Team Swagg Written Report

CMPE 226

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Table of Contents

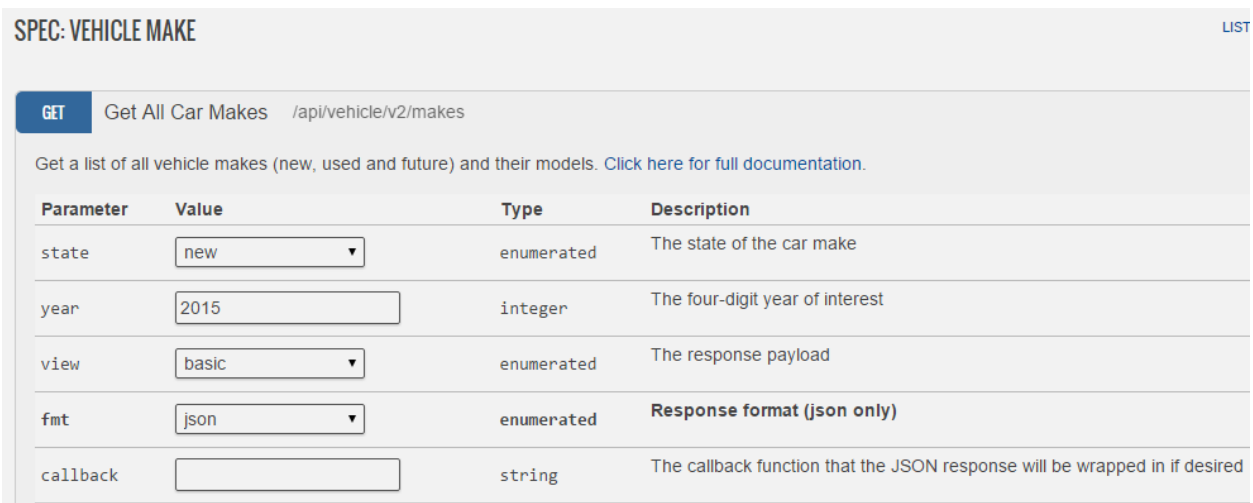
Application 2
Data 2
ER Diagram 5
RELATIONAL SCHEMA 6
STAR SCHEMA 8
ANALYTICAL TABLE DATA ANALYSIS 9
STAR SCHEMA QUERY ANALYSIS 1 11
STAR SCHEMA QUERY ANALYSIS 2 12
STAR SCHEMA QUERY ANALYSIS 3 13
Example user actions and screenshots of results 15

Application

When a customer goes to a car dealership, the customer ask the car dealer what kind or type of car they have in their dealership. Customer tends to have preference of car which they like to see and car dealers should show the cars that match customer's preference. The problem for car dealer is that every year there are more than 300 different models and types of the cars made by different makes. It's difficult for car dealers to memorize all the cars which fits customer's preference. To minimize the hardship of the car dealer, they can use this application to find customer's preference car by searching the database. If the car dealership do not have the customer's preference car in stock, they can find the assembly plant by selecting make and model of the car and contact them.

Data

The list of automotive assembly plants in the United States were taken from Wikipedia (https://en.wikipedia.org/wiki/List_of_automotive_assembly_plants_in_the_United_States). Given the assembly plant name and address, we were able to get the latitude and longitude coordinates for each location. Based on the list of make and models that each assembly plant produces, we retrieved the detailed information for each from the Edmund's Developer Network. First we filtered the list of make and model by limiting the dataset to only new cars that are produced in the year 2015. The corresponding API call equivalent to the below query is:
https://api.edmunds.com/api/vehicle/v2/makes?state=new&year=2015&view=basic&fmt=json&api_key=y47r865rvxxxxxxxxxxxxxx.


SPEC: VEHICLE MAKE

LIST

GET Get All Car Makes /api/vehicle/v2/makes

Get a list of all vehicle makes (new, used and future) and their models. Click here for full documentation.

Parameter	Value	Type	Description
state	new	enumerated	The state of the car make
year	2015	integer	The four-digit year of interest
view	basic	enumerated	The response payload
fmt	json	enumerated	Response format (json only)
callback		string	The callback function that the JSON response will be wrapped in if desired

Figure 1: To retrive vehicle detail information from Edmunds's Developer Site

For each available make and model, we then queried for each vehicle model to get the Edmund's style id for a particular series. The corresponding API call equivalent to the below query is:
https://api.edmunds.com/api/vehicle/v2/honda/accord?state=new&year=2015&view=basic&fmt=json&api_key=y47r865rvxxxxxxxxxxxxxx.

