



CRAFT

## EXPLORE ST. LOUIS

**St. Louis Craft Brewery**

**Database Proposal**

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## St. Louis Craft Beer Database



### Introduction

Since the 1990's, St. Louis has seen a considerable rise in independent breweries (St. Louis Brewers Guild., 2018). The greater St. Louis area is currently home to over 60 breweries with more new breweries being founded each year (St. Louis Brewers Guild., 2018). Trips to experience local breweries and brewery crawls are on the rise in the United States. Travelocity surveyed 1,003 people and more than 75% said “they would like to go on a trip where they visited craft breweries and sampled local beer” (Herz, J. ,2016). According to Travelocity, St. Louis is not listed as one of their top choices for beer towns (Michael, 2016). With so many breweries in St. Louis that are in short distance of each other along with easy access to public transportation, ride sharing, and inexpensive lodging, St. Louis should be at the top of the list for places to take a “beer-cation”. In the case of Denver, being a top “beer-cation” destination resulted in the Great American Beer Festival which generated \$28.6 million of revenue (Herz, J. ,2016).

Currently, all the information about St. Louis craft beers is spread out over multiple websites and is not in an easily digestible format. Providing an accessible source for craft brewery information could improve tourists' experiences by allowing them to curate their own beer tasting adventure based on the type of beer that they like. This could lead to more tourists visiting more breweries that are less well known, generating more money for small businesses in St. Louis. Having a single source for craft brewery information could help companies like Travelocity and TripAdvisor direct tourists to St. Louis as a premier beer-cation destination.

## **Proposal**

For St. Louis to gain potentially millions of dollars in additional revenue, a singular data source for St. Louis craft breweries is necessary. With a thorough and up-to-date archive of beers, breweries, tour days, etc., tourists will be able to browse what brewery options St. Louis has to offer. Currently, there is no such single source of information for people interested in finding previously unknown or undiscovered destinations for brewery touring, a new and popular means of vacationing. This team has the ability collect and compile data into a database that will provide a complete and reliable source of information on craft breweries. The objective of this project will be to obtain data on St. Louis breweries from brewery websites and contact brewers who lack a web presence. In the following sections of this paper, descriptions and explanations of the proposed database will be provided in detail.

## **Goals and Anticipated Outcomes**

The goal of this project is to catalog craft breweries in St. Louis and the beer that the brew in hopes for making a quick reference guide for tourists. The stakeholders in this project are the St. Louis Department of Tourism and the local breweries. The scope of the data collection for this project is craft beers that are brewed in the Greater St. Louis area. A craft brewery is defined as having three distinct features: small (producing 6 million barrels a year or less), independent (less than 25 percent of the craft brewery is owned or controlled by an outside stakeholder), and traditional (creating most of their beers with barley, hops, malt, and water) (Brewers Association, 2018). This database will include information on St. Louis craft beers, craft breweries, brewery tours, and search beers by key words.

In the future, tourists will be able to access this database through a website, mobile app, and public API. This will create the opportunity to generate revenue through ad space on the website and mobile app. Expectations for this project would be to increased tourism through user interaction of the craft brewery database. The anticipated outcome will be an increase in local revenue due to tourism.

## **Business Rules and Requirements**

To begin the Craft Brewery Database, the scope of the data needs to be defined. Business rules help create a clear vision for a database. They are designed to define clear relationships among entities - people, places, or things about which data can be stored (Hoffer, Ramesh, & Topi, 2016). Business rules are intended to establish structure or control on a specific aspect of business. In the case of the St. Louis craft brewery database, the entities are defined as Beer, Brewery, BreweryTour, BeerKeyword, and Keyword. Business rules also provide directives for constraints of a database that will clarify the relationships between entities. The database business rules are as follows:

1. A brewery brews zero, one, or many beers.
2. Every beer must be brewed by one and exactly one brewery to exist within the database.
3. A brewery conducts zero, one, or many brewery tours. Not all breweries conduct brewery tours.
4. Every brewery tour is conducted by one and exactly one brewery to exist within the database.
5. Every beer must be described by one or many keywords.
6. Every keyword describes one or many beers.

## Definitions

This section will be used to define terms and concepts that will be used throughout this document. An *entity*, as stated above, is a person place or thing about which data is being stored. *Attributes* are characteristics of an entity that are of interest. This section will clearly lay out the entities of the database, as well as, the attributes of each entity of the Craft Brewery Database. The database has five entities: Beer, Brewery, BreweryTour, BeerKeyword, and Keyword.

*Beer:* Beer has a **BeerID**, which is assigned sequentially. Beer also includes BeerName (name of the beer), BeerType (the classification or style of the beer), ABV (the alcohol content of the beer), and Availability (seasonal or year-round beer). References *Brewery*.

*Brewery:* Brewery has a **BreweryID**, which is assigned sequentially. Brewery also includes BreweryName (name of the brewery), BreweryAddress (street address of the brewery), and BreweryZip (zip code of the brewery).

*BreweryTours:* BreweryTours has a **TourID**, which is assigned sequentially. BreweryTours also includes Day (day of the week that the brewery tour is offered, e.g. Monday, Tuesday, Wednesday, etc.) and Cost (the cost of the brewery tour). References *Brewery*.

*BeerKeyword:* BeerKeyword references *Beer* and *Keyword*. BeerKeyword acts a bridge between *Beer* and *Keyword* so that beers can be searchable based on keywords.

