

APPENDIX G

METHODOLOGY FOR DEVELOPING FUTURE TRAFFIC MODEL DATA

Proposed Methodology for Developing Future Traffic Model Data

February 13, 2002

Task 1. Target Population for 2025

Each city's land use plan will consider more than one growth scenario, but adopt only one. Establish the forecast population for each growth scenario for each city to be used in the traffic model.

On May 7, 2001 Dennis Potter, Grand Forks Planning Director, sent a memo to the mayor, city council, etc., calling for public discussion on updating the City's land use plan. This memo proposes that growth scenarios of 0.6%, 0.9% and 1.2% per year growth rates be considered. These growth rates would project the 2025 population to be 57,277 at the low rate, 61,704 at the moderate rate, 66,458 at the high rate.

Considering the same growth rates for East Grand Forks, the populations projections for East Grand Forks in 2025 would be 8,711 at the low rate, 9,384 for the moderate rate, and 10,107 at the high rate.

These forecasts are for population that would be within city limits in 2025. Population growth in areas beyond those future city limits will be dealt with in Task 17.

Task 2. Household and Non-household population

Estimate what part of each target population will live in households, dormitories, nursing homes, etc.

In 2000 92.26% of Grand Forks population lived in households, 6.59% in dormitories, 0.93% in nursing homes, and 0.22% in other group quarters. Dormitory population is not expected to increase. Nursing home and other group quarters population is expected to grow as fast or faster than the general population. In 2000 1.55% of the non-dormitory population lived in nursing home and other group quarters. Therefore, the target household population will be computed as target population – dormitory population (3,102) x 0.9845. The target household populations would 53,335 at the low rate, 57,694 at the moderate rate, and 62,374 at the high rate of growth.

In 2000, 99.05 % of the East Grand Forks population lived in households and .095 % lived in nursing homes or group quarters. The population living in nursing homes or other group quarters is expected to grow at approximately the same rate or slightly faster than the general population. Therefore, the household population will be computed as the target population – nursing home or other group quarters population. The target household populations would be 8,629 at the low rate, 9,295 at the moderate rate, and 10,011 at the high rate.

Task 3. Household Size and Vacancy Rate Assumptions

Household size has declined for decades and can be assumed to continue to decline in the future, but possibly at a slowing rate. In order to determine the number of housing units that will be needed to meet the target populations, it will be necessary to forecast household size for single and multiple housing units, as well as reasonable vacancy rates.

Forecasting household size is difficult, but critical overall household size was 2.54 in 1980, 2.43 in 1990 and 2.31 in 2000. Household size of renter occupied units has declined very little, from 2.31 in 1980 to 1.94 in 2000. Unfortunately the census does not provide data by the same housing types used in the model. In the past the traffic model has used owner occupied size for single family and renter size for multiple family. This is further complicated by the fact that the model considers townhouses and other single family attached as single family even though their household size is much closer to that of apartments.

	<u>Grand Forks</u>		
	1980	1990	2000
Owner occupied household size	3.02	2.84	2.68
Renter occupied household size	2.31	2.04	1.94
Average household size	2.54	2.43	2.31
Average family size	3.21	3.07	2.96

By applying this data to Grand Forks, it can be estimated that:

If owner occupied household size were to decline at the same rate as in the last 20 years, it would be down to about 2.28. Renter occupied size would be down to about 1.80. At these sizes, household population within city limits would be 64,934 in 2025 if all areas shown in the land use plan were fully developed. If these sizes are changed to 2.48 and 1.85, the population would be 69,105.

