Transportation-Land Use Research

Baltimore Metropolitan Council

Status Update: Nov. 17, 2004

Purpose of Research Effort

- Study relationships between land use patterns and travel behavior
- Develop better link between macro & micro land use patterns and transportation system performance (traffic congestion, transit use)
- Enhance regional travel forecasting model for more challenging applications
- Evolve new tools for project evaluations

Research Framework

Travel Behavior = *f* [SOC + Reg Acc + 3Ds)

Travel: Vehicle trips, VMT, Transit & Walk

SOC: Household Composition, Income, Life Cycle, Vehicle Ownership

Reg Acc: Ease of reaching regional opportunities with modal options available

3D's: Density, Diversity & Design characteristics of local land use

Resources

2001 Regional Travel Survey

- 3500 households
- 24-hour travel diaries

BMC Travel Forecasting Tools

- TAZ network
- Travel times/costs by mode

Regional GIS Capabilities

- Land cover
- Land use mix
- 3Ds

Types of Analyses

Aggregate:

- Group 1300 households into 32 “neighborhoods”
- Compare travel characteristics based on simple land use variables

Disaggregate:

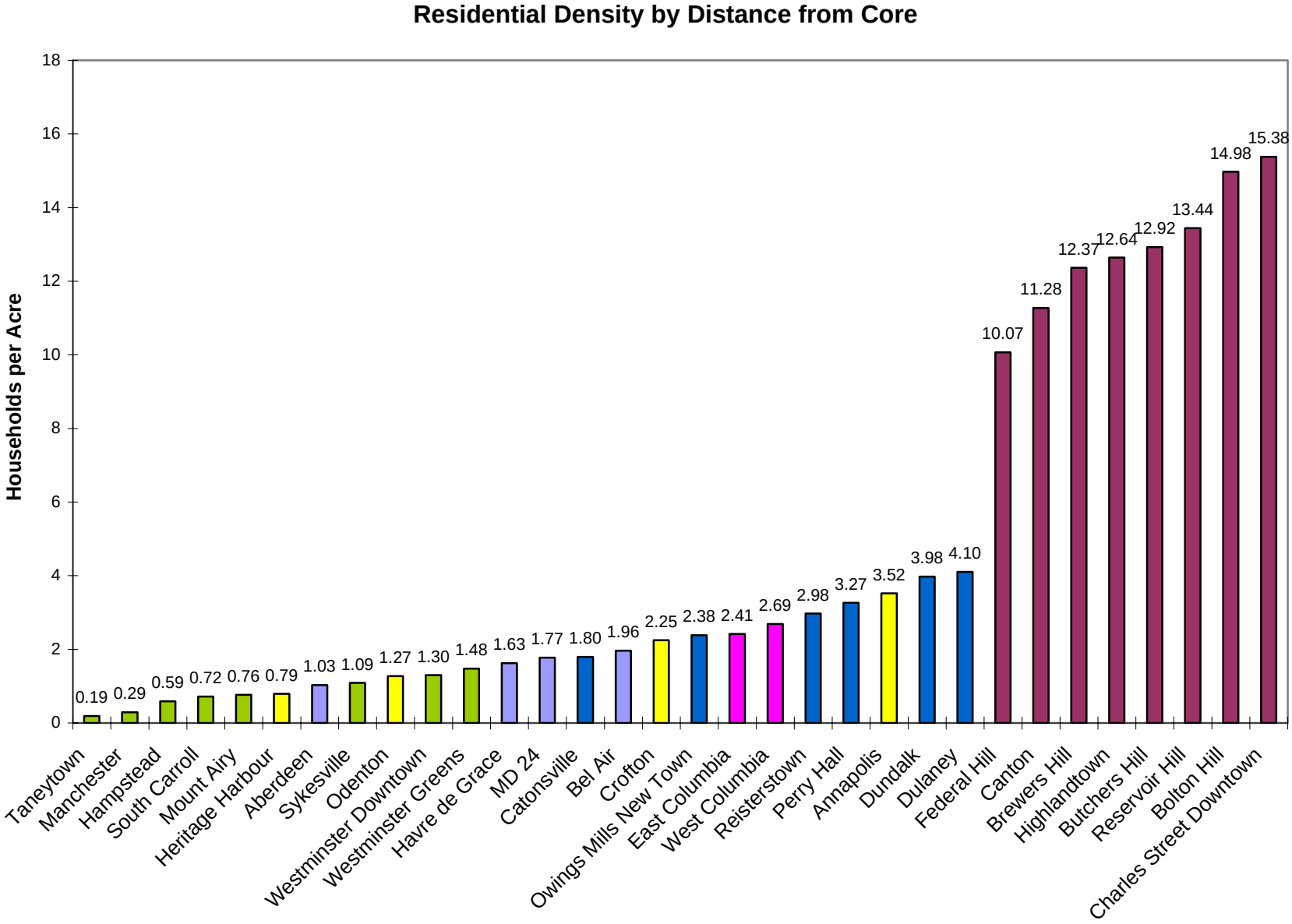
- Analyze at level of individual household
- Much more effective at introducing context

