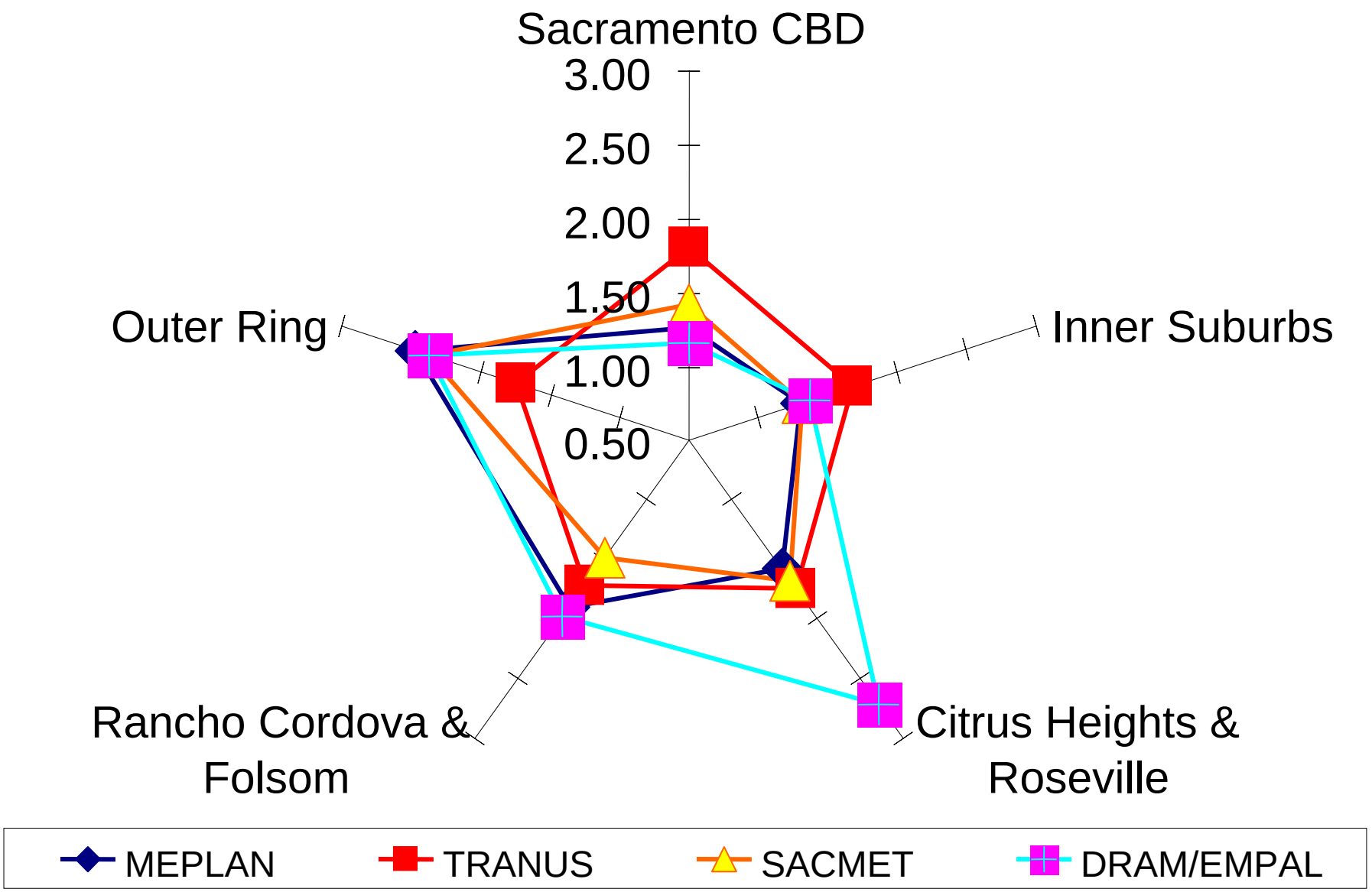
Changes in Total Households



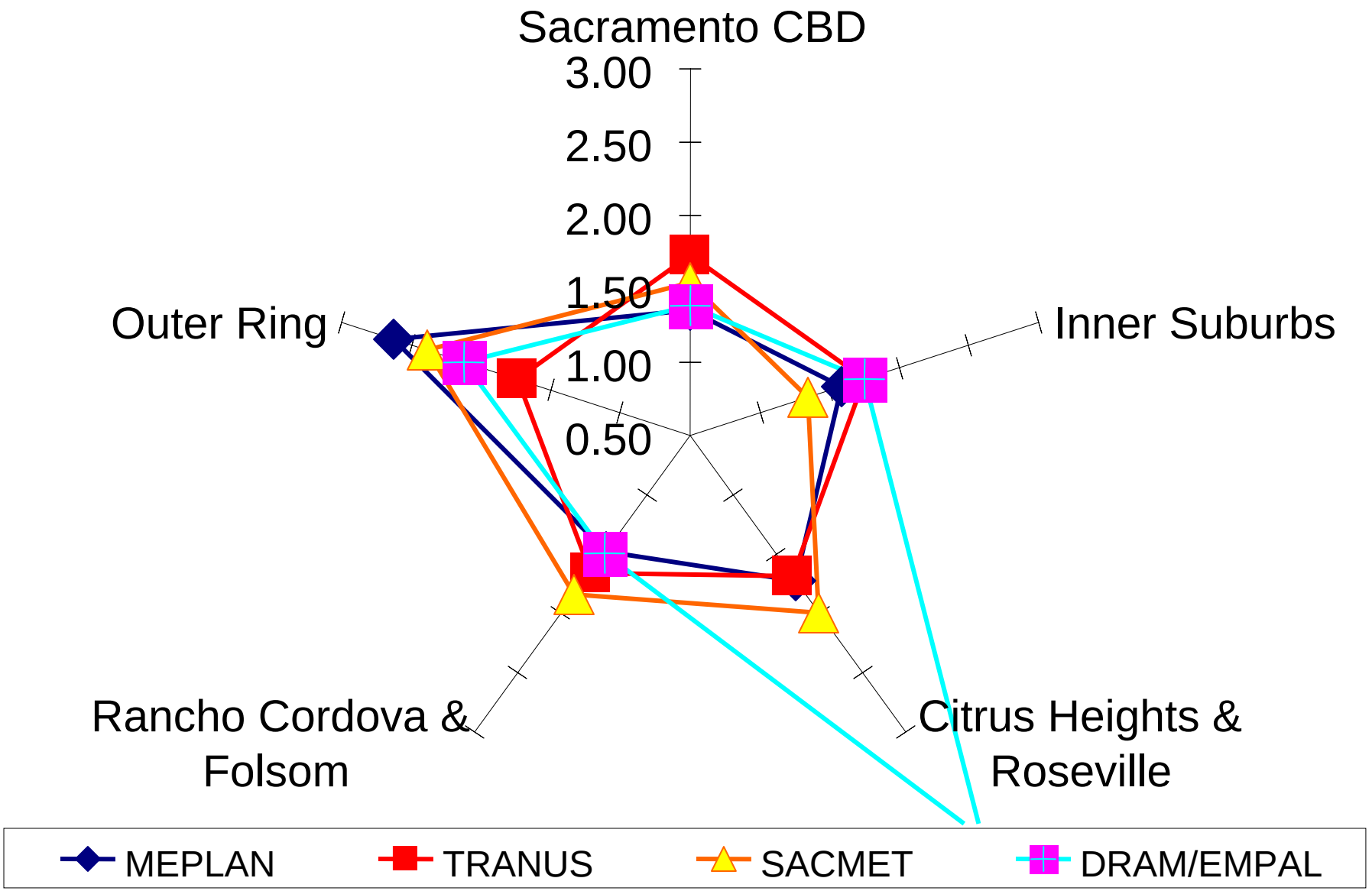
Changes in Households in Sacramento CBD



