

Optimal Site Selection: Convenience Stores | Answer Key

Summary

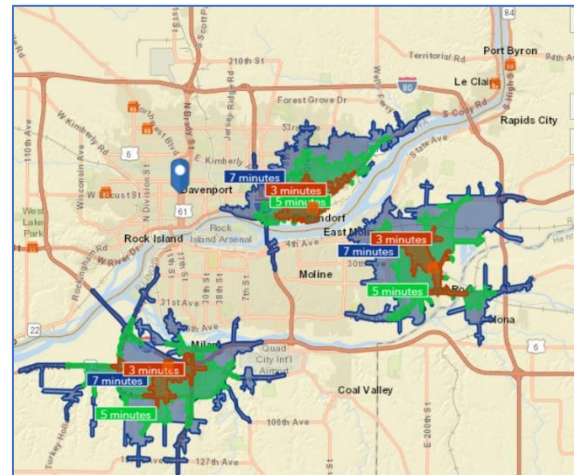
What factors influence the selection of the optimal site for convenience stores regionally and locally? Examine these questions and others in this lesson.

This activity uses Business Analyst Web, web-based GIS software, from Esri. This 30-question lesson is targeted toward university level learners; but could be used with upper secondary students. Estimated time for completion: 2-3 hours. Business Analyst Web requires a license to use; a trial version is available on www.esri.com.

Problem Statement

You work for a regional convenience store chain, Casey's General Stores. You are seeking to expand your network in a specific city to one additional store.

How can you select an ideal location using GIS tools, business, demographic, and behavioral data, and the spatial perspective?

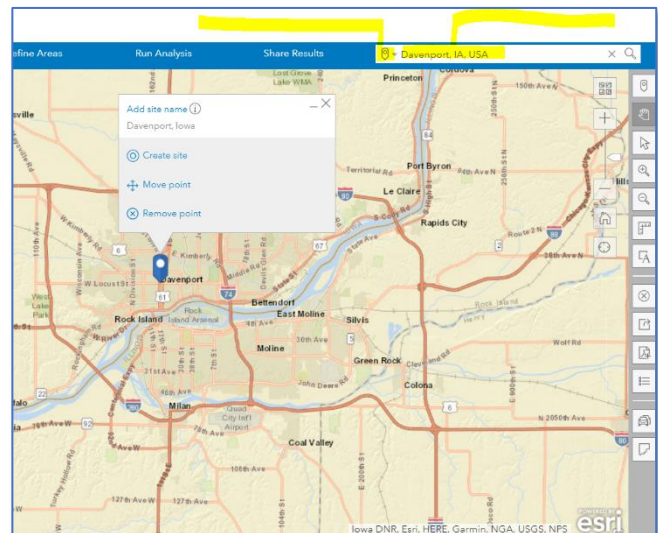


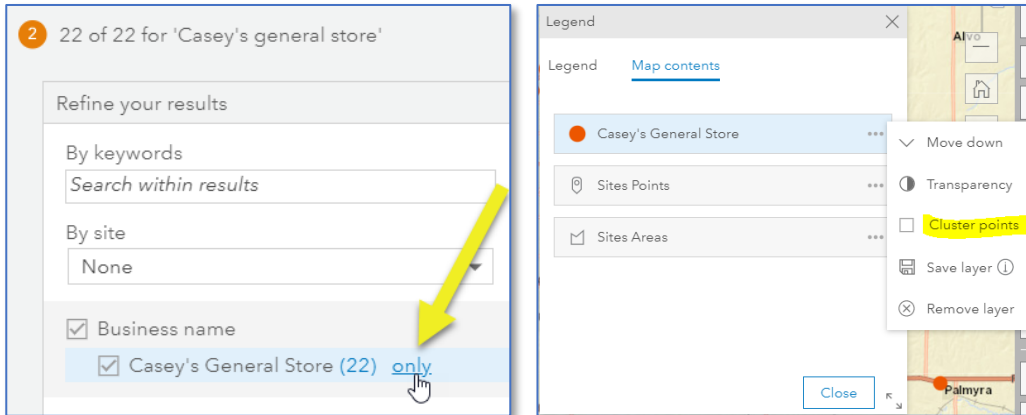
Map showing drive times around existing stores that you will create as a part of this activity.

