For this assignment, I wanted to find out if public transport was affected by population density – in other words, was more public transit available in areas with greater population density. I chose to focus on both Cambridge and Somerville for this, because this would encompass a greater amount of data as well as a greater variety of census blocks. It would also offer an opportunity to compare the two cities.

First, I created a basic map of population density. We had already done this using census information, so I repeated the process by dividing number of people by number of acres. I used the field calculator to create a new column in the table for just population density, dividing total population by dry acres:

Then, I selected by attribute to determine the areas with greatest population density. I chose to focus on those with 40 people or more per acre. See map on following page.
Also, to clean up the map a bit, I selected transportation features that were within the boundaries of the cities of Cambridge and Somerville. I did this by selecting by location on each layer, including only those features within the city boundaries. I then used the “Clip” function to trip any roads or transit lines that fell within the city boundaries but also extended beyond it.
Next, I examined statistics for the highest population areas using the **Statistics** function in the attribute table:

This graph shows more clearly that the densest areas range from 44-71 people per acre. Most are towards the lower end of that scale. This graph wasn’t absolutely vital to my investigation, but it helped me better see how my data was grouped and let me make sure that there weren’t any extremely high or low numbers that would require further consideration and investigation.

To examine the travel modes of the population in Cambridge and Somerville, I joined the travel modes and travel time layers to the census block layers. Now I would be able to compare these trends spatially:

Using this joined data, I was able to make the following map of the percentage of workers in Cambridge and Somerville who use public transportation, by census block:
It was here that I noticed that there is something wrong with my data for the Harvard Square area – it seems to be missing. In the attribute table the population is listed as zero and so is the number of workers. Not sure what happened here, but it certainly makes a hole right smack in the middle of my map.

Lastly, I performed a **spatial join** to see how many transit stops were within each area, in order to compare this map with the population density map.

Here is my spatial join, which now tells me how many bus stops are located in each of my densest census blocks. I did the same thing with T-stops, which of course wasn’t very exciting since there aren’t any T-stops within these blocks:
Since the data dealing with bus stops was more interesting, given the higher number of stops, I decided to make my final map using these (rather than including T-stops also) and to examine the whole area as well as the most dense blocks. I made another spatial join for the bus stops in all of Cambridge and Somerville. Then I mapped the number of bus stops to workers overall. Here is the spatial join between the bus stops and all Cambridge & Somerville:

### Attributes of bus stops overall

<table>
<thead>
<tr>
<th>CTV</th>
<th>CTV_ALONE</th>
<th>CTV_POOL</th>
<th>PUB_TRANS</th>
<th>BUS</th>
<th>TROLLEY</th>
<th>SIR</th>
<th>HR</th>
<th>FERRY</th>
<th>TAXI</th>
<th>CYCLE</th>
<th>BREE</th>
<th>WALK</th>
<th>OTHER</th>
<th>WORKRATION</th>
<th>Count</th>
<th>Sum_OBJECT</th>
<th>Sum_STOP</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.01</td>
<td>0.04</td>
<td>0.06</td>
<td>0.08</td>
<td>1.1</td>
<td>0.13</td>
<td>0.14</td>
<td>0.15</td>
<td>0.16</td>
<td>0.17</td>
<td>0.18</td>
<td>0.19</td>
<td>0.20</td>
<td>0.21</td>
<td>0.22</td>
<td>0.23</td>
<td></td>
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</tr>
<tr>
<td>0.24</td>
<td>0.25</td>
<td>0.26</td>
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<td>0.28</td>
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<td>0.30</td>
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<td>0.36</td>
<td>0.37</td>
<td>0.38</td>
<td>0.39</td>
<td></td>
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</tr>
</tbody>
</table>

And the resulting map is on the following page.
The map shows that there are the most bus stops per person in the Alewife area, which is one of the least dense areas. This makes sense since there are fewer people; however, does this mean that there is enough service, by comparison, in the denser areas?

There are several important defects in this study. Firstly, it only examines the spatial characteristics of the bus stops, without taking into account the frequency of service at these stops. Hopefully the T has taken into account population density and ridership density in providing these more highly-trafficked areas with more frequent service. In addition, it is possible that this map is not completely accurate / completely pertinent given that people who live in high-density areas could walk over the block boundary to another bus stop or T-stop, thus skewing the data on the spatial aspect of public transport use.

On the other hand, this study could be used to determine two important things: One, whether or not such high density areas are properly served by public transport; and Two, whether living in a high density area already provides such benefits as increased access to transport.