Households in Trend Scenario Relative to 1990

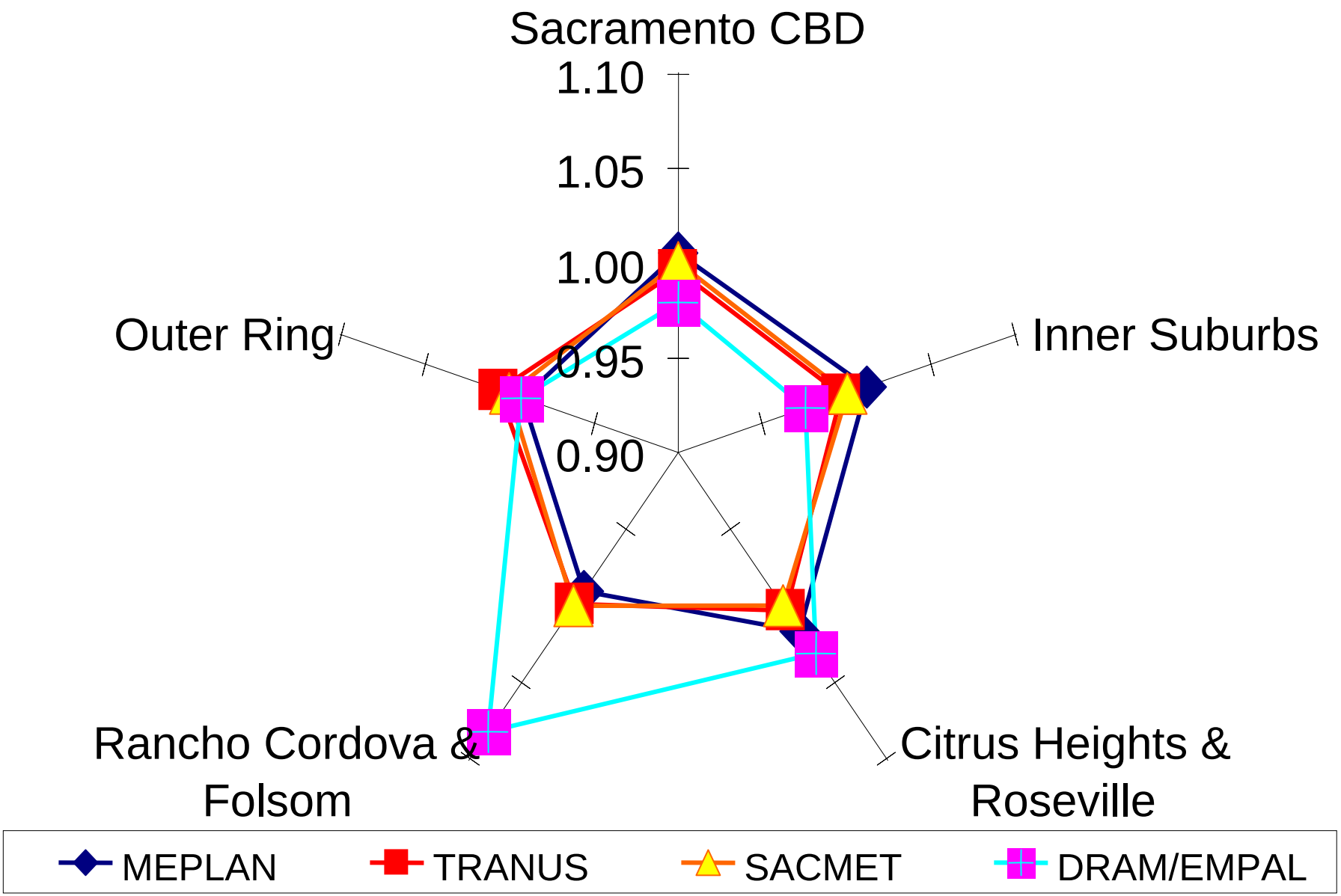


Employment in Trend Scenario Relative to 1990

