

**Proposal for Demographic Services for  
Andover Public Schools,  
Massachusetts**

*April 28, 2017*

**Cropper** GIS

## Demographic Services

**To:**

**Sheldon Berman, Ed.D**  
Superintendent  
Andover Public Schools  
36 Bartlet Street  
Andover, MA 01810  
(978) 247-7010 phone  
[Sheldon.berman@andoverma.us](mailto:Sheldon.berman@andoverma.us)

**From:**

**Matthew Cropper**  
President  
Cropper GIS Consulting, LLC  
P.O. Box 1308  
Delaware, Ohio 43015  
(614) 451-1242 phone  
[mcropper@croppergis.com](mailto:mcropper@croppergis.com)

**CC:**

**Jerome McKibben, Ph.D**  
Senior Demographer  
(978) 501-7069 phone  
[j.mckibben@mckibbendemographics.com](mailto:j.mckibben@mckibbendemographics.com)

**Date:**

April 28, 2017

Dr. Berman,

This proposal has been developed as a response to the Andover Public School's (District) request for demographics consultation services. This project will be completed by **Cropper GIS Consulting, LLC (Cropper)**. The project will be directed by Matthew Cropper, GISP and Jerome McKibben, PhD.

We are confident that you will find our team to be a good fit for this project, as we have a wealth of relevant experience and have performed these services to many other satisfied clients. We thank you for the opportunity to submit this proposal for the District, and look forward to working together.

**Firm Profile – Cropper GIS Consulting, LLC**

Since the company was formed in 2005, **Cropper GIS Consulting (Cropper)** has worked with clients on various demographic, redistricting, and GIS Implementation projects. The majority of clients served by **Cropper** are school districts, and all projects have met/exceeded our client’s expectations. Our firm’s expertise is in demographic studies, K-12 school redistricting, long-range facility planning, and GIS Implementation/Training.

Some of our more recent clients include:

- Wellesley Public Schools, Massachusetts
- Nantucket Public Schools, Massachusetts
- Albany Public Schools, New York
- Saratoga Springs Public Schools, New York
- Corning Painted Post School District, New York
- Schenectady City School District, New York
- North Colonie Schools, New York
- Buffalo Public Schools, New York
- Mariemont City Schools, Ohio
- Forest Hills School District, Ohio
- Lakota Local Schools, Ohio
- Cincinnati Public Schools, Ohio
- Westerville City Schools, Ohio
- Lakewood City Schools, Ohio
- Akron Public Schools, Ohio
- South-Western City Schools, Ohio
- Reading School District, Pennsylvania
- Carlisle Area School District, Pennsylvania
- Billings Public Schools, Montana
- Helena Public Schools, Montana
- Warwick Public Schools, Rhode Island
- Barrington Public Schools, Rhode Island
- U.S. Department of Justice, Civil Rights Division
- Baltimore County Public Schools, Maryland
- Frederick County Public Schools, Maryland
- Henrico County Public Schools, Virginia
- Downers Grove District 58, Illinois
- Community Consolidated School District 59, Illinois
- DeKalb District 428, Illinois
- Marion Community Unit Schools #2, Illinois
- Champaign Community Unit Schools #4, Illinois
- Atlanta Public Schools, Georgia
- Charleston County Public Schools, South Carolina



Geographic Information Systems will be used extensively to analyze demographic data and **Cropper** are experts in the use of the software. **Cropper** are licensed consultants and resellers of ESRI GIS technology, which is utilized by local, state, and federal governments. Mr. Cropper has written multiple articles and presented at conferences across the country on GIS in educational planning. He is a pioneer in integrating new technology with age-old planning processes to refine and enhance accuracy of data when planning.

### Introduction and Project Objectives

The District would like to consider a district-level demographic study. The school level study includes a 10-year population and enrollment forecast for the district by grade.

There are 3 primary phases of the study. These phases are:

- Data Collection and Development.
- Data Analysis and Population/Enrollment forecasting

### Scope of Services

**Cropper** has identified two (2) primary phases of the project, which are:

#### Phase1: Data Collection and Development

**Cropper** will collect data from local sources such as the county auditor/assessor's office to support the upcoming planning work. In addition to GIS data, **Cropper** will collect current 2016-17 student enrollment databases from the District. Other parts of this phase include:

- o Trip to district to meet with district and perform field research of school district and surrounding region.
- o Collection of information from city, county, school district, census bureau.
- o Conversion of datasets into GIS format
- o Development of Census demographic profiles for the district.