*Keyword*: Keyword has a **KeywordID**, which is assigned sequentially. Keyword also includes the attribute Name, which acts as a searchable descriptor for the beer associated in the *BeerKeyword* table, e.g. Bitter, Stout, Dark, etc.

## Entity- Relationship Diagram (ERD)

The entities and relationships have been defined in preceding sections. Now, the relationships between entities can be modeled. An Entity-Relationship Diagram (ERD) is a type of database modeling. Modeling a database allows for visualization of business rules and entity relationships with attributes included. This ERD will be the roadmap for the St. Louis Craft Brewery Database's design.

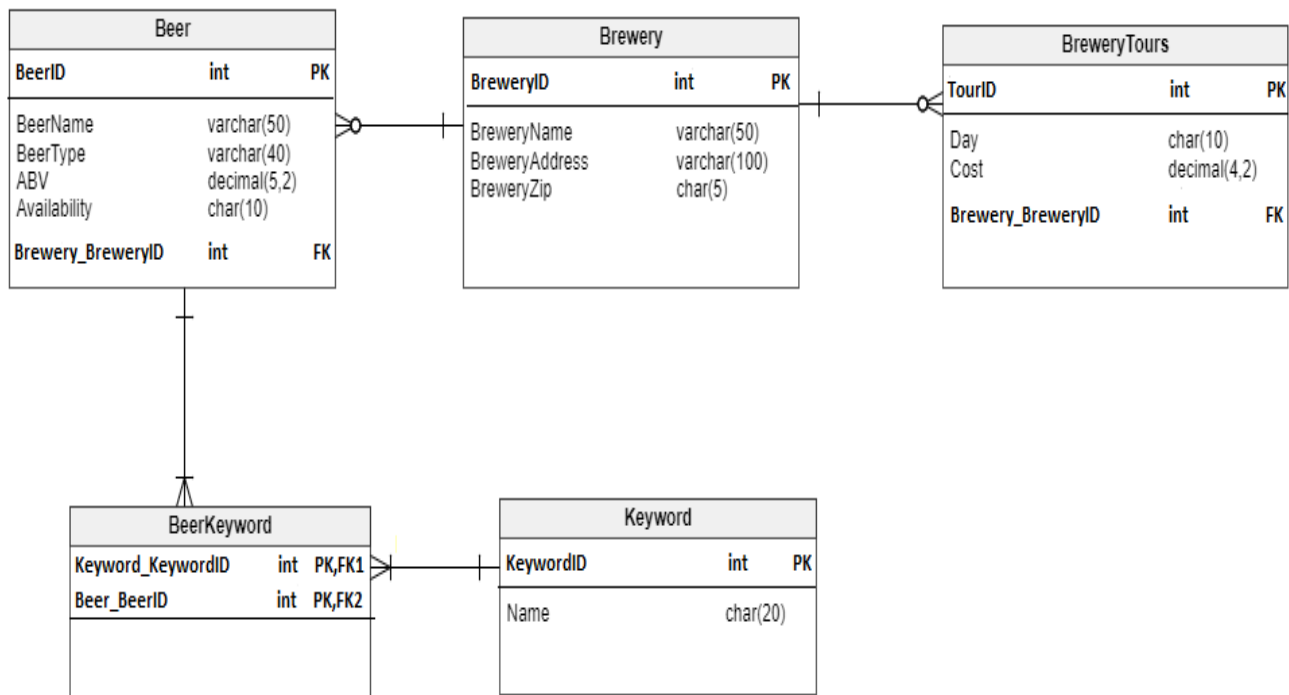


Figure 1

## Physical Database Design

Moving from the Craft Brewery ERD in **Figure 1** to the physical database design, the entities will become tables within the Craft Brewery Database. Attributes of entities will become columns within the database (this is similar to how data is displayed in an excel spreadsheet). Relationships within the ERD will be delineated by Foreign Keys within the physical data model. In the creation of the Craft Brewery Database a programming language called Structured Query Language, or SQL, will be used. The SQL script can be executed using a Database Management System (DBMS), such as SQL Server.

The following section contains examples from the SQL script that will be used to create the Craft Brewery Database. The SQL code statements below will create the entities from the ERD on the previous section as tables.

The following statement is used to create the Brewery table:

```
CREATE TABLE Brewery (  
    BreweryID int IDENTITY (1,1) NOT NULL PRIMARY KEY,  
    BreweryName varchar (50) NOT NULL,  
    BreweryAddress varchar(100),  
    BreweryZip char(5),  
);
```

The following statement creates the Beer table:

```
CREATE TABLE Beer (  
    BeerID int IDENTITY (1,1) NOT NULL PRIMARY KEY,  
    BreweryID int NOT NULL,  
    BeerName varchar(50) NOT NULL,  
    BeerType varchar(50) NOT NULL,  
    ABV decimal (2,1),  
    BeerAvailability char(30),  
    FOREIGN KEY (BreweryID) REFERENCES Brewery(BreweryID)  
);
```



The following statement creates the BreweryTour table:

```
CREATE TABLE BreweryTour (  
  TourID int IDENTITY (1,1) NOT NULL PRIMARY KEY,  
  BreweryID int NOT NULL,  
  TourDay char(30),  
  TourCost decimal(2,2),  
  FOREIGN KEY (BreweryID) REFERENCES Brewery(BreweryID)  
);
```

The following statement creates the Keyword table:

```
CREATE TABLE Keyword (  
  KeywordID int IDENTITY (1,1) PRIMARY KEY,  
  KeywordName char(30),  
);
```

The following statement creates the BeerKeyword table:

```
CREATE TABLE BeerKeyword (  
  KeywordID int NOT NULL,  
  BeerID int NOT NULL,  
  PRIMARY KEY CLUSTERED ( KeywordId, BeerId ),  
  FOREIGN KEY (KeywordID) REFERENCES Keyword(KeywordID),  
  FOREIGN KEY (BeerID) REFERENCES Beer (BeerID)  
);
```

The order in which these scripts are executed (or run) is important. Three of these tables contain foreign keys, or unique identifiers, from other tables. These tables need to be created after their corresponding relationship table is created so that the references can exist. This methodology ensures that the relationship constraints provided in the business rules section are upheld on data creation and manipulation.