Example output:

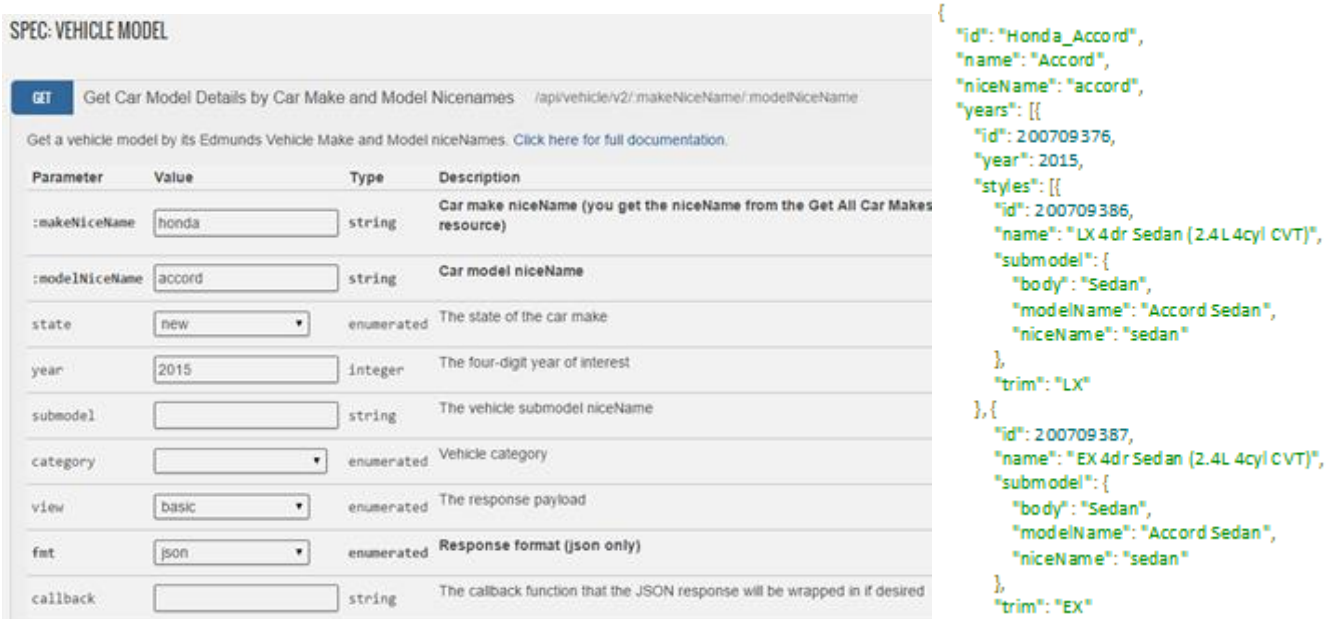


Figure 2: Example output of vehicle models

From this information, we extracted the style ids to get detailed information for each make, model, series. The corresponding API call equivalent to the below query is:
https://api.edmunds.com/api/vehicle/v2/styles/200709386?view=full&fmt=json&api_key=y47r865rvm7txd3aahy8mm8n

Figure 3: Example output of detailed vehicle by Style ID

Example output:


```
{
  "make": {
    "id": 200001444,
    "name": "Honda",
    "niceName": "honda"
  },
  "model": {
    "id": "Honda_Accord",
    "name": "Accord",
    "niceName": "accord"
  },
  "engine": {
    "id": "20070939B",
    "name": "Engine 4cyl",
    "equipmentType": "ENGINE",
    "compressionRatio": 11.1,
    "cylinder": 4,
    "size": 2.4,
    "displacement": 2356.0,
    "configuration": "inline",
    "fuelType": "regular unleaded",
    "horsepower": 185,
    "torque": 181,
    "totalValves": 16,
    "type": "gas",
    "code": "4INAG2.4",
    "compressorType": "NA",
    "rpm": {
      "horsepower": 6400,
      "torque": 3900
    },
    "valve": {
      "timing": "variable valve timing",
      "gear": "double overhead camshaft"
    }
  },
  "transmission": {
    "id": "200709402",
    "name": "continuously variableA",
    "equipmentType": "TRANSMISSION",
    "automaticType": "Continuously variable",
    "transmissionType": "AUTOMATIC",
    "numberOfSpeeds": "continuously variable"
  },
  "drivenWheels": "front wheel drive",
  "numOfDoors": "4",
  "options": [],
  "colors": [{
    ...
  }],
  "manufacturerCode": "CR2F3FEW",
  "price": {
    "baseMSRP": 22905.0,
    "baseInvoice": 20967.0,
    "deliveryCharges": 820.0,
    "usedTmvRetail": 19352.0,
    "usedPrivateParty": 18126.0,
    "usedTradeIn": 16502.0,
    "estimateTmv": false
  },
  "categories": {
    "market": "N/A",
    "EPAClass": "Midsize Cars",
    "vehicleSize": "Midsize",
    "primaryBodyType": "Car",
    "vehicleStyle": "Sedan",
```


This returned information on the vehicle's model, engine, transmission, drivetrain, number of doors, price, size, sub-model, trim, mpg, etc. We cleansed the json data to removed extra information that we don't plan on using, such as the vehicle's interior and exterior colors. We took advantage that the data returned includes IDs for most of the categories, which we used as the primary and foreign keys in our relational tables. Since we chose to use MySQL DB as our backend database, we believe it is easier to convert the data from json to csv format to easily manipulate and load into MySQL. After the data for all vehicles and assembly plants were converted to csv, we ended up with 35 columns of raw data that we will need to determine the entity-relational diagram for.