#### Phase 2: -Data Analysis and Population/Enrollment forecasting

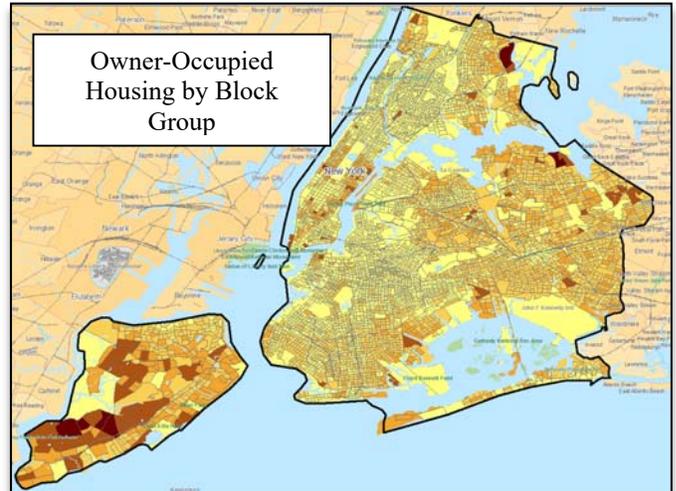
Work in this phase includes:

- o Creation of population and enrollment forecasts for the district.
- o Development of report that identifies the forecast assumptions, depicts maps used to assist in the study, and interprets the population and enrollment forecast findings. Also, the report will provide an interpretation of former enrollment projections.

### Forecasting Methodology

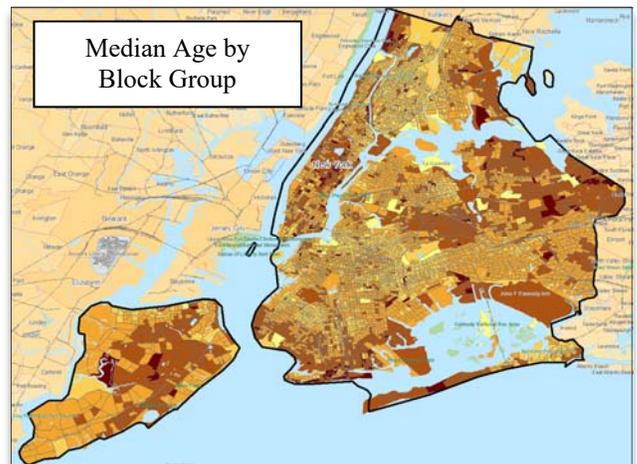
Below is the process that **Cropper** uses to develop a demographic study, which utilizes the best methods that are proven to have the best results.

To truly understand the complex enrollment patterns of any school district, an examination of the past, present and future demographic trends of the area is required. This does not mean just examining the school district in question, but also all of the surrounding area. In demographic terms, (as well as economic terms) no geographic area stands alone. Each area's demographic trends are interwoven with the trends in all of its neighboring areas. Furthermore, the historical trends of the number of children in each school grade have little or no effect on the future trends of a district's enrollment. The only way to accurately ascertain what the future enrollment patterns of a district be is to be able the projection the trends of the total population. Consequently, our forecast method is a three step procedure that examines the demographic trends of both the district under study and all of its geographical areas under study.



The first step is to overlay the district's geographical boundaries with Census Bureau's 2010 TIGER maps. This allows us to identify which census tracts and blocks make up each geographical area. Once this is established, the detailed 2010 Census information from files SF1, SF3 and SF4 can be downloaded, creating a demographic and economic profile of each individual area.

This data, which can be attained at the block or block group level, forms the base information that will be used later in the construction of the population forecast models. The variables obtained from the Census Bureau include, but are not limited to, age, gender, race, ethnicity, median family and household income, household composition, home value, median rent, age of householder, number of owner and renter households and group quarters populations.



The second step is to calculate a total population forecast for all geographic areas under study. This forecast allows us to find how differences and changes in each area's fertility, mortality and migration rates will affect the composition of the area's future population.

