Development and Calibration of the UPlan Land Use Planning Model



July 2005

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Created in 1965, the Delaware Valley Regional Planning Commission (DVRPC) is an interstate, intercounty, and intercity agency that provides continuing, comprehensive, and coordinated planning to shape a vision for the future growth of the Delaware Valley region. The region includes Bucks, Chester, Delaware, and Montgomery counties, as well as the City of Philadelphia in Pennsylvania. It also includes Burlington, Camden, Gloucester, and Mercer counties in New Jersey. DVRPC provides technical assistance and services, conducts high-priority studies that respond to the request and demands of member state and local governments, fosters cooperation among various constituents to forge a consensus on diverse regional issues, determines and meets the needs of the private sector, and practices public outreach efforts to promote two-way communication and public awareness of regional issues and the commission.



Our logo is adapted from the official DVRPC seal, and is designed as a stylized image of the Delaware Valley. The outer ring symbolizes the region as a whole while the diagonal bar signifies the Delaware River. The two adjoining crescents represent the Commonwealth of Pennsylvania and the State of New Jersey.

DVRPC is funded by a variety of sources including federal grants from the US Department of Transportation's Federal Highway Administration (FHWA) and Federal Transit Administration (FTA), the Pennsylvania and New Jersey departments of transportation, as well as by DVRPC's state and local member governments. This report was primarily funded by the Pennsylvania Department of Transportation and the Federal Highway Administration. The authors, however, are solely responsible for its findings and conclusions, which may not represent the official views or policies of the funding agencies.

On the cover: The cover displays the 2000 DVRPC Land Use Inventory at the regional scale in the same land use categories and colors that are used in the figures and analyses included herein. Purple designates industrial; red commercial; orange high density residential; and yellow low density residential. There is a strong tendency for commercial land uses to be located near major highways. This causes major roadways of the region to be outlined as series of red dots.

TABLE OF CONTENTS

| EXEC | CUTIVE SUMMARY 1 |
|------|---|
| I. | INTRODUCTION |
| II. | UPLAN MODEL GENERAL DESCRIPTION |
| | A. Attractions for Development |
| III. | UPLAN MODEL CALIBRATION |
| | A.Land Use Inventories and Codes13B.Parameter Structure18C.Error Structure18D.Parameter Estimation Methodology19E.Generalized Model Variable Selections and Coefficients20F.MCD Specific Parameter Settings21G.Use of Exclusion Masks33 |
| IV. | COUNTY AND MCD LEVEL CALIBRATION RESULTS 41 |
| | A. Pennsylvania Counties41B. New Jersey Counties42C. Calibration Error Summary43 |
| V. | CONCLUSIONS |
| APPE | ENDIX - Comparison of UPlan Allocation with 1990 to 2000 Census Population and Employment Change by County |
| | Bucks CountyA-3Chester CountyA-7Delaware CountyA-11Montgomery CountyA-15Burlington CountyA-19Camden CountyA-21Gloucester CountyA-23Mercer CountyA-25 |

LIST OF TABLES

| 1. | Land Use Category (LUC) Correspondence 1 | 16 |
|-----|--|----|
| 2. | Attractions and Discouragements for Industrial, Residential, and Commercial | |
| | Development | 21 |
| 3. | GIS Variable Buffer Size in Feet and Weight | 22 |
| 4. | Municipality Calibration Factors for Bucks County (Attractors Positive, | |
| | Discouragements Negative) | 27 |
| 5. | Municipality Calibration Factors for Chester County (Attractors Positive, | |
| | Discouragements Negative) | 29 |
| 6. | Municipality Calibration Factors for Delaware County (Attractors Positive, | |
| | Discouragements Negative) | 31 |
| 7. | Municipality Calibration Factors for Montgomery County (Attractors Positive, | |
| | Discouragements Negative) | 34 |
| 8. | Municipality Calibration Factors for Burlington County (Attractors Positive, | |
| | Discouragements Negative) | 36 |
| 9. | Municipality Calibration Factors for Camden County (Attractors Positive, | |
| | Discouragements Negative) | 37 |
| 10. | Municipality Calibration Factors for Gloucester County (Attractors Positive, | |
| | Discouragements Negative) | 38 |
| 11. | Municipality Calibration Factors for Mercer County (Attractors Positive, | |
| | Discouragements Negative) | 39 |
| 12. | Average Absolute UPlan MCD Population Allocation Error by County | 14 |
| 13. | Average Absolute UPlan MCD Employment Allocation Error by County 4 | 14 |

LIST OF FIGURES

| 1. | Attractiveness Buffers Resulting from Freeway Interchanges and Major Roadways | . 7 |
|----|--|-----|
| 2. | High Congestion Discouragement Areas | . 8 |
| 3. | Environmental Exclusion Areas Resulting from Wetlands, Streams, and Water Bodies | 10 |
| 4. | County and Minor Civil Division Boundaries | 14 |
| 5. | Typical 2000 Aerial Photograph with Land Use Inventory Designations | 15 |
| 6. | Clipped 2000 Land Use Inventory with 1990 Development Grayed Out | 17 |
| 7. | Medium Density Residential Composite Attractiveness | 23 |
| 8. | UPlan Land Use Allocations | 25 |

EXECUTIVE SUMMARY

This report presents UPlan; a land use planning model developed at the University of California that spatially allocates new development for use in long-range land use planning and scenario testing. UPlan is a growth area allocation model. It allocates new development (new building footprint) to areas that are currently open space or designated for redevelopment. Land consumption is accounted for by explicit allocations to growth areas defined by a boundary in space. Land use categories included in UPlan are industrial, high density commercial, low density commercial, high density residential, medium density residential, low density residential, and very low density residential. Commercial land uses include office, retail, and most government services activities.

Because of the stability of existing land uses and the availability of a detailed parcel-level countywide comprehensive plan disaggregated by land use type, UPlan is applied in California though simplified rule based allocation methods such as "preserve all agricultural lands" or "encourage high density residential development." These rules or policies generate alternative development scenarios for environmental, land consumption, and related planning analysis. This type of analysis makes minimal use of the transportation/land use allocation interface in UPlan.

When UPlan was applied at Delaware Valley Regional Planning Commission (DVRPC), new methods were needed to statistically allocate the various development types to specific geographical locations (grids). UPlan's Geographical Information System (GIS) based transportation/land use model was calibrated based on historical transportation and land use interactions. This model is intended to estimate the effect of existing and proposed transportation facilities on land use patterns, as recommended by federal guidelines. The calibrated model can be thought of as an approximate, synthetic, land use market which emulates market development decisions, given the existing and proposed transportation systems, land use plans, and policies.

The enhanced DVRPC version of UPlan retains its character as a corridor or county level land use planning model. The synthetic market imbedded in the calibrated model strengthens UPlan through inclusion of transportation and economic factors. Using UPlan's land use allocation outputs as guidelines, generalized growth areas can be identified by specific land use type as part of corridor or countywide comprehensive planning scenarios. This type of analysis promotes smart growth objectives and the economic viability of the DVRPC Region through the efficient use of transportation infrastructure .

The calibrated UPlan model does an accurate job of allocating the various categories of land uses to areas that grew between 1990 and 2000. The model tends to associate each growth area grid with its highest economic use given the transportation system, base year development patterns, and other factors. This replicates the results of actual development decisions, which are predominately market driven. When converted to equivalent population and employment, the average Minor Civil

Division (MCD) population allocation error for the Region as a whole was 364 persons or 4.5 percent. The corresponding MCD errors for employment were 364 workers or 11.5 percent.

I. INTRODUCTION

UPlan is a land use planning model, developed in California, that spatially allocates new footprint development. New footprint refers to new development in areas formally open space, agricultural, or wooded. Areas with intensive existing development are assumed to be stable in the current land uses. UPlan was originally designed to allocate the county net growth of population, household, and employment to growth areas based on zoning designations in a county-wide comprehensive plan. UPlan land use categories include industry, high density commercial, low density commercial, high density residential, medium density residential, low density residential, and very low density residential. In California, the growth area for each land use type has explicit boundaries in space defined by aggregating parcel level zoning designations. California applications of UPlan are essentially zoning build-out analyses, where land preservation and environmental concerns are superimposed on existing zoning through arbitrary rules such as "protection of all agricultural lands" or "restricting development in agricultural lands to very low density residential" and so forth. Based on these allocation rules, open space is typically assumed to be developed as per zoning right and the land consumption effect of the scenario rule on agricultural areas, old growth forests, environmental habitats, and so forth tabulated and analyzed.

Similar types of land use planning are underway at the Delaware Valley Regional Planning Commission (DVRPC), but Geographical Information System (GIS) land use parcel data containing zoning classifications are not yet available. This severely limits the usefulness of rule based allocation methods which rely on parcel zoning classifications to distinguish between the various types of industrial, commercial, and residential growth areas.

Agricultural activities in Sonoma, Napa, and Merced counties are dominated by wineries and agrabusiness. The crops are valuable and important to the local economy. Because of the economic viability and stability of existing land uses, and the existence of county-wide comprehensive plans disaggregated by land use type, the assumptions in UPlan are roughly true in California. The model did not need to be calibrated on historical data because it was intended for scenario testing. Instead, UPlan relied on fine-grained parcel level zoning data that represented existing local and county comprehensive plans, and other relevant natural and man made topographical features to define the model. It was deterministic and rule-based, so as to be easily understood by decision makers. In these rule based applications, proximity to freeway interchanges and other transportation infrastructure, congestion levels, and other economic factors are given relatively small importance.

When the California version of UPlan was applied at the DVRPC, certain shortcomings emerged. County-wide detailed comprehensive plans and zoning maps are not yet available. Future growth areas are defined as only one combined land use category. Furthermore, some older developed areas of the DVRPC Region are declining and a portion of forecasted population and employment growth may be accommodated by in-fill into existing developed areas. These factors are not consistent with the UPlan model assumptions and manual adjustments to the UPlan output may be necessary.

In the DVRPC Region, the transportation and economic aspects of UPlan are important because of the rapid suburbanization of rural areas and the ongoing transformation of the economic base of the region. The effect of transportation improvements on land use patterns is of great interest to businesses, citizens and decision makers. Enhanced methods are needed to statistically allocate new land uses to specific locations (grids) using a GIS based land use model, calibrated with historical transportation facility and land use changes. The transportation and economic variables selected and the parameter values determined in the calibration are useful to forecast the approximate location and extent of the each type of development pattern given the proposed transportation system.

UPlan is calibrated at the county level, with separate models for Bucks, Chester, Delaware, and Montgomery counties in Pennsylvania and Mercer, Burlington, Camden, and Gloucester counties in New Jersey. Philadelphia is not included in the UPlan calibration because the City is almost completely built over, and there limited changes in land use to analyze between 1990 and 2000. UPlan is applicable in Philadelphia and other urban areas to allocate new land uses to redevelopment areas.

This base year calibration exercise is significant because it is the first attempt to prepare a formal calibration of a totally GIS based land use model and represents a significant potential extension to the usefulness of this category of model. The completed calibrated model can be thought of as an approximate, synthetic, land use market which emulates development decisions, given the existing and proposed transportation systems and land use plans and policies.

II. UPLAN MODEL GENERAL DESCRIPTION

The UPlan model works based on the following assumptions:

- 1. Population growth can be converted into demand for land use by applying conversion factors to forecasted employment and household totals.
- 2. New urban expansion will conform to City and Minor Civil Division (MCD) comprehensive plans. This primarily means areas designated for future development, although portions of counties can also be designated as "urban reserve" and made available for development when the development areas are exhausted.
- 3. Cells have different attraction weights because of accessibility to transportation and infrastructure.
- 4. Some grid cells, such as lakes and streams, will not be developed. Other cells, such as environmentally sensitive habitats and flood plains, may be covered by policies to discourage new development.

The consequence of population and employment growth is the urban expansion of physical size and conversion of land use types. By applying a set of conversion formulas, UPlan converts the population and employment growth into the acres needed for future employment and housing. All the conversions are based on factors such as persons per household, the percentage allocations of households into the various density categories and the corresponding households per acre. Similarly, the percent allocation of employees to the industrial and commercial categories is based on employees per square foot and floor area ratios. In the calibration exercise, these conversion parameters are base on 2000 data by county and are taken largely from the DVRPC report entitled "Suburban Density Strategies."

The UPlan land use allocations assume that (1) future growth will have no effect on existing land use. That is, the current land use categories will remain unchanged in the future, and all new growth will go into the designated categories; (2) no abandonment, redevelopment or shift of land use from one type to another take place unless explicitly included in future development areas. These assumptions follow directly from the heavy reliance of UPlan on the GIS land use inventory. This inventory has no information on whether existing housing and industrial/commercial areas are stable, declining, being abandoned, or even unoccupied in the inventory year. This type of analysis requires time series Census and other tabular data sets and detailed land use surveys that are beyond the scope of this UPlan effort. The UPlan model described in this report applies only to "new footprint" development – new development areas taken from open space and/or areas designated for redevelopment (urban renewal and brown fields). New footprint development an important aspect of most ongoing land use planning activities.

In forecasting runs of the model, the composite land use category specified by DVRPC's future growth area layer will be separated into seven land-use categories by the calibrated model. UPlan has a strict order of superiority based on bid price potential in the land use allocation. It always allocates industry first, then high density commercial, high density residential, low density commercial, and then medium density residential, low density residential, and finally, very low density residential. Commercial land uses include office, retail, and most government services activities. The DVRPC land use inventory does not break out retail as a separate category.

A. Attractions for Development

It is assumed that development occurs in areas that are attractive due to their proximity to existing urban areas and transportation facilities, such as freeway ramps. It is also assumed that the closer a vacant property is to an attraction, the more likely it will be developed in the future. For example, a property that is a quarter mile away from existing/proposed freeway ramp or existing development (or any attraction for that matter) is more desirable than one that is a mile away from the same location.

Following this assumption, each development attraction (described below) is surrounded by user-specified buffers. The user can designate the number and size of the buffer intervals and assign an attractiveness weight to each buffer. Buffer specifications are applied to each of the attraction grids and then the grids are overlaid and added together to make a composite Attraction Grid. *Figure 1* illustrates attractiveness buffers resulting from freeway ramps and major roadways within Montgomery County. Note that the freeway interchanges serving major roadways get a higher attractiveness value (red) than interchanges serving minor roadways (green). This is because the attractiveness resulting from the interchange is added to the attractiveness provided by the major roadway in the composite value.

The composite Attraction Grid is a single grid consisting of the sum of the weights specified for each individual attraction factor. Each cell in this grid has a value resulting from the summation. Grid cells with the highest summation are considered the most attractive areas for development.

B. Discouragements to Development

Some features such as protected habitats, 100-year flood plains, brown fields or farmland might be developable at a high societal or economic price. These features are called discouragements. Any features which are judged to discourage development can be used as discouragements. *Figure 2* displays the pattern of discouragements resulting from high roadway congestion. High congestion levels discourage new development. Congestion is calculated as an average of roadways over four square kilometer - (about 1 ¹/₂ square miles) - (see Chapter III, Section E page 20 for a detailed definition of this variable). The user can specify the range of







Figure 2. High Congestion Discouragement Areas

buffers and weights, indicating to what extent the development will be discouraged. The weight should be a positive number (the program changes it to a negative attraction). The discouragements will be combined with attractions to form a final attraction grid. The values of impacted cells in the final attraction grid will be smaller because of the discouragements.

C. Exclusions Against Development

In most scenarios, there are areas where development cannot occur, called exclusions. Exclusions include features such as lakes and rivers, public open space, existing built-out urban areas, and other such features. The user can also specify the percentage of vacant parcels within urban areas that will not be used for industrial, residential and commercial development. Once the user decides which features are to be excluded, the model adds the various exclusion grids to generate a "Mask." The Mask Grid is the composite (union) of the individual exclusion grids. In this case, however, grid cell values are not important; rather, simply having a value makes a cell part of the Exclusion Mask. *Figure 3* illustrates the environmental exclusion areas in Burlington County resulting from stream beds, water bodies, and wetlands. Existing urban areas are for the most part masked out except for imbedded open areas larger than a minimum size. Abandonment or in-fill associated with existing urban areas is handled by adjustments to socioeconomic variables outside of UPlan.

D. Allocation of Future Growth

Once the attraction, discouragement, and the exclusion mask grids are generated, the model overlays the attraction and discouragement grids calculates the net attraction for each grid. This net attraction is then overlaid over the exclusion mask and the attraction cells that fall within the mask are converted to "no data" cells, thereby removing them from possible development allocations. This process creates the suitability grid, which becomes the template for the allocation of projected land consumption in the forecast. The suitability grid is overlaid with a grid of the future development and urban reserve areas (rural areas in the DVRPC 2025 Land Use Plan) from the land use plan map for each DVRPC county, enabling the model to further isolate areas which are suitable for each of the land use categories that are allocated. The model is then ready to allocate projected acres of land consumed in the future. The DVRPC version of UPlan assumes that all land uses are allowed to go into future development areas and any overflow not accommodated by these development areas is allocated to unprotected rural areas (urban reserve) or may be reclassified as in-fill within existing urban areas.

UPlan allocates future growth starting with the highest valued cells. As the higher valued cells are consumed, the model looks for incrementally lower valued cells until all acres of projected

Figure 3. Environmental Exclusion Areas Resulting from Wetlands, Streams and Water Bodies



land consumption are allocated. The model does this in turn for each of the land use categories, with different attractiveness and suitability grids calculated for each land use. The land area associated with the current land use category's allocation is deducted from the suitability grid before the next land use category in the allocation order is processed.