## Data Creation

Once the tables are created, data can be stored within the Craft Brewery Database. This section will include examples of data that will be stored in the craft beer database. In SQL, insert statements allow data to be inserted into database table. The following are examples of insert statements for the Craft Brewery Database.

To insert data into the Brewery table, the SQL insert statement would look like:

```
INSERT INTO Brewery (BreweryName, BreweryAddress, BreweryZip)
VALUES ('The Saint Louis Brewery', '7260 Southwest Ave.', '63143'),
      ('Alpha', '4310 Fyler Ave', '63116');
SELECT*FROM Brewery
```

To insert data into the Beer table:

```
INSERT INTO Beer (BreweryID, BeerName, BeerType, ABV, BeerAvailability)
VALUES ((Select BreweryID FROM Brewery WHERE BreweryName = 'The Saint Louis Brewery'),'Schaflly Pilsner', 'Pilsner', '5.0', 'Year-Round'),
      ((SELECT BreweryID FROM Brewery WHERE BreweryName = 'Alpha'), 'Belgian Blonde ', 'Blonde Ale', '5.0', 'Year-Round') ;
```

To insert data into the Keyword table:

```
INSERT INTO Keyword (KeywordName)
Values ('light'),
      ('lager'),
      ('German');
```

To insert data into the BeerKeyword Table:

```
INSERT INTO BeerKeyword (keywordID, BeerID)
VALUES((SELECT KeywordID FROM Keyword WHERE KeywordName = 'light'),(SELECT BeerID FROM Beer WHERE BeerName = 'Schaflly Pilsner')),
      ((SELECT KeywordID FROM Keyword WHERE KeywordName = 'German'),(SELECT BeerID FROM Beer WHERE BeerName = 'Schaflly Pilsner')),
      ((SELECT KeywordID FROM Keyword WHERE KeywordName = 'lager'),(SELECT BeerID FROM Beer WHERE BeerName = 'Schaflly Pilsner'));
```

To insert data into the BreweryTour Table:

```
INSERT INTO BreweryTour (BreweryID, TourDay, TourCost)
VALUES ((Select BreweryID FROM Brewery WHERE BreweryName = 'The Saint Louis Brewery'), 'Saturday', '0.00');
```

As these statements are executed the DBMS will make sure that the data falls in line with the constraints declared in the create statements from the previous section. This will help prevent from data contamination and broken references. The subqueries within the insert statements help ensure that the appropriate foreign key is inserted into the referencing table.

## Data Manipulation

With the tables created and the data inserted, the data in the database can be manipulated using SQL script. These scripts will be used to ensure that the data was inserted properly, the constraints were upheld, and data can be updated without any errors.

First to see if the data was inserted into the appropriate table, the query “**SELECT \* FROM Brewery**” is run to see all rows in the brewery table.

	BreweryID	BreweryName	BreweryAddress	BreweryZip
1	1	The Saint Louis Brewery	7260 Southwest Ave.	63143
2	2	Alpha	4310 Fyler Ave	63116
3	3	Modern Brewery Co.	5231 Manchester ave.	63110
4	4	Urban Chestnut	4465 Manchester Ave	63110
5	5	2nd Shift Brewing	1601 Sublette Ave.	63110
6	6	Civil Life	3714 Holt Ave	63116
7	7	Earthbound Beer	2724 Cherokee St.	63118
8	8	Exit & Brewery	5055 State Highway Nŷ	63304
9	9	Greer Brewing Co.	16050 Manchester Rd.	63011
10	10	Heavy Riff Brewery	6413 Clayton Ave	63139
11	11	Kirkwood Station Brewing Company	105 E Jefferson Ave.	63122
12	12	Mackenzie Brewing Co.	932 Meramec Station Road	63088
13	13	Mark Twain Brewing Co.	422 N Main S	63401
14	14	Narrow Gauge Brewing Co.	1595 US-67	63031
15	15	Public House Brewing Co.	600 North Rolla Street	65401
16	16	Six Mile Bridge Beer	11841 Dorsett Rd	63043
17	17	Third Wheel Brewing	4008 I-70 North Outer Rd	63376
18	18	Trailhead Brewing Co.	921 S Riverside Dr	63301
19	19	Two Plumbers Brewery + Arcade	2236 1st Capitol Dr	63301
20	20	Wellbeing Brewing Co.	45 Progress Pkwy	63043
21	21	William K Busch Brewing Co	8047 Litzsinger Rd	63144
22	22	Morgan Street Brewery	721 N 2nd St	63102
23	23	Square One Brewery & Distillery	1727 Park Ave	63104
24	24	Perennial Artisan Ales	8125 Michigan Ave	63111
25	25	Ferguson Brewing Co.	418 S Florissant Rd	63135
26	26	Center Ice Brewery	3126 Olive St	63103
27	27	Charleville Brewing Co.	2101 Chouteau Ave	63103
28	28	Side Project	7458 Manchester Rd.	63143
29	29	Steampunk Brew Works	231 Lamp and Lantern Vil...	63017
30	30	4 Hands Brewing Co	1220 S 8th St	63104
31	31	Augusta Brew Haus	5521 Water St	63332
32	32	Griesedieck Brothers Brewery	P.O. Box 31203	63131
33	33	Good News Brewing Co	330 Sonderen St.	63366
34	34	O'Fallon Brewery	45 Progress Pkwy	63043
35	35	Cathedral Square Brewery	10070 Gravios Ave	63123
36	36	The BeerHouse	777 River City Casino Blvd	63125
37	37	Missouri Beer Company	22 West Industrial Dr	63366
38	38	Friendship Brewing Co	100 E Pitman Ave	63385
39	39	Bastard Brothers Brewing	2114 Penta Driveŷ	63049
40	40	4204 Main St. Brewing Co	4204 W. Main St	62002
41	41	Hofbrauhaus	123 St. Eugene Dr	62223