ER Diagram

An Entity Relationship Diagram (ERD) is a graphical representation of an information system that shows the relationship between objects or concepts within the system. It shows the logical structure of database. There are three main components of an ERD: entities, relationships and cardinality. Entities represents an objects that contains a data. Our ERD represents the information system of vehicle with an assembly.

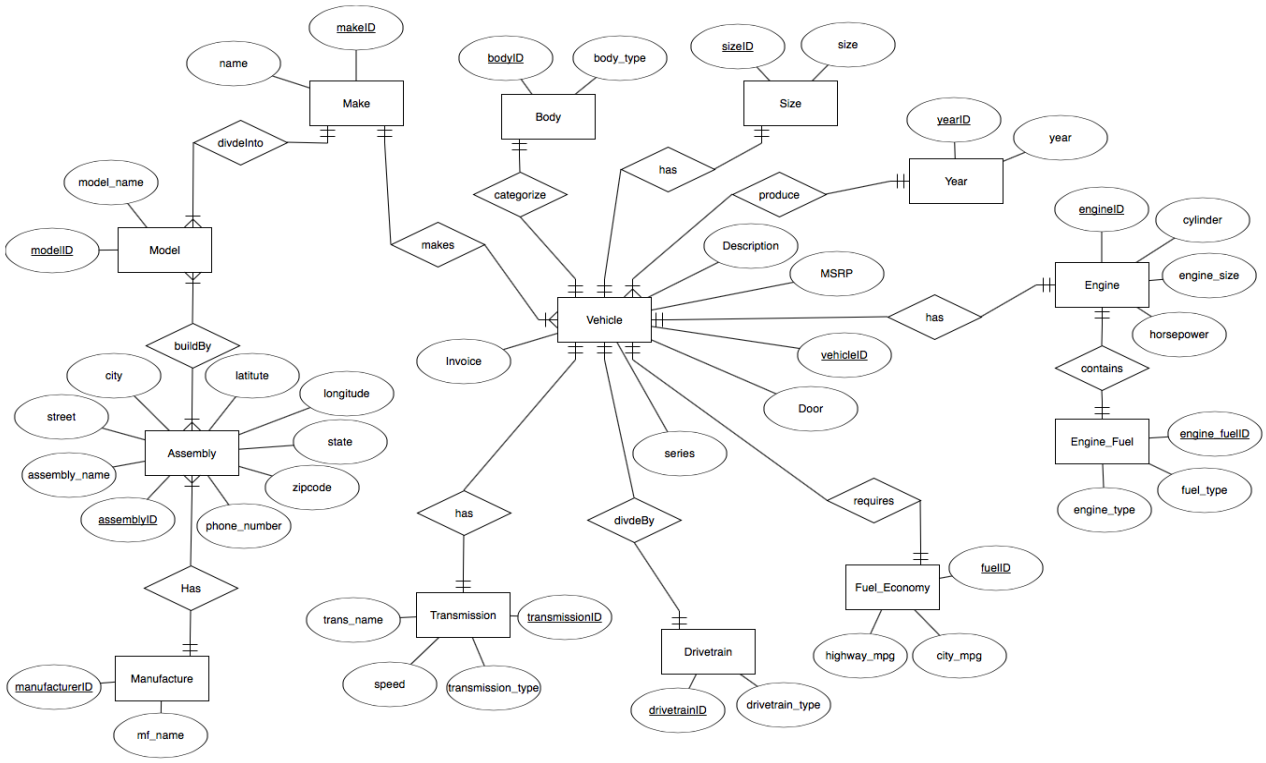


Figure 4: ER diagram

First, we determined what our entities are, the main objects of a vehicle that can be described with attribute(s). From there, we assigned the attributes to the corresponding entity which they describe.

```
Manufacture: manu_name
Assembly: assembly_name, street, city, state, zipcode, phone_number, latitude, longitude
Model: model_name
Make: name
Vehicle: description, msrp, invoice, series, door
Transmission: trans_name, speed, transmission_type
Drivetrain: drivetrain_type
Fuel_Economy: highway_mpg, city_mpg
Engine_fuel: engine_type, fuel_type
Engine: horsepower, engine_type, cylinder
Year: year
Size: size
Body: body_type
```

The relationships were the most challenging part when designing the ERD. After many debates, we decided to go with the relationships defined in this ERD, which is not in 3rd normal form.

Although a vehicle's model was almost all unique per vehicle, we did not include it as an attribute of the Vehicle table because a user should be able to query for all make and models an assembly plant produces without needing to go through the Vehicle, which may or may not have been produced yet. Although there are only two values for doors, we decided that it should be an attribute of Vehicle instead of being its own table to have better performance. Same as doors, invoice and msrp are also attributes of Vehicle because we feel that being in its own table will provide too much overhead. Since our application is to provide information about Vehicles and Assembly Plants to Dealers, we only have addresses for Assembly Plants, which is why address is part of the Assembly table.