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III. UPLAN MODEL CALIBRATION

The calibration is based on grid level land use changes between DVRPC's 1990 and 2000 land use inventories, summarized by Minor Civil Division, see Figure 4 for MCD boundaries. The corresponding differences between the 1990 and 2000 Census population and employment data, at the MCD level of analysis, are used as a secondary check to complete the calibration and validate the model outputs. The base year is 1990 and its land use inventory is treated as existing land use, while the 2000 inventory is used to represent forecast year predicted land use. In the land use inventories, there are 26 land use types, and each land use type has an explicit geographic boundary determined from aerial photographs. The classification of land uses is consistent across the region and across time. However, the classification system is not exactly what is needed for the UPlan model. As much as possible, the inventoried land categories were re-classified for the UPlan calibration. However, it was not possible to separate high (more than two stories) from low density commercial and medium density residential from low density residential in the DVRPC land use inventory. *Figure 5* presents a typical aerial photograph with the UPlan boundaries and land use designations overlaid. Industrial land uses are colored purple, commercial in red, high density residential in orange and medium/low density residential in yellow. Comparisons of population and employment from the 1990 and 2000 Censuses help to make that distinction. Higher densities produce larger number of persons and employees. Comparing the estimates of persons and employees that come out of UPlan with the Census numbers gives a good indication of UPlan calibration errors in terms of the estimated prevailing density of a given MCD. Refinement of the UPlan parameters is needed to correct these allocation errors.

A. Land Use Inventories and Codes

Table 1 lists the cross-relations between the land use types in DVRPC's land use inventory and the land use codes in UPlan. As noted above, commercial development has only one category and is not spatially split into high density commercial (CH) and low density commercial (CL) in DVRPC's land use inventory. Similarily, single family residential is a combination of medium density residential (RM), low density residential (RL), and very low density residential (RVL). In the DVRPC land use inventory, retail developments are included in the commercial land use category.

The calibration is based on DVRPC's 1990 and 2000 land use inventory GIS maps. The land use maps are spatially detailed consisting of small polygons. Only residential and employment related land uses are considered. Industrial, commercial and residential land areas were isolated from the 1990 inventory to form a 1990 existing urban layer. Then, industrial, commercial and residential land uses were extracted from the 2000 inventory to form the corresponding 2000 existing urban area layer. The 1990 urban area layer was then clipped







from the 2000 developed area layer. The remaining polygons in the 2000 layer represent areas that were developed between 1990 and 2000 and are used as growth areas for purposes of the UPlan calibration. This clipping preserved the land use type designations shown in Table 1 for model calibration and validation. *Figure 6* shows the clipped inventory for the same area as Figure 5, with the existing development in the 1990 and 2000 were considered available for all types of industrial, commercial and residential development (summation of the purple, red, orange, and yellow polygons in Figure 6). The model was used to allocate the various types of land uses to the 2000 growth areas for comparison with actual development patterns.

| LUC in DVRPC Inventory | LUC in UPlan |
|--------------------------------------|--------------------------------|
| Agriculture | Agriculture |
| Commercial/service | Commercial |
| Community service | Commercial |
| Manufacturing-Heavy | Industrial |
| Manufacturing-Light | Industrial |
| Military | Public/open space |
| Mining | Industrial |
| Parking-Agriculture | Agriculture |
| Parking-Commercial/Service | Commercial |
| Parking-Community Service | Commercial |
| Parking-Manufacturing | Industrial |
| Parking-Military | Public/open space |
| Parking-Multi-family Housing | High density residential |
| Parking-Recreation | Public/open space |
| Parking-Transportation | Public open space |
| Parking-Utility | Public/open space |
| Recreation | Public/open space |
| Residential-Mobile Homes | High density residential |
| Residential-Multi-Family | High density residential |
| Residential-Row Homes | High density residential |
| Residential-Single Family (Detached) | Medium/Low density residential |
| Transportation | Public/open space |
| Utility | Public/open space |
| Vacant | Vacant |
| Water | Water |
| Wooded | Public/open space |

Table 1. Land Use Category (LUC) Correspondence





B. Parameter Structure

As noted previously, the UPlan parameter structure is made up of buffers, weights, and masks. There is a separate set of parameters for each land use type, reflecting the unique transportation service and other special requirements of that type of development. There are two categories of parameters, 1) generalized attractions and discouragements that apply everywhere in the region -- to all nine counties (including Philadelphia) without modification; and 2) MCD specific attraction adjustment coefficients. Generalized parameters mostly reflect proximity to and service levels provided by transportation system elements such as freeway interchanges, the non-freeway roadway network, and transit facilities, but may also indicate proximity to existing land use clusters that may attract new footprint land uses of the same type. However, MCD-specific attraction coefficients are set individually for land uses within selected MCDs. The MCD-specific parameters account for non-transportation factors in location decisions such as local zoning and land use policies, perceived market desirability factors (wooded lots, local tax incentives, etc.), other nuances in land ownership and availability, and any other unexplained deviations from the norm generated by the UPlan generalized parameter structure.

C. Error Structure

The UPlan model can be thought of as a series of simultaneous equations, with one equation for each land use. Each equation relates grid level land consumption to a number of independent variables reflecting the transportation system, proximity to existing land uses, traffic congestion, and so forth. The land use category allocation order assumed in UPlan leads directly to a triangulated error structure as follows:

| L | = | $k_1V_1 + k_2V_2 + + k_nV_n + e_i$ | (1) |
|-----------------|---|---|-----|
| L_{ch} | = | $k_1V_1 + k_2V_2 + + k_nV_n + e_i + e_{ch}$ | (2) |
| L_{rh} | = | $k_1V_1 + k_2V_2 + + k_nV_n + e_i + e_{ch} + e_{rh}$ | (3) |
| L _{cl} | = | $k_1V_1 + k_2V_2 + + k_nV_n + e_i + e_{ch} + e_{rh} + e_{cl}$ | (4) |
| L _{rm} | = | $k_1V_1 + k_2V_2 + + k_nV_n + e_i + e_{ch} + e_{rh} + e_{cl} + e_{rm}$ | (5) |
| L _{rl} | = | $k_1V_1 + k_2V_2 + + k_nV_n + e_i + e_{ch} + e_{rh} + e_{cl} + e_{rm} + e_{rl}$ | (6) |

where:

- $L_i = 1$ if grid cell from suitability grid allocated to industrial, zero otherwise.
- $L_{ch} = 1$ if grid cell from suitability grid allocated to commercial high density, zero otherwise.
- $L_{rh} = 1$ if grid cell from suitability grid allocated to residential high density, zero otherwise.
- $L_{cl} = 1$ if grid cell from suitability grid allocated to commercial low density, zero otherwise.
- $L_{rm} = 1$ if grid cell from suitability grid allocated to residential medium density, zero otherwise.

- L_{rl} = 1 if grid cell from suitability grid allocated to residential low density, zero otherwise.
- $V_i = 1$ if grid cell within buffer area for variable i, zero otherwise. Please note that the GIS variable selected and associated buffer size for a given V_i varies from land use type to land use type.

 $k_i = \text{weight in the attractiveness/discouragement composite grid associated with variable i.}$ $e_i , e_{ch} , e_{rh} , e_{cl} , e_{rm} , e_{rl} = \text{the error terms associated with industrial, commercial high, residential high, commercial low, residential medium, and residential low density land uses, respectively.}$

It is immediately apparent the error terms in equations 1 through 6 resemble a triangle, hence the term Triangulated Error Structure. This structure has significant advantages from a model calibration standpoint; when preceding recursively down the list, each equation can be calibrated individually. The error terms from the previous equations are introduced into the current equation by deducting the grids allocated to higher land uses from the Suitability Grid.

It is interesting to note that the binary structure of the grid cell allocation variables (L) is consistent with discrete choice theory and maximum likelihood calibration methods. The land use allocation methods and simultaneous equation error structure prohibits the use of usual public transit logit calibration methods. In future work, it may be possible to incorporate more sophisticated statistical methods into the calibration process.

D. Parameter Estimation Methodology

The calibration of the model was done in two stages. First the generalized model that applies to all counties was developed; and then in a second step, the MCD specific attraction/discouragements were calibrated for each county to reduce the magnitude of significant MCD level errors in the output of the generalized model. For the generalized model, the GIS variables to be included in the attractiveness grid for each land use category were selected and the associated buffer distances and weights set for each variable. Initially, the generalized model was calibrated with Mercer and Chester county data. These two counties taken together provide a range of land use types and new footprint distributions characteristic of the entire DVRPC Region. Mercer County contains a mixture of urban decline, older suburban, and new development, while Chester County's land use changes are dominated by its new footprint development in formerly agricultural and rural areas.

The initial selection and settings of the generalized variables were taken from UPlan experience in California. The land use allocations and associated population and employment growths from the initial run were analyzed at the MCD level. Associations were made between UPlan model mis-allocations and errors and GIS transportation and land use data overlays. The GIS land use data was used to evaluate the broad distributions of industrial, commercial, and residential allocations. MCD level Census population and employment growths provided guidance on the reasonableness of allocated mixtures of high and low density land uses. That is, underestimated population or employment implies the need for more high density development and also the converse.

This was a time consuming process, involving significant amount of judgement. Many trial runs of the model were required. Once the generalized model was optimized for Mercer and Chester counties, trial runs were made for the six remaining counties and the required adjustments to the generalized model implemented.

The final step was to set the MCD specific attraction and discouragement weights to eliminate large MCD level errors in land use allocations and simulated population and employment growth. This analysis was done separately for each county again using trial and error methods. In general, the object was to attain an acceptable calibration while minimizing the number and magnitude of these MCD specific attraction adjustments.

E. Generalized Model Variable Selections and Coefficients

Table 2 presents the GIS variables selected for each land use type in the generalized model. The exact buffer and weight settings are given in **Table 3** (page 22). As one might expect, highway ramps, major arterials, and minor arterials are attractive to most commercial and residential land use types. Other transportation facilities such as collector roadways, rail stations and bus lines are attractive primarily to residential land uses, as are areas with low and medium highway congestion. These attractions are applied to all counties with identical distance buffers and weights.

Highway congestion level is calculated as an average value over four square kilometer. Grids within areas having an average volume-capacity ratio (V/C ratio) smaller than 0.39 are classified as low congestion areas, and those grids whose V/C ratio is between 0.39 and 0.65 are classified as medium congestion areas and over 0.65 as high congestion. Another significant attraction is census blocks with net population growth between 1990 and 2000. This attraction is only applied to residential land uses in order to encourage homogeneous development patterns (clustering) by in-filling open spaces in existing developed areas with similar types of development. Existing 1990 developed areas for a given land use also functions as an attraction for new footprint industrial development. Similarly, commercial and high, medium, and low density residential developments tend to cluster together to form contiguous areas of similar development. *Figure* 7 (Page 23) illustrates the composite medium density residential attractiveness.

| Attractions | | | | |
|--------------------------------------|-------------------------|--|--|--|
| Variable | Attractive to | | | |
| Freeway Ramps | IND, CH, CL, RH, RM | | | |
| Major arterials | IND, CH, CL, RH, RM, RL | | | |
| Minor arterials | CH, CL, RH, RM, RL | | | |
| Collectors | RM, RL | | | |
| Bus lines | RH, RM | | | |
| Rail stations | RH, RM | | | |
| Low congestion area | RH, RM, RL | | | |
| Medium congestion area | RH, RM, RL | | | |
| Census blocks with population growth | RH, RM | | | |
| 1990 Industrial | IND | | | |
| 1990 Commercial | CH, CL | | | |
| 1990 High density residential | RH | | | |
| 1990 single family residential | RM, RL | | | |
| | | | | |
| Discour | agements | | | |
| Variable | Detractive to | | | |
| High congestion area | RM | | | |

Table 2. Attractions and Discouragements for Industrial, Residential, and Commercial Development

Note: IND = Industry, CH = Commercial high density, CL = Commercial Low density, RH = Residential High density, RM = Residential Medium density, RL = Residential Low density.

Very low density residential is modeled as a residual after all other land uses are allocated. As opposed to attractions, discouragements reduce the allocation of new footprint development. There is only one discouragement in the generalized model. High congested areas (highway V/C ratios greater than 0.65) discourage new medium density residential development.

F. MCD Specific Parameter Settings

The MCD population and employment growths associated with the new footprint development allocations prepared by the generalized model do not always match population and employment differences between 1990 and 2000 recorded by the Census. Special attraction and discouragement coefficients are needed for some MCDs to produce adequate accuracy from the UPlan calibration. Attractions have positive coefficients and discouragements negative coefficient values. They have only one buffer, and the buffer distance is 0, restricting the area of influence to the exact MCD boundary. These MCD coefficients are set individually for each

| | npul | strial | Commer | rcial High | Comme | cial Low | Residen | tial High | Residentia | al Medium | Residen | tial Low |
|---|---------------------|----------|---------------------|------------|-------------------------|----------------|-----------------------|----------------|----------------------------------|-----------|---------------------|----------|
| Variable | Burrer Size (Ft) | Weight | Burrer Size (Ft) | Weight | Burrer Size (Ft) | Weight | Burrer Size (Ft) | Weight | Burrer Size (Ft) | Weight | Burrer Size (Ft) | Weight |
| Freeway Ramps Major Arterials Minor Arterials Collectors | 1,000 1,000 | 15 15 | 3,000 1,000 | 15 10 | 3,000 3,000 1,500 | 15 15 10 | 1,500 1,000 800 | 15 10 10 | 3,000 3,000 1,000 1,000 | 0 0 0 0 | 3,000 3,000 | 0 0 |
| Bus Lines Bus Lines | | | | | | | 400 800 | 10 6 | 400 800 | 10 6 | | |
| Rail Stations Rail Stations | | | | | | | 400 800 | 10 6 | 400 800 | 10 6 | | |
| Low Congestion Area Medium Congestion Area High Congestion Area | | | | | | | 0 0 | N QI | 000 | ν Ω | 0 | ъ 2 |
| Census Blocks with Population Growth | | | | | | | | | 0 | 30 | | |
| 1990 Industrial 1990 Commercial | 1,500 | 50 | 3,000 | 40 | 3,000 | 40 | | | | | | |
| 1990 High Density Residential | | | | | | | 1,000 | 40 | | | | |
| 1990 Single Family Residential | | | | | | | | | 3,000 | 50 | 500 | 0 |

Table 3. GIS Variable Buffer Size in Feet and Weight





land use type. They are potentially very numerous consisting of up $2,106(351 \times 6)$ individual coefficients. The MCD attraction adjustments were set by trial and error through trial runs of the UPlan model. The effect of the MCD correction coefficients is included in *tables 12-13* Chapter IV (page 44) which present the MCD calibration results for each county. It is possible to fine tune these factors to get the UPlan forecast very close to the actual 2000 Census data, although accuracy is limited by the growth areas identified in the 1990 and 2000 land use inventories. The extent of these growth areas may not exactly match the population and employment changes recorded by the Census. This is especially true for employment because the Census data are based on a one in six sample and expansion factors are needed to expand to the statistical universe and to convert primary work trip destinations to total employment at the place of work (to account for part time positions, second jobs, sick days, vacations, etc). Both the 1990 and 2000 employment estimates contain sampling error, particularly for MCDs with small employment totals. Also, the MCD attraction coefficients are interrelated. Changes in one MCD's coefficient for a given land use modifies the outputs for all MCD's land use allocations in the county, not just the MCD and land use category under revision. The MCD factors must be set jointly. This requires a large number of calibration runs.

Overuse of these factors may be suspect for long range forecasts because of changing MCD land use policies and other circumstances. UPlan implicitly assumes that land use patterns are in economic equilibrium with the supporting transportation infrastructure. This equilibrium evolves over time as land uses adjust in response to changes in the transportation system, and also, economic and regulatory factors. Equilibrium may never be completely achieved. In the tables that follow, only the worst discrepancies are corrected. We assume that the policies and anomalies that required MCD attraction adjustments will persist at roughly the same levels into the future.

For purposes of estimating the attraction coefficient matrices, maximum allowable errors for both population and employment allocations were 1,000 persons/employees MCDs with base year population or employment totals less than 10,000 or 10 percent of the total for MCDs with base year totals greater than 10,000. This is good accuracy for a land use model and reflects a reasonable compromise between calibration accuracy and model stability. Econometric land use models cannot even reach the MCD level of geographic specificity, let alone forecast MCD growth to this level of accuracy. *Figure 8* displays the detailed UPlan development allocations from the calibrated model, for the same area shown in *figures 5 through 7*. A comparison with the clipped areas shown in *Figure 6* (page 17) shows that the UPlan land use allocations are not perfect, but the model output has a strong tendency to follow the development patterns identified in the Land Use Inventories. The scale of this map is rather fine; the individual UPlan grid cells are 50 meters (150 feet) on a side. At this scale, developer preferences and land market factors (demand, supply, cost, availability, zoning issues, etc.) can strongly



influence the location, timing, and type of land use development in ways not directly considered by the allocation model.

Tables 4 through 7 present the MCD attraction correction coefficients developed as part of the UPlan calibration for Bucks, Chester, Delaware, and Montgomery counties in Pennsylvania and in *tables 8 through 11* for Burlington, Camden, Gloucester, and Mercer counties in New Jersey, respectively. As noted previously, Philadelphia and most older urban areas in the suburbs are not included in the calibration because the land area of these area were almost completely built over in 1990 and most changes in population and employment between 1990 and 2000 were declines. The generalized model described above is also applicable to existing urban areas, but UPlan can be applied within the context of urban renewal planning which assembles growth areas for new footprint development.

As shown in *Table 4* (pages 27 and 28), the correction coefficient matrix for Bucks County is largely empty (72.3 percent zero). This is desirable because it shows that the generalized regional model is for the most part able to produce acceptable results. The non-zero coefficients are concentrated in the commercial high density and medium density residential columns. Both of these columns have significant numbers of negative and positive values. This indicates MCD level aberrations from the regional norms, but little countywide bias in the UPlan generalized model.

The coefficient matrix for Chester County (see *Table 5* pages 29 and 30), is also largely empty (69.4 percent), with the non-zero values concentrated in the commercial low and residential low density categories. Both columns contain positive and negative values, although there may be some tendency to promote low density commercial and discourage low density residential. Delaware County's correction matrix is shown in *Table 6* (pages 31 and 32). This matrix appears irrational at first glance, because almost all cells contain negative values -- for the most part -150. The purpose of these factors is to concentrate new footprint development in the few MCD's that experienced net population and employment growth between 1990 and 2000. As was pointed out in the technical memo documenting tests of the California Version of UPlan with DVRPC data¹, Delaware County was largely developed by 1990, and is declining in many areas, particularly in the eastern part of the County. UPlan can be used to forecast new footprint development in the western portion of the county that still has significant open space and new footprint development potential. UPlan is of limited use for the remainder of Delaware County, except as part of urban renewal planning.

