THE POPULATION PROJECTIONS PROGRAM

Stages in the Preparation of the Population Projections

The overall set of population projections is produced in a series of stages which are carried out at the state, and then region and county levels. They are as follows:

Creating the State Forecast

1.   First, a draft state level <u>economic forecast</u> is prepared using the CBEF model. The model, as constructed, provides a forecast of employment (by industrial division at the state level only), employed persons, unemployed persons, (and thus,) persons in the **labor force (demanded** by the economy), and personal income. The model also forecasts approximate levels of **net migration** and population which are used internally to forecast activities in the construction and consumer service sectors of the economy.

2.   In step #2, the levels of net migration forecasted by the economic model are used in the demographic model to create a first draft <u>population forecast</u>. We then derive forecasts of the civilian non-institutional population by multiplying the population forecast by age-sex specific ratios of the civilian non-institutional population and the total population derived from data provided by the 2000 Census. Then, the forecast populations of non-institutional population by age and sex are multiplied by projected age-and sex-specific labor force participation rates to produce an initial forecast of the <u>labor force (supply)</u>.

3.   In step #3, this demographically-produced labor force supply is compared with the labor force (demand) generated by the economic model and an attempt is made to reconcile the differences that result from the running of the two models. Initially it is assumed that the demographic model correctly forecasts the labor supply for various levels of net migration and thus population. Thus, the relationships related to net migration and/or labor force demand in the economic model are adjusted slightly in the direction that would bring the labor force demand closer to the labor supply projected by the demographic model.

        If these adjustments do not bring the labor force demand in line with the projected supply then consideration is given to changing certain assumptions in the demographic model. The two assumptions most likely to be considered are the labor force participation rates and the age-sex distribution of migrants. The adjustments, however, large or small, are based on what seem to be the most reasonable assumptions given what is known about the economy and the natures of the two models. Generally, the results of the models can be brought into an alignment -- where labor force supply projected by the demographic model equals the labor force demand projected by the economic model without having to make unreasonable assumptions.

Creating the Region and County Forecasts

4.   In step#4, the region and county <u>economic</u> forecasts are prepared:

4A.   In step #4A, economic forecasts of <u>jobs</u> are prepared for each of the state's planning and management regions (by CBEF), and then for the counties within them. In general, these forecasts are based on the region's share historically of the state total, and then the county's share of the region total. However, where more detailed economic analysis exists, the job forecasts are developed in two stages: In the first, the region's or county's share of the state total is determined for each of the area's basic industries. Then, its non-basic industries are projected on the basis of historical levels of these industries in relation to the base industries for these areas.

4B.   In step #4B, the number of <u>employed persons</u> by region and by county are forecasted on the basis of the forecasted number of jobs. First, because the number of jobs is by <u>place of work</u> and the number of employed persons is by <u>place of residence</u>, the forecast (of employed persons) needs to account for existing and expected patterns of commuting between counties. In addition, these forecasts need to account for the number of multiple job holders. One <u>employed person</u> can hold more than one <u>job</u>. The number of multiple job holders was determined using the 1990 Census Public Use Microdata Samples data by sub-state region and the Current Population Survey was used to indicate change since 1990 (2000 Census data was not a reliable indicator of change from 1990 because of specific errors in regions with group quarter populations and the subsequent determination of employment).

4C.   In step #4C, the <u>labor force (demand)</u> forecast is prepared on the basis of the jobs-employed persons. This is achieved by forecasting an <u>unemployment rate</u> and thus the number of unemployed persons, and by adding together the forecasts of employed persons and unemployed persons.

5.   In step #5, the region and county <u>population</u> forecasts are prepared:

5A.   In step #5A, the initial region and county population forecasts are prepared on the basis of historic, current, and anticipated levels of <u>net migration</u>.

       Adjustments are made in the region's and state's assumed age-sex distribution of migration. As was explained in the section on page 2 regarding our "middle-up, middle-down" approach, there is a need to fine tune these assumed age-sex distributions of migrants so that the sum of the regions for each age group approximates the size of the age-sex groups that result from a state-level projection. It is at this point that this work is done.

       A committee of state agencies has been formed to assist staff in the reviewing and evaluating the age-sex population forecasts. These agencies, as part of their service responsibilities, monitor the existence of age-sex specific conditions or activities which are often reflective of the amounts of populations in certain age-sex groups.

5B.   In step #5B, initial <u>labor force (supply)</u> forecasts are prepared at the region and then county levels based on the initial population forecasts and forecasts of regional age-sex-specific labor force participation rates.

6.   In Step #6, the initial forecast of the demand for labor is compared to the initial forecast of the supply of labor at first the region and then county levels. Adjustments are then made in the economic and/or demographic forecasts and/or the projected labor force participation rates so that the forecasts of labor force demand equals that of labor force supply. At this point, staff-produced **preliminary** economic and population forecasts have been completed.

7.   In step #7, the preliminary economic and demographic forecasts are reviewed at the region (and county) levels. While potentially all assumptions contained in either model are subject to review, the primary focus will be on the forecast for several key variables; namely: jobs, employed persons, labor force (demand), net migration, and labor force participation and the resulting labor force supply. It is not expected that initially these numbers will all fit together. The review will most likely lead to revisions in some of the assumptions and in the forecasts of some of the key variables.