4-Step BMC Model:

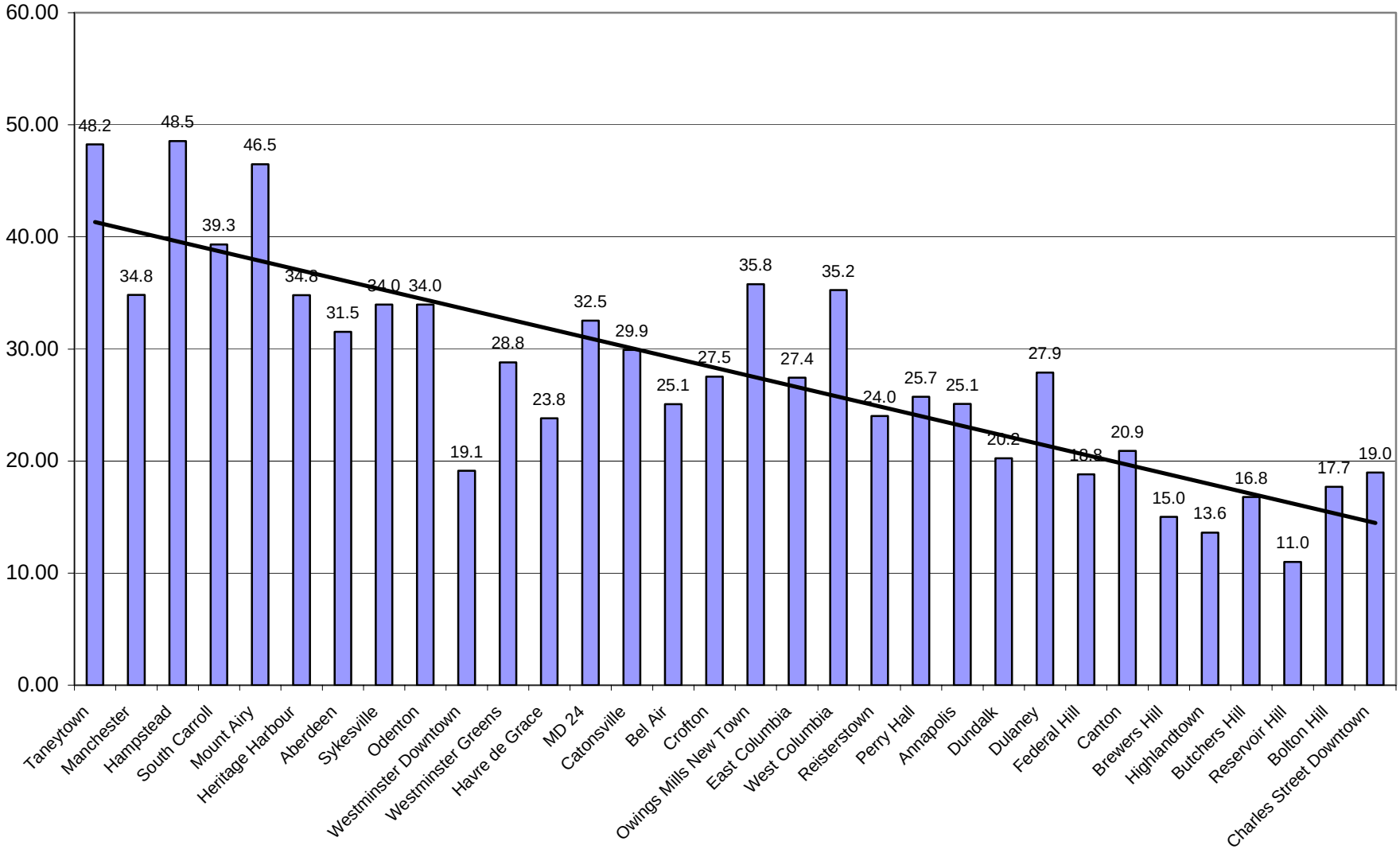
- Study effect of land use on auto ownership & trip generation
- Improve upon existing process of 4 Density Codes