RELATIONAL SCHEMA

The relational schema serves as a blueprint to implement the database schema into a fully functional relational database. The actual implementation can be achieved using a variety of commercial relational database technologies and for this project, MySQL was chosen to generate a working database. The relational schema consists of the following elements: attributes, primary keys, foreign keys and tables. All four of these elements are translated from the entity relational diagrams. The entities from the entity relational diagram translate to tables in a relational schema. The attributes from the entity relational diagram are represented by the additional columns in each table for the relational schema. While the primary keys are represented the same way between ER and relational diagrams with an underlined attribute. Foreign keys are unique to the relational schema and have an additional "FK" notation referencing the primary key of another table. This representation can either be a 1:1 relationship or a 1:M relationship. M:N relationships are represented by an additional junction table in the relational schema. The junction table is composed of two 1:M relationships with the foreign key of one table referencing one of the respective primary keys of the junction table. Below is a depiction of the relational schema using the Cisco Information Server.

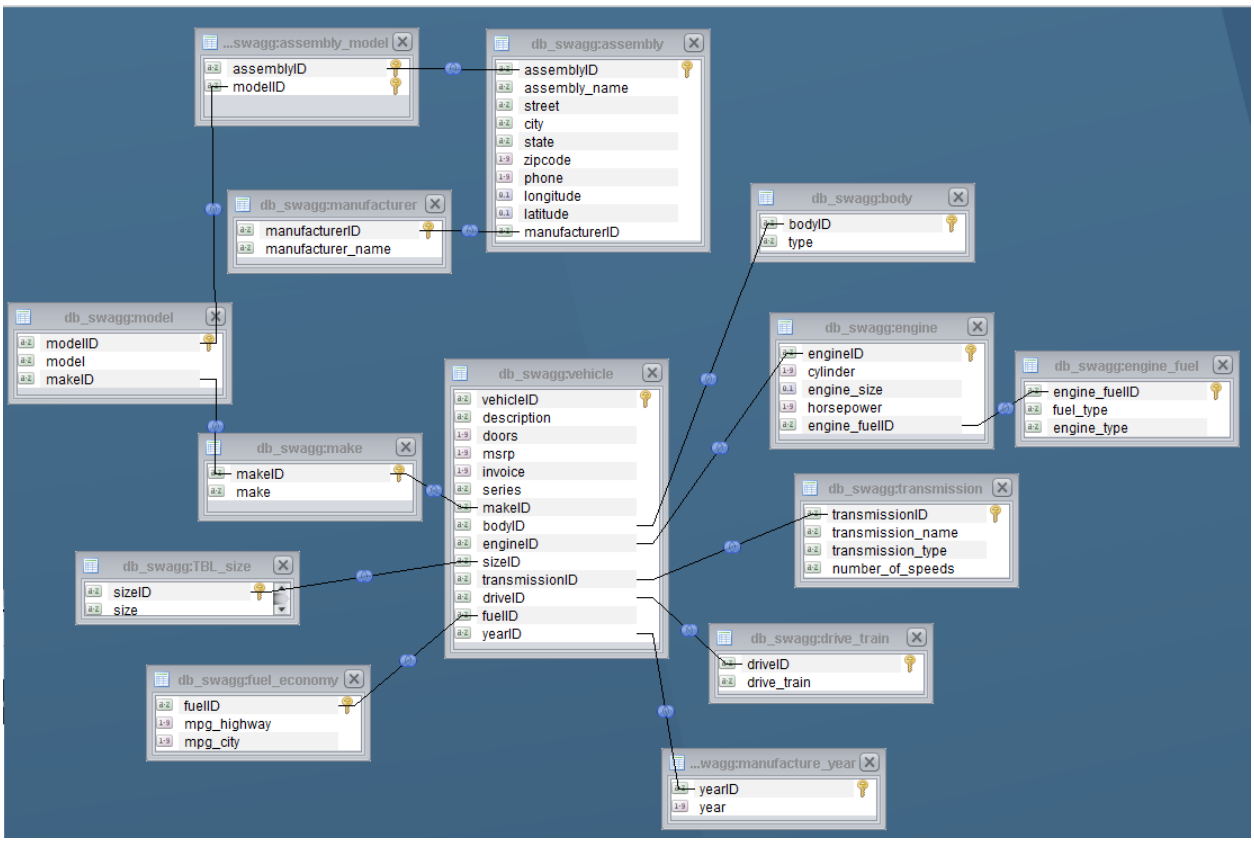


Figure 5: Relational Schema (Cisco Information Server)

Based on our ERD diagram, this is the relational schema generated. Each entity from the ERD corresponds to a table and the attributes associated with each entity correspond to the columns in the table. The Vehicle table consists of foreign keys mapping to the other tables: body, engine, size, transmission, drive_train, fuel_economy, and manufacture_year.

From the Relational Schema, it is clearly depicted that there are two main focal points, Vehicle and Assembly. The Vehicle table and Assembly table represent focal points of our database design and schema as they serve as two main subjects in which to quantify data. The Vehicle table describes the actual product that the assembly plant produces. A particular vehicle can have different engines, makes, sizes, bodies, fuel economies, manufacturing years, drivetrains, sizes and transmissions. An assembly plant can produce different models and is owned by different manufacturers.