¹ Gao, Shengyi, and Johnston, Robert A, <u>Testing of the Merced County California</u> <u>Version of UPlan with DVRPC Data</u>, Department of Environmental Science and Policy, University of California, Davis

| Municipality | IND | СН | CL | RH | RM | RL |
|----------------------------|-----|-----|----|-----|-----|----|
| Bedminster Township | | 20 | | -40 | -50 | |
| Bensalem Township | | 13 | | | 6 | |
| Bridgeton Township | | | | | -20 | |
| Bristol Borough | | -60 | | | -26 | |
| Bristol Township | | -50 | | | -42 | |
| Buckingham Township | | 19 | | | 15 | |
| Chalfont Borough | -60 | -40 | | | 15 | |
| Doylestown Borough | | -80 | | | -49 | |
| Doylestown Township | | 13 | | | | |
| Dublin Borough | | | | | -15 | |
| Durham Township | | | | | -12 | |
| East Rockhill Township | | 13 | | | | |
| Falls Township | -60 | -5 | | -40 | -55 | |
| Haycock Township | | 14 | | | -22 | |
| Hilltown Township | | 15 | | | -24 | |
| Hulmeville Borough | | | | | | |
| Ivyland Borough | | | | | | |
| Langhorne Borough | | | | 23 | | |
| Langhorne Manor Borough | | 16 | | | | |
| Lower Makefield Township | | 20 | 50 | 30 | | |
| Lower Southampton Township | | | | | 50 | |
| Middletown Township | | | | | -21 | |
| Milford Township | | | | | 11 | |
| Morrisville Borough | | -40 | | | 20 | |
| New Britain Borough | | 20 | | | 20 | |
| New Britain Township | | 15 | | | 1 | |
| New Hope Borough | | -40 | | | | |
| Newtown Borough | | | | | | |
| Newtown Township | | 15 | | | 10 | |
| Nockamixon Township | | 15 | | | 25 | |
| Northampton Township | | 11 | | | -14 | |
| Penndel Borough | | 12 | | | | |
| Perkasie Borough | | | | | 5 | |
| Plumstead Township | | 17 | | | | |
| Quakertown Borough | | -50 | | | -40 | |
| Richland Township | | 15 | | | -5 | |
| Richlandtown Borough | | | | | | |
| Sellersville Borough | | | | | | |
| Silverdale Borough | | | | | | |
| Solebury Township | | 23 | | -15 | -14 | |
| Springfield Township | | 22 | | | -50 | |
| Telford Borough | | 31 | | | 28 | |
| Tinicum Township | | 13 | | -40 | -35 | |
| Trumbauersville Borough | | | | | | |

Table 4. Municipality Calibration Factors for Bucks County
(Attractors Positive, Discouragements Negative)

| Municipality | IND | СН | CL | RH | RM | RL |
|----------------------------|-----|-----|----|-----|-----|----|
| Tullytown Borough | | 12 | | | | |
| Upper Makefield Township | | 15 | | -5 | -21 | |
| Upper Southampton Township | | 35 | | | -40 | |
| Warminster Township | | -60 | | -50 | -50 | |
| Warrington Township | | | 50 | 30 | 18 | |
| Warwick Township | | 23 | 50 | 30 | 30 | |
| West Rockhill Township | | 23 | | | -50 | |
| Wrightstown Township | | 3 | | -20 | -21 | |
| Yardley Borough | | | | | | |

Table 4. Municipality Calibration Factors for Bucks County (Attractors Positive, Discouragements Negative) (Continued)

Note: IND = Industry, CH = Commercial High density, CL = Commercial Low density, RH = Residential High density, RM = Residential Medium density, RL = Residential Low density

| Municipality | IND | СН | CL | RH | RM | RL |
|---------------------------|-----|----|-----|-----|----|--------|
| Atglen Borough | | | | | | |
| Avondale Borough | | | | | | |
| Birmingham Township | | | | | | |
| Caln Township | | | | | | -10 |
| Charlestown Township | 50 | | | | | |
| Coatesville City | | | | -50 | | |
| Downingtown Borough | | | | | | |
| East Bradford Township | | | | 30 | | |
| East Brandywine Township | | | | | | |
| East Caln Township | 10 | 30 | | | | |
| East Coventry Township | | | | | | -10 |
| East Fallowfield Township | | | | | | |
| East Goshen Township | | | | | | 15 |
| East Marlborough Township | | | -15 | | | |
| East Nantmeal Township | | | | | | |
| East Nottingham Township | | | | | | |
| East Pikeland Township | | | | | | |
| Easttown Township | | | | -20 | | -15 |
| East Vincent Township | | | 55 | | | |
| East Whiteland Township | | 30 | 65 | | | 20 |
| Elk Township | | | | | | -10 |
| Elverson Borough | | | 38 | | | |
| Franklin Township | | | | | | -60 |
| Highland Township | | | | | | -35 |
| Honey Brook Borough | | | | | | -10 |
| Honey Brook Bownship | | | | | | |
| Kennett Township | | | | | 30 | |
| Kennett Square Borough | | | | | | |
| London Britain Township | | | | | | |
| Londonderry Township | | | | | | |
| London Grove Township | | | | | | |
| Lower Oxford Township | | | | | | |
| Malvern Borough | | | -50 | | | 55 |
| Modena Borough | | | | | | 20 |
| New Garden Township | | 30 | 50 | 2 | 30 | 10 |
| Newlin Township | | | | | | -8 |
| New London Township | | | | | | 30 |
| North Coventry Township | | | 10 | | | -13 |
| Oxford Borough | | | -50 | | | 25/-45 |
| Parkesburg Borough | | | -5 | | | 70 |
| Penn Township | | 30 | | | | -20 |
| Pennsbury Township | | | | | | -50 |
| Phoenixville Borough | | | -10 | | | |
| Pocopson Township | | | | | | -7 |

Table 5. Municipality Calibration Factors for Chester County
(Attractors Positive, Discouragements Negative)

| Municipality | IND | СН | CL | RH | RM | RL |
|---------------------------|-----|----|-----|-----|----|-----|
| Sadsbury Township | | | -50 | | | |
| Schuylkill Township | | | | | | |
| South Coatesville Borough | | | | | | |
| South Coventry Township | | | | | | -25 |
| Spring City Borough | | | | | | |
| Thornbury Township | | | | | 30 | 10 |
| Tredyffrin Township | | 30 | 10 | | | -20 |
| Upper Oxford Township | | | -20 | | | |
| Upper Uwchlan Township | | 30 | 23 | 30 | 30 | 5 |
| Uwchlan Township | | | 50 | | | 10 |
| Valley Township | | | 45 | 30 | | 10 |
| Wallace Township | | | | | | -8 |
| Warwick Township | | | | | | |
| West Bradford Township | | | -15 | | | -10 |
| West Brandywine Township | | | -8 | -50 | | |
| West Caln Township | | | | | | |
| West Chester Borough | | | | | | |
| West Fallowfield Township | | | | | | |
| West Goshen Township | | 50 | 50 | | | 15 |
| West Grove Borough | | | | 30 | | 55 |
| West Marlborough Township | | | | | | -15 |
| West Nantmeal Township | | | | | | -7 |
| West Nottingham Township | | | | | | |
| West Pikeland Township | | | -80 | | | |
| West Sadsbury Township | | | | | | |
| Westtown Township | | | | | | -60 |
| West Vincent Township | | | -20 | | | |
| West Whiteland Township | | 30 | 45 | 30 | 30 | 15 |
| Willistown Township | | | -50 | | | -35 |

Table 5. Municipality Calibration Factors for Chester County(Attractors Positive, Discouragements Negative)(Continued)

Note: IND = Industry, CH = Commercial High density, CL = Commercial Low density, RH = Residential High density, RM = Residential Medium density, RL = Residential Low density
| Municipality | IND | СН | CL | RH | RM | RL |
|----------------------------|-----|-------|------|------|------|------|
| Aldan Borough | | -150 | -150 | -150 | -150 | -150 |
| Aston Township | | 100 | 100 | -10 | 100 | 100 |
| Bethel Township | | | | -10 | | |
| Brookhaven Borough | | | -150 | | -150 | -150 |
| Chadds Ford Township | | -150 | | -150 | -30 | -20 |
| Chester City | | -150 | -150 | -150 | -150 | -150 |
| Chester Heights Borough | | -150 | | -150 | -10 | |
| Chester Township | | | -150 | -5 | -150 | -160 |
| Clifton Heights Borough | | -150 | -150 | -150 | -150 | -150 |
| Collingdale Borough | | -150 | -150 | -150 | -150 | -150 |
| Colwyn Borough | | -150 | -150 | -150 | -150 | -150 |
| Concord Township | | | | -5 | | |
| Darby Borough | | | -150 | | -150 | -150 |
| Darby Township | | | -150 | -5 | -150 | -150 |
| East Lansdowne Borough | | -150 | -150 | -150 | -150 | -150 |
| Eddystone Borough | | -150 | -150 | -150 | -150 | -150 |
| Edgmont Township | | | | | | |
| Folcroft Borough | | -150 | -150 | -150 | -150 | -150 |
| Glenolden Borough | | -150 | | -150 | | |
| Haverford Township | | -150 | -150 | -150 | -150 | -150 |
| Lansdowne Borough | | -150 | -150 | -150 | -150 | -150 |
| Lower Chichester Township | | | -150 | -20 | -150 | -150 |
| Marcus Hook Borough | | -150 | -150 | -150 | -150 | -150 |
| Marple Township | | | | | | |
| Media Borough | | -150 | -150 | -150 | -150 | -150 |
| Middletown Township | | | | -5 | | |
| Millbourne Borough | | -150 | | -150 | | |
| Morton Borough | | -150 | -150 | -150 | -150 | -150 |
| Nether Providence Township | | -150 | | -150 | | |
| Newtown Township | | . – . | | | | |
| Norwood Borough | | -150 | -150 | -150 | -150 | -150 |
| Parkside Borough | | | -150 | | -150 | -150 |
| Prospect Park Borough | | 450 | -150 | 450 | -150 | -150 |
| Radnor Township | | -150 | 450 | -150 | 450 | 15 |
| Ridley Park Borough | | -150 | -150 | -150 | -150 | -150 |
| Ridley Township | | -150 | -150 | -150 | -150 | -150 |
| Rose Valley Borough | | 150 | -150 | 150 | -150 | -150 |
| Rulleage Borougn | | -150 | 150 | -150 | 150 | 150 |
| | | | -150 | 10 | -150 | -150 |
| Swarthmore Borough | | | -150 | | -150 | -150 |
| Thorphury Township | | | | -10 | -10 | -10 |
| Tinicum Township | | | -150 | 10 | -150 | -150 |
| Trainer Borough | | | -150 | 10 | -150 | -150 |
| Hand Dorough | | | 100 | | 100 | 100 |

Table 6. Municipality Calibration Factors for Delaware County(Attractors Positive, Discouragements Negative)

Table 6. Municipality Calibration Factors for Delaware County(Attractors Positive, Discouragements Negative)(Continued)

| Municipality | IND | СН | CL | RH | RM | RL |
|---------------------------|-----|------|------|------|------|------|
| Upland Borough | | | -150 | | -150 | -150 |
| Upper Chichester Township | | | | | | |
| Upper Darby Township | | | | | | |
| Upper Providence Township | | | | | | |
| Yeadon Borough | | -150 | -150 | -150 | -150 | -150 |

Note: IND = Industry, CH = Commercial High density, CL = Commercial Low density, RH = Residential High density, RM = Residential Medium density, RL = Residential Low density

Like Chester County, Montgomery and Burlington counties have predominately empty (71.8 and 71.7 percent) correction coefficient matrices, see *Tables 7 and 8* (pages 34-36), with non-zero values concentrated in the low density commercial and residential columns, but in this case a preponderance of negative values tends to discourage both types of land use vis-a-vis the generalized model. Both counties are characterized by a mix of abandoned older industrial areas and suburban growth potential. Former industrial areas tend to redevelop at relatively high commercial and residential densities.

Camden County (*Table 9* page 37) has a relatively full (44.3 percent non-empty) correction matrix of predominately negative values. This is reminiscent of Delaware County, but not as extreme. Like Delaware County, Camden County is characterized by older developed areas, with most new footprint development occurring in the eastern end of the county, far from the urban core.

Gloucester County's correction matrix (*Table 10* page 38) is also largely negative, but in this case the effect is to discourage new footprint high density commercial and residential development versus the generalized model and also to discourage new development in older urban areas. This reflects predominant development patterns of the county which are concentrated in medium and low density land uses.

The attraction correction coefficient matrix for Mercer County given in (*Table 11* page 39) is also significantly filled with non-zero values (44.9 percent empty). However, these coefficients are, for the most part, relatively small and seem to be random except to discourage new footprint development in City of Trenton and to encourage new development in the greater Princeton and West Windsor Township areas.

In summary, the MCD attraction coefficient matrices carry significant unique information about the development history and prevailing patterns of new development of each of DVRPC's suburban counties into the UPlan model calibration. These factors are understandable and rational and may be assumed to remain constant into the future.

G. Use of Exclusion Masks

Masks specify places where development is not allowed. In this calibration, masks are unneeded because the Suitability Grid is limited to the portions of each county that developed between 1990 and 2000. Exclusion Masks such as water bodies, streams, environmental preservation areas, and the 2000 existing urban area footprint are valuable for the identification of potential growth areas when UPlan is used in the forecasting mode.

| Municipality | IND | СН | CL | RH | RM | RL |
|---------------------------|-----|-----|-----|-----|-----|-----|
| Abinaton Township | | -75 | | -70 | -70 | -75 |
| Ambler Borough | | | | | -70 | -80 |
| Bridgeport Borough | | | | | | |
| Bryn Athyn Borough | | | | | | |
| Cheltenham Township | | -80 | -70 | | | 3 |
| Collegeville Borough | | | 5 | | | |
| Conshohocken Borough | | | 13 | | | |
| Douglass Township | | | -20 | | | 5 |
| East Greenville Borough | | | -65 | | | -10 |
| East Norriton Township | | | -65 | -70 | -70 | -20 |
| Franconia Township | | | -3 | | | |
| Green Lane Borough | | | 9 | | | |
| Hatboro Borough | | | 11 | | | |
| Hatfield Borough | | | -70 | | | -10 |
| Hatfield Township | | -70 | -70 | | | -8 |
| Horsham Township | | | 6 | | | -4 |
| Jenkintown Borough | | | 9 | | | -20 |
| Lansdale Borough | | | 5 | | | -40 |
| Limerick Township | | | -8 | | -5 | |
| Lower Frederick Township | | | 3 | | | |
| Lower Gwynedd Township | | | -14 | | | -14 |
| Lower Merion Township | | -70 | -70 | | | -2 |
| Lower Moreland Township | | -80 | -70 | | -50 | -70 |
| Lower Pottsgrove Township | | | 5 | | | 5 |
| Lower Providence Township | | | -8 | | | |
| Lower Salford Township | | | 5 | | -5 | -8 |
| Marlborough Township | | | | | | -65 |
| Montgomery Township | | | -3 | | | 10 |
| Narberth Borough | | | | | | |
| New Hanover Township | | | -3 | | | |
| Norristown Borough | | | -70 | | | |
| North Wales Borough | | | 15 | | | -20 |
| Pennsburg Borough | | | _ | | | |
| Perkiomen Township | | | 9 | | | 12 |
| Plymouth Township | | | 3 | -70 | | -20 |
| Pottstown Borough | | | -70 | | | -15 |
| Red Hill Borough | | | | | | |
| Rockledge Borough | | | _ | | 05 | -65 |
| Royersford Borough | | | 5 | | -65 | |
| Salford Township | | | | | | 0 |
| Schwenksville Borough | | | 0 | | 40 | 6 |
| Skippack Township | | | 9 | | -10 | -5 |
| Souderton Borougn | | 70 | -70 | 70 | 70 | 9 |
| Springtiela Lownship | | -70 | -70 | -70 | -70 | |

Table 7. Municipality Calibration Factors for Montgomery County (Attractors Positive, Discouragements Negative)

Table 7. Municipality Calibration Factors for Montgomery County (Attractors Positive, Discouragements Negative) (Continued)

| Municipality | IND | СН | CL | RH | RM | RL |
|---------------------------|-----|-----|-----|-----|-----|-----|
| Telford Borough | | | -70 | | | -20 |
| Towamencin Township | | | 8 | | | |
| Trappe Borough | | | | | | -5 |
| Upper Dublin Township | | -80 | -70 | | | -6 |
| Upper Frederick Township | | | | | | |
| Upper Gwynedd Township | | | 8 | | | |
| Upper Hanover Township | | | 8 | | | -5 |
| Upper Merion Township | | | 10 | | | |
| Upper Moreland Township | | | | -70 | -70 | -45 |
| Upper Pottsgrove Township | | | 17 | | | |
| Upper Providence Township | | 12 | 12 | -5 | | |
| Upper Salford Township | | | | | | |
| West Conshohocken Borough | | | 5 | | | |
| West Norriton Township | | | | | | -3 |
| West Pottsgrove Township | | | | | | -20 |
| Whitemarsh Township | | | 8 | | | |
| Whitpain Township | | | 5 | | | -8 |
| Worcester Township | | | 8 | | | -5 |