The following analysis was done in order to determine household size by housing types used in the database. Each census block was classified using housing Grand Forks database housing type. If 80% of the housing units in the block were the same type, the block was classified as that type. Using this method, household size is as follows:

Single family detached	2.92
Single family attached	1.99
Mobile homes	2.72
Apartments/condos	1.87

According to the 2000 census the vacancy rate for owner occupied units was 2.4% and 6.7% for renter occupied. The traffic model will use 2.0% for single family and 5.0% for multiple family

Forecasting household size in East Grand Forks is not as difficult as in Grand Forks due to the homogenous nature of housing in East Grand Forks. East Grand Forks housing units are predominately single family detached, with some single family attached, a small number of multifamily housing units and a limited number of mobile homes. Owner occupied household size in East Grand Forks has declined from 2.99 in 1990 to 2.83 in 2000. Household size of renter occupied units has declined very little from 1.96 in 1990 to 1.93 in 2000. Unfortunately the census does not provide data by the same housing types used in the model. In the past the traffic model has used owner occupied size for single family and renter size for multiple family.

	<u>East Grand Forks</u>	
	1990	2000
Owner occupied household size	2.99	2.83
Renter occupied household size	1.96	1.93
Average household size	2.67	2.54
Average family size	3.43	

By applying this data to East Grand Forks, it can be estimated that:

If owner occupied household size were to decline at the same rate it has in the last 10 years it would be down to about 2.60 in twenty years. Renter occupied size would be about 1.85 in twenty years. At these sizes household population within East Grand Forks city limits would be 9010 in 2025 if all areas shown in the land use plan were fully developed. If renter household size remained constant at 1.85 and owner occupied was changed to 2.70, the population would be 9,350.

The East Grand Forks traffic model will utilize the vacancy rates that were established for Grand Forks.

Task 4. Ratio of Employment to Population

The forecast employment must largely be based on forecast population. It is assumed that the ratio of employment to population will not differ significantly in the next twenty years. This ratio will need to be established in order to make reasonable employment forecasts.

The decline in the school age population should not have a significant impact on the size of the workforce population, which this model considers to be individuals between the ages of 18 and 64. The decline in the school age population will not significantly enlarge the size of the workforce because the decline of the school age population is offset by the increasing size of the retired population. In 1980, the workforce comprised 67 percent of the population, in 1990 67.5, and in 2000 68.8. Assuming this trend continues the workforce will comprise about 70.6 percent of the population in 2025. Apply this factor to the growth scenarios, 40,437 individuals would be included in the workforce population for the low-growth scenario, 43,563 for the mid-growth scenario, and 46,919 for the high-growth scenario.

Workers per 1000 Population

	Grand Forks	East Grand Forks
Retail	183	117
Non-retail	539	280

There is a great deal of cross-river commuting, but the above table indicates that many more East Grand Forks residents work in Grand Forks than the other way around. Perhaps the best way of forecasting employment is to assume that it will increase at the same rate as population. Using this method, the target employment for Grand Forks would be as follows:

	Grand Forks		East Grand Forks	
	Retail	Non-retail	Retail	Non-Retail
Low growth	10,606	31,262	1,116	2,664
Moderate	11,428	33,686	1,203	2,870
High growth	12,305	36,271	1,299	3,100

Task 5. Estimate Household and School Age Population

The traffic model uses household population to generate the origin of school trips. Household population by TAZ can be estimated by applying household size by type to number of occupied housing units by type in each TAZ. Since this variable is used for generating school trips, an effort should be made to estimate school age population as a part of the effort to forecast household size. The proportion of school age population to total household population varies greatly. Would the model be more reliable if forecast school age population were used instead of household population? Single family and mobile homes tend to have many more children than townhouses and apartments. One added complication is that family size is declining causing the percentage of school age population to decline.

Task 6. Determine the Need for New Schools

Since 1980 the percentage of Grand population under the age of 17 has declined. In 1980 this age group composed 24.6 percent of the population, in 1990 23.3 percent and in 2000 21.4 percent of the population. Assuming this trend continues, approximately 18.4 percent of the 2025 population will be composed of school age individuals. Applying this factor to the growth scenarios, 10,539 individuals would be included in the school age population for the low-growth scenario, 11,353 for the mid-growth scenario, 12,229 for the high-growth scenario.