Analysis

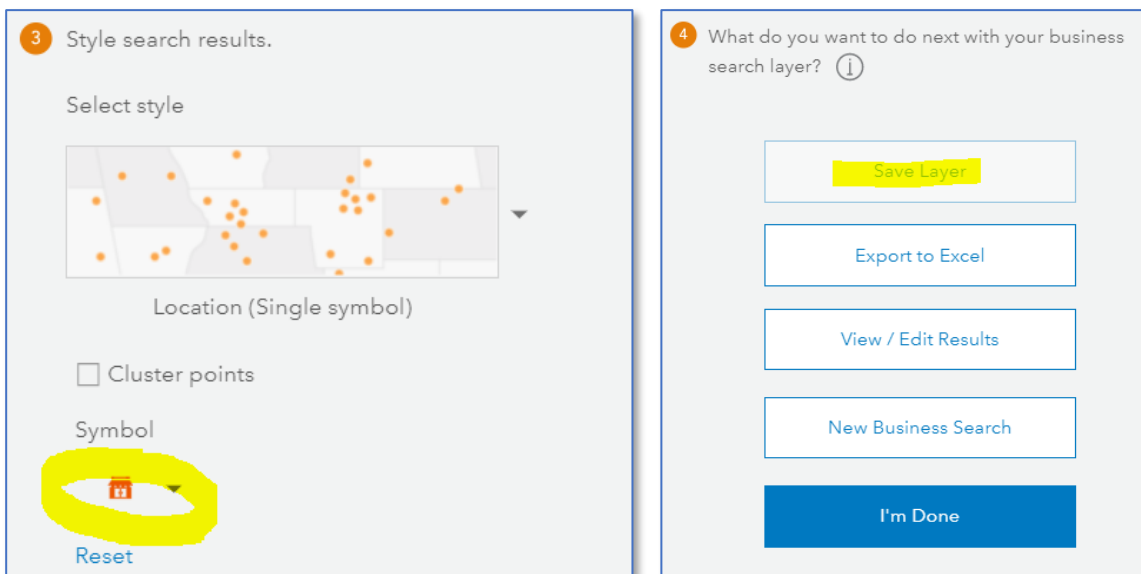
Studying Spatial Patterns of Businesses

- (1) Access [Business Analyst Web](#). Make sure your country of selection in the upper right is USA. Start a new project and name it Local Convenience Store Analysis. Zoom to the lower 48 US states.
- (2) Search for Davenport IA USA, add a pin there, and zoom out so you are examining the entire Davenport Iowa metropolitan area. The metropolitan area extends across the Mississippi River into Illinois (as shown).
- (3) Use Create Maps > Business and Facilities Search → Enter “Casey’s General Store.” In the results pane to the left of the map, click on Casey’s General Store **only** (so you will only get the Casey’s general stores and not any other business named Casey’s) (as shown). In the Legend at the right, un-check the “cluster points” so you can see **all** of the Casey’s locations (as shown).





- (4) Click > Next. At #3, style search results > change the symbol from the default to > Business > Store front (as shown).
- (5) At #4, “What do you want to do next?” > Save Layer, naming it “Casey’s General Stores in Davenport IA-IL” > Click “I’m Done.”



- (6) Examine your map. Note that Casey’s stores are scattered throughout the metropolitan area, but especially on the northwest (Iowa) side of the river. Only two stores exist on the southeast (Illinois) side of the river, one in Milan and one in Carbon Cliff, and thus you decide to focus your efforts here. Click on each one of these locations to obtain the addresses: The one to the southwest is at 1105 10th Ave W in Milan, and one to the northeast is at 306 2nd Ave in Carbon Cliff. But you also note that there one near the river on the Iowa side at 3902 State St in Bettendorf IA that could potentially attract customers from the Illinois side who could drive across the river. You note that no Rock Island or Moline store currently exists, so you further narrow your search in this location for a possible new store.

Analyzing Business Sites and Neighborhoods

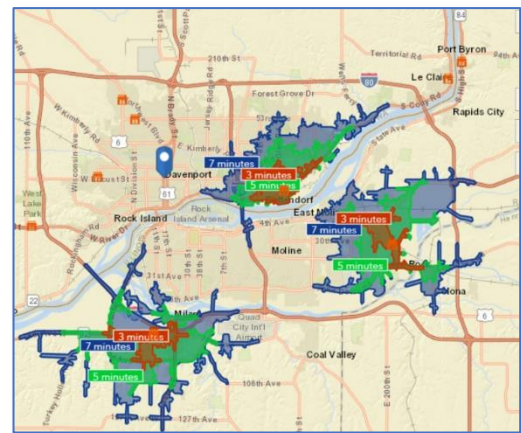
- (7) Change the basemap to Imagery with Labels. Zoom to each of the 3 existing store locations, noting the two structures that make up each Casey's location (see example shown). Knowing that these are convenience stores, what is underneath of each of the 2 different structures at each location? Structure #1 is **the store**. Structure #2 is **the awning (roof) over the gas pumps**.
- (8) Revisit each location one more time, noting the predominant type of neighborhood that each Casey's is located, filling out the following table:



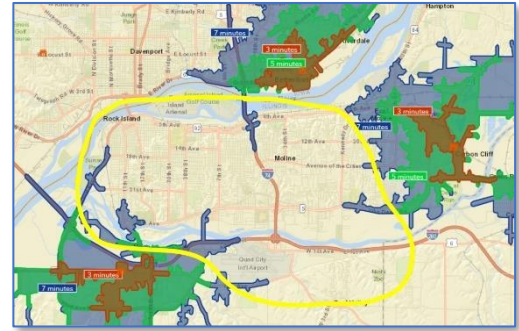
Casey's Location	Type of Neighborhood (residential, industrial, or commercial).
1105 10 th Ave W, Milan IL	Commercial is best answer; although Industrial is also acceptable.
306 2nd Av, Carbon Cliff IL	Residential
3902 State St, Bettendorf IA	Industrial

Creating Drive Time Buffers

- (9) With each of the 3 stores still clicked and selected (as shown) > Create buffers. Threshold distances, or the distance that people are willing to travel, vary for different types of businesses. Threshold distances may be in hours (by car) for an Ikea, Cabela's, or other large regional business, 30-45 minutes for a business such as a Home Depot, and 10 minutes or less for a business such as a convenience store. Considering this, you decide to create drive-time buffers at 3, 5, and 7 minutes around each Casey's in Davenport, as follows > Create buffers > Drive Time > 3, 5, 7 minutes. When done > Save layer.



- (10) Because no area in Rock Island or Moline (circled in yellow) lies within 7 minutes of an existing Casey's, this confirms your suspicions that this area might be a good potential location for a new Casey's (as shown). However, you need more information to make an informed decision.
- (11) You first decide to consider behavior at this local scale. Do you think that in the case of convenience stores, will people simply choose closest convenience store to their home or job site?



Any answer acceptable.

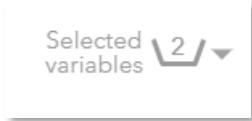
- (12) Name one reason why people might choose the closest convenience store to their home or job site, and one reason why they might **not** choose the closest one. **Any answer acceptable but look for thoughtful justification for each.**

Mapping Competitors

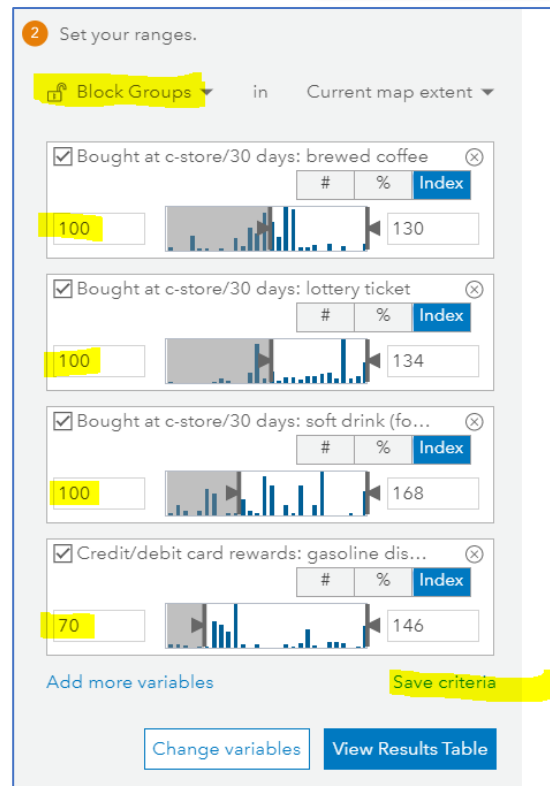
- (13) Another piece of information you need is whether competitors are already entrenched in the area. Zoom in to Rock Island and Moline. Use Create Maps > Business and Facilities Search > search for Circle K, a national convenience store that may have stores in this area. Symbolize the Circle K stores as a blue “store front” symbol and save the layer named Circle K. You note that these stores are on the west side of Rock Island, leaving a swath of urban area in central Rock Island and in Moline that are perhaps underserved by convenience stores. Zoom in until you are at the block group (neighborhood) scale.

Mapping Consumer Behavior

- (14) You also need information about the potential customers in the area. Specific products such as lottery tickets, coffee, and gasoline are important to convenience stores to draw in customers. Using market research that indicates the types of consumers that are most likely to visit your store, you make sure you are still at the block group scale. Then use Create Maps > Smart Map Search, and select the following 4 variables. You use “index” instead of raw numbers because the index will yield the neighborhoods more likely to be the kind of customers you are seeking, with 100 representing the national average for that variable. For each variable, select Index and then the variable name, so that the basket in the upper right “fills up” with variables as you progress (as shown).