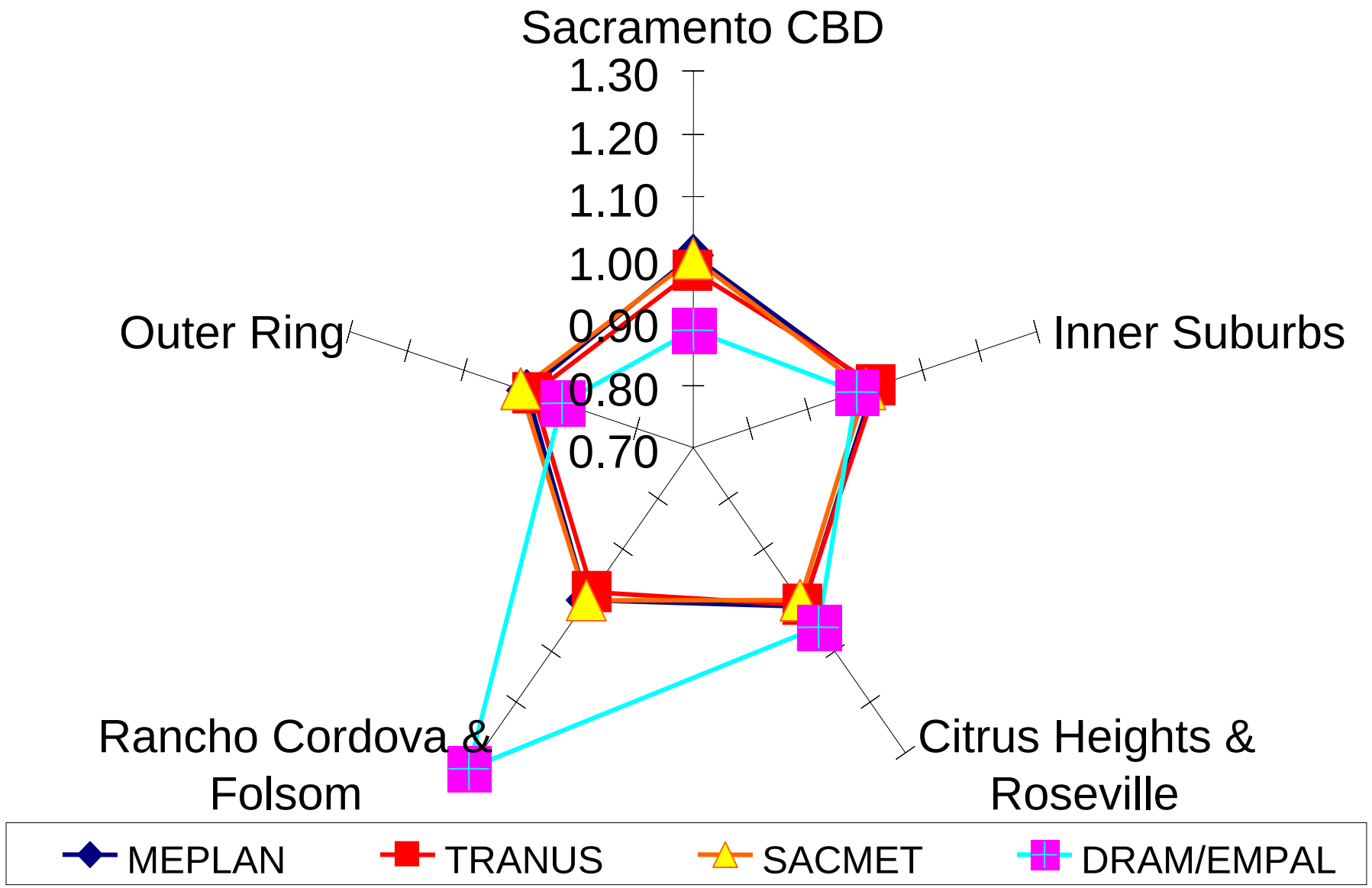


Model Results for Differences Among Scenarios

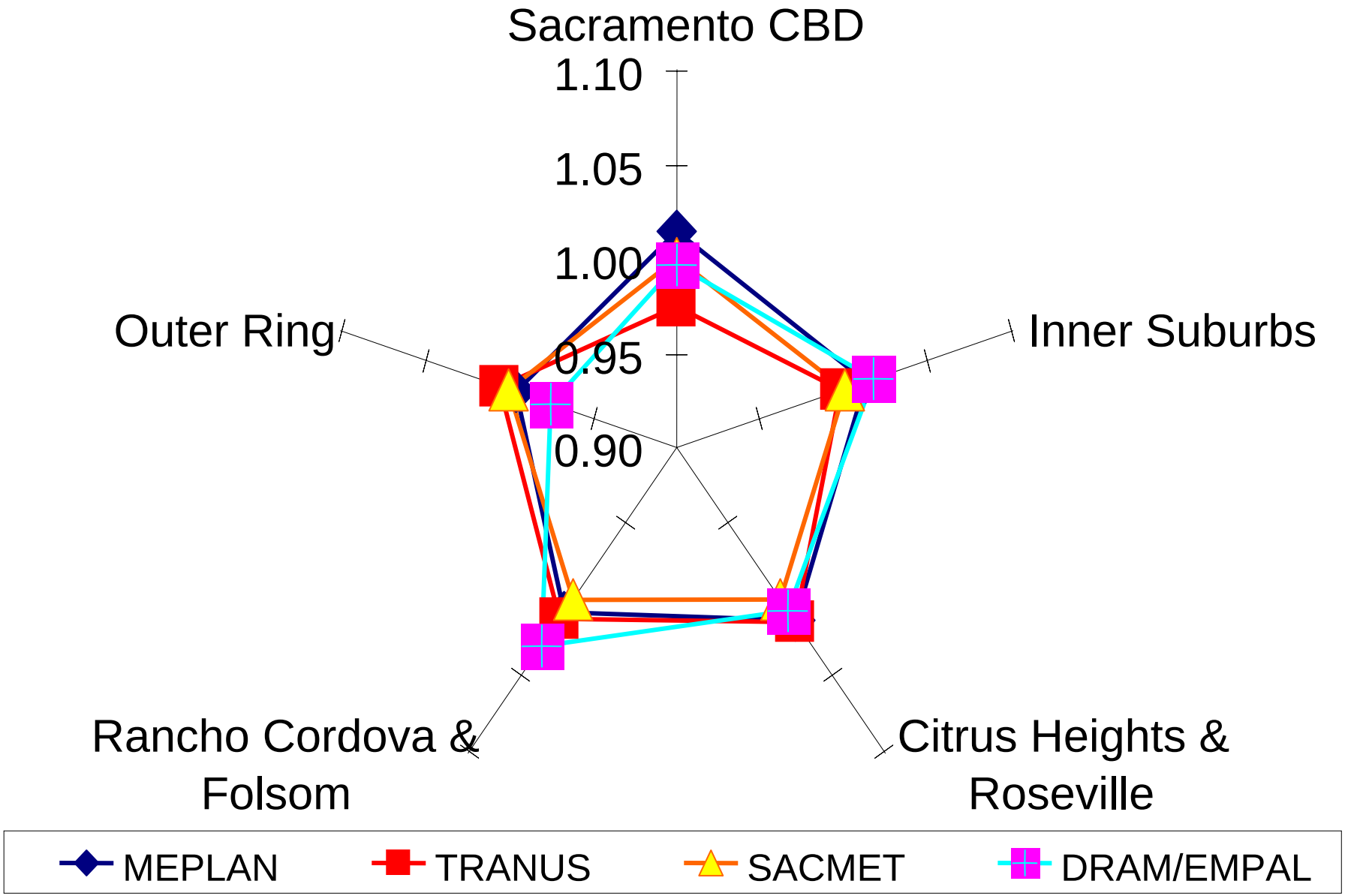