Detailed Descriptions of Assumptions and Data Sources
Used in the Preparation of the Demographic Model

The Demographic Section has made a number of estimates and assumptions in applying this model to Colorado and its counties. These are described briefly below:

Survival Rates. The number of deaths in each projection year is calculated by applying a survival rate to each single year age-sex group. Base year survival rates are derived by calculating annual average age-sex specific death rates. Resident deaths for one-half of 1999 and all of 2000 constitute the numerator and the 2000 (April 1) Census population the denominator for each age-sex group. Survival rates are assumed to improve slightly over time, maintaining their current ratio to rates projected by the Census Bureau for the U. S.. Expectation of life at birth for Colorado males is assumed to increase from 73.6 years in 1990 to 76.4 years in 2020. Comparable figures for females are 79.7 years in 1990 and 82.4 in 2020. A single set of survival rates is used for all counties in the state.

Fertility Rates. The number of births in each projection year is calculated by applying age-specific fertility rates (by five year age groups) to the resident female population 15 - 49. Fertility rates are derived by calculating the annual average fertility rate using resident births for one-half of 1999 and all of 2000 as the numerator and the 2000 (April 1) Census female population in each age group as the denominator. The total fertility rate for the State is 1995 births per 1000 women 15 - 49 and, consistent with national projections of fertility rates, is expected to remain constant throughout the projection period.

Because there is much greater regional variation in fertility rates than survival rates different fertility rates are used for different regions in the state. Thus, region-specific fertility rates were calculated and used in the model. The fertility rates for each region and the region's constituent counties are shown in the table on the next page. The rates are shown for both when the special population women are excluded and when they are included. The former rates (which excluded the special population women, primarily college students) are the rates used in the model since the special population women are not included in the female population that generates the births in the projection model.

Migration. As described above, the current application of the model sets future net migration levels for each geographic unit -- except counties in the Denver metropolitan area (CMSA) -- such that the supply of labor is equal to the demand for labor forecast by the econometric model. The levels are set at each five-year interval, and then interpolated for the intervening years, such that the average of the annual differences between the demand and supply of labor over the period approximates zero.

The assumed age-sex distribution of migrants is estimated on the basis of prototype patterns by age and by a "residual analysis" of population change. In the latter analysis, the age-sex distribution of migrants is estimated by surviving forward from the 1990 Census population (adjusted for estimated undercount), subtracting actual deaths (by age and sex), and adding actual births (by sex, and by year of birth) to create an expected 2000 population by age and sex. The difference between the expected (survived plus born) population and the population enumerated in the 2000 Census is assumed to represent net migration by age and sex for the decade. This distribution is scaled to the projected annual net migration total to achieve the projection year age-sex specific migration pattern.

Total Fertility Rates by Region

PROJ. REGION	COUNTIES	TOTAL FERTILITY RATES	
		Excl. Special Pop.	Incl.
1. Denver-Bldr CMSA	Adams, Arapahoe, Boulder, Denver, Douglas, Jefferson	2092	1955
2. Region 2	Larimer, Weld	2144	1773
3. Colo. Sprgs. MSA	El Paso	2399	2293
4. Pueblo MSA	Pueblo	2188	1983
5. N. Central Mtns.	Clear Creek, Gilpin, Eagle, Grand, Jackson, Pitkin, Routt, Summit	1969	1594
6. Northwest Colorado	Garfield, Mesa, Moffat, Rio Blanco	2196	2028
7. SW Colorado	Delta, Gunnison, Hinsdale, Montrose, Ouray, San Miguel, Archuleta, Dolores, La Plata, Montezuma, San Juan, Park, Teller, Chaffee, Custer, Fremont, Lake	2178	1951
8. Southern Colorado	Alamosa, Conejos, Costilla, Mineral, Rio Grande, Saguache, Huerfano, Las Animas, Baca, Bent, Crowley, Kiowa, Otero, Prowers	2523	2316
9. Northeastern Plains	Cheyenne, Elbert, Kit Carson, Lincoln, Logan, Morgan, Phillips Sedgwick, Washington, Yuma	2470	2354
STATE TOTAL	All 63 counties.	1985	1985

Treatment of Denver-Metro Area Counties. Net migration and population for the six counties within the Denver metropolitan area -- Adams, Arapahoe, Boulder, Denver, Douglas, and Jefferson -- are calculated differently. First, assumed future levels of net migration for the metropolitan area as a whole are calculated in the same manner as described above. Then, the future populations of the region are distributed to the respective counties in a manner consistent with the distributions developed by the Denver Regional Council of Governments in their 2000 projections update, with the 2000 Census counts, and their 2005 short-term (2002) projected distributions. Accordingly, net migration for the counties within the region is adjusted to achieve these projected population totals.

For the Denver metropolitan area, the age-sex migration pattern is determined first for the area as a whole in the manner described in the paragraph before last. From this set of net migrants a certain number of net migrants by age and sex are assigned to Denver County in a manner consistent with that county's age-sex specific migration pattern and with the total required by the DRCOG projection. The remaining net migrants for each age-sex group are then distributed to the other five counties in proportion to each county's share of total net migration.