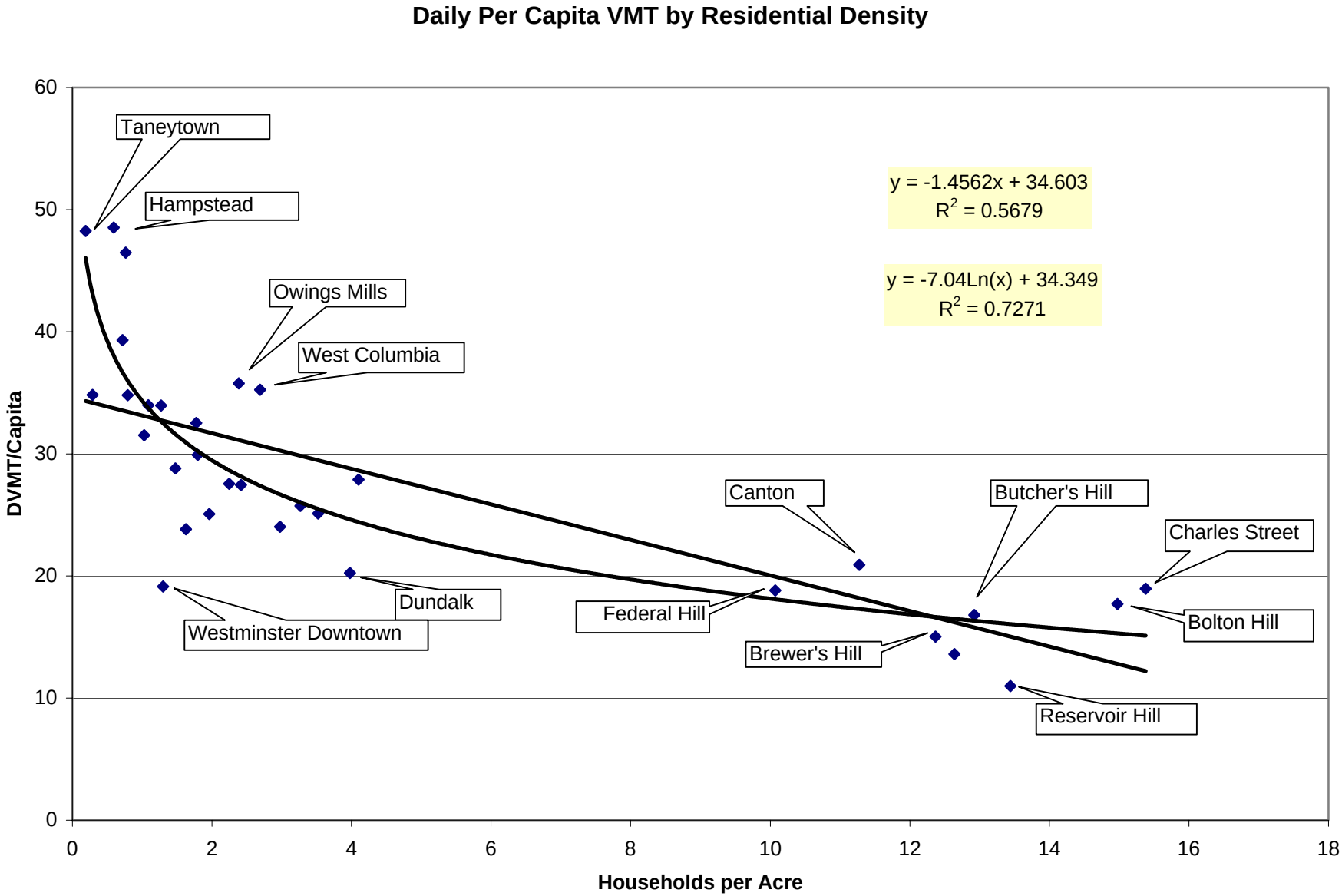
Aggregate Analysis – 32 Centers

- **Baltimore City:** Charles St., Bolton Hill, Reservoir Hill, Butchers Hill, Highlandtown, Canton, Brewers Hill, Federal Hill
- **Anne Arundel:** Annapolis, Crofton, Odenton, Heritage Harbor
- **Baltimore County:** Dulaney, Dundalk, Perry Hall, Reisterstown, Owings Mills, Catonsville
- **Carroll County:** Westminster Greens & Downtown, Mt. Airy, Sykesville, S. Carroll, Hampstead, Manchester, Taneytown
- **Howard County:** East & West Columbia
- **Harford County:** Bel Air, MD 24, Havre de Grace, Aberdeen