Figure 2

To test the constraints, a more complicated query can be run that will join two tables. This means that the script will be finding data in one table and using the foreign keys in another table to get a clearer picture of the information available in the Craft Brewery Database. One useful example of this type of joining would be to view the Beer Names with Beer Keywords. This requires passing the BeerID through a table that has a composite key, the BeerKeyword table. A composite key is a unique identifier that is made up of two or more foreign keys from other tables. These foreign keys together make a unique value that can be used to simplify relationships between two or more entities when there is a many-to-many relationship. The following is an example of how joining two or more tables together will be used in the Craft Brewery Database.

```
SELECT Beer.BeerName, Keyword.KeywordName
FROM Beer
JOIN BeerKeyword on Beer.BeerID = BeerKeyword.BeerID
JOIN Keyword on Keyword.KeywordID = BeerKeyword.KeywordID
```

A portion of the output result is:

	BeerName	KeywordName
398	Belgian-Style Abb...	Belgian
399	Belgian-Style Whit...	Belgian
400	Belgian Golden	Belgian
401	Belgian Wit	Belgian
402	Dry Hopped APA	Bitter
403	British Bitter	Bitter
404	British Bitter Mild	Bitter
405	Mahlab ESB	Bitter
406	Augusta ESB	Bitter
407	Augusta Roggen ...	Bitter
408	Tower Hill Burton-...	Bitter
409	Mercator	Sour
410	Layla	Sour
411	Going Once. Goin...	Sour
412	SavantBlanc	Sour
413	Bretta Sang	Sour
414	Pulling Nails	Sour

Figure 3

The output seen in **Figure 3** gives a clear picture of how the beers in the Craft Brewery Database will be described by different keywords. This is useful information that tourists could use to find beers that suit their individual tastes.

Breweries often create new beers and, at times, discontinue older brew recipes. When a brewery adds new beer, the beer table can be changed using an insert statement. The following statements illustrate how the Craft Brewery Database could perform this operation:

```
INSERT INTO Beer (BreweryID, BeerName, BeerType, ABV, BeerAvailability)
VALUES ((Select BreweryID FROM Brewery WHERE BreweryName = '4 Hands Brewing Co'),'New 4 Hands beer', 'Ale', '6.1', 'Year-Round')
```

One way to see if the insert statement was executed properly:

```
SELECT Beer.BreweryID, Brewery.BreweryName, Beer.BeerID, Beer.BeerName, Beer.BeerType, Beer.ABV, Beer.BeerAvailability
FROM Beer
JOIN Brewery on Brewery.BreweryID = Beer.BreweryID
WHERE Brewery.BreweryName = '4 Hands Brewing Co'
```

	BreweryID	BreweryName	BeerID	BeerName	BeerType	ABV	BeerAvailability
32	30	4 Hands Brewing Co	439	Lemon Gose	Wheat Ale	4.5	Summer
33	30	4 Hands Brewing Co	440	Liquid IPA	IPA	7.5	Fall
34	30	4 Hands Brewing Co	441	Bone of Contention	Saison	5.0	Fall
35	30	4 Hands Brewing Co	442	Zellige	Stout	7.5	Fall
36	30	4 Hands Brewing Co	443	Genevieve	Wheat Ale	5.5	Fall
37	30	4 Hands Brewing Co	444	Azza	Stout	13.5	Fall
38	30	4 Hands Brewing Co	445	La Belleza	Stout	10.5	Fall
39	30	4 Hands Brewing Co	446	Ba Bona Fide	Stout	10.0	Winter
40	30	4 Hands Brewing Co	1002	New 4 Hands beer	Ale	6.1	Year-Round

**Figure 4**

At the bottom of **Figure 4** is the beer that was inserted with the Insert statement. All the data is seen, and the insert statement was executed properly. Similarly, when a brewery discontinues a beer, the record can be removed using delete statement. If 4 Hands Brewing Co were to discontinue the new beer that was inserted, a delete statement like the subsequent query could be used:

```
DELETE FROM Beer
WHERE Beername = 'New 4 Hands beer'
```

The same query from before can be used to see if the Delete statement was executed properly.

```
SELECT Beer.BreweryID, Brewery.BreweryName, Beer.BeerID, Beer.BeerName, Beer.BeerType, Beer.ABV, Beer.BeerAvailability
FROM Beer
JOIN Brewery on Brewery.BreweryID = Beer.BreweryID
WHERE Brewery.BreweryName = '4 Hands Brewing Co'
```