STAR SCHEMA

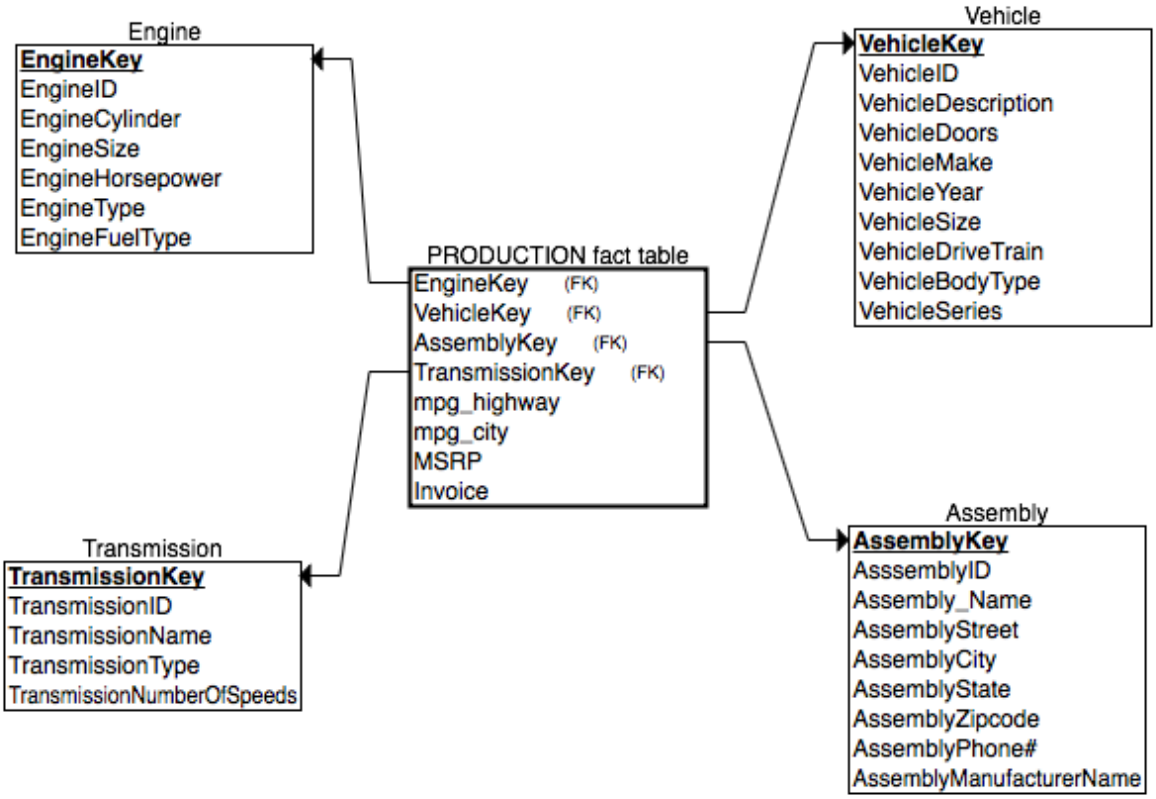


Figure 6: Star Schema

The Star Schema is the simplest style of data mart schema. It consists of one or more fact tables referencing any number of dimension tables. The star schema is an important special case of the snowflake schema, and is more effective for handling simpler queries. The star schema separates business process data into facts, which hold the measurable, quantitative data about a business, and dimensions which are descriptive attributes related to fact data. Examples of fact data include sales price, sale quantity, and time, distance, speed, and weight measurements. Related dimension attribute examples include product models, product colors, product sizes, geographic locations, and salesperson names.

Since our application is for dealers to search for vehicles and assembly plant information, we used Vehicle, Assembly, Engine, and Transmission as our dimensional tables. These dimensional tables contain information about the vehicles and are easy to check and search. We used PRODUCTION as our fact table, with some foreign keys, vehicle's MPG and price information to be analyzed, as they are all measurable information. Our project is not aimed to sell cars and vehicle parts, it is an informative database that does not require calendar dates.