- ✓ Search on “convenience store” > Select 2019 bought at convenience store in the last 30 days: Brewed Coffee > Index.
- ✓ On the same convenience store screen > Select 2019 bought at convenience store in the last 30 days: Lottery Ticket.
- ✓ On the same convenience store screen > Select 2019 bought at convenience store in the last 30 days: Soft drink (fountain).
- ✓ Go back to the Data Browser > search on gas > Credit or debit card rewards: gasoline discounts > Index.



When done, you should have 4 selected variables > Apply > Then, to the left of the map, you will see ranges > Set ranges. Slide each of the lower ranges for the first 3 variables (coffee, lottery tickets, soft drinks) to 100, and the lower range for the credit/debit card rewards for gasoline to 70 (as shown) > save criteria with a suitable names such as “convenience store consumer preferences”.

- (15) Where do you think the consumer behavior data comes from? **Any answer acceptable as it is the students' reasoned guess, but the consumer behavior primarily comes from databases of credit card purchases.**
- (16) Examine your resulting map. The map shows three clusters of block groups shown in gray that are **outside** the 7 minute drive time from existing Casey's **and** also some distance away from the Circle K stores, **and** they meet the 4 behavioral criteria (as shown). Two of those clusters are in the northern part of the area you are considering, in the central downtown areas of Rock Island and Moline, near the Mississippi River, and one of the clusters is to the south of these cities, near the Quad Cities Airport and Interstate Highway 74 (as shown).



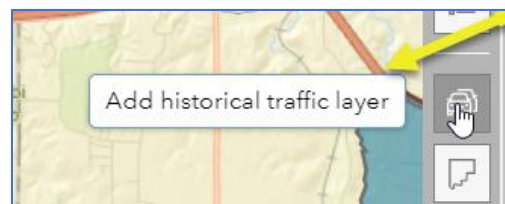
- (17) Next, view the results table > View full table, where you can sort on each variable to find the neighborhood (block group) that is highest for each of the variables. List the block group numbers that are the best for each variable in the table below:

Block group best for coffee consumption	Block group best for lottery ticket consumption	Block group best for soft drink consumption	Block group best for credit/debit card rewards gas consumption
171610241.012	171610241.012	171610228.002	171610241.012

Does any block group appear more than once in the above table? **Yes. 171610241.012.** This block group that appears more than once meets multiple criteria for your optimal store. Find this block group on your map (hint—look west of I-280 on the Iowa side, west of the area you have been examining; you may have to zoom out a bit). What is the problem with this block group's location that rules it out from further consideration? **It is not in the study area of Rock Island or Moline.**

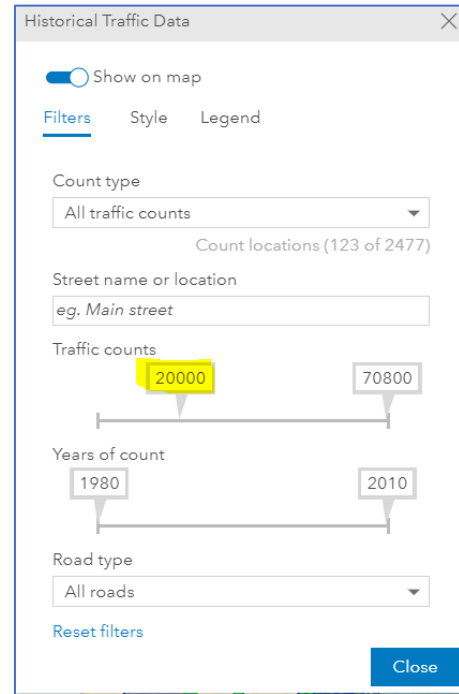
Investigating Traffic Patterns

- (18) There is one more variable that you need, and it has to do with the fact that a key factor in the optimal site for these types of stores has to do with access and convenience. This includes being able to, ideally, turn right into a store rather than left (across traffic) into a store, and on or near a busy arterial to assure a steady flow of customers. To the right of the map > Add historical traffic layer (as shown). Filter the traffic counts to 20,000 (as shown) so you are only mapping streets where the average annual daily



traffic is at least 20,000 vehicles. If you cannot drag the filter tool to exactly 20,000, you can enter the number in the box.