	BreweryID	BreweryName	BeerID	BeerName	BeerType	ABV	BeerAvailability
31	30	4 Hands Brewing Co	438	Hopeless Romantic	Saison	6.0	Summer
32	30	4 Hands Brewing Co	439	Lemon Gose	Wheat Ale	4.5	Summer
33	30	4 Hands Brewing Co	440	Liquid IPA	IPA	7.5	Fall
34	30	4 Hands Brewing Co	441	Bone of Contention	Saison	5.0	Fall
35	30	4 Hands Brewing Co	442	Zellige	Stout	7.5	Fall
36	30	4 Hands Brewing Co	443	Genevieve	Wheat Ale	5.5	Fall
37	30	4 Hands Brewing Co	444	Azza	Stout	13.5	Fall
38	30	4 Hands Brewing Co	445	La Belleza	Stout	10.5	Fall
39	30	4 Hands Brewing Co	446	Ba Bona Fide	Stout	10.0	Winter

Figure 5

4 Hands Brewing Co's "New 4 Hands Beer" is no longer in the database. The delete statement was executed properly.

A Brewery may decide to move locations. In this case the Brewery table will also need to be updated using an Update statement.

```
UPDATE Brewery
SET BreweryAddress = '123 Maple St', BreweryZip = '63116'
WHERE BreweryName = 'Civil Life'
```

These are just some examples of data manipulation and data querying in SQL using the Craft Beer Database. For data integrity and security reasons, data manipulations and querying directly from within the DBMS will be reserved for the database administrator. In a later section, the user front-end will be discussed, and examples of forms and reports in Microsoft Access will be provided.

## Answering Data Questions

The importance of having a craft brewery database is so that tourists will have access to data. Along with the raw data, SQL will be answer more specific questions through querying. Querying was briefly discussed in the section, but not in detail. A query is used to retrieve data from the database in a straightforward format. A query can use a SELECT statement to make an inquiry into the database.

Some interesting questions the database can answer, along with their potential queries, are:

### *Who brews the most beers?*

```
SELECT TOP 1 TopBrewery, BeerCount
FROM(
    SELECT Brewery.BreweryName as TopBrewery, COUNT(Beer.BreweryID) as BeerCount
    FROM Beer
    JOIN Brewery on Brewery.BreweryID = Beer.BreweryID
    GROUP BY Brewery.BreweryName, Beer.BreweryID
) BeersByBrewery
ORDER BY BeerCount desc
```

Returns:

	TopBrewery	BeerCount
1	Perennial Artisan Ales	72

Figure 6

Perennial Artisan Ales brews the most beers out all the St. Louis Brewers! If a tourist wanted to go to one brewery to try the most beers, Perennial would be the place to go. With 72 different beers, there's something for everyone.

***What are the most popular brewing styles in St. Louis?***

```
SELECT TOP 5 TopBrewingStyle, CountOfStyle
FROM(
    SELECT Beer.BeerType as TopBrewingStyle, COUNT(Beer.BeerType) as CountOfStyle
    FROM Beer
    GROUP BY Beer.BeerType
) TopBrewing
ORDER BY CountOfStyle desc
```

TopBrewingStyle	CountOfStyle
Ale	110
IPA	74
Stout	60
Saison	51
Wheat Ale	47

**Figure 7**

Four of the five most popular brewing styles at breweries in Saint Louis are Ales. Beer enthusiasts would be interested to know that Saint Louis is a major destination for trying out different types of Ales.

***Which beers have high alcohol content, or ABV, and which sell these beers?***

```
SELECT Brewery.BreweryName as Brewery, Beer.BeerName as Beer, ABV
FROM Beer
JOIN Brewery on Brewery.BreweryID = Beer.BreweryID
WHERE ABV > 8.5
ORDER BY ABV DESC
```