Households in HOV Scenario Relative to Trend



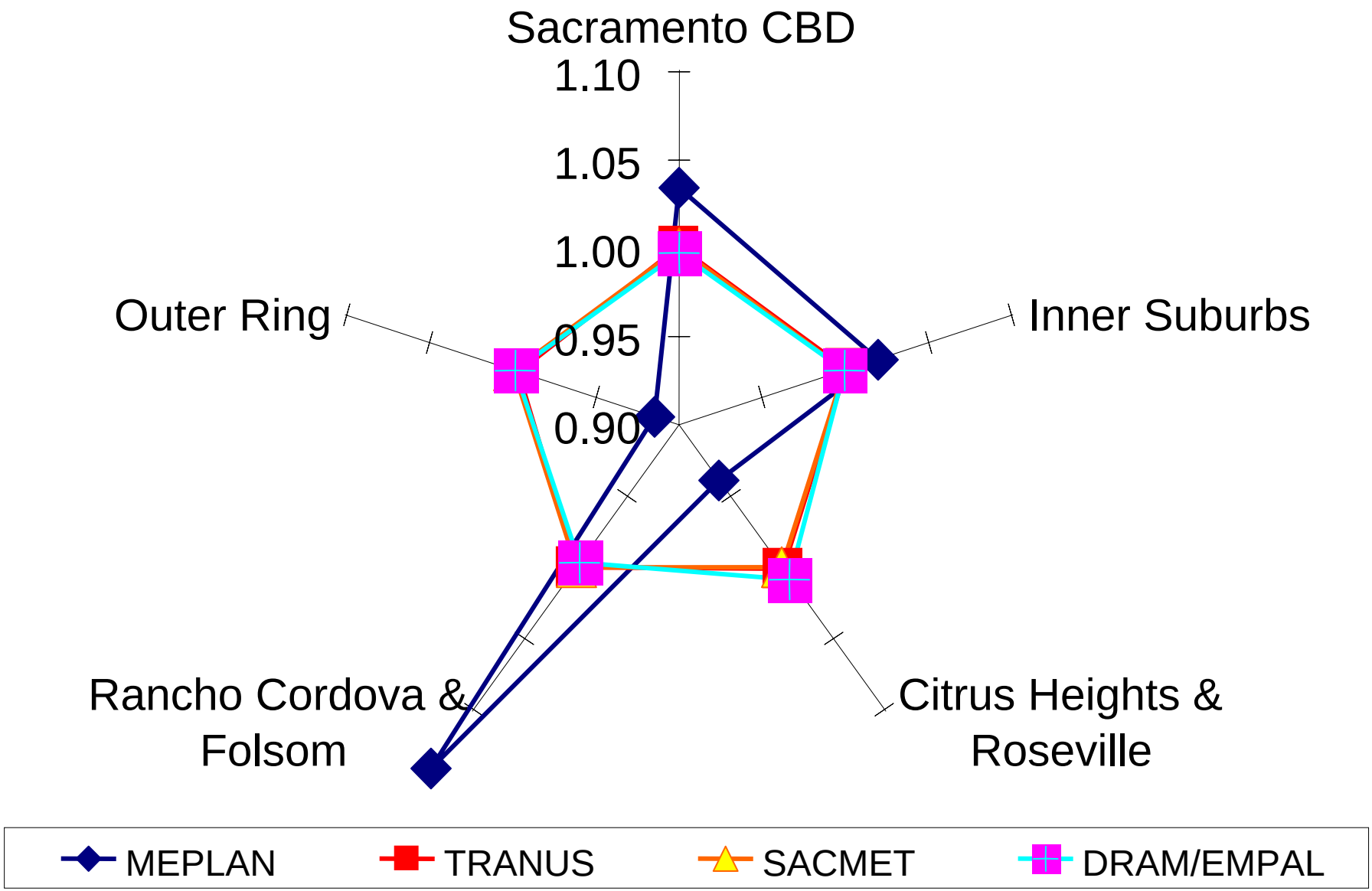
Households in HOV & Beltway Scenario Relative to Trend