Note: IND = Industry, CH = Commercial High density, CL = Commercial Low density, RH = Residential High density, RM = Residential Medium density, RL = Residential Low density

| Municipality | IND | СН | CL | RH | RM | RL |
|-------------------------|-----|-----|--------|----|-----|-----|
| Bass River Township | | -70 | -3 | | | |
| Beverly City | | | | | | -70 |
| Bordentown City | | | -70 | | -70 | -70 |
| Bordentown Township | | -70 | | | | 4 |
| Burlington City | | | | | -70 | -70 |
| Burlington Township | | | -5 | 10 | 10 | 10 |
| Chesterfield Township | | | -70 | | | |
| Cinnaminson Township | | | 0 | | | -10 |
| Delanco Township | | | 15 | | | |
| Delran Township | | | 0 | | | 34 |
| Eastampton I ownship | | | | | | 4 |
| Edgewater Park Township | 4.0 | 4.0 | -70 | 40 | -70 | -70 |
| Evesham Township | 10 | 10 | 5 | 10 | 10 | 15 |
| Fieldsboro Borough | | | 70 | | | |
| Florence Township | | | -70 | | | -4 |
| Hainesport Township | | | 3 | | 10 | 3 |
| Lumberton Township | | | 3 | | 10 | 13 |
| Manla Shada Tawashin | | | ۲ ۲ | | | 10 |
| Modford Lakos Borough | | | -15 | | | -10 |
| Medford Township | | | -70 | | | -70 |
| Moorestown Township | | | 2 | | | -05 |
| Mount Holly Township | | | -70 | | | 0 |
| Mount Laurel Township | 10 | 10 | 1 | 10 | 10 | 12 |
| New Hanover Township | | -70 | -70 | | | |
| North Hanover Township | | Ē | | | -70 | -70 |
| Palmyra Borough | | | -70 | | | |
| Pemberton Borough | | | | | | |
| Pemberton Township | | | 10 | | | -70 |
| Riverside Township | | | -70 | | | |
| Riverton Borough | | | | | | |
| Shamong Township | | | | | | -2 |
| Southampton Township | | | | | | -2 |
| Springfield Township | | | | | | -2 |
| Tabernacle Township | | | | | | -40 |
| Washington Township | | | 30 | | | |
| Westampton Township | | | | | | |
| Willingboro Township | | -70 | -70 | | -70 | -70 |
| Woodland Township | | | | | | -70 |
| Wrightstown Borough | | | 55 | | | -70 |

Table 8. Municipality Calibration Factors for Burlington County(Attractors Positive, Discouragements Negative)

Note: IND = Industry, CH = Commercial High density, CL = Commercial Low density, RH = Residential High density, RM = Residential Medium density, RL = Residential Low density

| Municipality | IND | СН | CL | RH | RM | RL |
|------------------------|-----|-----|-----|-----|-----|-----|
| Audubon Borough | | -30 | -90 | | | |
| Audubon Park Borough | | | | | | -50 |
| Barrington Borough | | | -30 | | | |
| Bellmawr Borough | | | -9 | -30 | -70 | -70 |
| Berlin Borough | | -30 | -43 | | | -3 |
| Berlin Township | | | 5 | | | -30 |
| Brooklawn Borough | | | | | | 6 |
| Camden City | | | | -30 | -70 | -70 |
| Cherry Hill Township | | -30 | -60 | -60 | -20 | -5 |
| Chesilhurst Borough | | | | | | -40 |
| Clementon Borough | | | | -30 | -70 | -70 |
| Collingswood Borough | | | | -30 | -70 | -72 |
| Gibbsboro Borough | | -30 | -60 | | | -8 |
| Gloucester City City | | | -10 | -30 | -70 | -70 |
| Gloucester Township | | | -12 | | | |
| Haddon Heights Borough | | | | -30 | -70 | -70 |
| Haddon Township | | | -60 | | | -20 |
| Haddonfield Borough | | -30 | -60 | | | |
| Hi-Nella Borough | | | | | | |
| Laurel Springs Borough | | | | -30 | -70 | -70 |
| Lawnside Borough | | | -10 | | | -40 |
| Lindenwold Borough | | | 6 | -30 | -70 | -70 |
| Magnolia Borough | | | -20 | -30 | -70 | -70 |
| Merchantville Borough | | | | -30 | -70 | -70 |
| Mount Ephraim Borough | | -30 | -90 | | | -10 |
| Oaklyn Borough | | -30 | -60 | -30 | -70 | -70 |
| Pennsauken Township | | -30 | -60 | | | |
| Pine Hill Borough | | | 5 | | | |
| Runnemede Borough | | | | -30 | -70 | -70 |
| Somerdale Borough | | -30 | -60 | -30 | -70 | -70 |
| Stratford Borough | | -30 | -60 | -30 | -70 | -70 |
| Voorhees Township | | | 5 | | 4 | 4 |
| Waterford Township | | | | -30 | -70 | -70 |
| Winslow Township | | | -18 | | | -15 |
| Woodlynne Borough | | | | | | 9 |

Table 9. Municipality Calibration Factors for Camden County(Attractors Positive, Discouragements Negative)

Note: IND = Industry, CH = Commercial High density, CL = Commercial Low density, RH = Residential High density, RM = Residential Medium density, RL = Residential Low density

| Municipality | IND | СН | CL | RH | RM | RL |
|--------------------------|-----|-----|-----|-----|-----|-----|
| Clayton Borough | | -80 | -80 | -80 | | -70 |
| Deptford Township | | | -5 | | | |
| East Greenwich Township | | -80 | -30 | | -12 | -5 |
| Elk Township | | -80 | | -80 | -70 | -20 |
| Franklin Township | | -80 | -2 | -80 | -8 | -2 |
| Glassboro Borough | | -80 | -80 | -80 | -2 | 2 |
| Greenwich Township | | -80 | -30 | | -70 | |
| Harrison Township | | -80 | | -80 | | -4 |
| Logan Township | | -80 | 3 | 20 | -13 | -5 |
| Mantua Township | | -80 | -70 | -80 | 4 | 6 |
| Monroe Township | | -80 | 15 | -80 | | |
| National Park Borough | | -80 | | -80 | -70 | -70 |
| Newfield Borough | | -80 | -80 | -80 | -70 | |
| Paulsboro Borough | | -80 | -80 | -80 | -70 | -70 |
| Pitman Borough | | -80 | -80 | -80 | | |
| South Harrison Township | | -80 | 15 | -80 | | -2 |
| Swedesboro Borough | | -80 | 27 | -80 | | |
| Washington Township | | | | -80 | | |
| Wenonah Borough | | -80 | | -80 | | |
| West Deptford Township | | -80 | 3 | | -60 | |
| Westville Borough | | -80 | -80 | -80 | -70 | -70 |
| Woodbury City | | -80 | | -80 | | -70 |
| Woodbury Heights Borough | | -80 | -80 | -80 | | |
| Woolwich Township | | -80 | | -80 | -10 | |

Table 10. Municipality Calibration Factors for Gloucester County (Attractors Positive, Discouragements Negative)

Note: IND = Industry, CH = Commercial High density, CL = Commercial Low density, RH = Residential High density, RM = Residential Medium density, RL = Residential Low density

| Municipality | IND | СН | CL | RH | RM | RL |
|-----------------------|-----|-----|-----|-----|----|-----|
| East Windsor Township | | -20 | -30 | 40 | 30 | |
| Ewing Township | | -30 | -30 | | 30 | |
| Hamilton Township | | 23 | 15 | -30 | | -15 |
| Hightstown Borough | | -20 | | | | |
| Hopewell Borough | | | 40 | -20 | | 15 |
| Hopewell Township | | | 40 | -20 | | 15 |
| Lawrence Township | | -50 | -10 | | 25 | 5 |
| Pennington Borough | | 15 | 10 | | | |
| Princeton Borough | | 32 | 40 | 40 | 40 | 20 |
| Princeton Township | | 32 | 40 | 40 | 40 | 20 |
| Trenton City | | -40 | -10 | | | -50 |
| Washington Township | | | 40 | | 30 | |
| West Windsor Township | | 30 | 33 | 40 | 25 | |

Table 11. Municipality Calibration Factors for Mercer County
(Attractors Positive, Discouragements Negative)

Note: IND = Industry, CH = Commercial High density, CL = Commercial Low density, RH = Residential High density, RM = Residential Medium density, RL = Residential Low density

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IV. COUNTY AND MCD LEVEL CALIBRATION RESULTS

This section presents the accuracy of UPlan for each DVRPC county by comparing the UPlan predicted allocation with the actual population growth and employment growth recorded by the 2000 Census for each MCD within the county. These predicted 2000 populations and employments were calculated from the detailed grid-level land use growth allocations prepared by the final UPlan county-level model runs. In the current configuration, UPlan allocations are limited to new footprint land use development. MCDs with negative growth (that is declines) in population and employment are assumed to have no new footprint residential or employment development. For this reason, the sum of positive MCD population and employment changes for each county were allocated by the UPlan model. This is not strictly true, as some declining MCDs have newly developed areas in the 2000 Land Use Inventory and a corresponding UPlan allocation, but these new growth areas tend to be small and relatively insignificant compared to the MCD totals.

This leads to a special consideration that is needed to properly interpret calibration statistics. For purposes of calculating UPlan error statistics, zero population and employment growth is considered perfect prediction for declining MCDs. This is slightly unfair to UPlan in the evaluation, as the allocations of new footprint growth areas within declining MCDs may very well be correct, but these "errors" are small. For purposes of estimating the attraction coefficient matrices, maximum allowable errors for both population and employment allocations were 1,000 persons/employees MCDs with base year population or employment totals less than 10,000 or 10 percent of the total for MCDs with base year totals greater than 10,000. This is good accuracy for a land use model and reflects a reasonable compromise between calibration accuracy and model stability.

A. Pennsylvania Counties

The UPlan Bucks County MCD population and employment allocation errors are given in appendix *tables A-1 and A-2*, respectively. Of the 53 Bucks County municipalities only six --Buckingham (12.5 percent), Hilltown (-12.0 percent), New Britain (-1,096), Solebury (-1,159), Warrington (15.0 percent), and Warwick townships (23.5 percent) -- have errors that exceed the standard given above, and only Warwick by a significant margin. For employment, only two Bucks MCDs exceed the standard – Doylestown (-1,599) and West Rockhill (1,213) townships. These discrepancies are localized and should be addressable by further refinement of the MCD coefficients, if greater accuracy is required.

As shown in appendix *Table A-3*, Chester County has four of 73 MCDs out of standard for population: East Bradford (-1,655), New Garden (1,927), Westtown (24.4 percent), and West Whiteland (19.0 percent) townships. Five Chester County MCDs (*Table A-4*) exceed the employment standard – North Coventry (1,366), Schuylkill (1,939), Tredyffrin (-14.4 percent), Uwchlan (-1,462), and Westtown townships (2,147). The UPlan employment allocation for

Schuylkill Township may be largely correct, as the 281 jobs lost between the 1990 and 2000 censuses may be the net difference of industrial/commercial abandonments and new developments. The problem in West Whiteland may be in the mix of high and low density residential and employment development and Westtown Township seems to have significant areas developed between 1990 and 2000 that are not reflected in the Census numbers.

There are no Delaware County MCDs that exceed the population standard, although the overall population increase and number of growth MCDs is small compared to the more rural counties of the region (appendix *Table A-5*). As shown in *Table A-6*, six of 49 Delaware County MCDs exceed the employment standard – Brookhaven Borough (-2,103), Edgmont (2,467), Middletown (18.6 percent), Newtown (1,865), Tinicum (-50.7 percent), and Upper Chichester (1,402) townships. The most significant employment error was in Tinicum Township where airport expansion increased employment through more intensive use of existing developed areas in ways not recorded in the land use inventory. Most of the other errors reflect mixes of abandonment and redevelopment of employment sites. These errors for the most part cannot be corrected by adjustments the MCD attractiveness coefficients.

Montgomery County's allocation error statistics are shown in appendix *Table A-7* for population and *Table A-8* for employment. Four of 62 MCD's exceed the population standard – Lower Gwynedd (14.1 percent), Perkiomen (-1,699), Upper Providence (-18.7 percent), and Worcester (22.4 percent) townships. Nine MCD's exceed the employment standard – Conshohocken (-1,264), Jenkintown (-1,240), and West Conshohocken (-1,188) boroughs, and Lower Gwynedd (1,484), Lower Pottsgrove (-1,122), Skippack (1,474), Towamencin (2,084), Upper Gwynedd (2,003), and Whitpain (2,356) townships. These Montgomery County error exceedences are marginal and may, if required, be reduced by refining the development density mixes that are produced by the Montgomery County MCD coefficient matrix.

B. New Jersey Counties

DVRPC's New Jersey counties generally had fewer MCDs with errors beyond the calibration standard than Pennsylvania. This results primarily from historical boundaries that have resulted in larger MCDs. The larger average MCD land areas and associated populations and employments in New Jersey made the MCD totals more statistically stable and easier to forecast.

The calibration results for Burlington County are given in appendix *Table A-9* for population and *Table A-10* for employment. There is only one Burlington County MCD with a population allocation beyond the standard – Mount Laurel Township with an error exceedence of -11.9 percent. Two Burlington County MCDs were beyond the employment standard; Westhampton Township (-27.2 percent) and Wrightstown Borough (-35.4 percent). Employment in

Wrightstown is largely military related and subject to policy fluctuations beyond market development effects.

Camden County had no MCDs with population errors beyond the standard (appendix *Table A-11*) and only one MCD with an employment standard violation (Winslow Township at 13.8 percent); see *Table A-12*. The Gloucester County results shown in appendix *tables A-13 and A-14* show similar accuracy with one MCD beyond the population standard; Glassboro Borough with -13.4 percent allocation error, and one MCD beyond the employment standard, Swedesboro Borough with -50.2 percent. The Glassboro error probably resulted from higher density housing associated with the expansion of Rowan University. Swedesboro might be improved with adjustments to the MCD calibration coefficients, although it is not clear what caused Swedesboro employment to double between 1990 and 2000.

Mercer County also had very few MCDs beyond the calibration standard (see appendix *tables A-15 and A-16*). One MCD population error – Princeton Borough (-2,151 or -15.1 percent) and one MCD employment allocation error – Washington Township at -28.7 percent exceeded the standard. The Princeton Borough error, probably resulted from expansion of Princeton University related high density housing.

C. Calibration Error Summary

Average absolute error statistics by county and for the Region are given for population in *Table 12* and employment in *Table 13*. Average absolute error differs from average error in that the sign of the MCD allocation error is ignored. This prevents negative and positive errors from canceling out and is therefore more representative of the degree of mis-allocation.

The average population errors at the MCD level are all less than 500 persons ranging from 199 in Delaware County to 483 in Montgomery County. Pennsylvania and New Jersey have average absolute errors in about the same range, however, the percentage errors are much smaller in the New Jersey counties (2.8 percent versus 5.3 percent), reflecting the larger average MCD population (fewer MCDs/county) in New Jersey. For the region as a whole, the UPlan average MCD allocation error is 367 persons or about 4.5 percent of the average MCD's population.

The range of MCD average absolute employment errors given in Table 13 is similar to the population errors -- 228 employees per MCD for Camden County to 554 employees in Mercer County. In percentage terms, the allocation error is higher because average MCD employment value is less than half of average MCD population. As in population, New Jersey percentage allocation errors are less than Pennsylvania's because of larger MCD employment totals (7.6 percent versus 13.3 percent). The higher percentage errors in the UPlan employment

allocations also reflect larger sampling errors in the actual MCD employment estimates. As noted previously, the population numbers are based on a 100 percent sample of households, while the MCD employment totals are estimated with a one in six sample.

| | Average Absolute | | | |
|------------------------|------------------|-------------|--|--|
| | | Percent | | |
| | | Diff. | | |
| County | Diff. | (2000 Pop.) | | |
| Bucks | 462 | 5.7% | | |
| Chester | 363 | 6.9% | | |
| Delaware | 119 | 1.7% | | |
| Montgomery | 483 | 6.0% | | |
| Sub-Total Pennsylvania | 367 | 5.3% | | |
| Burlington | 401 | 2.6% | | |
| Camden | 270 | 2.5% | | |
| Gloucester | 403 | 3.7% | | |
| Mercer | 358 | 2.6% | | |
| Sub-Total New Jersey | 356 | 2.8% | | |
| Regional Total | 360 | 4.5% | | |

Table 12. Average Absolute UPIan MCD PopulationAllocation Error by County

| Table 13. | Average Absolute UPIan MCD Employment |
|-----------|---------------------------------------|
| | Allocation Error by County |

| | Average Absolute Percer Dif | | | |
|------------------------|-----------------------------------|-------------|--|--|
| County | Diff. | (2000 Emp.) | | |
| Bucks | 305 | 11.5% | | |
| Chester | 369 | 21.2% | | |
| Delaware | 421 | 7.9% | | |
| Montgomery | 480 | 10.1% | | |
| Sub-Total Pennsylvania | 393 | 13.3% | | |
| Burlington | 276 | 7.8% | | |
| Camden | 228 | 5.6% | | |
| Gloucester | 315 | 10.7% | | |
| Mercer | 554 | 7.0% | | |
| Sub-Total New Jersey | 302 | 7.6% | | |
| Regional Total | 364 | 11.5% | | |

V. CONCLUSIONS

The calibrated UPlan model does a reasonably accurate job of allocating the various categories of land uses to predefined growth areas. The model acts as a synthetic land use market which associates each growth area grid with its highest economic use given the transportation system, base year development patterns, and other factors.

This high level of geographic specificity and precision is made possible by the detailed GIS land use and transportation system data that underlies the UPlan calculations. The GIS boundaries and features are geographically accurate to about six feet. The exact locations of undeveloped land grids, together with each parcel's orientation with respect to the transportation system and other geographic features is known, and assigned to 50 meter by 50 meter grids in the UPlan development allocation process.

The new footprint aspect of UPlan, which excludes declines in existing urban areas, complicates the interpretation of calibration data and the predicted results. Elimination of this limitation requires collecting data on the use and occupancy status of existing industrial, commercial, and residential buildings at the 50 meter grid level.

The current UPlan implementation is imbedded within the existing DVRPC socioeconomic forecasting process. The primary concern that DVRPC's UPlan model was designed to address is the effect of proposed transportation improvements on new footprint development in areas that are currently open space or within planned redevelopment areas. The DVRPC model can address these concerns in a straight forward and effective way.

UPlan retains its character as a land use planning model, rather than as a pure socio-economic forecasting process. The synthetic market imbedded in the calibrated model strengthens UPlan as a planning tool. Using UPlan's unconstrained land use allocation outputs, developable areas can be designated for specific land uses as part of a countywide comprehensive plan, on a scenario basis. This type of analysis promotes smart growth objectives, maximizing the efficacy of the use of available open space and other developable land.