ANALYTICAL TABLE DATA ANALYSIS

With our dimensional model consisting of fact and dimensional tables, different queries can be executed to analyze the dataset. We created views for our fact and dimensional tables in order to easily run star schema queries. The following SQL statements show how the fact and dimension tables are created and populated:

```
create table engineD as
select
  engine.engineID,
  engine.cylinder,
  engine.engine_size,
  engine.horsepower,
  engine_fuel.fuel_type,
  engine_fuel.engine_type
from engine, engine_fuel
where engine.engine_fuelID = engine_fuel.engine_fuelID;

ALTER table `engineD`
  ADD column `engineKey` int(10) unsigned PRIMARY KEY AUTO_INCREMENT;

create table vehicleD as
select
  vehicle.vehicleID,
  vehicle.description,
  vehicle.doors,
  make.make,
  manufacture_year.year,
  size.size,
  drive_train.drive_train,
  body.type,
  vehicle.series
from vehicle,body,size,drive_train, manufacture_year,make
where vehicle.bodyID = body.bodyID
and vehicle.sizeID = size.sizeID
and vehicle.driveID = drive_train.driveID
and vehicle.yearID = manufacture_year.yearID
and vehicle.makeID = make.makeID;

ALTER TABLE `vehicleD`
  ADD column `vehicleKey` int(10) unsigned PRIMARY KEY AUTO_INCREMENT;

CREATE table assemblyd as
SELECT A.AssemblyID, A.Assembly_Name, A.street, A.city, A.state, A.zipcode, A.Phone,
B.manufacturer_name
FROM assembly A, manufacturer B
WHERE A.manufacturerID = B.manufacturerID;

ALTER TABLE `assemblyd`
  ADD column `assemblyKey` int(10) unsigned PRIMARY KEY AUTO_INCREMENT;

CREATE table transmissiond as
SELECT *
FROM transmission;
```

```
ALTER TABLE `transmissiond`
  ADD column `transmissionKey` int(10) unsigned PRIMARY KEY AUTO_INCREMENT;

create table productionf as
select vehicle.vehicleID,
  engine.engineID,
  transmission.transmissionID,
  assembly.assemblyID,
  fuel_economy.mpg_highway,
  fuel_economy.mpg_city,
  vehicle.msrp,
  vehicle.invoice
from vehicle, engine, transmission, fuel_economy
where vehicle.engineID = engine.engineID
  and vehicle.transmissionID = transmission.transmissionID
  and vehicle.fuelID = fuel_economy.fuelID
  and vehicle.assemblyID = assembly.assemblyID;

ALTER TABLE `productionf`
ADD `vehicleKey` INT(10) NOT NULL FIRST,
ADD `engineKey` INT(10) NOT NULL AFTER `vehicleKey`,
ADD `transmissionKey` INT(10) NOT NULL AFTER `engineKey`,
ADD `assemblyKey` INT(10) NOT NULL AFTER `transmissionKey`;

ALTER TABLE `productionf` ADD INDEX(`vehicleKey`);
ALTER TABLE `productionf` ADD INDEX(`engineKey`);
ALTER TABLE `productionf` ADD INDEX(`transmissionKey`);

ALTER TABLE `productionf` ADD FOREIGN KEY (`vehicleKey`)
REFERENCES `swagg`.`vehicled`(`vehicleKey`) ON DELETE RESTRICT ON UPDATE RESTRICT;
ALTER TABLE `productionf` ADD FOREIGN KEY (`engineKey`)
REFERENCES `swagg`.`engined`(`engineKey`) ON DELETE RESTRICT ON UPDATE RESTRICT;
ALTER TABLE `productionf` ADD FOREIGN KEY (`transmissionKey`)
REFERENCES `swagg`.`transmissiond`(`transmissionKey`) ON DELETE RESTRICT ON UPDATE RE
STRICT;

update productionf INNER JOIN vehicleD
set productionf.vehicleKey = vehicleD.vehicleKey
where productionf.vehicleID = vehicleD.vehicleID;

update productionf INNER JOIN engineD
set productionf.engineKey = engineD.engineKey
where productionf.engineID = engineD.engineID;

update productionf INNER JOIN transmissiond
set productionf.transmissionKey = transmissiond.transmissionKey
where productionf.transmissionID = transmissiond.transmissionID;

update productionf INNER JOIN assemblyd
set productionf.assemblyKey = assemblyd.assemblyKey
where productionf.assemblyID = assemblyd.assemblyID;
```

STAR SCHEMA QUERY ANALYSIS 1

This is the query to find a relationship between the invoice of all vehicles in relation to engine size and horsepower. As expected, the higher the horsepower output, the more expensive the starting price of a vehicle is. There are a few outliers such as the Ford Mustang with ecoboost which does not follow this trend. Further research indicates that the Mustang is a new model which uses new engine technology. By this analysis, a relative bargain was identified for the consumer.

```
SELECT DISTINCTROW p.invoice, v.make, e.horsepower
from productionf p,engineD e, vehicleD v
where p.engineKey = e.engineKey
and p.vehiclekey = v.vehiclekey
ORDER BY p.invoice;
```

invoice	make	horsepower
14474	Chevrolet	138
16018	Toyota	132
16089	Chevrolet	138
16183	Ford	160
16480	Dodge	160
16555	Chevrolet	138
16853	Jeep	158
17008	Honda	143
17124	Chevrolet	138
17189	Toyota	132
17394	Jeep	158
17559	Toyota	140
17629	Hyundai	145
17773	Toyota	132
18582	Honda	143
18942	Mitsubishi	148