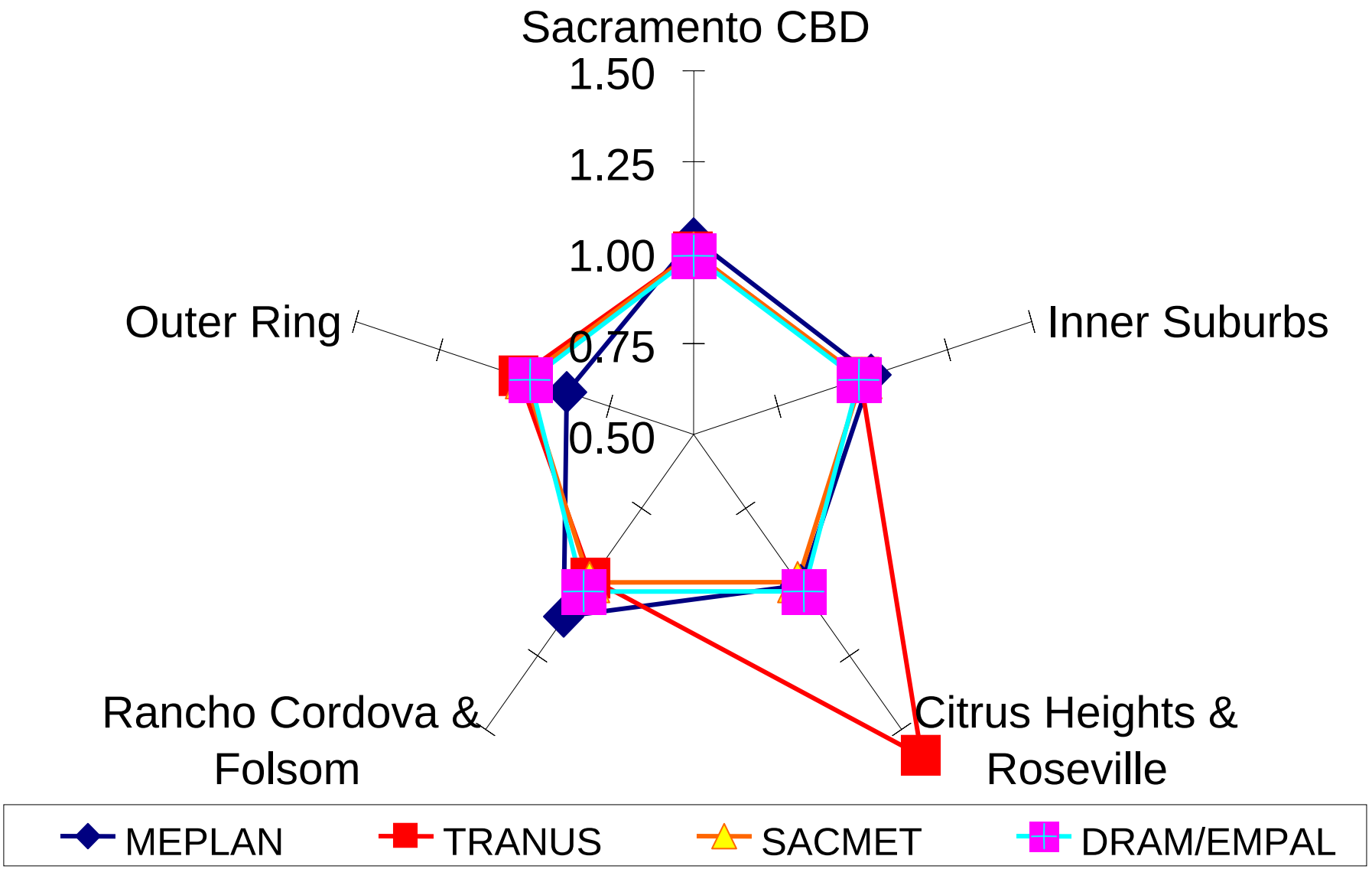
Households in LRT & Pricing Scenario Relative to Trend