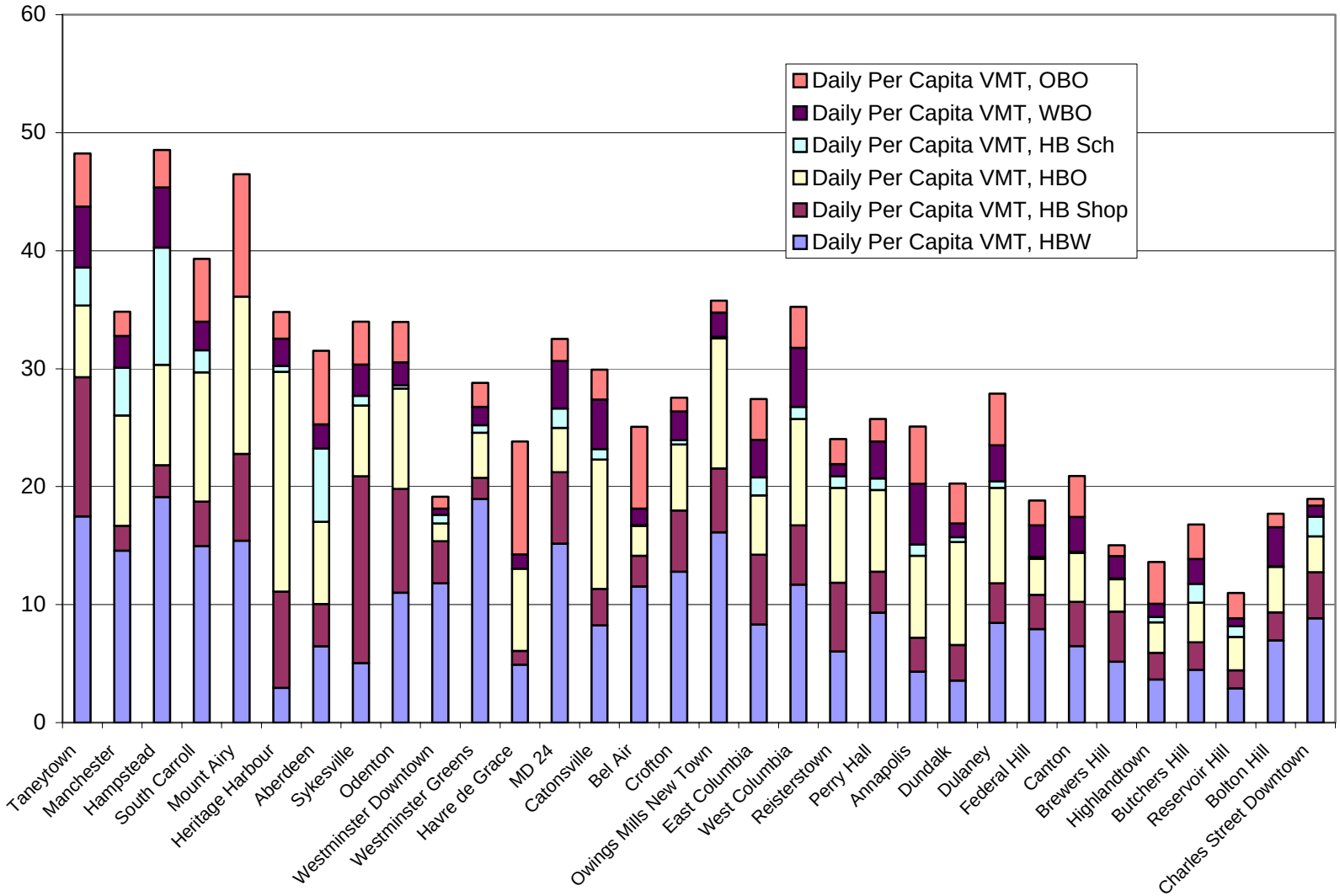

Residential Density by Distance from Core
Households per Acre
0
2
4
6
8
10
12
14
16
18
0.19
0.29
0.59
0.72
0.76
0.79
1.03
1.09
1.27
1.30
1.48
1.63
1.77
1.80
1.96
2.25
2.38
2.41
2.69
2.98
3.27
3.52
3.98
4.10
10.07
11.28
12.37
12.64
12.92
13.44
14.98
15.38
Taneytown
Manchester
Hampstead
South Carroll
Mount Airy
Heritage Harbour
Aberdeen
Sykesville
Odenton
Westminster Downtown
Westminster Greens
Havre de Grace
MD 24
Catonsville
Bel Air
Crofton
Owings Mills New Town
East Columbia
West Columbia
Reisterstown
Perry Hall
Annapolis
Dundalk
Dulaney
Federal Hill
Canton
Brewers Hill
Highlandtown
Butchers Hill
Reservoir Hill
Bolton Hill
Charles Street Downtown