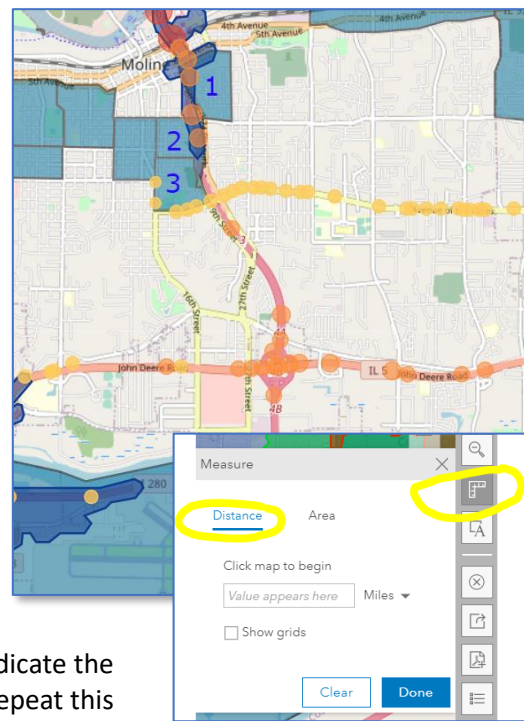
- (19) Examine your resulting map. Does the pattern surprise you? Why or why not? **Answers may vary, but it might be noted that major streets and freeways have the most traffic, which is to be expected.** Notice that only a few streets and highways in your neighborhoods under consideration have streets where at least 20,000 vehicles travel: I-74 running north-south, Avenue 23rd Av (Avenue of the Cities) running east-west, the John Deer Expy running east-west, and on the south side, US 6 (W 1st Ave). Four block groups (from north to south: 171610216.002, 171610217.002, 171610217.003, and 171610230.001) (as shown, as neighborhoods 1, 2, 3, and 4, respectively) meet your behavioral criterion **and** they are traversed by the required number of vehicles. Use the Add Annotation tool to the right of the map > Add the numbers 1, 2, 3, and 4 in the locations as shown.



- (20) Change the base map to OpenStreetMap. Next, zoom in and look more closely at the lanes and ramps on I-74 as it passes block groups 1, 2, and 3, and discover that the only **exit** off I-74 in this area is at 23rd St (Avenue of the Cities). You cannot locate a store directly on an interstate highway; it must be along a city street. Therefore, you rule out neighborhoods 1 and 2, but neighborhood 3 still has potential, as it is located where many vehicles exit the interstate highway and travel on 23rd Street.

Examining comparable sites

- (21) You turn your attention now to neighborhood 4; which also has potential. Is it feasible to locate your store near the Quad Cities Airport? **Answers may vary.** To help answer this question, you wonder if Casey's locate near airports in other cities. To find out, use the search locations tool to the upper right of the map to find Burlington, IA. This is down the river from Davenport. Once your map is in that vicinity, use Create Maps > Business and Facilities search, and find the Casey's General Stores in and around Burlington. Use the measure tool to measure the distance between the Burlington airport and the nearest Casey's. Indicate the units you are using (miles or km). How far is it? Repeat this



process for a city up the river from Davenport: Dubuque Iowa. How far is the nearest Casey's to the Dubuque Regional Airport? Fill in the table below. Indicate the units you are using.

Distance from Burlington airport to nearest Casey's	Distance from Dubuque airport to nearest Casey's
.2 mi or .3 km	3.6 mi or 5.9 km

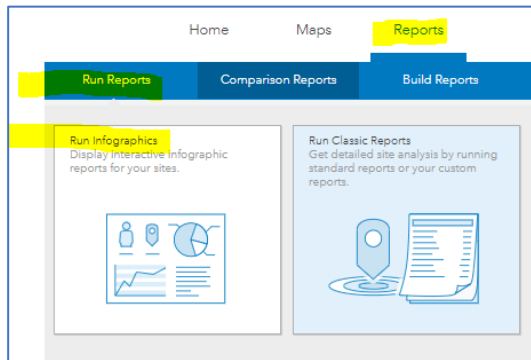
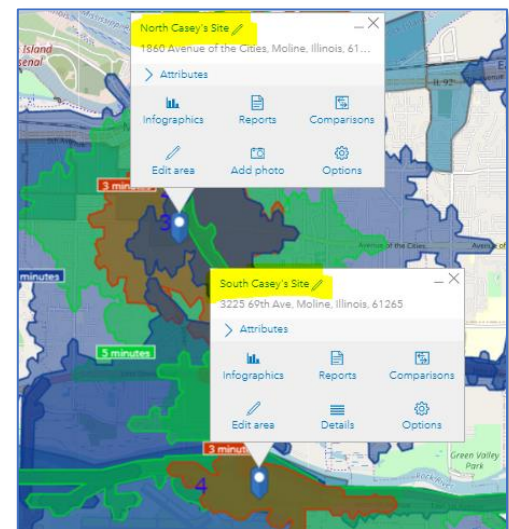
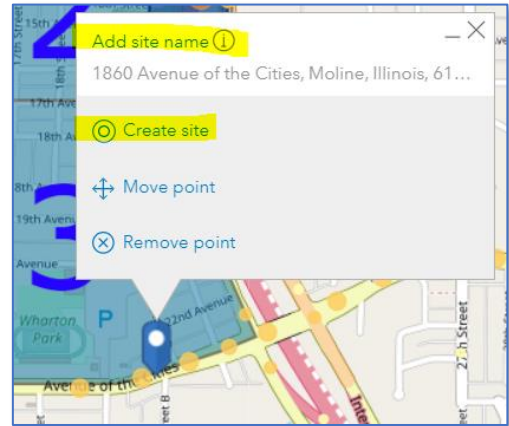
- (22) Based on the above investigation in Burlington and Dubuque, are you confident that an airport location would be suitable for a Casey's? **Yes, based on the other cities, a location near the airport in the Quad Cities seems as though it would work.**