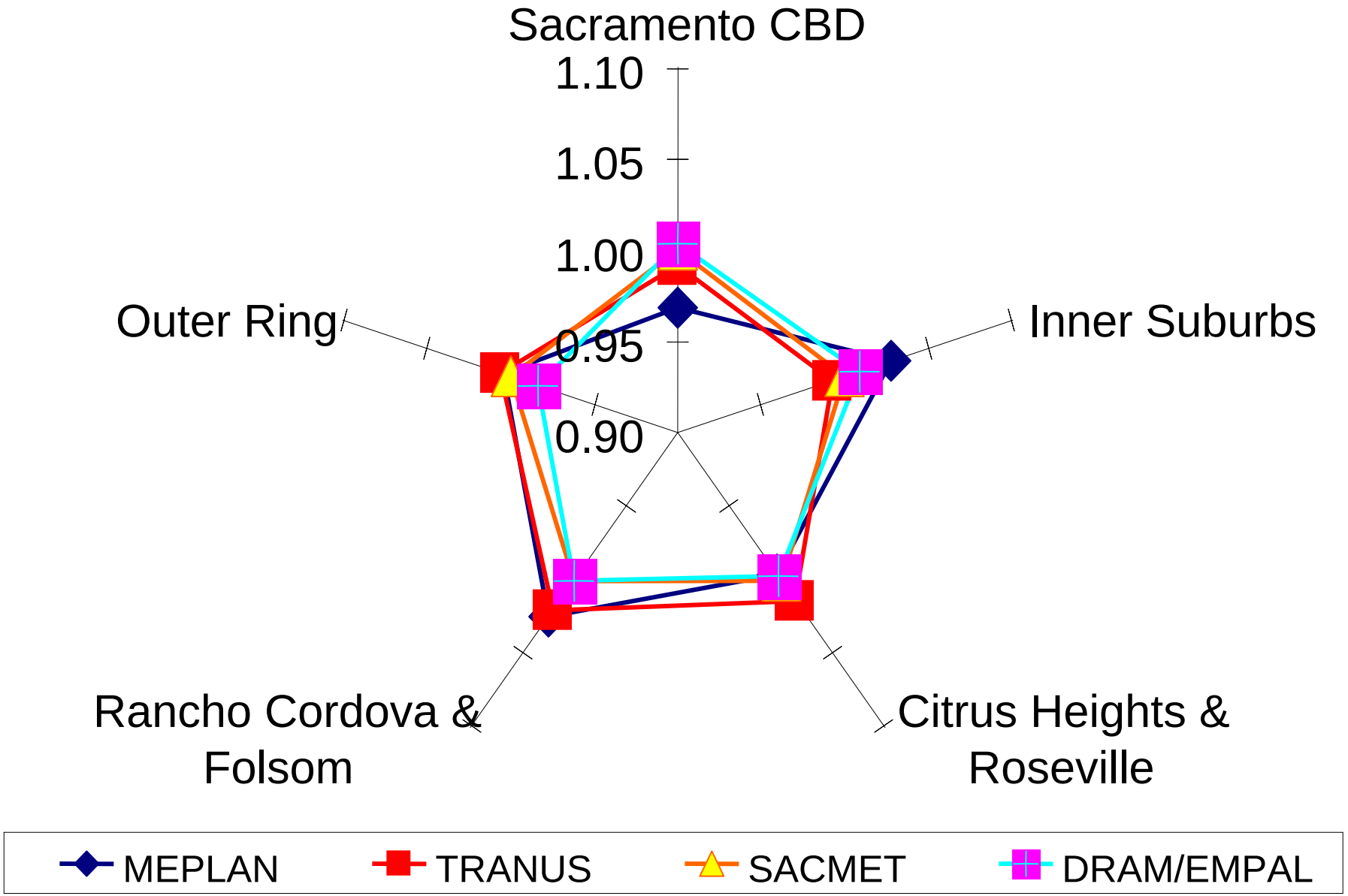
Employment in HOV Scenario Relative to Trend



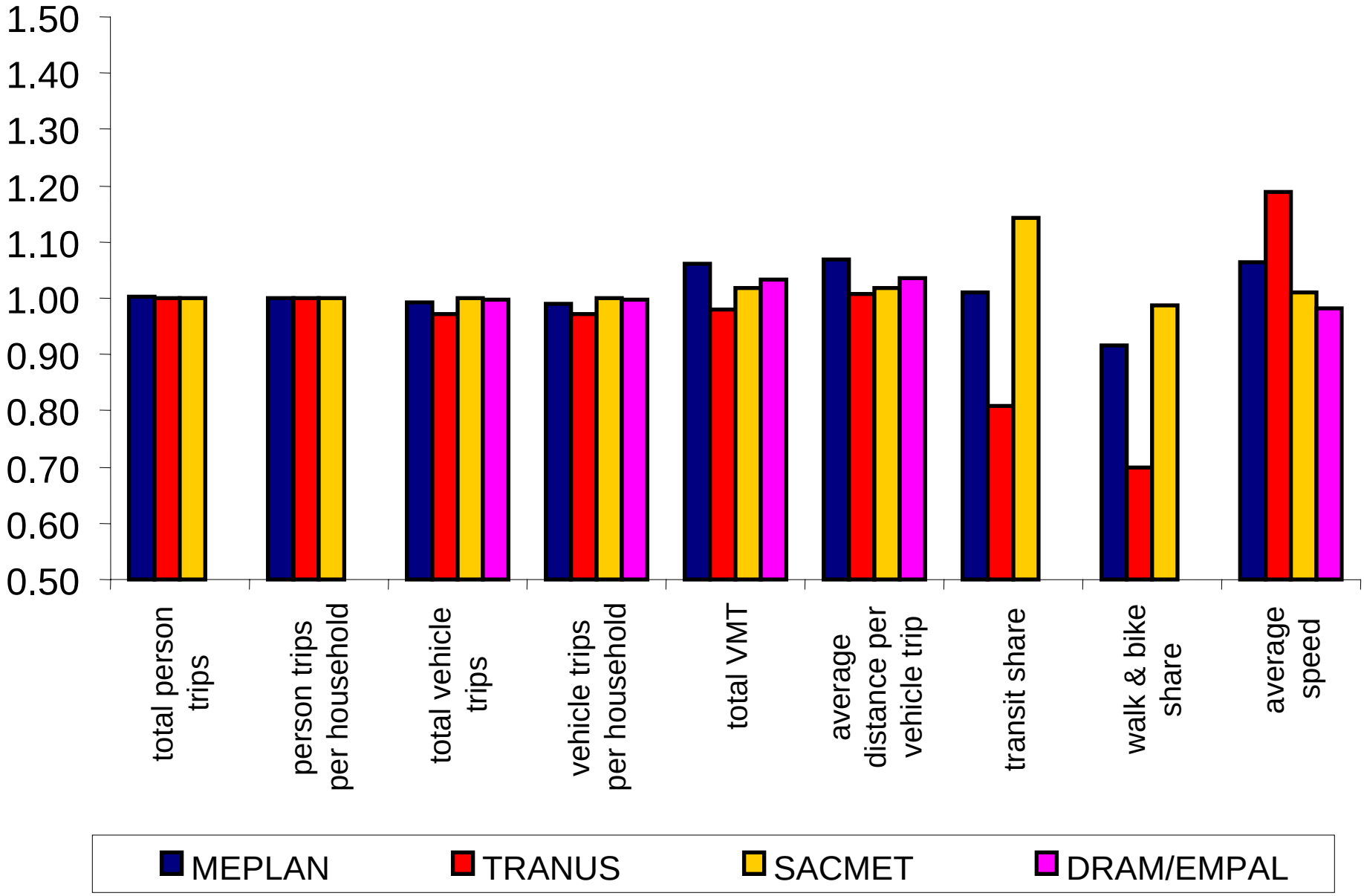
Employment in HOV & Beltway Scenario Relative to Trend