Daily VMT Per Capita by Place

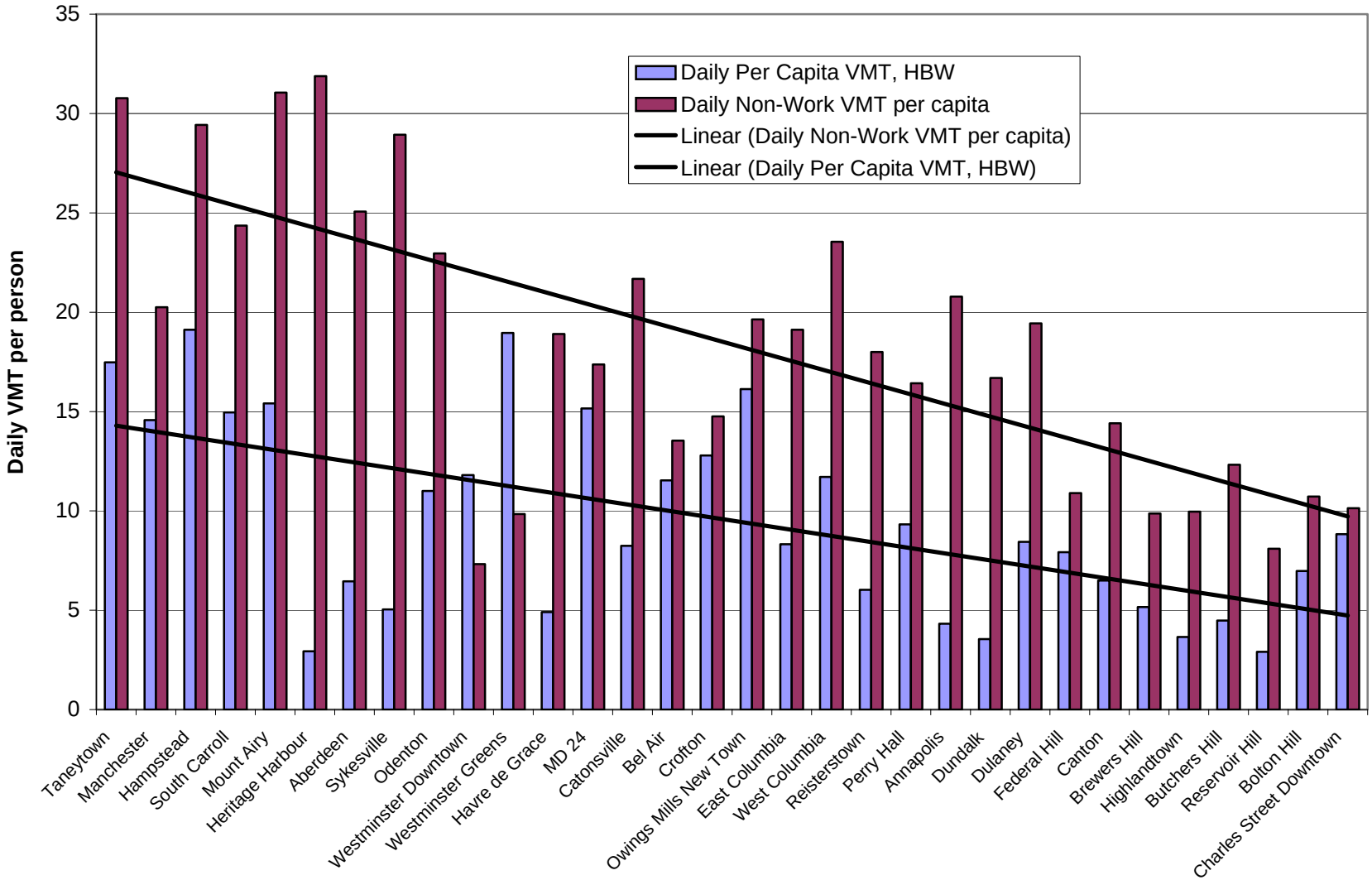


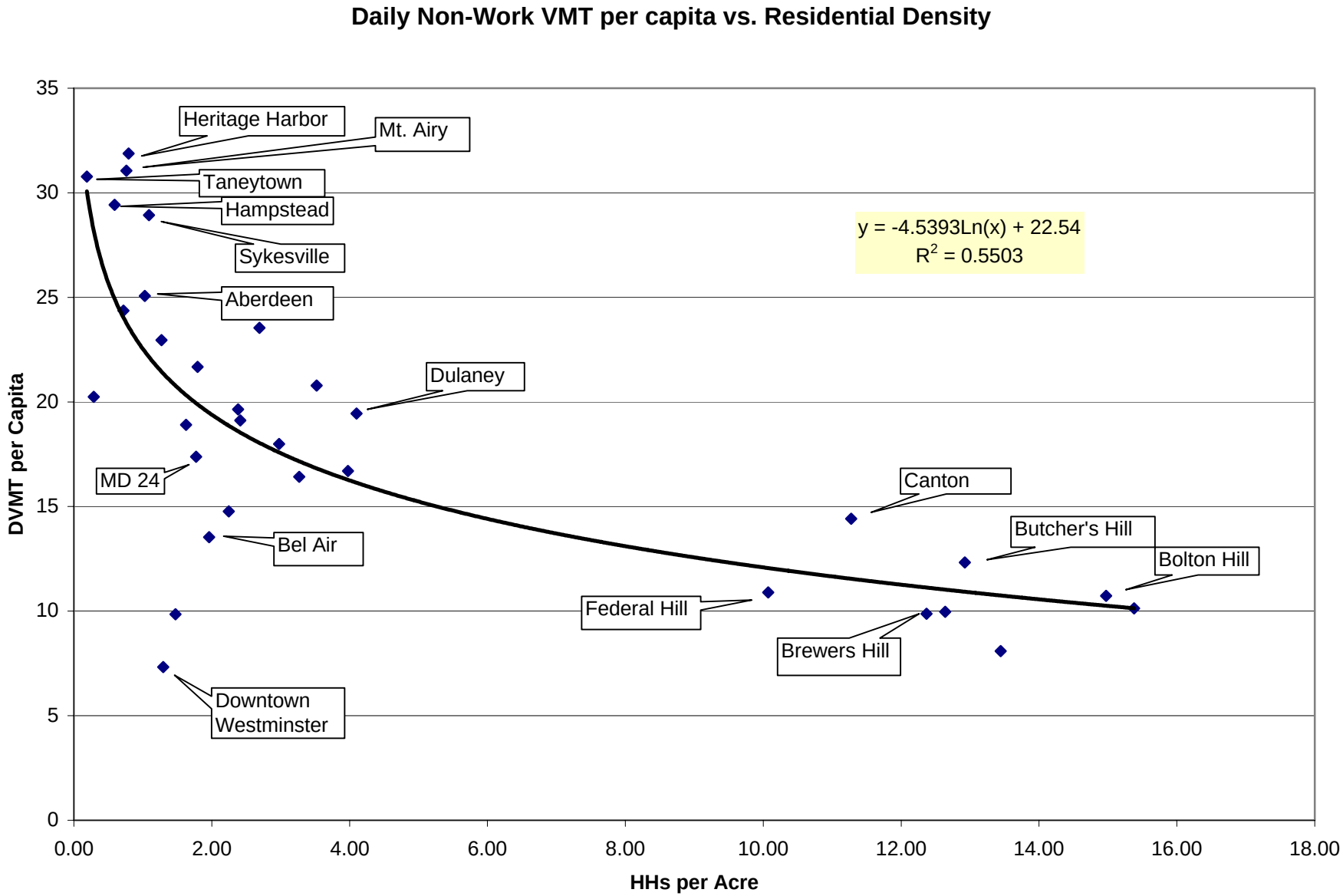

Daily Per Capita VMT by Residential Density
DVMT/Capita
Households per Acre
0
10
20
30
40
50
60
0
2
4
6
8
10
12
14
16
18
y = -1.4562x + 34.603
R2 = 0.5679
y = -7.04Ln(x) + 34.349
R2 = 0.7271
Taneytown
Hampstead
Owings Mills
West Columbia
Canton
Butcher's Hill
Charles Street
Bolton Hill
Federal Hill
Brewer's Hill
Reservoir Hill
Dundalk
Westminster Downtown