	Brewery	Beer	ABV		Brewery	Beer	ABV
1	Side Project	Beer : Barrel : Time	15.0	40	Side Project	Langst	10.0
2	Side Project	Derivation	15.0	41	Side Project	Orviamo	10.0
3	Side Project	Double Barrel Derivation	15.0	42	Side Project	Black & Berry	10.0
4	Side Project	Anabasis	14.0	43	Side Project	Blanc de Blancs	10.0
5	Side Project	Styrbjorn	14.0	44	Side Project	Black & Wild	10.0
6	Perennial Artisan Ales	Barrel-Aged Vermillion	13.7	45	Perennial Artisan Ales	Mon Ami	10.0
7	Perennial Artisan Ales	Vermillion Barleywine	13.6	46	Perennial Artisan Ales	Fete de Noel	10.0
8	4 Hands Brewing Co	Azza	13.5	47	Perennial Artisan Ales	Heart of Gold	10.0
9	Square One Brewery & Distillery	Barley Wine	12.3	48	Missouri Beer Company	Dark As Funk	10.0
10	Square One Brewery & Distillery	Single Malt Scotch Ale	12.3	49	Side Project	Unblended #25	10.0
11	Center Ice Brewery	Nash Year's Eve Imperial Blonde Ale	12.1	50	Side Project	Trail Dubbel	10.0
12	Charleville Brewing Co.	Barleywine	12.0	51	Cathedral Square Brewery	Bourbon Age Holy Moly!	10.0
13	Perennial Artisan Ales	Reverie	12.0	52	Cathedral Square Brewery	Ave Maria	10.0
14	The Saint Louis Brewery	Quad Rupel Ale	12.0	53	Main & Mill Brewing Co	DWIPA	9.5
15	Mark Twain Brewing Co.	BA Passport to Russia	12.0	54	Augusta Brew Haus	Augusta Barley Wine	9.5
16	2nd Shift Brewing	Liquid Spiritual Delight	11.5	55	Morgan Street Brewery	Baltic Porter	9.4
17	Perennial Artisan Ales	Devil's Heart of Gold	11.5	56	2nd Shift Brewing	Brewcocky	9.3
18	Perennial Artisan Ales	Barrel-Aged 17	11.5	57	4 Hands Brewing Co	Madagascar	9.3
19	Perennial Artisan Ales	Barrel-Aged Sump Coffee Stout	11.5	58	Square One Brewery & Distillery	Imperial IPA	9.2
20	Perennial Artisan Ales	Barrel-Aged Abraxas	11.0	59	Augusta Brew Haus	Augusta Dingo Double IPA	9.2
21	Urban Chestnut	Wolpertinger	11.0	60	Ferguson Brewing Co.	Scotch Ale	9.2
22	Perennial Artisan Ales	Maman	11.0	61	Perennial Artisan Ales	Woodside	9.1
23	Cathedral Square Brewery	Canes of Judas	11.0	62	Square One Brewery & Distillery	DoublePilsner	9.1
24	Perennial Artisan Ales	Prodigal	10.6	63	Perennial Artisan Ales	Til the Night Closes In	9.0
25	Charleville Brewing Co.	Box of Chocolate	10.5	64	The Saint Louis Brewery	Grand Cru Ale	9.0
26	Ferguson Brewing Co.	Bavarian Wheatwine	10.5	65	Exit & Brewery	Imperial Pumpkin Porter	9.0
27	Perennial Artisan Ales	Sump Coffee Stout	10.5	66	Heavy Riff Brewery	Black Dog	9.0
28	4 Hands Brewing Co	La Belleza	10.5	67	Heavy Riff Brewery	Kiss The Sky	9.0
29	Urban Chestnut	Innovator	10.5	68	Perennial Artisan Ales	Irene	9.0
30	The Saint Louis Brewery	Imperial Stout	10.5	69	Perennial Artisan Ales	Goodnight Irene	9.0
31	The Saint Louis Brewery	Barleywine-Style Ale	10.2	70	Augusta Brew Haus	Augusta Tripel	9.0
32	Kirkwood Station Brewing Co...	Peaberry Coffee Stout	10.2	71	Augusta Brew Haus	Augusta Tripel IPA	9.0
33	Kirkwood Station Brewing Co...	Red IPA	10.2	72	Cathedral Square Brewery	Peaching to the Choir	9.0
34	The Saint Louis Brewery	Tripez	10.0	73	Cathedral Square Brewery	Gabriel IPA	9.0
35	Perennial Artisan Ales	Coffee Abrax	10.0	74	Cathedral Square Brewery	Repent Rye IPA	9.0
36	Perennial Artisan Ales	17	10.0	75	Cathedral Square Brewery	Holy Moly! Imperial Stout	9.0
37	Perennial Artisan Ales	Abraxas	10.0	76	4 Hands Brewing Co	White Flannel	9.0
38	Public House Brewing Co.	Anthony's Pacification	10.0	77	Friendship Brewing Co	Laplander DIPa	9.0
39	4 Hands Brewing Co	Ba Bona Fide	10.0	78	Cathedral Square Brewery	Immaculate Collaboration V	9.0

Figure 8

With 78 beers with an ABV of over 8.5. Tourists have many options for high-alcohol-content beers. Side Project Brewery has the top-5 highest ABV beers in the database. If a tourist was interested in beer with a high ABV, a good place to start a beer-cation would be at the Side Project Brewery.

***What is the most popular season for creating a special seasonal brew?***

```
SELECT COUNT(BeerID) NumberOfBeersAvailable, BeerAvailability
FROM Beer
WHERE BeerAvailability IS NOT NULL AND BeerAvailability != 'Year-Round'
GROUP BY BeerAvailability
ORDER BY NumberOfBeersAvailable desc
```

	NumberOfBeersAvailable	BeerAvailability
1	52	Winter
2	45	Summer
3	42	Spring
4	29	Fall

**Figure 9**

Winter is the most popular time for brewers to create seasonal beers. If a tourist were looking for a unique seasonal beer experience, s/he might consider taking a trip to St. Louis in the winter time.

***What is the most popular tour day?***

```
SELECT COUNT(TourID) NumberOfTours, TourDay
FROM BreweryTour
GROUP BY TourDay
ORDER BY NumberOfTours DESC
```

	NumberOfTours	TourDay
1	8	Saturday
2	3	Sunday
3	1	Friday

**Figure 10**

Tourists planning a trip to St. Louis would be interested to know what days of the week are good for going on a guided brewery tour. Saturday is the best day for tourist to go on the most tours. Tourists may want to avoid a beer-cation during the work week, because there are no guided brewery tours available.

*What are the most popular areas for breweries based on zip code?*

```
SELECT COUNT(Brewery.BreweryZip) NumberInZipCode, BreweryZip
FROM Brewery
GROUP BY BreweryZip
ORDER BY NumberInZipCode DESC;
```

	NumberInZipCode	BreweryZip
1	3	63043
2	3	63110
3	2	63103
4	2	63104
5	2	63143

**Figure 11**

Three Breweries are in the zip code 63043, which is the Maryland Heights area in St. Louis County, and in the 63110 zip code, which is the Central West End area in St. Louis City.