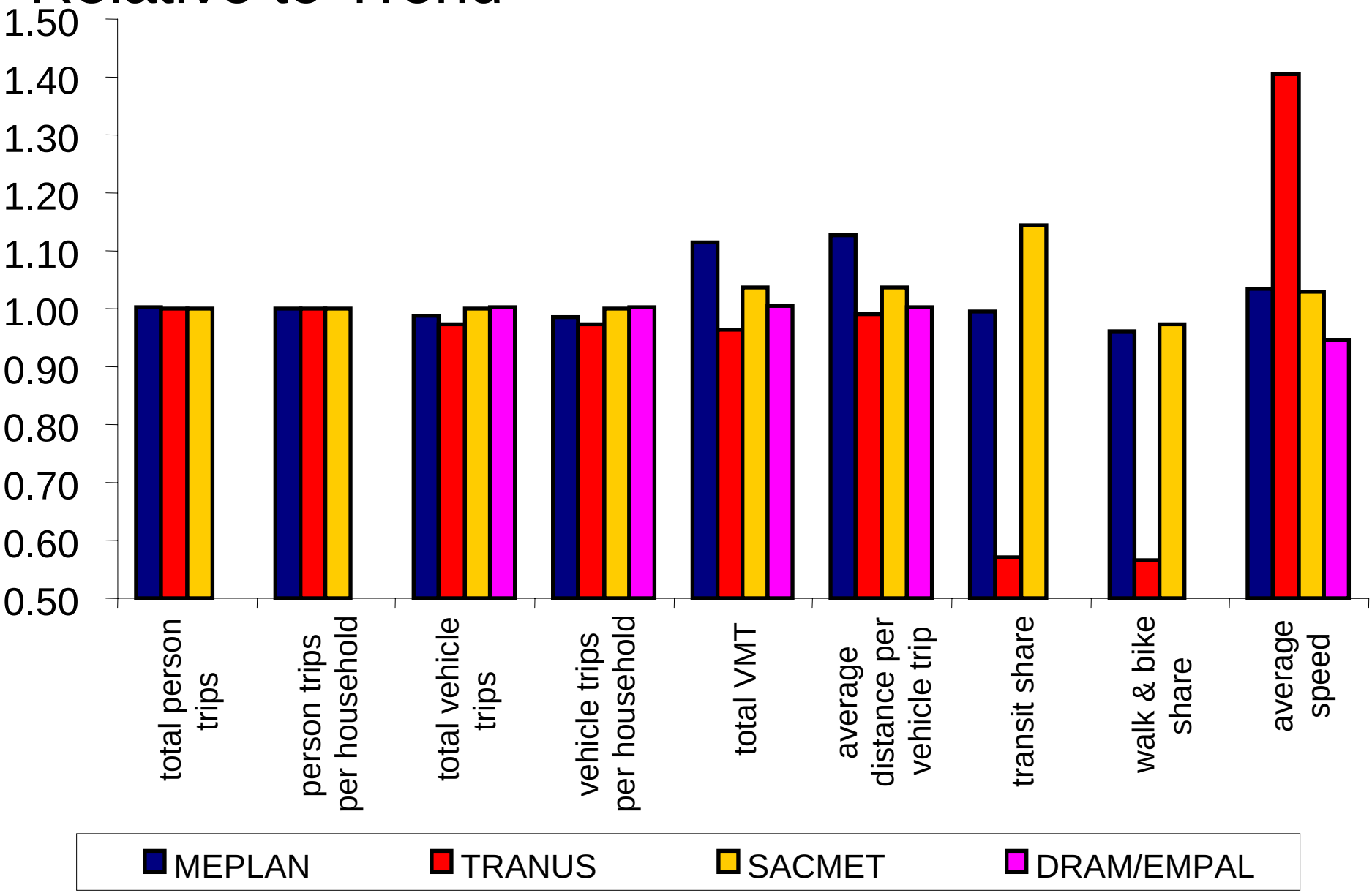
Employment in LRT & Pricing Scenario Relative to Trend