The land use plan will show the possible location of several new schools. The school district does not anticipate the need for any new school construction before 2025. It is not clear what growth assumptions were used by the district. The public elementary schools currently have some surplus capacity, primarily because 6th graders now attend middle schools. The capacity of the city's 10 public elementary schools is 4,418. The May 2001 enrollment in these schools was 3109, down from 3,216 the year before.

Because school enrollment is down in Grand Forks, many assume that the city has stopped growing. This is not a valid assumption. Population losses due to the flood are a one time event causing the 2000 population to be virtually the same as 1990. Family size has declined, but housing continues to increase.

There were 307 fewer children ages 5 to 17 in Grand Forks in 2000 than in 1990. This decline and losses at the Air Force Base are sufficient to explain the temporary decline in school enrollments. If the city resumes its pre-flood growth, the city will eventually need new schools, even though the school age population will be a smaller percentage of the overall population.

It is assumed that ages 5 to 10 correspond to grades K to 5, ages 11 to 13 to grades 6 to 8, and ages 14 to 17 to grades 9 to 12. The following is the population of these cohorts for Grand Forks from the census.

	1990	Percent	2000
Elementary (5-10)	4,027	51	3,439
Middle (11-13)	1,739	22	1,705
High School (14-17)	2,135	27	2,511
Total	7,901	100	7,655

In 1990 the school age population was 17.52 percent of the total population. By 2000 it had dropped to 16.82 percent. It is assumed that it would drop to 16.00 by 2025.

It is assumed that 16 percent of the projected household population in each growth scenario would be school age and that 51 percent would be elementary, 22 percent middle school and 27 percent high school.

	Grand Forks Public Schools			
	2000 Enrollment	Added Enrollment		
		Low	Moderate	High
Elementary	3,216	448	804	1,186
Middle School	1,647	193	347	512
High School	2,527	237	425	628

It was assumed that all of the projected growth in school age cohorts would be increased enrollment in the public schools. In reality, some would go to private schools or home schooling. No effort was made to forecast the change in enrollment from areas outside of the city. The added enrollment was spread among the schools with more going to schools in the south, but not exceeding the capacity of any school. Enrollment was increased in private schools in approximate proportion to projected population increase.

In East Grand Forks the percentage of household population in school age cohorts increased from 21.78 to 22.11 between 1990 and 2000. This increase is considered an anomaly and is probably due to the loss of elderly population after the flood. It is assumed that school age population will decline to 21 percent by 2025. The same general methodology was used in estimating East Grand Forks school enrollments.

Task 7. Land Use Configurations

Establish one or more proposed configurations of residential, commercial, and industrial uses for the areas expected to develop in the next twenty years.

The May 7th memo proposes two land use options. The only difference between the two is option 1 shows residential development west of North 55th Street between Gateway Drive and DeMeres Avenue and option 2 does not. These options can easily be evaluated separately by setting the percentage of expected development to zero in TAZs 42, 43, 62, and 63 for option 2 in Task 17.

Task 8. Ratio of Net to Gross Land Area

Determine the probable percentage of land area that will be devoted to street right-of-ways for residential and non-residential areas where street right-of-ways have not yet been established.

All properties already have some right-of-way, even if it is only the 33 foot easement on section lines. It is assumed that 25% of property area will be needed for additional right-of-way in residential areas classified as level 4 residential in Task 14. Only 15% would be needed for commercial and industrial areas. East Grand Forks will assume that 25% of property area will be needed for additional right of way in residential areas classified as level 4 in residential. Commercial and industrial areas classified as level 4 will assume that 15% of the area will be needed for additional right of way.

Task 9. Residential Densities

Using the recent past as a guide, establish reasonable number of various types of housing units per net acre that can be expected in the model time frame. Establish the expected mix of residential types. Use these to estimate the number of single family and multiple family units that would exist when an area is fully developed.