STAR SCHEMA QUERY ANALYSIS 2

This is the query to find a relationship between the invoice price of all vehicles and the fuel economy, mpg for highway and city. The result of the query shows that the fuel economy has no trend with the the price of a vehicle. The price can be higher or lower for the same fuel economy figure. From the sample analysis, the make of the vehicle has more effect on the invoice price than the fuel economy figures. This is as expected because vehicles today, due to heavy environment regulation, are required to have a minimum miles per gallon rating which result in similar fuel economy numbers for all. As a result, fuel economy is less of a decision point for consumers looking to purchase new vehicles.

```
SELECT DISTINCTROW p.invoice, v.make, v.series, p.mpg_highway,  p.mpg_city
From productionf p, vehicleD v
where p.vehiclekey = v.vehiclekey
ORDER BY p.invoice;
```

invoice	make	series	mpg_highway	mpg_city
14474	Chevrolet	LS	35	26
16018	Toyota	L	37	28
16089	Chevrolet	L	36	25
16183	Ford	S	36	26
16480	Dodge	SE	36	25
16555	Chevrolet	LT	35	25
16853	Jeep	Sport	30	23
17008	Honda	LX	36	28
17124	Chevrolet	LS	36	25
17189	Toyota	LE	38	29
17394	Jeep	Altitude Edition	27	22
17559	Toyota	LE Eco	42	30
17629	Hyundai	SE	38	28
17773	Toyota	S	37	29
18582	Honda	SE	39	30
18942	Mitsubishi	ES	30	24

STAR SCHEMA QUERY ANALYSIS 3

This is a query to find a relationship between the invoice and size of the vehicle. Looking at the results, we can see that although there are some smaller cars that cost more, all the large cars are near the end of the higher invoice spectrum. Midsize vehicles are fairly distributed across, but have a small cluster around the middle of the invoice spectrum.

```
SELECT DISTINCTROW p.invoice, v.make, v.series, v.size
From productionf p, vehicleD v
where p.vehiclekey = v.vehiclekey
ORDER BY p.invoice;
```

invoice	make	series	size
14474	Chevrolet	LS	compact
16018	Toyota	L	compact
16089	Chevrolet	L	midsize
16183	Ford	S	compact
16480	Dodge	SE	midsize
16555	Chevrolet	LT	compact
16853	Jeep	Sport	compact
17008	Honda	LX	compact
17124	Chevrolet	LS	midsize
17189	Toyota	LE	compact
17394	Jeep	Altitude Edition	compact
17559	Toyota	LE Eco	compact
17629	Hyundai	SE	compact
17773	Toyota	S	compact
18582	Honda	SE	compact
18942	Mitsubishi	ES	compact
19291	Chevrolet	Eco	midsize
19654	Toyota	Base	compact
19693	Honda	EX	compact

Going in the opposite direction...

```
SELECT DISTINCTROW p.invoice, v.make, v.series, v.size
From productionf p, vehicleD v
where p.vehiclekey = v.vehiclekey
ORDER BY p.invoice DESC;
```

invoice	make	series	size
90671	Dodge	GTC	compact
90271	Dodge	GT	compact
83654	Mercedes_Benz	GL550 4MATIC	large
83472	Cadillac	Platinum	large
81371	Dodge	SRT	compact
80000	Tesla	85	large
75000	Tesla	70D	large
74982	Cadillac	Premium	large
74768	Chevrolet	Z06	compact
73206	Cadillac	Luxury	large
69900	Tesla	60	large
68227	Cadillac	Base	large
64990	BMW	xDrive50i	midsize
62110	Chevrolet	LTZ	large
60462	Lincoln	L	large
59599	Chevrolet	LTZ	large
59427	Mercedes_Benz	AMG C63	midsize
59148	Mercedes_Benz	GL350 BlueTEC 4MATIC	large
58530	Toyota	Platinum	large
58406	Lincoln	Base	large
55363	Ford	Platinum	large
55079	GMC	SLT	large
53690	Chevrolet	Stingray	compact
52993	Ford	EL Limited	large
50411	Chevrolet	LT	large

Example user actions and screenshots of results

This map view allows car dealers to easily identify where in the United States the assembly plants are located.