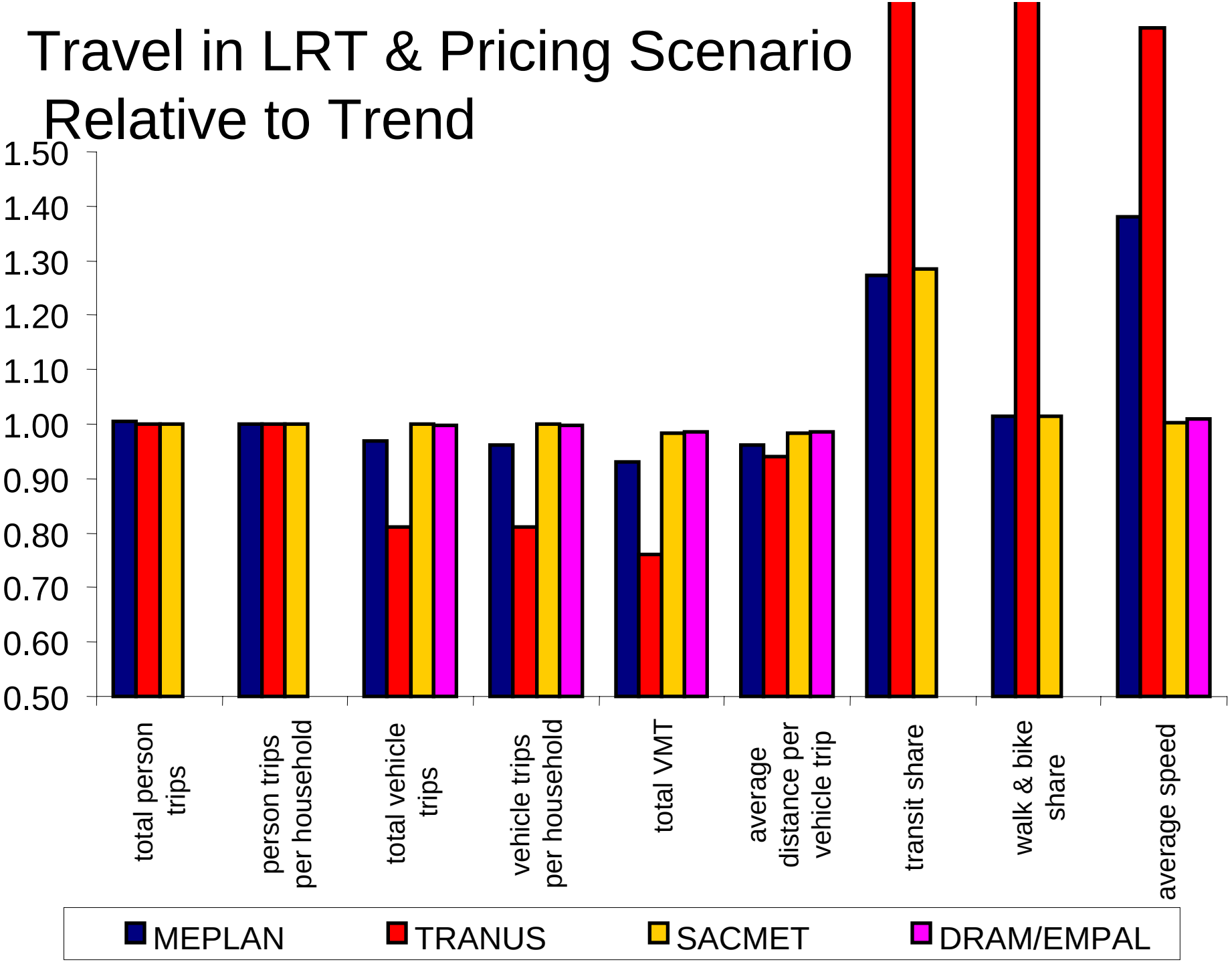
Travel in HOV Scenario Relative to Trend



Travel in HOV & Beltway Scenario Relative to Trend



Travel in LRT & Pricing Scenario Relative to Trend



Conclusions

Conclusions

- Tried to stay away from ‘right or wrong’ judgements, consistent with intention to assess effects of model components
- Partial supply representation w/wo partial demand representation can have big impact; ‘networks don’t aggregate well’; use sketch-planning models, but be aware of limitations, particularly regarding network effects
- Framework affects model results
- Floorspace prices provide important feedback to dampen development trends

Conclusions

- Other important influences on location choice besides transport and these can ‘swamp’ transport; so these other important influences deserve attention in model development
- Transport influences can be discerned somewhat by comparing ‘model with model’, but differences in calibration can result in different indications at this level, possibly altering policy guidance
- Very aggregate representations difficult to interpret - need to consider zones and intermediate values

Conclusions

- Calibration also affects model results; a ‘good’ framework alone does not ensure a ‘good’ model
- Calibration of land use transport interaction behavior difficult with cross-sectional data on its own
- Not enough in calibration to consider general trends - must consider elasticities with respect to transport conditions in particular

Conclusions

- Useful to include data indicating (or to directly specify) certain elasticities, data for two time points
- Some direct tests of elasticities also needed to assist interpretations of results
- Frameworks considered so far are fairly similar; would be informative and interesting to consider wider range of more different frameworks - an invitation