Base Year Population. The projections by age and sex are initially based on a July 1, 2000 extrapolation of the total population counted in the April 1, 2000 Census of the Population. The distribution of the population by age and sex for July 1, 2000 is the same as counted in the Census, i.e., the population of each age-sex group is scaled up or down from the April 1 count so that their total equals the July 1 total. The total population is forecast from a 2001 base determined by the Division's multivariate estimate model mentioned before.

The Treatment of "Special" Populations. In thirty counties, the model recognizes the existence of "special" populations whose demographic behaviors different than that assumed for the general population. These special populations include college students, state prison inmates, ski resort employees, and military personnel. The size and age-sex composition of special populations is projected separately based on their special characteristics derived from census and other sources. They are not subject to the mortality and fertility schedules of the cohort-component model nor the migration assumptions projected by the econometric model.

COUNTIES WITH SPECIAL POPULATIONS

COLLEGE: Alamosa, Boulder, Denver, El Paso, Gunnison, Jefferson,
      La Plata, Larimer, Las Animas, Logan, Mesa, Otero, Prowers,
      Pueblo, Rio Blanco, and Weld.
STATE PRISON: Bent, Chaffee, Crowley, Delta, Fremont, Garfield,
      Jefferson, and Lincoln.
SKI RESORT: Eagle, Grand, Pitkin, Routt, San Miguel, Summit.
MILITARY: Adams, Arapahoe, Denver and El Paso.

Treatment of Elderly Populations. For each estimate year (2001-current) the population 65 and over is adjusted to be consistent with data on Medicare enrollments. The basis of this adjustment is the ratio of the population 65 and over to Medicare enrollment at the time of the 2000 Census. For these years the total population 65 and over is calculated by multiplying the 2000 ratio times the number of that year's Medicare enrollers. The population 65 and over that is projected by the model is adjusted to be consistent with this total.

The Accuracy of the Projections

Actual population change is likely to differ from projected change because it is unlikely that any statistical model can completely anticipate the future. The principal source of forecast error is the discrepancy between assumptions incorporated in these projections about the components of population change, and, in particular, that regarding migration, and the actual values of these components. (For example, the projected number of new births may exceed actual births if fertility rates fall below those assumed in these projections.) Other potential sources of forecast error are the historical data and current estimates used to calibrate the model. (For example, a projection may be too low if there was a significant underenumeration of an area.) Generally, projections for longer time periods and for areas with more volatile population trends will prove to be poorer forecasts than those for the near future and for larger areas with more stable population trends.

Below is a series of comments on the reasonableness of likely accuracy of each component of the model used in preparing these projections.

Survival Rates. Data on current mortality levels and projections of future trends are probably the most accurate part of the cohort-component projections. Current levels are estimates from records of resident deaths by age and sex provided by the Colorado Department of Health. There is relatively little variation in mortality levels by region or over time. Changes in mortality are likely to follow the slight improvement assumed in these projections.

Fertility. While current estimates of fertility have a high degree of accuracy, there is substantial variation in fertility rates among different regions of the state and there has been substantial variation in fertility levels in past decades. If actual fertility diverges from the levels assumed in these projections, this divergence will have a significant impact on the projections for the young age groups but a relatively small impact on the projection of total population in the near future.

Migration. In this projection system, migration is determined by projected changes in employment. Thus, the process begins with a projection of employment. Then, projected changes in employment are used to project changes in the demand for labor. Finally, changes in the demand for labor are balanced by changes in supply which, after accounting for projected changes in labor force participation of the resident population, is achieved by migration in or out of the region. As can be appreciated, there is the potential for error in the assumptions used at each step in this process:

Nobody knows with any certainty or precision the future course of our international and national economies and the exact role Colorado and each of its counties will play within such prospective developments. However, the State forecast ultimately chosen by the Center for Business and Economic Forecasting and the Colorado Division of Local Government has been prepared within the context of national projections prepared by the U. S. Bureau of Economic Analysis and Fair Associates, a national economic forecasting firm, plus information from a variety of other national and local sources. The regional and county projections were prepared on the basis of studies by BEA and CBEF and the evaluation of many experts including those of the Labor Market Information section of the Colorado Department of Labor and Employment. Thus, the employment forecasts used here, are consistent with the views of a wide range of experts regarding future growth in Colorado counties given past trends and current developments.

The accuracy of the projections of the labor force supply of a county are determined by the accuracy of the estimates and forecasts of the population, and in particular by age and sex, and that of the labor force participation rates that are projected for each age-sex group. Further, an undercount of the population can lead to an underestimate of the labor supply and given a demand for labor can overstate the need for new migrants. Data on labor force participation have been prepared for considerable age-sex detail and are tied to national trends for each group. However, they are based on 2000 data.

The migration forecasts produced by this economic-demographic approach are reviewed by professionals in each of the regions throughout the State. The numbers are evaluated against recent trends regarding migration in each county and in the context of expected future economic and residential developments.