Analyzing Infographics of the Two Proposed Store Sites

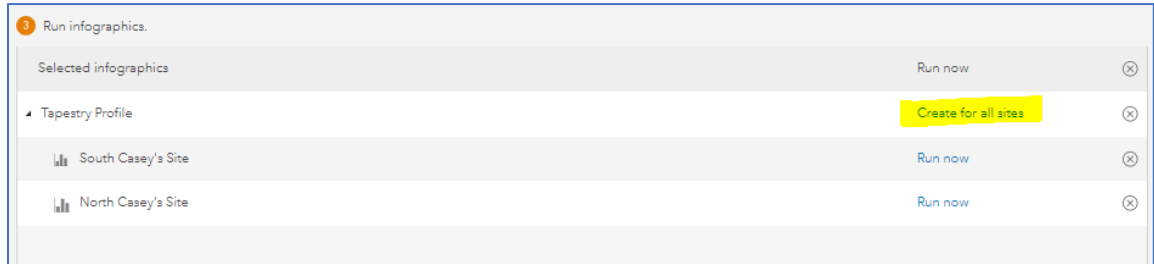
- (23) *Tapestry Infographic*. Next, go back to your study area in Davenport. In neighborhood 3, you are particularly interested in the intersection of 23rd Av (Avenue of the Cities) and 19th Street, on the southeast corner of the off ramp with I-74). This is the address 1860 Avenue of the Cities, Moline IL. In neighborhood 4, you are particularly interested in the location just east of the intersection of the north-south road's that extends to the south of I-74, US 6 (69th Av), and the Airport Ring Road. This is the address 3225 69th Av., Moline IL.

Using the find location box in the upper right, enter the address 1860 Avenue of the Cities, Moline, IL. Once the pin is located, which should be at the south end of neighborhood 3 > Add site name and name it North Casey's Site, and > Create Site. Create 3, 5, and 7 minute drive times around this site (the same criteria you used earlier when you were examining existing Casey's stores). Then > again using the find location box in the upper right, enter the address 3225 69th Av, Moline, IL > Create Site. Name it South Casey's Site (as shown).

Then > Reports > Run Reports > Run infographics (as shown).



#1 Select sites to report on > make sure your north and south Casey's sites are selected > #2 Select infographics > Under the list of **Standard** Infographics, select > Tapestry Profile. Tapestry is a geodemographic system that identifies 68 distinctive markets in the US based on socioeconomic and demographic characteristics. These comprehensive "neighborhood types" of consumers will help you select the optimal neighborhood for your Casey's (north or south). Tapestry Segments are classified into 14 LifeMode Groups and 68 Segments. Once Tapestry Profile is selected > in the #3 Run Infographics panel at the right > Run for all sites (your north and south Casey's site, as shown). If you have created other sites, remove those other sites so your infographic is only generated for the north and south Casey's proposed locations.



Your infographic will be built. When it is done, examine it. Its columns indicate the neighborhood characteristics for the 3, 5, and 7 minute drive times around each of the 2 sites you are considering. You note that the neighborhoods of two proposed sites share many characteristics with one major difference: Number of households.

- (24) Which of the two proposed sites has more households within the 3, 5, and 7 minute drive times (particularly within a 3 minute drive)? **The North Casey's Site**. How important is total number of households to a convenience store's neighborhood? **Answers may vary but generally, the more customers living in the area, the better.** You also, though, consider that some of the area around your south location is undeveloped. Despite this, you also know from studying your maps that it would be on a street that people who may not **live** in the area but who are **flying into** the airport would pass by.