APPENDIX

Comparison of UPIan Allocation with 1990 to 2000 Census Population and Employment Change by County

Note: Philadelphia County, is not available.

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| | | 1990 | - 2000 | | |
|----------------------------|----------------------|----------------------|----------------------|--------|----------------------|
| | 2000 | Census | UPlan | | Percent |
| Municipality | Census Population | Population Change | Population Change | Diff | Diff. (2000 Pop.) |
| | . opulation | enange | enange | 2 | (|
| Bedminster Township | 4,800 | 198 | 0 | -198 | -4.1% |
| Bensalem Township | 58,435 | 1,647 | 1,791 | 144 | 0.2% |
| Bridgeton Township | 1,410 | 32 | 11 | -21 | -1.5% |
| Bristol Borough | 9,923 | -482 | 44 | 44 | 0.4% |
| Bristol Township | 55,521 | -1,608 | 21 | 21 | 0.0% |
| Buckingham Township | 16,440 | 7,076 | 9,134 | 2,058 | 12.5% |
| Chalfont Borough | 3,900 | 831 | 575 | -256 | -6.6% |
| Doylestown Borough | 8,230 | -345 | 6 | 6 | 0.1% |
| Doylestown Township | 17,620 | 3,110 | 4,480 | 1,370 | 7.8% |
| Dublin Borough | 2,085 | 100 | 113 | 13 | 0.6% |
| Durham Township | 1,313 | 104 | 49 | -55 | -4.2% |
| East Rockhill Township | 5,200 | 1,447 | 1,453 | 6 | 0.1% |
| Falls Township | 34,865 | -132 | 33 | 33 | 0.1% |
| Haycock Township | 2,190 | 25 | 30 | 5 | 0.2% |
| Hilltown Township | 12,100 | 1,518 | 63 | -1,455 | -12.0% |
| Hulmeville Borough | 895 | -21 | 32 | 32 | 3.6% |
| Ivyland Borough | 492 | 2 | 38 | 36 | 7.3% |
| Langhorne Borough | 1,980 | 619 | 95 | -524 | -26.5% |
| Langhorne Manor Borough | 925 | 118 | 54 | -64 | -6.9% |
| Lower Makefield Township | 32,691 | 7,608 | 8,700 | 1,092 | 3.3% |
| Lower Southampton Township | 19,275 | -585 | 9 | 9 | 0.0% |
| Middletown Township | 44,140 | 1,077 | 479 | -598 | -1.4% |
| Milford Township | 8,810 | 1,450 | 662 | -788 | -8.9% |
| Morrisville Borough | 10,020 | 255 | 189 | -66 | -0.7% |
| New Britain Borough | 3,125 | 951 | 30 | -921 | -29.5% |
| New Britain Township | 10,695 | 1,596 | 500 | -1,096 | -10.2% |
| New Hope Borough | 2,250 | 850 | 483 | -367 | -16.3% |
| Newtown Borough | 2,310 | -255 | 8 | 8 | 0.3% |
| Newtown Township | 18,206 | 4,521 | 5,319 | 798 | 4.4% |
| Nockamixon Township | 3,520 | 191 | 111 | -80 | -2.3% |
| Northampton Township | 39,384 | 3,978 | 1,212 | -2,766 | -7.0% |
| Penndel Borough | 2,420 | -283 | 41 | 41 | 1.7% |
| Perkasie Borough | 8,830 | 952 | 489 | -463 | -5.2% |
| Plumstead Township | 11,410 | 5,121 | 5,837 | 716 | 6.3% |
| Quakertown Borough | 8,935 | -47 | 9 | 9 | 0.1% |
| Richland Township | 9,920 | 1,360 | 1,291 | -69 | -0.7% |
| Richlandtown Borough | 1,285 | 90 | 100 | 10 | 0.8% |
| Sellersville Borough | 4,564 | 85 | 192 | 107 | 2.3% |
| | | | | | |

Table A-1. Comparison of UPIan Allocation with 1990 to 2000 CensusPopulation Change for Bucks County

Table A-1. Comparison of UPIan Allocation with 1990 to 2000 CensusPopulation Change for Bucks County (Continued)

| | | 1990 | - 2000 | | |
|----------------------------|----------------------|----------------------|----------------------|--------|-----------------------|
| | 2000 | Census | UPlan | | Percent |
| Municipality | Census Population | Population Change | Population Change | Diff. | Diff. (2000 Pop.) |
| Silverdale Borough | 1,000 | 119 | 165 | 46 | 4.6% |
| Solebury Township | 7,740 | 1,742 | 583 | -1,159 | -15.0% |
| Springfield Township | 4,965 | -212 | 24 | 24 | 0.5% |
| Telford Borough | 2,201 | 528 | 32 | -496 | -22.5% |
| Tinicum Township | 4,205 | 38 | 43 | 5 | 0.1% |
| Trumbauersville Borough | 1,060 | 166 | 124 | -42 | -4.0% |
| Tullytown Borough | 2,035 | -304 | 13 | 13 | 0.6% |
| Upper Makefield Township | 7,180 | 1,231 | 667 | -564 | -7.9% |
| Upper Southampton Township | 15,765 | -311 | 9 | 9 | 0.1% |
| Warminster Township | 31,383 | -1,449 | 20 | 20 | 0.1% |
| Warrington Township | 17,580 | 5,411 | 8,040 | 2,629 | 15.0% |
| Warwick Township | 11,975 | 6,060 | 8,872 | 2,812 | 23.5% |
| West Rockhill Township | 4,230 | -288 | 19 | 19 | 0.4% |
| Wrightstown Township | 2,840 | 414 | 203 | -211 | -7.4% |
| Yardley Borough | 2,500 | 212 | 290 | 78 | 3.1% |
| County Total | 596,773 | 62,793 | 62,787 | -6 | 0.0% |

| | | 1990 | - 2000 | | |
|----------------------------|------------|------------|------------|--------|--------------|
| | 2000 | Census | UPlan | | Percent |
| | Census | Employment | Employment | - | Diff. |
| Municipality | Employment | Change | Change | Diff. | (2000 Emp.) |
| Bedminster Township | 1.258 | 438 | 545 | 107 | 8.5% |
| Bensalem Township | 36,059 | 2,674 | 3,822 | 1,148 | 3.2% |
| Bridgeton Township | 348 | 12 | 0 | -12 | -3.4% |
| Bristol Borough | 6,003 | -2,289 | 0 | 0 | 0.0% |
| Bristol Township | 20,616 | -15 | 0 | 0 | 0.0% |
| Buckingham Township | 7,011 | 4,033 | 3,866 | -167 | -2.4% |
| Chalfont Borough | 1,864 | -60 | 0 | 0 | 0.0% |
| Doylestown Borough | 10,960 | -264 | 0 | 0 | 0.0% |
| Doylestown Township | 9,076 | 3,353 | 1,754 | -1,599 | -17.6% |
| Dublin Borough | 788 | 205 | 0 | -205 | -26.0% |
| Durham Township | 328 | 45 | 0 | -45 | -13.7% |
| East Rockhill Township | 1,775 | 133 | 0 | -133 | -7.5% |
| Falls Township | 15,409 | 1,012 | 762 | -250 | -1.6% |
| Haycock Township | 190 | 136 | 0 | -136 | -71.6% |
| Hilltown Township | 4,860 | 1,558 | 2,482 | 924 | 19.0% |
| Hulmeville Borough | 183 | 62 | 0 | -62 | -33.9% |
| Ivyland Borough | 1,438 | -28 | 0 | 0 | 0.0% |
| Langhorne Borough | 1,085 | 164 | 0 | -164 | -15.1% |
| Langhorne Manor Borough | 1,954 | 574 | 359 | -215 | -11.0% |
| Lower Makefield Township | 5,335 | 2,258 | 1,808 | -450 | -8.4% |
| Lower Southampton Township | 10,214 | -366 | 0 | 0 | 0.0% |
| Middletown Township | 20,582 | 1,103 | 457 | -646 | -3.1% |
| Milford Township | 1,920 | 496 | 152 | -344 | -17.9% |
| Morrisville Borough | 3,810 | -873 | 0 | 0 | 0.0% |
| New Britain Borough | 1,747 | 740 | 1,187 | 447 | 25.6% |
| New Britain Township | 3,412 | 832 | 1,503 | 671 | 19.7% |
| New Hope Borough | 2,085 | -266 | 0 | 0 | 0.0% |
| Newtown Borough | 3,109 | -428 | 0 | 0 | 0.0% |
| Newtown Township | 8,376 | 2,090 | 1,089 | -1,001 | -12.0% |
| Nockamixon Township | 811 | 280 | 610 | 330 | 40.7% |
| Northampton Township | 9,711 | 698 | 1,504 | 806 | 8.3% |
| Penndel Borough | 1,150 | 111 | 0 | -111 | -9.7% |
| Perkasie Borough | 3,252 | -123 | 0 | 0 | 0.0% |
| Plumstead Township | 4,742 | 1,663 | 1,317 | -346 | -7.3% |
| Quakertown Borough | 7,327 | -503 | 0 | 0 | 0.0% |
| Richland Township | 4,477 | 784 | 828 | 44 | 1.0% |
| Richlandtown Borough | 186 | 7 | 0 | -7 | -3.8% |
| Sellersville Borough | 2,388 | -2,655 | 0 | 0 | 0.0% |
| Silverdale Borough | 257 | 20 | 0 | -20 | -7.8% |
| Solebury Township | 2,718 | 1,933 | 2,962 | 1,029 | 37.9% |
| Springfield Township | 597 | 227 | 0 | -227 | -38.0% |
| Telford Borough | 1,311 | 432 | 370 | -62 | -4.7% |
| Tinicum Township | 1,224 | 151 | 0 | -151 | -12.3% |

Table A-2. Comparison of UPIan Allocation with 1990 to 2000 CensusEmployment Change for Bucks County

| Municipality | 2000 Census Employment | 1990 Census Employment Change | - 2000 UPlan Employment Change | Diff. | Percent Diff. (2000 Emp.) |
|----------------------------|------------------------------|--|---|-------|----------------------------------|
| Trumbauersville Borough | 507 | 10 | 0 | -10 | -2.0% |
| Tullytown Borough | 2,439 | 530 | 631 | 101 | 4.1% |
| Upper Makefield Township | 1,500 | 588 | 327 | -261 | -17.4% |
| Upper Southampton Township | 8,772 | 1,317 | 392 | -925 | -10.5% |
| Warminster Township | 12,946 | -6,654 | 0 | 0 | 0.0% |
| Warrington Township | 7,084 | 987 | 1,721 | 734 | 10.4% |
| Warwick Township | 2,846 | 1,466 | 1,938 | 472 | 16.6% |
| West Rockhill Township | 5,142 | 2,566 | 3,779 | 1,213 | 23.6% |
| Wrightstown Township | 1,278 | 217 | 0 | -217 | -17.0% |
| Yardley Borough | 2,405 | 367 | 0 | -367 | -15.3% |
| County Total | 266,865 | 36,272 | 36,165 | -107 | 0.0% |

Table A-2. Comparison of UPIan Allocation with 1990 to 2000 CensusEmployment Change for Bucks County (Continued)

| | | 1990 | - 2000 | | |
|---------------------------|------------|------------|------------|--------|--------------|
| | 2000 | Census | UPlan | | Percent |
| | Census | Population | Population | | Diff. |
| Municipality | Population | Change | Change | Diff. | (2000 Pop.) |
| Atglen Borough | 1,215 | 390 | 80 | -310 | -25.5% |
| Avondale Borough | 1,110 | 156 | 30 | -126 | -11.4% |
| Birmingham Township | 4,220 | 1,584 | 1,084 | -500 | -11.8% |
| Caln Township | 11,916 | -81 | 15 | 15 | 0.1% |
| Charlestown Township | 4,050 | 2,174 | 1,664 | -510 | -12.6% |
| Coatesville City | 10,838 | -200 | 0 | 0 | 0.0% |
| Downingtown Borough | 7,590 | -159 | 733 | 733 | 9.7% |
| East Bradford Township | 9,405 | 2,656 | 1,001 | -1,655 | -17.6% |
| East Brandywine Township | 5,825 | 646 | 256 | -390 | -6.7% |
| East Caln Township | 2,855 | 236 | 459 | 223 | 7.8% |
| East Coventry Township | 4,565 | 115 | 50 | -65 | -1.4% |
| East Fallowfield Township | 5,160 | 727 | 369 | -358 | -6.9% |
| East Goshen Township | 16,825 | 1,687 | 2,495 | 808 | 4.8% |
| East Marlborough Township | 6,315 | 1,534 | 1,243 | -291 | -4.6% |
| East Nantmeal Township | 1,785 | 337 | 712 | 375 | 21.0% |
| East Nottingham Township | 5,515 | 1,674 | 2,426 | 752 | 13.6% |
| East Pikeland Township | 6,550 | 725 | 476 | -249 | -3.8% |
| Easttown Township | 10,265 | 695 | 393 | -302 | -2.9% |
| East Vincent Township | 5,493 | 1,332 | 1,865 | 533 | 9.7% |
| East Whiteland Township | 9,335 | 937 | 407 | -530 | -5.7% |
| Elk Township | 1,490 | 361 | 319 | -42 | -2.8% |
| Elverson Borough | 960 | 490 | 204 | -286 | -29.8% |
| Franklin Township | 3,850 | 1,071 | 547 | -524 | -13.6% |
| Highland Township | 1,125 | -74 | 17 | 17 | 1.5% |
| Honey Brook Borough | 1,285 | 101 | 124 | 23 | 1.8% |
| Honey Brook Township | 6,280 | 831 | 829 | -2 | 0.0% |
| Kennett Township | 6,450 | 1,826 | 1,535 | -291 | -4.5% |
| Kennett Square Borough | 5,275 | 57 | 25 | -32 | -0.6% |
| London Britain Township | 2,795 | 124 | 124 | 0 | 0.0% |
| Londonderry Township | 1,630 | 387 | 387 | 0 | 0.0% |
| London Grove Township | 5,265 | 1,343 | 1,084 | -259 | -4.9% |
| Lower Oxford Township | 4,320 | 1,056 | 1,397 | 341 | 7.9% |
| Malvern Borough | 3,060 | 116 | 143 | 27 | 0.9% |
| Modena Borough | 610 | 47 | 0 | -47 | -7.7% |
| New Garden Township | 9,080 | 3,650 | 5,577 | 1,927 | 21.2% |
| Newlin Township | 1,150 | 58 | 135 | 77 | 6.7% |
| New London Township | 4,585 | 1,864 | 985 | -879 | -19.2% |
| North Coventry Township | 7,380 | -126 | 17 | 17 | 0.2% |
| Oxford Borough | 4,315 | 546 | 58 | -488 | -11.3% |
| Parkesburg Borough | 3,375 | 394 | 151 | -243 | -7.2% |

Table A-3. Comparison of UPIan Allocation with 1990 to 2000 CensusPopulation Change for Chester County

| | | 1990 | - 2000 | | |
|---------------------------|------------|------------|------------|-------|--------------|
| | 2000 | Census | UPlan | | Percent |
| | Census | Population | Population | | Diff. |
| Municipality | Population | Change | Change | Diff. | (2000 Pop.) |
| Penn Township | 2,810 | 553 | 501 | -52 | -1.9% |
| Pennsbury Township | 3,505 | 179 | 165 | -14 | -0.4% |
| Phoenixville Borough | 14,795 | -271 | 3 | 3 | 0.0% |
| Pocopson Township | 3,350 | 84 | 84 | 0 | 0.0% |
| Sadsbury Township | 2,580 | 70 | 190 | 120 | 4.7% |
| Schuylkill Township | 6,965 | 549 | 182 | -367 | -5.3% |
| South Coatesville Borough | 995 | -31 | 3 | 3 | 0.3% |
| South Coventry Township | 1,895 | 213 | 25 | -188 | -9.9% |
| Spring City Borough | 3,305 | -128 | 3 | 3 | 0.1% |
| Thornbury Township | 2,678 | 1,547 | 1,540 | -7 | -0.3% |
| Tredyffrin Township | 29,065 | 1,037 | 782 | -255 | -0.9% |
| Upper Oxford Township | 2,095 | 480 | 630 | 150 | 7.2% |
| Upper Uwchlan Township | 6,850 | 2,454 | 2,076 | -378 | -5.5% |
| Uwchlan Township | 16,575 | 3,576 | 3,820 | 244 | 1.5% |
| Valley Township | 5,115 | 1,108 | 220 | -888 | -17.4% |
| Wallace Township | 3,240 | 699 | 129 | -570 | -17.6% |
| Warwick Township | 2,555 | -20 | 17 | 17 | 0.7% |
| West Bradford Township | 10,775 | 369 | 237 | -132 | -1.2% |
| West Brandywine Township | 7,160 | 1,176 | 715 | -461 | -6.4% |
| West Caln Township | 7,055 | 912 | 327 | -585 | -8.3% |
| West Chester Borough | 17,861 | -180 | 0 | 0 | 0.0% |
| West Fallowfield Township | 2,485 | 143 | 399 | 256 | 10.3% |
| West Goshen Township | 20,495 | 2,413 | 2,860 | 447 | 2.2% |
| West Grove Borough | 2,650 | 522 | 28 | -494 | -18.6% |
| West Marlborough Township | 855 | -19 | 14 | 14 | 1.6% |
| West Nantmeal Township | 2,030 | 72 | 50 | -22 | -1.1% |
| West Nottingham Township | 2,634 | 451 | 437 | -14 | -0.5% |
| West Pikeland Township | 3,550 | 1,227 | 864 | -363 | -10.2% |
| West Sadsbury Township | 2,440 | 280 | 259 | -21 | -0.9% |
| Westtown Township | 10,352 | 415 | 2,943 | 2,528 | 24.4% |
| West Vincent Township | 3,170 | 908 | 1,100 | 192 | 6.1% |
| West Whiteland Township | 16,500 | 4,097 | 7,233 | 3,136 | 19.0% |
| Willistown Township | 10,015 | 635 | 927 | 292 | 2.9% |
| County Total | 433,512 | 58,096 | 58,159 | 63 | 0.0% |