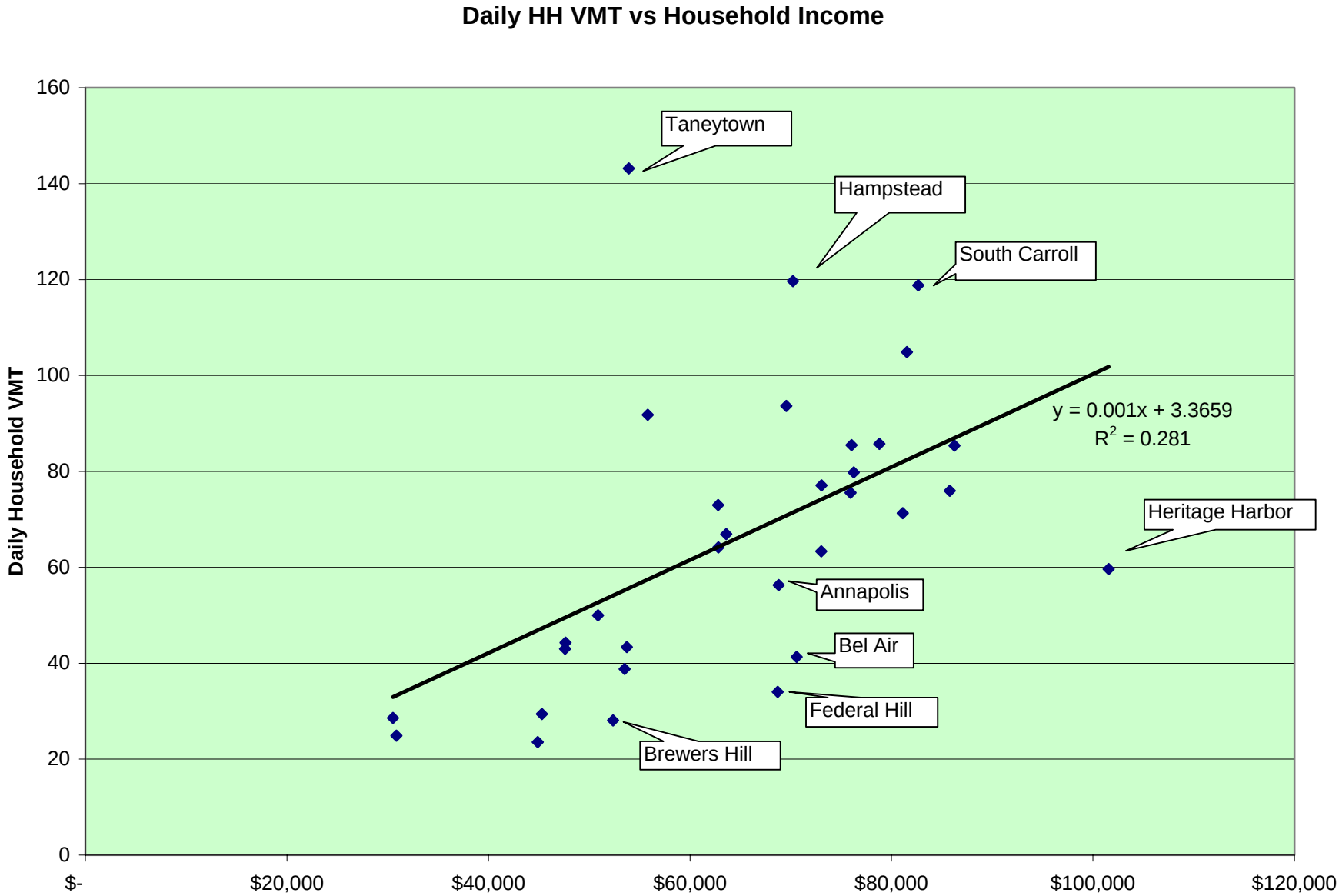
DVMT per Capita by Trip Purpose



Daily Work and Non Work VMT per Capita




Daily Non-Work VMT per capita vs. Residential Density
DVMT per Capita
HHs per Acre
y = -4.5393Ln(x) + 22.54
R2 = 0.5503
Heritage Harbor
Mt. Airy
Taneytown
Hampstead
Sykesville
Aberdeen
Dulaney
MD 24
Bel Air
Canton
Butcher's Hill
Bolton Hill
Federal Hill
Brewers Hill
Downtown Westminster
0
5
10
15
20
25
30
35
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00


Daily HH VMT vs Household Income
Daily Household VMT
160
140
120
100
80
60
40
20
0
$-
$20,000
$40,000
$60,000
$80,000
$100,000
$120,000
Taneytown
Hampstead
South Carroll
Heritage Harbor
Annapolis
Bel Air
Federal Hill
Brewers Hill
y = 0.001x + 3.3659
R2 = 0.281

Disaggregate Analysis

- Analysis at individual household level
- Test more refined measures of regional accessibility
- Develop new measures of local context
- Employing factor analysis and regression techniques to better understand data

Regional Accessibility Measures

Cumulative Opportunities:

- Number of jobs reachable within X minutes by highway or transit

Gravity Model:

- Total regional jobs discounted by respective distance

Full Cost:

- Opportunities discounted in relation to time & cost attractiveness of all modes available (“logsum” utility expression from mode choice model)

Local Accessibility (3Ds)

Mix: Number of different uses present

Dissimilarity: Relative proportions & balance of uses

Entropy: How well uses are dispersed

Opportunities: Number of activities within ¼ mile radius of home

Walkability: Ease of walking re. street configuration & intersections

Clustering & Patterning: Do some patterns work better

Current Activities

- Regression analyses of relation between VMT and SOC, regional accessibility and 3Ds
- Get down to travel by purpose groups
- Look at mode choice
- Look at travel tours (especially work-based)

Expected Products

- Travel forecasting model enhancements
- Better tools for Red Line ridership forecasting
- Tools for examining TOD projects