The following is based on new residential construction in Grand Forks from 1980 to present:

	Number	Percent Units	Average Sq Ft	Percent Area
Single family detached	1435	27.8	13,558	60.52
Single family attached	787	15.2	5,000	12.40
Multiple family	2695	52.1	2,529	21.20
Mobile home	252	4.9	7,500	5.88

Using these proportions and areas an average net acre would be divided as follows:

	Sq Ft	Units per net acre
Single family detached	26,362.5	1.94
Single family attached	5,401.4	1.08
Mobile home	2,561.3	<u>.34</u>
		3.36
Multiple family	<u>9,234.7</u>	3.65
	43,560.0	

East Grand Forks has considerably smaller percentage of single family attached and multiple family housing units than Grand Forks. Additionally, East Grand Forks has no recently opened mobile home parks. Therefore, the percentage of area occupied by single family detached housing is considerably larger than Grand Forks. Single family detached lots are also larger than in Grand Forks.

The following is based on new residential construction in East Grand Forks from 1980 to present:

	Number	Percent Units	Average Sq Ft	Percent Area
Single family detached	424	63.9	14,831	85.1
Single family attached	77	11.6	7,136	7.4
Multiple family	163	24.5	3,392	7.5

Using these proportions and areas an average net acre would be divided as follows:

	Sq Ft	Units per net acre
Single family detached	37,070	2.50
Single family attached	3,223	<u>.45</u>
		2.95
Multiple family	<u>3,267</u>	.96
	43,560	

If one square mile of land were to develop as residential using these densities, 160 acres would be used for street right-of-way and the remaining 480 acres would have the following number of housing units:

	Grand Forks	East Grand Forks
Single family detached	931	1,200
Single family attached	518	216
Mobile home	163	0
Multiple family	<u>1,752</u>	<u>461</u>
	3,364	1,877

Task 10. High Residential Density Scenario

By planning and developing our land uses in concert with transportation infrastructure and services, we can do more for less. There is a strong interrelationship between land use and transportation. The amount of demand placed on the transportation is overwhelmingly determined by the type, location, and intensity of land use. Urban form and land use layout determine, to a large degree, the amount of travel and travel patterns within the city. Dispersed urban form increases the need to travel and the need for transportation facilities. Compact urban form increases the concentration of travel, yet allows each of us to do more while traveling less. It allows us to increase the efficiency of existing transportation facilities and managing travel demand.

Less infrastructure is needed when residential densities are higher. Higher residential densities can be achieved by reducing the size of lots and/or increasing the percentage multiple family. The traffic model will explore the saving that could occur at higher residential densities.

New residential construction has typically utilized a lot size of 13,500 sq. ft. for single family detached housing units. Higher residential densities can be achieved through a reduction in the square footage of the lot that a single family detached housing unit occupies.

The following is based on a reduction of the average single family detached lot to 10,000 sq. ft. and slight increases in the percentage of area occupied by single family attached and multiple family housing units.

	Percent Units	Sq. Ft.	Percentage Area
Single family detached	22	10,000	45.36
Single family attached	18	5,000	18.56
Multiple family	55	2,500	28.35
Mobile home	5	7,500	7.73

Using these proportions an areas and average net acre would be divided as follows:

	Sq. Ft	Units per net acre
Single family detached	19,758.8	1.97
Single family attached	8,084.7	1.62
Mobile home	3,367.2	<u>.45</u>
		4.04
Multiple family	<u>12,349.3</u>	4.94
	43,560.0	

East Grand Forks has traditionally experienced different housing patterns than Grand Forks. The community of East Grand Forks is predominately single family detached housing units. Therefore the high

density residential Scenario for the east Grand Forks community will have to include a higher percentage of area dedicated to single family detached housing units than the Scenario that was developed for Grand Forks.

The Following high density scenario is based on a reduction of the average single-family detached housing unit to 10,000 square feet and slight increases in the percentage of area occupied by single family attached and multiple family housing units. The East Grand Forks community is not expected to have a substantial increase in the number of mobile homes.

	Percentage Units	Sq. Ft.	Percentage Area
Single family detached	50%	10,000	74%
Single family attached	22%	5,000	16%
Multiple family	28%	2,500	10%

Using these proportions and areas an average net acre would be divided as follows:

	Sq. Ft.	Units per net acre
Single family detached	32,234	3.22
Single family attached	6,970	<u>1.40</u>
		4.62
Multiple family	4,356	1.74

Task 11. Employment Densities

Select recently developed commercial and industrial areas to establish an average number of employees per net acre.