Issues examined include but are not limited to the following:

1. The number of women in child bearing age in both the district and the surrounding area. Changes in the number of women 20-29 years old in an area have a far greater impact on the number of births than changes in the overall fertility rate.
2. Changes in the area's Mortality rates. Significant moves up or down in the mortality rate indicate that much of the local population change is due to factors relating to the elderly population and not to young families that would have school age children.
3. The magnitude and prevalence of out migration patterns by age. Typically, most school districts have a large amount of out migration in the 18-21 age groups as these students leave their parent's home and go to college. Other major out

migration patterns that need to be identified is young college graduates moving to cities to start their careers (ages 22-26), young families go to the suburbs (25-35), people buy "move up" houses (33-50), and the "down sizing" movers (ages 50-85).

4. Conversely, the magnitude and prevalence of the area's in migration patterns. For people who changes households each year, the majority of new residences are within a 30 mile radius of the old residence. Further the rate of existing home and new home sales in each area is used as a primary variable to establish both the magnitude and population composition of the in and out migration flow. This is especially key given that the current national average of existing homes to new homes sold is 8 to 1.

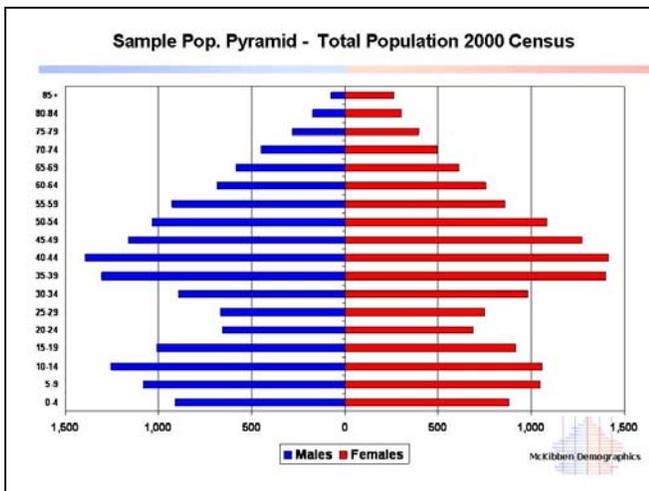
5. All of the geographic areas within the District have their own unique characteristics and demographic trends. To ensure that as many neighborhood social, economic and demographic factors are included in the projections modeling procedure, field research will be conducted throughout the entire district to ascertain the impact of housing changes, planned construction, infrastructure status and neighborhood dynamics.

State	Migration to Champaign County 2005 to 2006 From	Number of Households	Number of People	Persons Per Household
IL	Champaign Count Tot Mig-US	5,689	8,994	1.58
IL	Champaign Count Tot Mig-US	4,973	8,211	1.65
IL	Champaign Count Tot Mig-Sam	2,635	4,198	1.59
IL	Champaign Count Tot Mig-Dif	2,338	4,013	1.72
IL	Champaign Count Tot Mig-For	716	783	1.09
IL	Champaign Count Non-Migrant	61,554	126,763	2.06
IL	Cook County	472	692	1.47
IL	Vermilion County	268	489	1.82
IL	Piatt County	154	256	1.66
IL	McLean County	150	233	1.55
IL	Douglas County	129	222	1.72
IL	Ford County	129	215	1.67
IL	Du Page County	102	140	1.37
IL	Coles County	94	158	1.68
IL	Sangamon County	87	135	1.55
IL	Macon County	80	133	1.66
IL	Will County	74	118	1.59
IL	Peoria County	62	104	1.68
IL	Iroquois County	59	89	1.51
IL	Kankakee County	53	96	1.81
IL	Lake County	52	74	1.42
IL	Kane County			
CA	Los Angeles County			
IL	Jackson County			
MO	St Louis County			

Sample IRS Migration Data used for study

The population forecasts are developed by using the Cohort-Component Method of population forecasting. Five data sets are required to generate population and enrollment forecasts. These five data sets are:

- a base-year population (here, the 2010 Census population for the district and attendance areas);
- a set of age-specific fertility rates for the district and attendance areas to be used over the forecast period;
- a set of age-specific survival (mortality) rates for the district and attendance areas;
- a set of age-specific migration rates for the district and attendance areas;
- Historical enrollment figures by grade for all facilities to be projected.