Table A-3. Comparison of UPIan Allocation with 1990 to 2000 CensusPopulation Change for Chester County (Continued)

| | | 1990 |) - 2000 | | |
|---------------------------|------------|------------|------------|-------|-------------|
| | 2000 | Census | UPlan | | Percent |
| Municipality | Census | Employment | Employment | D:# | Diff. |
| Municipality | Employment | Change | Change | Diff. | (2000 Emp.) |
| Atglen Borough | 531 | 17 | 283 | 266 | 50.1% |
| Avondale Borough | 1,187 | -37 | 0 | 0 | 0.0% |
| Birmingham Township | 619 | 508 | 501 | -7 | -1.1% |
| Caln Township | 6,927 | -1,189 | 0 | 0 | 0.0% |
| Charlestown Township | 2,109 | 958 | 140 | -818 | -38.8% |
| Coatesville City | 2,310 | -2,512 | 0 | 0 | 0.0% |
| Downingtown Borough | 7,104 | -35 | 0 | 0 | 0.0% |
| East Bradford Township | 1,435 | 395 | 327 | -68 | -4.7% |
| East Brandywine Township | 676 | 287 | 87 | -200 | -29.6% |
| East Caln Township | 2,756 | 1,928 | 1,625 | -303 | -11.0% |
| East Coventry Township | 724 | 315 | 305 | -10 | -1.4% |
| East Fallowfield Township | 570 | 185 | 218 | 33 | 5.8% |
| East Goshen Township | 7,480 | 2,035 | 2,483 | 448 | 6.0% |
| East Marlborough Township | 2,643 | 1,538 | 1,241 | -297 | -11.2% |
| East Nantmeal Township | 334 | 120 | 44 | -76 | -22.8% |
| East Nottingham Township | 1,533 | -80 | 152 | 152 | 9.9% |
| East Pikeland Township | 1,542 | 592 | 871 | 279 | 18.1% |
| Easttown Township | 5,251 | -167 | 544 | 544 | 10.4% |
| East Viincent Township | 1,467 | 183 | 0 | -183 | -12.5% |
| East Whiteland Township | 23,800 | 5,199 | 6,902 | 1,703 | 7.2% |
| Elk Township | 106 | 57 | 0 | -57 | -53.8% |
| Elverson Borough | 1,436 | 472 | 958 | 486 | 33.8% |
| Franklin Township | 347 | 132 | 0 | -132 | -38.0% |
| Highland Township | 320 | -545 | 0 | 0 | 0.0% |
| Honey Brook Borough | 462 | -64 | 0 | 0 | 0.0% |
| Honey Brook Township | 1,786 | 385 | 762 | 377 | 21.1% |
| Kennett Township | 2,438 | 407 | 1,002 | 595 | 24.4% |
| Kennett Square Borough | 4,933 | -121 | 0 | 0 | 0.0% |
| London Britain Township | 236 | 148 | 44 | -104 | -44.1% |
| Londonderry Township | 268 | 113 | 348 | 235 | 87.7% |
| London Grove Township | 1,612 | 928 | 1,590 | 662 | 41.1% |
| Lower Oxford Township | 1,128 | 540 | 610 | 70 | 6.2% |
| Malvern Borough | 2,825 | -2,659 | 0 | 0 | 0.0% |
| Modena Borough | 131 | -12 | 0 | 0 | 0.0% |
| New Garden Township | 4,571 | 1,994 | 1,677 | -317 | -6.9% |
| Newlin Township | 169 | 59 | 0 | -59 | -34.9% |
| New London Township | 555 | 288 | 0 | -288 | -51.9% |
| North Coventry Township | 2,152 | 965 | 2,331 | 1,366 | 63.5% |
| Oxford Borough | 2,197 | -124 | 0 | 0 | 0.0% |
| Parkesburg Borough | 927 | -199 | 0 | 0 | 0.0% |
| Penn Township | 1,101 | 823 | 1,143 | 320 | 29.1% |

Table A-4. Comparison of UPIan Allocation with 1990 to 2000 CensusEmployment Change for Chester County

| | | 1990 | - 2000 | | |
|---------------------------|------------|------------|------------|--------|--------------|
| | 2000 | Census | UPlan | | Percent |
| | Census | Employment | Employment | | Diff. |
| Municipality | Employment | Change | Change | Diff. | (2000 Emp.) |
| Pennsbury Township | 692 | 449 | 44 | -405 | -58.5% |
| Phoenixville Borough | 4,773 | -1,169 | 0 | 0 | 0.0% |
| Pocopson Township | 1,154 | 527 | 0 | -527 | -45.7% |
| Sadsbury Township | 437 | 58 | 0 | -58 | -13.3% |
| Schuylkill Township | 2,531 | -287 | 1,939 | 1,939 | 76.6% |
| South Coatesville Borough | 907 | -32 | 0 | 0 | 0.0% |
| South Coventry Township | 683 | 629 | 327 | -302 | -44.2% |
| Spring City Borough | 1,032 | -389 | 0 | 0 | 0.0% |
| Thornbury Township | 669 | 484 | 0 | -484 | -72.3% |
| Tredyffrin Township | 36,522 | 11,316 | 6,065 | -5,251 | -14.4% |
| Upper Oxford Township | 281 | 179 | 0 | 0 | 0.0% |
| Upper Uwchlan Township | 1,993 | 117 | 163 | 46 | 2.3% |
| Uwchlan Township | 9,208 | 3,967 | 2,505 | -1,462 | -15.9% |
| Valley Township | 1,779 | 758 | 1,133 | 375 | 21.1% |
| Wallace Township | 589 | 4 | 0 | -4 | -0.7% |
| Warwick Township | 481 | 282 | 0 | -282 | -58.6% |
| West Bradford Township | 1,565 | -344 | 0 | 0 | 0.0% |
| West Brandywine Township | 2,419 | 261 | 0 | -261 | -10.8% |
| West Caln Township | 710 | 194 | 22 | -172 | -24.2% |
| West Chester Borough | 14,063 | -139 | 0 | 0 | 0.0% |
| West Fallowfield Township | 808 | 248 | 240 | -8 | -1.0% |
| West Goshen Township | 18,802 | 3,881 | 5,097 | 1,216 | 6.5% |
| West Grove Borough | 1,111 | -512 | 0 | 0 | 0.0% |
| West Marlborough Township | 290 | 167 | 0 | -167 | -57.6% |
| West Nantmeal Township | 405 | 211 | 0 | -211 | -52.1% |
| West Nottingham Township | 773 | 166 | 370 | 204 | 26.4% |
| West Pikeland Township | 803 | -6 | 0 | 0 | 0.0% |
| West Sadsbury Township | 847 | 250 | 26 | -224 | -26.4% |
| Westtown Township | 3,115 | 486 | 2,633 | 2,147 | 68.9% |
| West Vincent Township | 506 | 361 | 0 | -361 | -71.3% |
| West Whiteland Township | 20,173 | 5,213 | 4,846 | -367 | -1.8% |
| Willistown Township | 7,822 | -268 | 0 | 0 | 0.0% |
| County Total | 238,641 | 51,779 | 51,598 | -181 | -0.1% |

Table A-4. Comparison of UPIan Allocation with 1990 to 2000 CensusEmployment Change for Chester County (Continued)

| | | 1990 | - 2000 | | |
|----------------------------|----------------------|----------------------|----------------------|-------|-----------------------|
| | 2000 | Census | UPlan | | Percent |
| Municipality | Census Population | Population Change | Population Change | Diff. | Diff. (2000 Pop.) |
| Alden Bereugh | 4.245 | 004 | 0 | 0 | 0.00/ |
| Acton Township | 4,315 | -234 | 1 226 | 201 | 0.0% |
| Aston Township | 16,205 | 1,125 | 1,320 | 201 | 1.2% |
| Breakbayen Barayah | 0,420 | 3,090 | 3,200 | 100 | 2.0% |
| Chedda Ford Tourpahin | 7,900 | -062 | 0 | 20 | 0.0% |
| Chapter City | 3,170 | 52 | 00 | 20 | 0.9% |
| Chester Usights Paraugh | 30,000 2 4 9 1 | -5,001 | 0 | 165 | 0.0% |
| Chester Teyrabin | 2,401 | 208 | 373 | 105 | 0.7% |
| Clittee Leighte Dereugh | 4,605 | -794 | 0 | 0 | 0.0% |
| Calling data Resourch | 6,780 | -331 | 0 | 0 | 0.0% |
| | 8,665 | -510 | 0 | 0 | 0.0% |
| Colwyn Borougn | 2,455 | -158 | 0 | 0 | 0.0% |
| Concora i ownsnip | 11,235 | 4,302 | 5,156 | 854 | 7.6% |
| Darby Borougn | 10,300 | -840 | 0 | 0 | 0.0% |
| Darby Township | 9,625 | -1,330 | 0 | 0 | 0.0% |
| East Lansdowne Borougn | 2,585 | -106 | 0 | 0 | 0.0% |
| Eddystone Borougn | 2,440 | -6 - 1 4 0 0 | 0 | 0 | 0.0% |
| | 3,915 | 1,180 | 236 | -944 | -24.1% |
| Folcroft Borough | 6,980 | -526 | 0 | 0 | 0.0% |
| Glenolden Borough | 7,475 | 215 | 372 | 157 | 2.1% |
| Haverford Lownship | 49,608 | -240 | 0 | 0 | 0.0% |
| Lansdowne Borough | 11,044 | -668 | 0 | 0 | 0.0% |
| Lower Chichester Township | 3,590 | -70 | 0 | 0 | 0.0% |
| Marcus Hook Borough | 2,315 | -161 | 0 | 0 | 0.0% |
| Marple I ownship | 23,735 | 612 | 782 | 170 | 0.7% |
| Media Borough | 5,530 | -427 | 0 | 0 | 0.0% |
| Middletown Township | 16,065 | 1,935 | 1,439 | -496 | -3.1% |
| Millbourne Borough | 945 | 114 | 11 | -103 | -10.9% |
| Morton Borough | 2,715 | -136 | 0 | 0 | 0.0% |
| Nether Providence Township | 13,456 | 227 | 418 | 191 | 1.4% |
| Newtown Township | 11,705 | 339 | 123 | -216 | -1.8% |
| Norwood Borough | 5,985 | -177 | 0 | 0 | 0.0% |
| Parkside Borough | 2,265 | -104 | 0 | 0 | 0.0% |
| Prospect Park Borough | 6,595 | -169 | 0 | 0 | 0.0% |
| Radnor Township | 30,880 | 2,177 | 1,457 | -720 | -2.3% |
| Ridley Park Borough | 7,195 | -397 | 0 | 0 | 0.0% |
| Ridley Township | 30,790 | -379 | 0 | 0 | 0.0% |
| Rose Valley Borough | 945 | -37 | 0 | 0 | 0.0% |
| Rutledge Borough | 860 | 17 | 5 | -12 | -1.4% |
| Sharon Hill Borough | 5,465 | -306 | 0 | 0 | 0.0% |

Table A-5. Comparison of UPIan Allocation with 1990 to 2000 CensusPopulation Change for Delaware County

| Municipality | 2000 Census Population | 1990 Census Population Change | - 2000 UPlan Population Change | Diff. | Percent Diff. (2000 Pop.) |
|---------------------------|------------------------------|--|---|-------|----------------------------------|
| Swarthmore Borough | 6,170 | 13 | 418 | 405 | 6.6% |
| Thornbury Township | 5,787 | 731 | 458 | -273 | -4.7% |
| Tinicum Township | 4,355 | -85 | 0 | 0 | 0.0% |
| Trainer Borough | 1,905 | -366 | 0 | 0 | 0.0% |
| Upland Borough | 2,980 | -354 | 0 | 0 | 0.0% |
| Upper Chichester Township | 16,845 | 1,841 | 2,015 | 174 | 1.0% |
| Upper Darby Township | 81,821 | 644 | 774 | 130 | 0.2% |
| Upper Providence Township | 10,510 | 783 | 1,021 | 238 | 2.3% |
| Yeadon Borough | 11,762 | -218 | 0 | 0 | 0.0% |
| County Total | 551.989 | 19.605 | 19.720 | 115 | 0.0% |

Table A-5. Comparison of UPIan Allocation with 1990 to 2000 CensusPopulation Change for Delaware County (Continued)

| | | 1990 |) - 2000 | | |
|----------------------------|-------------|------------|------------|--------|---------|
| | 2000 | Census | UPlan | | Percent |
| Municipality | Census | Employment | Employment | Diff | Diff. |
| inanioipanty | Linploymont | Change | enange | | (2000 2 |
| Aldan Borough | 503 | -96 | 0 | 0 | 0.0% |
| Aston Township | 6,018 | 154 | 1,262 | 1,108 | 18.4% |
| Bethel Township | 915 | 6 | 0 | -6 | -0.7% |
| Brookhaven Borough | 5,091 | 2,854 | 751 | -2,103 | -41.3% |
| Chadds Ford Township | 2,052 | -3,435 | 0 | 0 | 0.0% |
| Chester City | 11,268 | -3,497 | 0 | 0 | 0.0% |
| Chester Heights Borough | 1,575 | -163 | 0 | 0 | 0.0% |
| Chester Township | 1,843 | 742 | 936 | 194 | 10.5% |
| Clifton Heights Borough | 1,775 | -1,546 | 0 | 0 | 0.0% |
| Collingdale Borough | 1,793 | -173 | 0 | 0 | 0.0% |
| Colwyn Borough | 249 | -82 | 0 | 0 | 0.0% |
| Concord Township | 6,035 | 2,061 | 1,263 | -798 | -13.2% |
| Darby Borough | 3,474 | 33 | 109 | 76 | 2.2% |
| Darby Township | 1,106 | 273 | 370 | 97 | 8.8% |
| East Lansdowne Borough | 358 | -140 | 0 | 0 | 0.0% |
| Eddystone Borough | 2,824 | -640 | 0 | 0 | 0.0% |
| Edgmont Township | 2,025 | 822 | 3,289 | 2,467 | 121.8% |
| Folcroft Borough | 2,841 | -1,200 | 0 | 0 | 0.0% |
| Glenolden Borough | 2,005 | -500 | 0 | 0 | 0.0% |
| Haverford Township | 13,509 | -919 | 0 | 0 | 0.0% |
| Lansdowne Borough | 2,725 | -264 | 0 | 0 | 0.0% |
| Lower Chichester Township | 866 | 67 | 120 | 53 | 6.1% |
| Marcus Hook Borough | 2,170 | -1,322 | 0 | 0 | 0.0% |
| Marple Township | 12,121 | 2,255 | 2,449 | 194 | 1.6% |
| Media Borough | 9,597 | -1,613 | 0 | 0 | 0.0% |
| Middletown Township | 11,252 | 526 | 2,623 | 2,097 | 18.6% |
| Millbourne Borough | 218 | -163 | 0 | 0 | 0.0% |
| Morton Borough | 1,285 | -63 | 0 | 0 | 0.0% |
| Nether Providence Township | 3,618 | -397 | 0 | 0 | 0.0% |
| Newtown Township | 8,488 | 1,293 | 3,158 | 1,865 | 22.0% |
| Norwood Borough | 776 | -7 | 0 | 0 | 0.0% |
| Parkside Borough | 246 | 62 | 0 | -62 | -25.2% |
| Prospect Park Borough | 1,687 | 66 | 87 | 21 | 1.2% |
| Radnor Township | 27,215 | -1,231 | 0 | 0 | 0.0% |
| Ridley Park Borough | 2,334 | -242 | 0 | 0 | 0.0% |
| Ridley Township | 11,700 | -139 | 0 | 0 | 0.0% |
| Rose Valley Borough | 166 | 45 | 44 | -1 | -0.6% |
| Rutledge Borough | 80 | -16 | 0 | 0 | 0.0% |
| Sharon Hill Borough | 2,552 | 415 | 283 | -132 | -5.2% |
| Springfield Township | 12,973 | 1,554 | 1,447 | -107 | -0.8% |
| Swarthmore Borough | 3,335 | 113 | 141 | 28 | 0.8% |
| Thornbury Township | 2,242 | 21 | 0 | -21 | -0.9% |
| Tinicum Township | 14,415 | 8,402 | 1,099 | -7,303 | -50.7% |

Table A-6. Comparison of UPIan Allocation with 1990 to 2000 CensusEmployment Change for Delaware County

| Municipality | 2000 Census Employment | 1990 Census Employment Change | - 2000 UPlan Employment Change | Diff. | Percent Diff. (2000 Emp.) |
|---------------------------|------------------------------|--|---|--------|----------------------------------|
| Trainer Borough | 1,214 | 393 | 44 | -349 | -28.7% |
| Upland Borough | 4,311 | 275 | 272 | -3 | -0.1% |
| Upper Chichester Township | 4,991 | 2,334 | 3,736 | 1,402 | 28.1% |
| Upper Darby Township | 21,595 | 320 | 458 | 138 | 0.6% |
| Upper Providence Township | 3,394 | 513 | 424 | -89 | -2.6% |
| Yeadon Borough | 3,216 | -169 | 0 | 0 | 0.0% |
| County Total | 238,041 | 25,599 | 24,365 | -1,234 | -0.5% |