The following TAZs were selected to be representative of future commercial development: 156, 159, 160, 161, 163, 168, 170, 172, 173, 177, 184, 192, 195, 201, 206, 222, 228, and 229. These areas average 7.93 non-retail workers and 10.36 retail workers per net acre.

The following TAZs were selected to be representative of future industrial development: 25, 26, 31, 32, 34, 94, 95, 96, and 97. These areas average 6.62 non-retail workers and 1.10 retail workers per net acre.

Based on these averages, if all areas shown in the Grand Forks land use plan were fully developed, there would be 19,855 retail employees and 41,818 non-retail employees.

East Grand Forks

Establishing employment densities in East Grand Forks is difficult due to the heterogeneity of commercial and industrial development in East Grand Forks. Additionally, establishing employment densities is further complicated by the lack of a large number of TAZs in the sample. When individual properties within commercial and industrial TAZs were examined, they yielded employment statistics that were very similar to those in Grand Forks. A decision was then made to use the statistics derived from the larger sample in Grand Forks.

Based on these numbers if all areas within the East Grand Forks land use plan were fully developed, there would be 1,591 retail employees and 3,123 non-retail employees

Task 12. Identify Developed Properties

Identify all properties in the database that are now developed or that will not be developed.

These properties have been given a code of Level 1.

Task 13. Classify Undeveloped Properties

Classify undeveloped properties based on their stage of platting and zoning development. Properties closest to development are already platted or have approved detailed development plans. Future land use for these properties is reasonably well established. These properties have been given a code of Level 2. These include 507 single-family lots and 234 apartments

Level 3 are properties that are already platted and further right-of-way is unlikely to be needed.

Level 4 are properties that are either not platted or platted into such large lots that additional right-of-way will be needed.

The land area of levels 3 and 4 is assigned to residential, commercial, or industrial future use. The area of some properties is divided among more than one use.

East Grand Forks

Properties closest to development are already platted or have approved detailed development plans. Future land use for these properties is reasonably well established. These properties have been given a code of Level 2. These include 278 single-family lots.

Level 4 are properties that are either not platted or platted into such large lots that additional right-of-way will be needed.

The land area of levels 3 and 4 is assigned to residential, commercial, or industrial future use. The area of some properties is divided among more than one use.

Task 14. Estimate Future Development for Each Undeveloped Property

Use criteria developed in the previous tasks to estimate the number of single family, multiple family, retail and non-retail employees for each property. This step will have to be repeated for each land use configuration, but not for each growth scenario.

Task 15. Aggregate Existing and Future Data by TAZ

Aggregate the traffic model data by TAZ for each land use configuration.

Task 16. Estimate Percentage of Development by TAZ

If all areas in the land use plan were to fully develop the population would far exceed the 2025 target. A percentage of expected development can be applied to each TAZ to bring forecast population and employment in line with target population. It may be necessary to apply a separate percentage to employment. A different set of percentages will need to be developed for each land use configuration and growth scenario.

Task 17. Estimate Population and Housing in the Rural Portions of the Study Area

Past traffic models have largely ignored areas beyond city limits assuming that populations were too small to have any significant impact. The 2000 census shows that there is more population in the outer portion of the study area than previously thought approximately 500 around Grand Forks and 750 around East Grand Forks. It should be assumed that there will be at least some growth in these areas. It may be appropriate to assume that these areas will grow at the same rate as the city. Whatever percentage growth rate is used cannot be applied to individual TAZ's because most have few, if any houses. In rural Grand Forks four new houses were added in each of ten out-lying TAZ's in low growth scenarios, six each in moderate growth scenarios, and eight in high growth scenarios. Fifty houses were added to out-lying East Grand Forks TAZ's in low growth scenarios, 90 for moderate, and 130 for high growth.