The population forecasts are calculated using a cohort-component method with the populations divided into male and female groups by five-year age cohorts that range from 0-to-4 years of age to 85 years of age and older (85+). Age- and sex-specific fertility, mortality, and migration models were constructed to specifically reflect the demographic characteristics of the school district.

In the third and final step enrollment forecasts are calculated using a modified average survivorship method. Average survivor rates (i.e., the proportion of students who progress from one grade level to the next given the average amount of net migration for that grade level) over the previous five years of year-to-year enrollment data are calculated for grades two through twelve.

The survivorship rates are modified, or adjusted, to reflect the average rate of projected migration of 5-to-9 and 10-to-14 year olds for the first 5 years of the forecast. These survivorship rates then are adjusted to reflect the projected changes in age-specific migration the district should experience over the next five years. These modified survivorship rates are used to forecast the enrollment of grades 2 through 12 for the first five years of the forecast. The survivorship rates are adjusted again for the second 5 years of the forecast to reflect the predicted

changes in the amount of age-specific migration in the districts for the period. Since the method doesn't depend on historical rates change it will more accurately reflect the current and future demographic situation as it relates to school enrollment.

Birth and death data are obtained from the State Department of Health for the previous 5-6 years. The net migration values are calculated using Internal Revenue Service migration reports. The data used for the calculation of migration models come from the United States Bureau of the Census, 2000 to 2010, and the models are assigned using an eco-demographic system. The 2010 Census data will be incorporated into the study.

Other locally obtained variables (Obtained via City Planning and Dept. of Economic Development) that will be used in the construction of the population forecast models include but are not limited to: sales of existing housing units, construction of new housing units, housing price, housing tenure, household size, household composition and planned infrastructure improvements. Other internet-based resources will be leveraged for housing sale/cost analysis including sources such as RealtyTrac and Zillow.

The forecasted enrollments for kindergarten and first grade are derived from the 5-to-9 year old population of the age-sex population projection at the attendance area and school district level. This procedure allows the changes in the incoming grade sizes to be factors of projected population change and not an extrapolation of previous class sizes. Given the potentially large amount of variation in kindergarten enrollment due to parental choice, changes in the state's minimum age requirement, and differing district policies on allowing children to start kindergarten early, first grade enrollment is deemed to be a more accurate and reliable starting point for the projections.

Historically, Population and Forecasts developed by **Cropper** have been highly accurate. The level of the accuracy for both the population and enrollment projections at the school district level is estimated to be +2.0% for the life of the forecast.

The forecasts assume the current economic, political, social, and environmental factors of the district remain the same through the year 2017. In particular, the forecasts assume that throughout the study period, there will be no short term economic recovery in the next 18 months and no further deterioration of the economic conditions;

- interest rates have reached an historic low, and will not fluctuate more than one percentage point in the short term;
- there will be no building moratorium within the district;
- business within the district will remain viable;
- housing turnover rates (sale of existing homes in the district) will remain at their current levels;
- open enrollment and private school attendance rates will remain constant; and
- there will be no major infrastructure changes.

**Timeline and Fees (District-Level Forecast by Grade by School)**

Once all data is received, it is anticipated to take 8 weeks to complete the study.

**Cropper** will work in May to build necessary pieces of the study. Assuming that district data is provided in a timely manner, forecasts and the demographic study report should be finalized by late July 2017.

A presentation to the school board (if needed/requested) can be provided at a time that works best for the District.

Professional fees for this project are \$9,000 including expenses for the demographic study. This fee does not include a school board presentation of findings.

If the district wishes to have a presentation of the demographic study findings to the school board, this would cost an additional \$900 which includes travel expenses to visit the district. It is only expected to have Dr. McKibben travel for this trip.

Additional time for work requested beyond what is scoped will be invoiced on an hourly basis at \$175 per hour plus expenses.

**Cropper** will coordinate printing with the district to keep expenses at a minimum. It is assumed that the demographic study will be presented in digital format, where the district can print as many copies as they wish.

If the district wishes to have **Cropper** print copies, the cost will be \$1 per page for color and \$.25 per page for black/white copies. Large-scale plots of maps are printed by a local print company, and typically cost between \$75 and \$100 per plot to print.