**Map of zip code 63043**



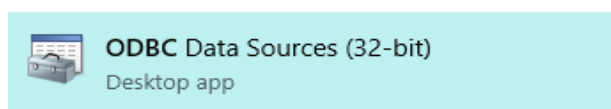
**Map of zip code 63110**

Geographical information will help tourists locate accommodations near multiple breweries, which would maximize convenience and fun for their beer-cation experience.

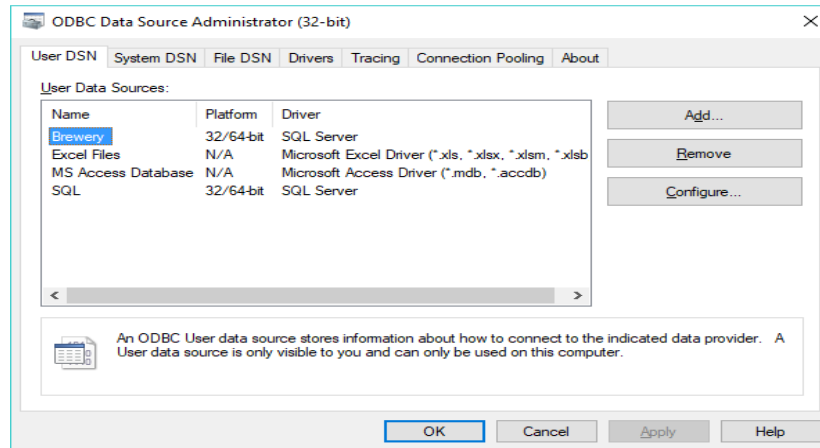
## Forms and Reports

In a previous section, front-end development was discussed. Thus far, there have been examples of SQL scripts that the database administrator may use. The front-end of a database refers to the user interface that facilitates the accessing of structured or raw data stored within the database. The front-end will be an application used for input that sends user requests to the database back-end. In other words, the front-end will be where the user utility happens. Users may want to add a new keyword to identify a beer they tried. They may have a craving for a certain type of beer and may want to use key words to find a beer that for example is "refreshing" and "fruity" or is "dark" and "savory". The front-end will be how the user will perform these interactions. In this section, an overview with example forms and reports will be previewed, as well as a brief discussion of safeguards for the database.

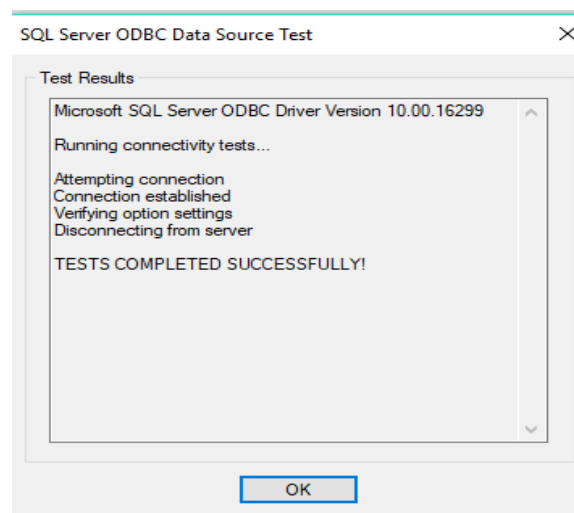
In order to connect the back-end of the database to the front end, an Open Database Connectivity (ODBC) connection can be used. For the Craft Brewery database, an ODBC connection will link SQL Server and Access. This will be useful for creating forms and reports in Access. The following are visual steps of how to connect the Craft Brewery Database to the ODBC.



The ODBC Data Source is a separate program from SQL Server and Access.



Configures the connection to the Brewery database.



Tests the connection to SQL Server

Now, that the back-end and front-end are connected, Access can communicate with the database to allow for form creation using the database tables. For more simplistic data entry, a form like the one seen in **Figure 12** could be used to enter new beer information. This form queries both the Beer and the Brewery tables.

## Beer Entry Form

BreweryName	<input style="width: 90%;" type="text" value="The Saint Louis Brewery"/>
BeerName	<input style="width: 90%;" type="text" value="Schafly Pilsner"/>
BeerType	<input style="width: 90%;" type="text" value="Pilsner"/>
ABV	<input style="width: 90%;" type="text" value="5"/>
BeerAvailability	<div style="border: 1px solid black; padding: 2px;">Year-Round</div>

**Figure 12**

For editing different keywords for beers, a form will make this process much more simplistic and straightforward. Because keywords and beers are linked through a composite table, SQL Insert statements can be complex and prone to errors. A form abstracts these SQL statements into a simple format.