Table A-6. Comparison of UPIan Allocation with 1990 to 2000 CensusEmployment Change for Delaware County (Continued)

| | | 1990 | - 2000 | | |
|---------------------------|----------------------|----------------------|----------------------|--------|-----------------------|
| | 2000 | Census | UPlan | | Percent |
| Municipality | Census Population | Population Change | Population Change | Diff. | Diff. (2000 Pop.) |
| Abington Township | 56,105 | -217 | 10 | 10 | 0.0% |
| Ambler Borough | 6,425 | -184 | 0 | 0 | 0.0% |
| Bridgeport Borough | 4,370 | 78 | 89 | 11 | 0.3% |
| Bryn Athyn Borough | 1,350 | 269 | 511 | 242 | 17.9% |
| Cheltenham Township | 36,880 | 1,957 | 1,391 | -566 | -1.5% |
| Collegeville Borough | 4,630 | 403 | 267 | -136 | -2.9% |
| Conshohocken Borough | 7,590 | -474 | 15 | 15 | 0.2% |
| Douglass Township | 9,104 | 2,056 | 2,921 | 865 | 9.5% |
| East Greenville Borough | 3,105 | -12 | 16 | 16 | 0.5% |
| East Norriton Township | 13,211 | -113 | 136 | 136 | 1.0% |
| Franconia Township | 11,525 | 4,301 | 3,312 | -989 | -8.6% |
| Green Lane Borough | 580 | 138 | 16 | -122 | -21.0% |
| Hatboro Borough | 7,390 | 8 | 31 | 23 | 0.3% |
| Hatfield Borough | 2,605 | -45 | 5 | 5 | 0.2% |
| Hatfield Township | 16,712 | 1,355 | 1,284 | -71 | -0.4% |
| Horsham Township | 24,234 | 2,338 | 4,002 | 1,664 | 6.9% |
| Jenkintown Borough | 4,475 | -99 | 29 | 29 | 0.6% |
| Lansdale Borough | 16,070 | -292 | 10 | 10 | 0.1% |
| Limerick Township | 13,535 | 6,844 | 7,653 | 809 | 6.0% |
| Lower Frederick Township | 4,795 | 1,399 | 1,436 | 37 | 0.8% |
| Lower Gwynedd Township | 10,420 | 462 | 1,935 | 1,473 | 14.1% |
| Lower Merion Township | 58,740 | 737 | 1,458 | 721 | 1.2% |
| Lower Moreland Township | 11,280 | -488 | 0 | 0 | 0.0% |
| Lower Pottsgrove Township | 11,213 | 2,405 | 1,244 | -1,161 | -10.4% |
| Lower Providence Township | 22,390 | 3,039 | 4,163 | 1,124 | 5.0% |
| Lower Salford Township | 12,895 | 2,130 | 860 | -1,270 | -9.8% |
| Marlborough Township | 3,110 | -6 | 0 | 0 | 0.0% |
| Montgomery Township | 22,025 | 9,846 | 8,017 | -1,829 | -8.3% |
| Narberth Borough | 4,235 | -43 | 5 | 5 | 0.1% |
| New Hanover Township | 7,365 | 1,409 | 1,724 | 315 | 4.3% |
| Norristown Borough | 30,595 | -154 | 110 | 110 | 0.4% |
| North Wales Borough | 3,340 | -462 | 66 | 66 | 2.0% |
| Pennsburg Borough | 2,730 | 270 | 236 | -34 | -1.2% |
| Perkiomen Township | 7,095 | 3,895 | 2,196 | -1,699 | -23.9% |
| Plymouth Township | 16,045 | 87 | 181 | 94 | 0.6% |
| Pottstown Borough | 21,859 | 28 | 36 | 8 | 0.0% |
| Red Hill Borough | 2,195 | 401 | 231 | -170 | -7.7% |
| Rockledge Borough | 2,575 | -104 | 0 | 0 | 0.0% |
| Royersford Borough | 4,245 | -213 | 62 | 62 | 1.5% |
| Salford Township | 2,365 | 149 | 639 | 490 | 20.7% |

Table A-7. Comparison of UPIan Allocation with 1990 to 2000 CensusPopulation Change for Montgomery County

| Municipality | 2000 Census Bopulation | 1990 Census Population | - 2000 UPlan Population | Diff | Percent Diff. |
|---------------------------|------------------------------|------------------------------|-------------------------------|--------|------------------|
| Municipanty | Population | Change | Change | | (2000 Pop.) |
| Schwenksville Borough | 1,695 | 369 | 16 | -353 | -20.8% |
| Skippack Township | 9,915 | 1,125 | 1,363 | 238 | 2.4% |
| Souderton Borough | 6,725 | 768 | 133 | -635 | -9.4% |
| Springfield Township | 19,530 | -82 | 477 | 477 | 2.4% |
| Telford Borough | 2,474 | -91 | 0 | 0 | 0.0% |
| Towamencin Township | 17,600 | 3,433 | 1,582 | -1,851 | -10.5% |
| Trappe Borough | 3,210 | 1,095 | 2,010 | 915 | 28.5% |
| Upper Dublin Township | 25,875 | 1,847 | 1,951 | 104 | 0.4% |
| Upper Frederick Township | 3,140 | 975 | 1,271 | 296 | 9.4% |
| Upper Gwynedd Township | 14,245 | 2,048 | 1,197 | -851 | -6.0% |
| Upper Hanover Township | 4,885 | 281 | 786 | 505 | 10.3% |
| Upper Merion Township | 26,863 | 1,141 | 1,919 | 778 | 2.9% |
| Upper Moreland Township | 24,990 | -323 | 0 | 0 | 0.0% |
| Upper Pottsgrove Township | 4,105 | 790 | 576 | -214 | -5.2% |
| Upper Providence Township | 15,395 | 5,713 | 2,833 | -2,880 | -18.7% |
| Upper Salford Township | 3,025 | 306 | 833 | 527 | 17.4% |
| West Conshohocken Borough | 1,445 | 151 | 42 | -109 | -7.5% |
| West Norriton Township | 15,585 | 376 | 764 | 388 | 2.5% |
| West Pottsgrove Township | 3,815 | -14 | 0 | 0 | 0.0% |
| Whitemarsh Township | 16,702 | 1,839 | 2,416 | 577 | 3.5% |
| Whitpain Township | 18,562 | 2,889 | 2,995 | 106 | 0.6% |
| Worcester Township | 7,789 | 3,103 | 4,847 | 1,744 | 22.4% |
| County Total | 748,978 | 74,340 | 74,308 | -32 | 0.0% |

Table A-7. Comparison of UPIan Allocation with 1990 to 2000 CensusPopulation Change for Montgomery County (Continued)

| | | 1990 - 2000 | | | |
|---------------------------|----------------------|----------------------|----------------------|--------|-----------------------|
| | 2000 | Census | UPlan | | Percent |
| Municipality | Census Employment | Employment Change | Employment Change | Diff | Diff. (2000 Emp) |
| | p.ojo | enange | enange | | (2000 2p.) |
| Abington Township | 26,085 | -2,329 | 0 | 0 | 0.0% |
| Ambler Borough | 2,699 | -629 | 0 | 0 | 0.0% |
| Bridgeport Borough | 1,803 | 187 | 0 | -187 | -10.4% |
| Bryn Athyn Borough | 816 | 56 | 0 | -56 | -6.9% |
| Cheltenham Township | 12,286 | -1,748 | 40 | 40 | 0.3% |
| Collegeville Borough | 3,300 | 593 | 958 | 365 | 11.1% |
| | 6,797 | 1,362 | 98 | -1,264 | -18.6% |
| Douglass Township | 3,525 | -5 | 0 | 0 | 0.0% |
| East Greenville Borougn | 903 | -46 | 0 | 0 | 0.0% |
| | 7,294 | -443 | 0 | 0 | 0.0% |
| Franconia Township | 5,282 | 95 | 141 | 46 | 0.9% |
| Green Lane Borough | 407 | 122 | 0 | -122 | -30.0% |
| Hatboro Borough | 4,956 | 750 | 196 | -554 | -11.2% |
| Hatfield Borough | 1,850 | -158 | 0 | 0 | 0.0% |
| Hatfield I ownship | 13,277 | -2,307 | 20 | 20 | 0.2% |
| Horsham Lownship | 27,465 | 4,182 | 6,881 | 2,699 | 9.8% |
| Jenkintown Borough | 7,113 | 1,284 | 44 | -1,240 | -17.4% |
| Lansdale Borough | 10,902 | 739 | 1,046 | 307 | 2.8% |
| Limerick I ownship | 5,341 | 103 | 98 | -5 | -0.1% |
| Lower Frederick Township | 464 | 169 | 0 | -169 | -36.4% |
| Lower Gwynedd Township | 8,618 | 239 | 1,723 | 1,484 | 17.2% |
| Lower Merion Township | 42,490 | -399 | 40 | 40 | 0.1% |
| Lower Moreland Township | 5,382 | -644 | 20 | 20 | 0.4% |
| Lower Pottsgrove Township | 4,185 | 2,317 | 1,195 | -1,122 | -26.8% |
| Lower Providence Township | 10,592 | 226 | 660 | 434 | 4.1% |
| Lower Salford Township | 6,591 | 1,929 | 2,722 | 793 | 12.0% |
| Marlborough Township | 500 | 70 | 0 | -70 | -14.0% |
| Montgomery Township | 19,229 | 3,497 | 4,069 | 572 | 3.0% |
| Narberth Borough | 1,540 | -62 | 0 | 0 | 0.0% |
| New Hanover Township | 1,224 | 79 | 0 | -79 | -6.5% |
| Norristown Borough | 14,550 | -2,009 | 0 | 0 | 0.0% |
| North Wales Borough | 1,879 | 656 | 0 | -656 | -34.9% |
| Pennsburg Borough | 1,839 | -44 | 0 | 0 | 0.0% |
| Perkiomen Township | 1,705 | 941 | 392 | -549 | -32.2% |
| Plymouth Township | 21,142 | 1,682 | 942 | -740 | -3.5% |
| Pottstown Borough | 13,174 | -1,592 | 40 | 40 | 0.3% |
| Red Hill Borough | 774 | -89 | 0 | 0 | 0.0% |
| Rockledge Borough | 925 | -237 | 0 | 0 | 0.0% |
| Royersford Borough | 1,683 | 357 | 22 | -335 | -19.9% |
| Salford Township | 310 | -20 | 0 | 0 | 0.0% |
| Schwenksville Borough | 697 | -50 | 0 | 0 | 0.0% |
| Skippack Township | 4,310 | 2,141 | 3,615 | 1,474 | 34.2% |
| Souderton Borough | 3,104 | -276 | 0 | 0 | 0.0% |

Table A-8. Comparison of UPIan Allocation with 1990 to 2000 CensusEmployment Change for Montgomery County

| | 2000 | 1990 Census | - 2000 UPlan | | Percent |
|---------------------------|----------------------|----------------------|----------------------|--------|-----------------------|
| Municipality | Census Employment | Employment Change | Employment Change | Diff. | Diff. (2000 Emp.) |
| Springfield Township | 7,494 | -585 | 20 | 20 | 0.3% |
| Telford Borough | 1,075 | -251 | 0 | 0 | 0.0% |
| Towamencin Township | 5,564 | 1,205 | 3,289 | 2,084 | 37.5% |
| Trappe Borough | 1,755 | 507 | 22 | -485 | -27.6% |
| Upper Dublin Township | 19,886 | -225 | 102 | 102 | 0.5% |
| Upper Frederick Township | 611 | 65 | 0 | -65 | -10.6% |
| Upper Gwynedd Township | 14,816 | 1,786 | 3,789 | 2,003 | 13.5% |
| Upper Hanover Township | 4,052 | 671 | 0 | -671 | -16.6% |
| Upper Merion Township | 52,027 | 5,599 | 3,233 | -2,366 | -4.5% |
| Upper Moreland Township | 15,153 | 980 | 218 | -762 | -5.0% |
| Upper Pottsgrove Township | 1,125 | 980 | 87 | -893 | -79.4% |
| Upper Providence Township | 9,152 | 5,371 | 5,761 | 390 | 4.3% |
| Upper Salford Township | 609 | 57 | 0 | -57 | -9.4% |
| West Conshohocken Borough | 2,988 | 1,232 | 44 | -1,188 | -39.8% |
| West Norriton Township | 7,537 | 681 | 98 | -583 | -7.7% |
| West Pottsgrove Township | 1,424 | -574 | 0 | 0 | 0.0% |
| Whitemarsh Township | 14,193 | 2,911 | 3,610 | 699 | 4.9% |
| Whitpain Township | 20,230 | 2,914 | 5,270 | 2,356 | 11.6% |
| Worcester Township | 3,968 | 1,319 | 1,263 | -56 | -1.4% |
| County Total | 492,667 | 51,736 | 51,768 | 32 | 0.0% |

Table A-8. Comparison of UPIan Allocation with 1990 to 2000 CensusEmployment Change for Montgomery County (Continued)

| | | 1990 | - 2000 | | |
|-------------------------|------------|------------|------------|--------|-------------|
| | 2000 | Census | UPlan | | Percent |
| Municipality | Census | Population | Population | Diff | Diff. |
| Municipanty | Fopulation | Change | Change | Din. | (2000 POp.) |
| Bass River Township | 1,510 | -70 | 8 | 8 | 0.5% |
| Beverly City | 2,660 | -313 | 0 | 0 | 0.0% |
| Bordentown City | 3,970 | -362 | 82 | 82 | 2.1% |
| Bordentown Township | 8,375 | 683 | 523 | -160 | -1.9% |
| Burlington City | 9,740 | -95 | 0 | 0 | 0.0% |
| Burlington Township | 20,290 | 7,836 | 6,546 | -1,290 | -6.4% |
| Chesterfield Township | 5,955 | 803 | 370 | -433 | -7.3% |
| Cinnaminson Township | 14,595 | 12 | 16 | 4 | 0.0% |
| Delanco Township | 3,235 | -81 | 0 | 0 | 0.0% |
| Delran Township | 15,535 | 2,357 | 1,507 | -850 | -5.5% |
| Eastampton Township | 6,205 | 1,243 | 592 | -651 | -10.5% |
| Edgewater Park Township | 7,865 | -523 | 3 | 3 | 0.0% |
| Evesham Township | 42,275 | 6,966 | 3,693 | -3,273 | -7.7% |
| Fieldsboro Borough | 522 | -57 | 0 | 0 | 0.0% |
| Florence Township | 10,745 | 479 | 91 | -388 | -3.6% |
| Hainesport Township | 4,125 | 876 | 510 | -366 | -8.9% |
| Lumberton Township | 10,455 | 3,750 | 3,085 | -665 | -6.4% |
| Mansfield Township | 5,090 | 1,216 | 641 | -575 | -11.3% |
| Maple Shade Township | 19,080 | -131 | 0 | 0 | 0.0% |
| Medford Lakes Borough | 4,175 | -287 | 0 | 0 | 0.0% |
| Medford Township | 22,250 | 1,724 | 569 | -1,155 | -5.2% |
| Moorestown Township | 19,020 | 2,904 | 2,008 | -896 | -4.7% |
| Mount Holly Township | 10,728 | 89 | 91 | 2 | 0.0% |
| Mount Laurel Township | 40,225 | 9,955 | 5,178 | -4,777 | -11.9% |
| New Hanover Township | 9,789 | 243 | 222 | -21 | -0.2% |
| North Hanover Township | 7,347 | -2,647 | 0 | 0 | 0.0% |
| Palmyra Borough | 7,090 | 34 | 21 | -13 | -0.2% |
| Pemberton Borough | 1,210 | -157 | 22 | 22 | 1.8% |
| Pemberton Township | 28,575 | -2,767 | 12 | 12 | 0.0% |
| Riverside Township | 7,910 | -64 | 0 | 0 | 0.0% |
| Riverton Borough | 2,760 | -15 | 0 | 0 | 0.0% |
| Shamong Township | 6,465 | 700 | 817 | 117 | 1.8% |
| Southampton Township | 10,388 | 186 | 359 | 173 | 1.7% |
| Springfield Township | 3,225 | 197 | 148 | -49 | -1.5% |
| Tabernacle Township | 7,170 | -190 | 60 | 60 | 0.8% |
| Washington Township | 621 | -184 | 8 | 8 | 1.3% |
| Westampton Township | 7,217 | 1,213 | 1,211 | -2 | 0.0% |
| Willingboro Township | 33,010 | -3,281 | 0 | 0 | 0.0% |
| Woodland Township | 1,290 | -773 | 0 | 0 | 0.0% |
| Wrightstown Borough | 705 | -3,138 | 0 | 0 | 0.0% |
| County Total | 423,397 | 28,331 | 28,393 | 62 | 0.0% |

Table A-9. Comparison of UPIan Allocation with 1990 to 2000 CensusPopulation Change for Burlington County

| | | 1990 - 2000 | | | |
|-------------------------|------------|-------------|------------|--------|-------------|
| | 2000 | Census | UPlan | | Percent |
| Municipality | Census | Employment | Employment | Diff | Diff. |
| Municipanty | Employment | Change | Change | | (2000 Emp.) |
| Bass River Township | 893 | 199 | 370 | 171 | 19.1% |
| Beverly City | 667 | -47 | 44 | 44 | 6.6% |
| Bordentown City | 2,112 | 195 | 87 | -108 | -5.1% |
| Bordentown Township | 5,438 | -246 | 0 | 0 | 0.0% |
| Burlington City | 5,987 | 339 | 197 | -142 | -2.4% |
| Burlington Township | 11,152 | 1,005 | 500 | -505 | -4.5% |
| Chesterfield Township | 822 | -212 | 0 | 0 | 0.0% |
| Cinnaminson Township | 8,267 | 206 | 523 | 317 | 3.8% |
| Delanco Township | 2,589 | 1,135 | 1,329 | 194 | 7.5% |
| Delran Township | 5,498 | 292 | 415 | 123 | 2.2% |
| Eastampton Township | 1,193 | 695 | 479 | -216 | -18.1% |
| Edgewater Park Township | 1,577 | -367 | 0 | 0 | 0.0% |
| Evesham Township | 21,534 | 5,345 | 6,992 | 1,647 | 7.6% |
| Fieldsboro Borough | 161 | 40 | 0 | -40 | -24.8% |
| Florence Township | 3,192 | -457 | 0 | 0 | 0.0% |
| Hainesport Township | 2,891 | 1,148 | 653 | -495 | -17.1% |
| Lumberton Township | 3,103 | 1,314 | 893 | -421 | -13.6% |
| Mansfield Township | 1,653 | 479 | 545 | 66 | 4.0% |
| Maple Shade Township | 6,161 | -72 | 0 | 0 | 0.0% |
| Medford Lakes Borough | 808 | -262 | 0 | 0 | 0.0% |
| Medford Township | 9,573 | 238 | 1,220 | 982 | 10.3% |
| Moorestown Township | 22,004 | 1,103 | 958 | -145 | -0.7% |
| Mount Holly Township | 10,062 | -1,451 | 0 | 0 | 0.0% |
| Mount Laurel Township | 29,141 | 7,980 | 6,643 | -1,337 | -4.6% |
| New Hanover Township | 8,169 | -9,610 | 0 | 0 | 0.0% |
| North Hanover Township | 782 | 171 | 152 | -19 | -2.4% |
| Palmyra Borough | 1,946 | -296 | 0 | 0 | 0.0% |
| Pemberton Borough | 876 | 56 | 0 | -56 | -6.4% |
| Pemberton Township | 8,309 | 876 | 1,177 | 301 | 3.6% |
| Riverside Township | 2,663 | -1,006 | 0 | 0 | 0.0% |
| Riverton Borough | 1,042 | -530 | 0 | 0 | 0.0% |
| Shamong Township | 1,139 | 437 | 784 | 347 | 30.5% |
| Southampton Township | 3,269 | 442 | 632 | 190 | 5.8% |
| Springfield Township | 1,001 | 289 | 479 | 190 | 19.0% |
| Tabernacle Township | 1,052 | 188 | 327 | 139 | 13.2% |
| Washington Township | 452 | 242 | 305 | 63 | 13.9% |
| Westampton Township | 3,731 | 1,537 | 523 | -1,014 | -27.2% |
| Willingboro Township | 5,302 | -1,925 | 0 | 0 | 0.0% |
| Woodland Township | 1,359 | -145 | 22 | 22 | 1.6% |
| Wrightstown Borough | 4,971 | 1,871 | 109 | -1,762 | -35.4% |
| County Total | 202,541 | 27,822 | 26,358 | -1,464 | -0.7% |