Scroll down to the lowest part of the infographic. What is the most common tapestry segment in the areas surrounding the 2 sites? Click on this segment name > scroll down > View full segment profile. You should now be examining the following page:

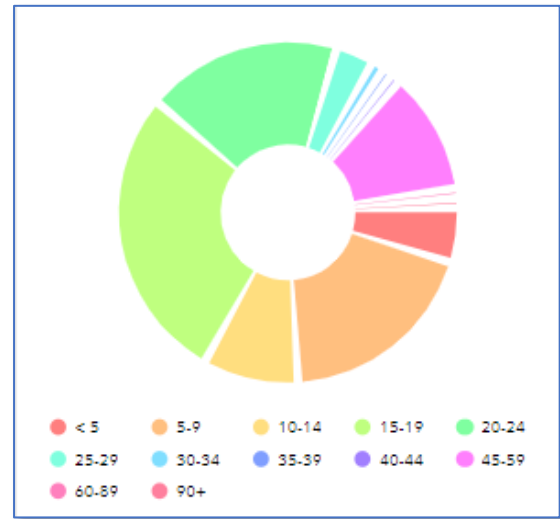
http://downloads.esri.com/esri_content_doc/dbl/us/tapestry/segment19.pdf

As you scroll down in this report and examine the market profile, you note the following statement: *Residents take advantage of convenience stores for fueling up and picking up incidentals.* This confirms that you are on the right track with considering these two sites. To the upper right of your infographic > Export your infographic as a PDF so that you can refer to it later.

- (25) **Bubble Infographic**. Next, create one more infographic so you can understand commuting patterns and population change: Then > Reports > Run Reports > Run infographics > #1 Select sites to report on > make sure your north and south Casey's sites are selected > #2 Select

infographics > Shared Infographics > select Bubbles (helent_biz) > #3 in the right panel > Create Bubbles for all sites (your north and south Casey's sites).

You noticed on your map that some land around the Casey's south site is currently undeveloped. Your bubble infographic contains one column for each of the 3, 5, and 7 minute drive time buffers around each proposed Casey's location for a total of 5 columns. The second row in the infographic is population growth. Is it reasonable to expect that your undeveloped land near your proposed south location will grow in the future? **No**. Why or why not? **The infographics indicate no growth in the area, but rather, population decline.** Next, examine the third row in the infographic, which provides commuting time, divided into commuting time segments from less than 5 minutes to over 90 minutes (a sample is shown). What is the most common commute time for all drive time buffers? **15-19 minutes.** List the total population within the 7 minute drive time buffer for the North Site: **49,188** and the South Site: **13,636**. Spend a few minutes analyzing the other variables such as age, owner-vs-renter, and median income. Then > Export the infographic to a PDF so that you can refer to it later.



Narrowing the search based on weights

- (26) You have analyzed the proposed two sites in detail. The infographic analysis yielded that each of the sites offers advantages, but the north site's total population seems to be a chief advantage there.

Close the infographic and go back to your map. Turn the historical traffic layer back on. Now, you need to decide between the two sites and make a recommendation to Casey's management. To do this, based on your research, you devise the following formula: The ideal site will be in the neighborhood outside drive time buffers of existing Casey's, a fair distance away from existing Circle K stores, **and** weighted 20% on the 7 minute drive time population **and** weighted 65% where the 4 consumer behaviors are cumulatively the highest, **and** 15% where the traffic is at least 20,000 vehicles. The latter three criteria will be summed into a Site Score calculated by the following formula:

$$= .2 (7 \text{ minute drive time population}) + .65 (\text{index of coffee} + \text{lottery} + \text{soft drinks} + \text{gas points}) + .15 (\text{traffic count}) = \underline{\hspace{2cm}} \text{ Site Score}$$

For the specific number to use in the traffic count, select the value at the following locations for neighborhoods that you have already been examining above that look particularly suitable for the convenience store in neighborhoods 3 (the north Casey's proposed site) and 4 (the south Casey's proposed site) (as shown).