## Beer with Keywords Form

BeerID	<input style="width: 90%;" type="text" value="253"/>																																																																					
BeerName	<input style="width: 90%;" type="text" value="Bailey's Chocolate Ale"/>																																																																					
Keywords	<div style="border: 1px solid orange; padding: 5px;"> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;">KeywordID</th> <th style="width: 40%;">KeywordName</th> <th style="width: 50%;"></th> </tr> </thead> <tbody> <tr><td>5</td><td>Chocolate</td><td></td></tr> <tr><td>21</td><td>Dark</td><td></td></tr> <tr><td>23</td><td>Sweet</td><td></td></tr> <tr><td>29</td><td>Ale</td><td></td></tr> <tr><td>54</td><td>High ABV</td><td></td></tr> <tr style="background-color: #e0f0ff;"><td>*</td><td></td><td></td></tr> <tr><td>1</td><td>light</td><td></td></tr> <tr><td>2</td><td>lager</td><td></td></tr> <tr><td>3</td><td>German</td><td></td></tr> <tr><td>4</td><td>Peanut</td><td></td></tr> <tr><td>5</td><td>Chocola</td><td></td></tr> <tr><td>6</td><td>Pumpkir</td><td></td></tr> <tr><td>7</td><td>Spicy</td><td></td></tr> <tr><td>8</td><td>Cinnamc</td><td></td></tr> <tr><td>9</td><td>Orange</td><td></td></tr> <tr><td>10</td><td>Coffee</td><td></td></tr> <tr><td>11</td><td>Bitter</td><td></td></tr> <tr><td>12</td><td>Peach</td><td></td></tr> <tr><td>13</td><td>German</td><td></td></tr> <tr><td>14</td><td>French</td><td></td></tr> <tr style="background-color: #e0f0ff;"><td>15</td><td>English</td><td></td></tr> <tr><td>16</td><td>Irish</td><td></td></tr> </tbody> </table> <div style="margin-top: 5px;"> <input type="button" value="No Filter"/> <input type="button" value="Search"/> </div> </div>	KeywordID	KeywordName		5	Chocolate		21	Dark		23	Sweet		29	Ale		54	High ABV		*			1	light		2	lager		3	German		4	Peanut		5	Chocola		6	Pumpkir		7	Spicy		8	Cinnamc		9	Orange		10	Coffee		11	Bitter		12	Peach		13	German		14	French		15	English		16	Irish	
KeywordID	KeywordName																																																																					
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14	French																																																																					
15	English																																																																					
16	Irish																																																																					

**Figure 13**

Forms are a way to create a user interface for a database application and this interface can make data entry more approachable for those that are not trained in database management or SQL. Access forms can be bound, which mean that they update the database. A bound form for the Craft Brewery Database would be necessary for data entry. Unbound forms have access to the database, but they cannot alter the data in the database. These forms will be used to view and query the database.

While a user can view data in forms, reports can be a better way to view data. Like the join queries seen in previous sections, reports also allow for configuration and summarization of the data so that complicated relationships can be seen in more basic terms. For example, a report can summarize information on brewery, brewery address, brewery zip code (from the Brewery table), and the day of brewery tour (from the BreweryTours table).

Brewery Tours			
Brewery Name	Address	Zip	TourDay
The Saint Louis Brewery	7260 Southwest Ave.	63143	Saturday
Urban Chestnut	4465 Manchester Ave	63110	Saturday
Mark Twain Brewing Co.	422 N Main S	63401	Saturday
Six Mile Bridge Beer	11841 Dorsett Rd	63043	Friday

**Figure 14**

An example was given at the beginning of this section of a how tourist may look for a beer with keywords of “refreshing” or “fruity”. A report can summarize this information and provide the name of the beer (from the Beer table), the name of the brewery (from the Brewery table), and the key word (from the Keyword table). This allows the user to see types of beer that s/he may be interested in trying and what brewery brews those beers.

Refreshing and Fruity Beers		
Beer	Brewery	KeywordName
Schafly Pilsner	The Saint Louis Brewery	Refreshing
Belgian Blonde	Alpha	Refreshing
Schafly Kolsch	The Saint Louis Brewery	Refreshing
Schafly Hefeweizen	The Saint Louis Brewery	Fruity
		Refreshing
Raspberry Hefeweize	The Saint Louis Brewery	Fruity
Citra Paradisi	Perennial Artisan Ales	Fruity
		Refreshing
Flat Rock Saison	Perennial Artisan Ales	Fruity
		Refreshing
Funky Wit	Perennial Artisan Ales	Fruity
		Refreshing
Pineapple Kumquat	Perennial Artisan Ales	Fruity
		Refreshing
Saison de Lis	Perennial Artisan Ales	Fruity
		Refreshing
Von Pampelmuse	Perennial Artisan Ales	Fruity
		Refreshing
Blueberry Flanders	Side Project	Fruity
		Refreshing
Framboise du Fermie	Side Project	Fruity
		Refreshing
Peche du Fermier	Side Project	Fruity
		Refreshing

Figure 15



These are just some examples of forms and reports that Access is capable of creating for the Craft Brewing Database. Forms and reports will be determined based on users' needs and demands.

## Summary

This has been an overview of the purpose, data, and design of the St. Louis Craft Brewery Database. In the preceding sections, the business rules were drawn out which informed the constraints of the data. These constraints were used in the data definitions which led to the design of the database. The design was introduced as an architecture for physical storage of the data inside of a DBMS. The subsequent sections described how this data will be created, manipulated, and maintained. Finally, a user-interface was proposed to allow tourists and database administrators to interact with the database without having to write complicated SQL scripts.

The number one goal of the Craft Brewery Database is to provide one accessible source of all St. Louis breweries and their beers for tourist use. While currently implemented in Microsoft Access, the final implementation would be in a web application using a web framework that supports splitting the application into a client-side, where the potential tourist will interact and browse, and a server-side, a server that will speak directly to the database and provide a simple API (read-only to the public). There are also potential utilities for other travel services and the breweries themselves. If this proposal is accepted, this database could change tourism in St. Louis. Help make St. Louis a beer-cation getaway!

## Reflections

This is the first database that I created. Being the first, I wanted to create a database that would be smaller and easier to manage. What I would do differently is to go bigger and include information on events, brewery ratings, beer costs, and hours of operation.

I learned a lot while making this database. I learned to back up data often. I lost most of my data twice and had to re-key the data by hand. It was a hard-earned lesson. I would go back tell myself, “Be careful and conscientious about your data always!” I found SQL coding to be a strong point for me in this project. I also enjoyed querying to find out more about my data.

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