Table A-10. Comparison of UPIan Allocation with 1990 to 2000 CensusEmployment Change for Burlington County
| | | 1990 | - 2000 | | |
|------------------------|------------|------------|------------|--------|--------------|
| | 2000 | Census | UPlan | | Percent |
| Municipality | Census | Population | Population | Diff | (2000 Pop) |
| indinoipanty | ropulation | onange | onunge | Dini. | (2000100.) |
| Audubon Borough | 9,180 | -25 | 334 | 334 | 3.6% |
| Audubon Park Borough | 1,100 | -50 | 0 | 0 | 0.0% |
| Barrington Borough | 7,084 | 292 | 559 | 267 | 3.8% |
| Bellmawr Borough | 11,265 | -1,338 | 0 | 0 | 0.0% |
| Berlin Borough | 6,150 | 478 | 241 | -237 | -3.9% |
| Berlin Township | 5,290 | -176 | 55 | 55 | 1.0% |
| Brooklawn Borough | 2,355 | 550 | 30 | -520 | -22.1% |
| Camden City | 79,905 | -7,587 | 0 | 0 | 0.0% |
| Cherry Hill Township | 69,960 | 612 | 285 | -327 | -0.5% |
| Chesilhurst Borough | 1,520 | -6 | 0 | 0 | 0.0% |
| Clementon Borough | 4,985 | -616 | 0 | 0 | 0.0% |
| Collingswood Borough | 14,326 | -963 | 0 | 0 | 0.0% |
| Gibbsboro Borough | 2,435 | 52 | 159 | 107 | 4.4% |
| Gloucester City City | 11,484 | -1,165 | 0 | 0 | 0.0% |
| Gloucester Township | 63,310 | 9,513 | 12,137 | 2,624 | 4.1% |
| Haddon Heights Borough | 7,545 | -315 | 35 | 35 | 0.5% |
| Haddon Township | 14,651 | -186 | 159 | 159 | 1.1% |
| Haddonfield Borough | 11,685 | 40 | 166 | 126 | 1.1% |
| Hi-Nella Borough | 1,035 | -10 | 38 | 38 | 3.7% |
| Laurel Springs Borough | 1,970 | -371 | 0 | 0 | 0.0% |
| Lawnside Borough | 2,692 | -149 | 458 | 458 | 17.0% |
| Lindenwold Borough | 17,410 | -1,324 | 5 | 5 | 0.0% |
| Magnolia Borough | 4,405 | -456 | 0 | 0 | 0.0% |
| Merchantville Borough | 3,800 | -295 | 0 | 0 | 0.0% |
| Mount Ephraim Borough | 4,495 | -22 | 395 | 395 | 8.8% |
| Oaklyn Borough | 4,188 | -242 | 0 | 0 | 0.0% |
| Pennsauken Township | 35,737 | 999 | 1,212 | 213 | 0.6% |
| Pine Hill Borough | 10,900 | 1,027 | 627 | -400 | -3.7% |
| Runnemede Borough | 8,535 | -507 | 16 | 16 | 0.2% |
| Somerdale Borough | 5,192 | -248 | 0 | 0 | 0.0% |
| Stratford Borough | 7,270 | -344 | 5 | 5 | 0.1% |
| Voorhees Township | 28,130 | 3,571 | 3,483 | -88 | -0.3% |
| Waterford Township | 10,494 | -446 | 0 | 0 | 0.0% |
| Winslow Township | 34,611 | 4,524 | 1,485 | -3,039 | -8.8% |
| Woodlynne Borough | 2,795 | 248 | 0 | -248 | -8.9% |
| County Total | 507,889 | 21,906 | 21,884 | -22 | 0.0% |

Table A-11. Comparison of UPIan Allocation with 1990 to 2000 CensusPopulation Change for Camden County

| | | 1990 | - 2000 | | |
|------------------------|----------------|----------------------|---------------------|--------|--------------|
| | 2000 Concus | Census Employment | UPlan Employment | | Percent |
| Municipality | Employment | Change | Change | Diff. | (2000 Emp.) |
| Audubon Borough | 2,006 | -311 | 229 | 229 | 11.4% |
| Audubon Park Borough | 607 | -76 | 0 | 0 | 0.0% |
| Barrington Borough | 1,781 | -5 | 228 | 228 | 12.8% |
| Bellmawr Borough | 5,462 | 109 | 425 | 316 | 5.8% |
| Berlin Borough | 5,172 | -627 | 22 | 22 | 0.4% |
| Berlin Township | 5,025 | 1,844 | 937 | -907 | -18.0% |
| Brooklawn Borough | 1,052 | 102 | 185 | 83 | 7.9% |
| Camden City | 32,054 | -9,963 | 0 | 0 | 0.0% |
| Cherry Hill Township | 48,140 | -2,569 | 22 | 22 | 0.0% |
| Chesilhurst Borough | 306 | 137 | 0 | -137 | -44.8% |
| Clementon Borough | 2,310 | -157 | 22 | 22 | 1.0% |
| Collingswood Borough | 5,197 | 100 | 446 | 346 | 6.7% |
| Gibbsboro Borough | 2,459 | -281 | 22 | 22 | 0.9% |
| Gloucester City City | 2,951 | 9 | 208 | 199 | 6.7% |
| Gloucester Township | 14,145 | 1,640 | 957 | -683 | -4.8% |
| Haddon Heights Borough | 2,853 | 201 | 577 | 376 | 13.2% |
| Haddon Township | 4,215 | -763 | 22 | 22 | 0.5% |
| Haddonfield Borough | 6,124 | -256 | 0 | 0 | 0.0% |
| Hi-Nella Borough | 156 | -12 | 0 | 0 | 0.0% |
| Laurel Springs Borough | 619 | -132 | 0 | 0 | 0.0% |
| Lawnside Borough | 2,499 | 463 | 207 | -256 | -10.2% |
| Lindenwold Borough | 3,260 | 458 | 370 | -88 | -2.7% |
| Magnolia Borough | 829 | -57 | 22 | 22 | 2.7% |
| Merchantville Borough | 1,287 | -141 | 0 | 0 | 0.0% |
| Mount Ephraim Borough | 1,035 | -297 | 0 | 0 | 0.0% |
| Oaklyn Borough | 1,100 | -190 | 0 | 0 | 0.0% |
| Pennsauken Township | 23,116 | -6,413 | 0 | 0 | 0.0% |
| Pine Hill Borough | 1,273 | 310 | 1,024 | 714 | 56.1% |
| Runnemede Borough | 3,212 | 648 | 979 | 331 | 10.3% |
| Somerdale Borough | 1,708 | -566 | 22 | 22 | 1.3% |
| Stratford Borough | 3,078 | -440 | 0 | 0 | 0.0% |
| Voorhees Township | 21,219 | 6,294 | 4,236 | -2,058 | -9.7% |
| Waterford Township | 2,832 | -145 | 0 | 0 | 0.0% |
| Winslow Township | 7,458 | 63 | 1,089 | 1,026 | 13.8% |
| Woodlynne Borough | 325 | -45 | 0 | 0 | 0.0% |
| County Total | 216,865 | 12,378 | 12,251 | -127 | -0.1% |

Table A-12. Comparison of UPIan Allocation with 1990 to 2000 CensusEmployment Change for Camden County

| Municipality | 2000 Census Population | 1990 Census Population Change | - 2000 UPlan Population Change | Diff. | Percent Diff. (2000 Pop.) |
|--------------------------|------------------------------|--|---|--------|----------------------------------|
| Clautan Danawah | | | 4 000 | 400 | 5 00/ |
| Clayton Borougn | 7,135 | 980 | 1,383 | 403 | 5.6% 4.2% |
| East Croopwich Township | 20,770 | 2,033 | 3,702 | 1,129 | 4.2% 2.00/ |
| Elk Township | 5,430 2,515 | 201 | 301 | 209 | 3.0% 0.0% |
| Eranklin Townshin | 15 470 | -291 | 0 472 | 515 | 0.0% |
| Classboro Borough | 10,470 | 900 2 456 | 473 | 2 546 | -3.3% |
| Greenwich Township | 19,070 | -204 | 910 | -2,540 | -13.4% |
| Harrison Township | 4,000 | 4 070 | 4 735 | 665 | 0.5% 7.6% |
| Logan Township | 6.035 | 4,070 | 1 179 | 291 | 4.8% |
| Mantua Township | 14 217 | 4 143 | 5 039 | 896 | 6.3% |
| Monroe Township | 28 967 | 2 264 | 2 364 | 100 | 0.3% |
| National Park Borough | 3 205 | -208 | 2,004 | 0 | 0.0% |
| Newfield Borough | 1 615 | 200 | 0 | -23 | -1 4% |
| Paulsboro Borough | 6 160 | -417 | 0 | 0 | 0.0% |
| Pitman Borough | 9,330 | -35 | 17 | 17 | 0.2% |
| South Harrison Township | 2 415 | 496 | 647 | 151 | 6.3% |
| Swedesboro Borough | 2,055 | 31 | 0 | -31 | -1.5% |
| Washington Township | 48,155 | 6.195 | 4.779 | -1.416 | -2.9% |
| Wenonah Borough | 2.315 | -16 | 0 | 0 | 0.0% |
| West Deptford Township | 19,370 | -10 | 40 | 40 | 0.2% |
| Westville Borough | 4,500 | -73 | 0 | 0 | 0.0% |
| Woodbury City | 10,305 | -599 | 17 | 17 | 0.2% |
| Woodbury Heights Borough | 2,990 | -402 | 0 | 0 | 0.0% |
| Woolwich Township | 3,030 | 1,571 | 2,176 | 605 | 20.0% |
| County Total | 255,719 | 29,910 | 27,924 | 14 | 0.0% |

Table A-13. Comparison of UPIan Allocation with 1990 to 2000 CensusPopulation Change for Gloucester County

| | | 1990 | - 2000 | | |
|--------------------------|----------------|--------|--------|--------|--------------|
| | 2000 Census | Census | UPlan | | Percent |
| Municipality | Employment | Change | Change | Diff. | (2000 Emp.) |
| Clayton Borough | 1,664 | -200 | 0 | 0 | 0.0% |
| Deptford Township | 12,304 | 1,564 | 1,600 | 36 | 0.3% |
| East Greenwich Township | 1,407 | -20 | 0 | 0 | 0.0% |
| Elk Township | 675 | 152 | 283 | 131 | 19.4% |
| Franklin Township | 3,100 | 449 | 0 | -449 | -14.5% |
| Glassboro Borough | 7,094 | -830 | 0 | 0 | 0.0% |
| Greenwich Township | 3,148 | -135 | 0 | 0 | 0.0% |
| Harrison Township | 2,486 | 1,239 | 2,047 | 808 | 32.5% |
| Logan Township | 6,126 | 3,146 | 2,548 | -598 | -9.8% |
| Mantua Township | 6,101 | -80 | 0 | 0 | 0.0% |
| Monroe Township | 7,477 | 1,589 | 2,462 | 873 | 11.7% |
| National Park Borough | 326 | -48 | 65 | 65 | 19.9% |
| Newfield Borough | 731 | -210 | 0 | 0 | 0.0% |
| Paulsboro Borough | 2,508 | -1,220 | 0 | 0 | 0.0% |
| Pitman Borough | 3,078 | -457 | 0 | 0 | 0.0% |
| South Harrison Township | 385 | 204 | 22 | -182 | -47.3% |
| Swedesboro Borough | 4,455 | 2,562 | 327 | -2,235 | -50.2% |
| Washington Township | 11,374 | 3,236 | 4,825 | 1,589 | 14.0% |
| Wenonah Borough | 675 | -76 | 131 | 131 | 19.4% |
| West Deptford Township | 8,797 | 2,464 | 2,221 | -243 | -2.8% |
| Westville Borough | 2,546 | -360 | 0 | 0 | 0.0% |
| Woodbury City | 10,593 | 490 | 393 | -97 | -0.9% |
| Woodbury Heights Borough | 1,479 | -636 | 0 | 0 | 0.0% |
| Woolwich Township | 907 | 534 | 414 | -120 | -13.2% |
| County Total | 99,436 | 17,629 | 17,338 | -291 | -0.3% |

Table A-14. Comparison of UPIan Allocation with 1990 to 2000 CensusEmployment Change for Gloucester County

| Municipality | 2000 Census Population | 1990 Census Population Change | - 2000 UPlan Population Change | Diff. | Percent Diff. (2000 Pop.) |
|-----------------------|------------------------------|--|---|--------|----------------------------------|
| East Windsor Township | 24,915 | 2,562 | 2,520 | -42 | -0.2% |
| Ewing Township | 35,710 | 1,525 | 1,585 | 60 | 0.2% |
| Hamilton Township | 87,108 | 556 | 253 | -303 | -0.3% |
| Hightstown Borough | 5,215 | 89 | 33 | -56 | -1.1% |
| Hopewell Borough | 2,035 | 67 | 6 | -61 | -3.0% |
| Hopewell Township | 16,105 | 4,515 | 4,118 | -397 | -2.5% |
| Lawrence Township | 29,160 | 3,373 | 3,686 | 313 | 1.1% |
| Pennington Borough | 2,695 | 158 | 100 | -58 | -2.2% |
| Princeton Borough | 14,200 | 2,184 | 33 | -2,151 | -15.1% |
| Princeton Township | 16,025 | 2,827 | 2,241 | -586 | -3.7% |
| Trenton City | 85,404 | -3,272 | 0 | 0 | 0.0% |
| Washington Township | 10,275 | 4,460 | 4,735 | 275 | 2.7% |
| West Windsor Township | 21,905 | 5,884 | 5,531 | -353 | -1.6% |
| County Total | 350,752 | 28,200 | 24,841 | -3,359 | -1.0% |

Table A-15. Comparison of UPIan Allocation with 1990 to 2000 CensusPopulation Change for Mercer County

Table A-16. Comparison of UPIan Allocation with 1990 to 2000 CensusEmployment Change for Mercer County

| Municipality | 2000 Census Employment | 1990 Census Employment Change | - 2000 UPlan Employment Change | Diff. | Percent Diff. (2000 Emp.) |
|-----------------------|------------------------------|--|---|--------|----------------------------------|
| East Windsor Township | 9,167 | -2,803 | 0 | 0 | 0.0% |
| Ewing Township | 28,473 | -3,761 | 0 | 0 | 0.0% |
| Hamilton Township | 33,104 | 1,467 | 4,955 | 3,488 | 10.5% |
| Hightstown Borough | 3,318 | -969 | 0 | 0 | 0.0% |
| Hopewell Borough | 698 | 52 | 0 | -52 | -7.4% |
| Hopewell Township | 8,025 | 3,855 | 3,288 | -567 | -7.1% |
| Lawrence Township | 25,419 | -605 | 66 | 66 | 0.3% |
| Pennington Borough | 1,158 | 343 | 22 | -321 | -27.7% |
| Princeton Borough | 15,864 | 664 | 0 | -664 | -4.2% |
| Princeton Township | 11,824 | 674 | 544 | -130 | -1.1% |
| Trenton City | 58,566 | -5,213 | 0 | 0 | 0.0% |
| Washington Township | 3,604 | 1,341 | 305 | -1,036 | -28.7% |
| West Windsor Township | 21,695 | 5,303 | 4,421 | -882 | -4.1% |
| County Total | 220,915 | 13,699 | 13,601 | -98 | 0.0% |

Publication No. : 05017

Date Published: July 2005

Geographic Area Covered: Delaware Valley Region comprised of five counties in Pennsylvania (Bucks, Chester, Delaware, Montgomery, and Philadelphia); and four counties in New Jersey (Burlington, Camden, Gloucester, and Mercer).

Key Words: UPIan, Graphical Information System (GIS), transportation/land use interactions, land use models, land use policies, corridor planning, model calibration, parameters, variables

ABSTRACT

This report presents the detailed model specification and calibration results of the DVRPC version of UPlan, a GIS based land use planning model that spatially allocates new development for use in long-range land use planning and scenario testing. It allocates new development (new building footprint) to areas that are currently open space or designated for redevelopment. This model is intended to estimate the effect of existing and proposed transportation facilities and development policies on land use patterns. Using UPlan's outputs as guidelines, generalized growth areas can be identified by specific land use type as part of corridor or countywide comprehensive planning scenarios. This type of analysis promotes smart growth objectives, the economic viability of the region, and the efficient use of transportation infrastructure.

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