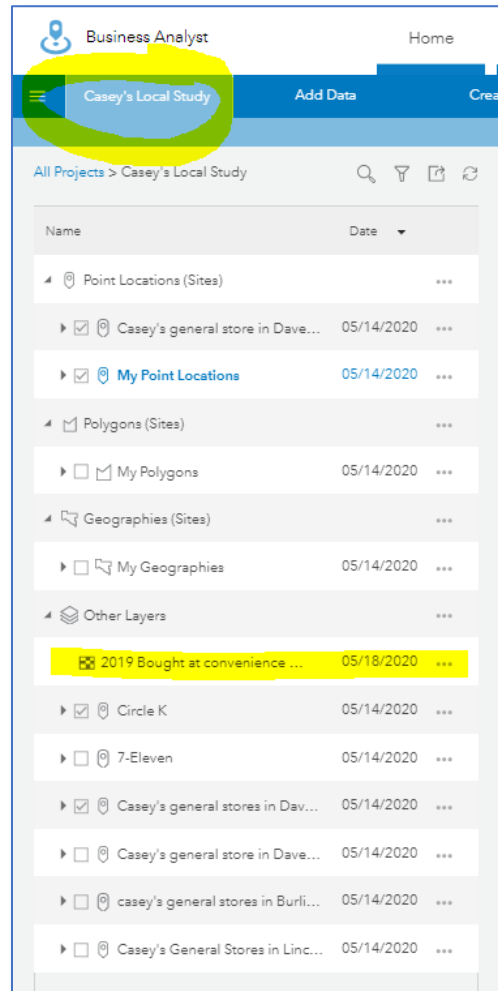
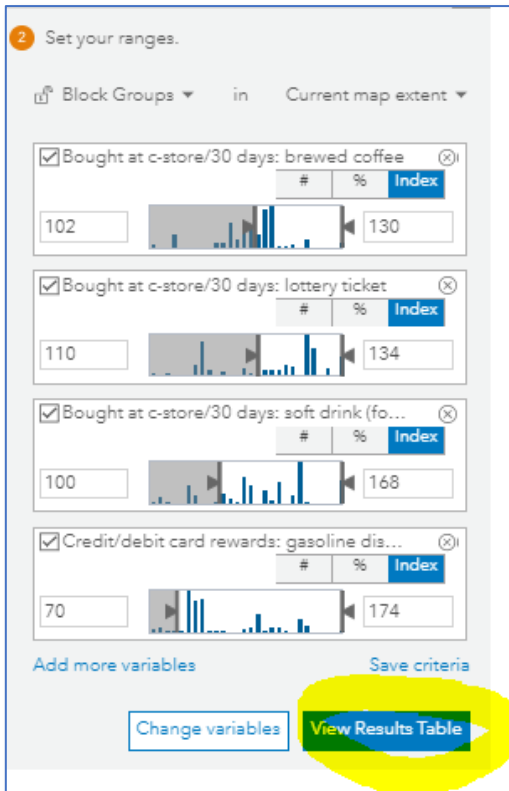




Using your formula, an example calculation would be:

$$\begin{aligned}
 \text{Neighborhood X:} &= .2 (40000) + .65 (105+122+139+73) + .15 (27,000) \\
 &= 8000 + 285.35 + 4050 \\
 &= 12335.35
 \end{aligned}$$

To get back to the table where the consumer behavior data is stored that you created earlier: Go to your Casey's Local Study project > (as shown), then > View Results table (as shown).



Then > View Full Table. Your table should look similar to that below (but may not be exact depending on the scale of your map).

43 Block Groups match your criteria.

Block Group	Bought at c-store/30 da...	Bought at c-store/30 day...	Bought at c-store/30 day...	Credit/debit card re...
171610201.005	130	124	112	124
170730302.011	130	123	111	123
171610204.002	130	124	112	123
171610241.012	130	124	112	123
171610204.004	102	112	120	77
170730301.003	102	113	119	76
171610202.003	102	113	119	76
171610201.003	102	112	120	75
171610202.002	102	113	119	75
171610243.003	102	112	119	75
171610243.001	102	112	119	75

Overlay color Transparency

Back Export to Excel

Sort the table on Block Group to find the north neighborhood 17160217.003 and the south neighborhood 17160243.003. For each neighborhood > fill in the following table using the variables for population, coffee, lottery, fountain drink, gas discounts, and traffic:

Neighborhood 3 (North Casey's)	Neighborhood 4 (South Casey's)
$= .2 (49188) + .65 (104 + 122 + 138 + 70) + .15 (21400)$ $= 9837.6 + 282.1 + 3210$ $= 13329.7$	$= .2 (13636) + .65(102 + 112 + 119 + 75) + .15 (22900)$ $= 2727.2 + 265.2 + 3435$ $= 6427.4$

Observe which neighborhood and site has the higher number. You decide that the neighborhood and site with the highest number is the optimal site for the proposed new Casey's.

- (27) Which of the two sites (north or south) are you now favoring for your proposed Casey's General Store? **North.**

Reflection, analysis, and presentation

- (28) What is 1 additional variable or method that you think would be important in site selection for this type of business, that time did not permit you to analyze in this lesson? If you have additional time, feel free to pursue it! **Answers will vary but could include zoning, land for sale, right vs left turns, other consumer behavior (such as the purchase of ice), other competitors not considered (such as 7 Eleven or other gas stations, costs for expanding the chain, different weights for the final analysis, and so on.**
- (29) Summarize in 2 sentences what you have learned about site selection, and how mapping tools helped you to make decisions. **Answers will vary but look for thoughtful answers that touch on spatial thinking and geospatial analysis.**
- (30) Give a 5-minute oral or written presentation to your colleagues with your sales pitch for the site that you have chosen, using your maps and infographics as an integral part of your presentation. For this presentation, you can use Business Analyst Web > Share Results, you can export your map(s) as PDFs or create a story map. Or you can show your results during your presentation directly from within Business Analyst Web. Or, you can use Prezi, Sway, PowerPoint, or a video for the presentation. **Answers will vary but look for rigorous use of maps, data, and clarity of presentation and graphics.**

Congratulations on your good work!