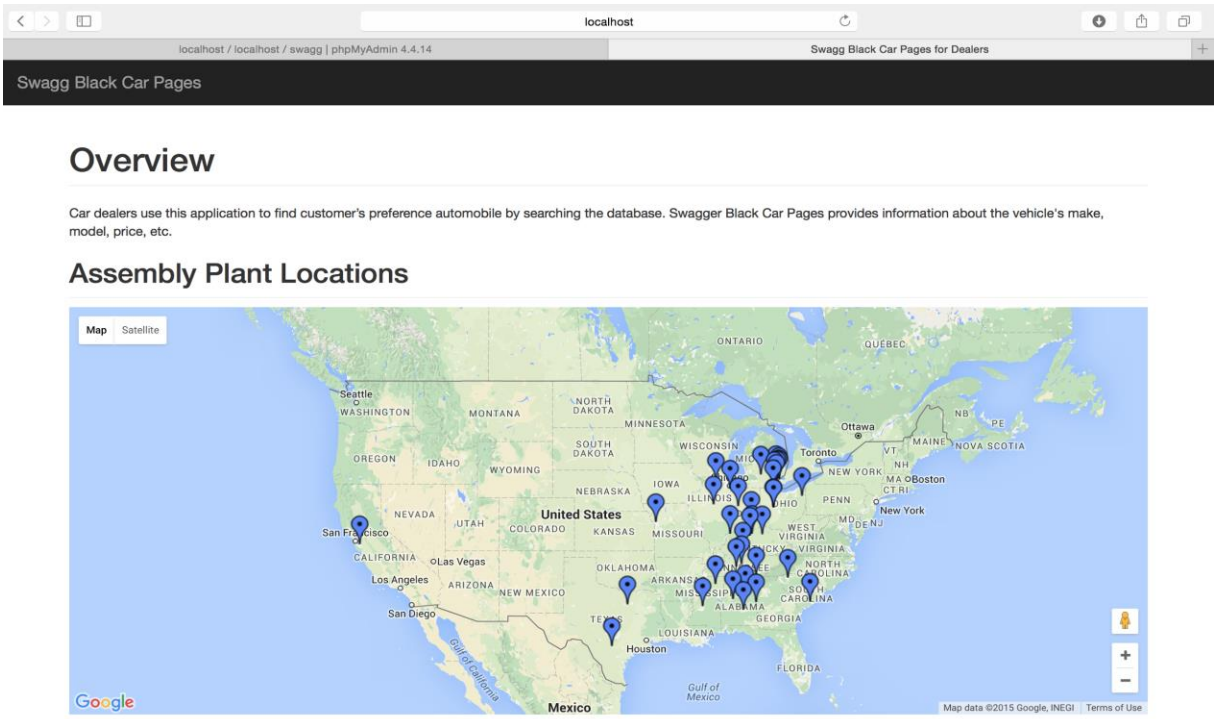


Figure 7: Initial page for website

Each marker on the map is clickable with the assembly plant's location and phone number.

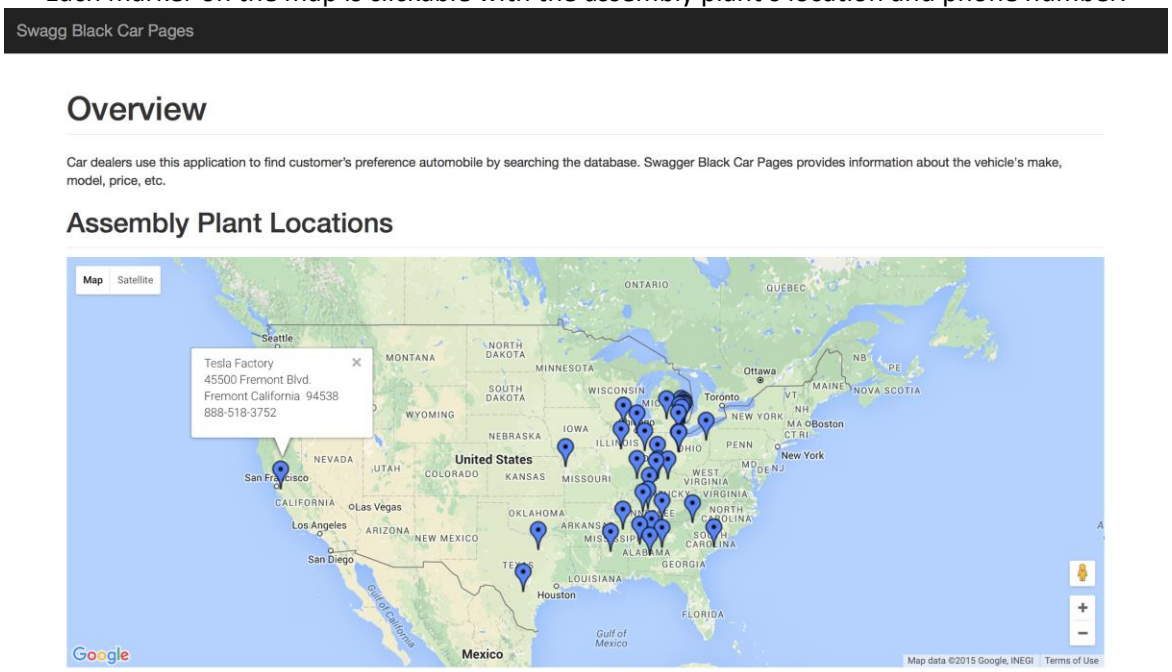


Figure 8: Clickable marker with assembly location

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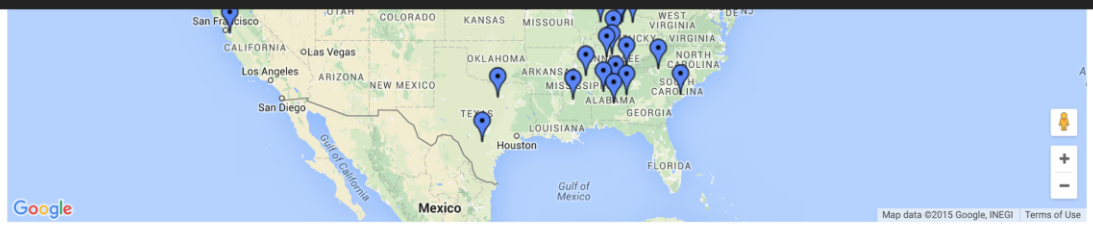

Swagg Black Car Pages

Search for Make: Tesla Go! ☑**Limit Rows**

3 results found

vehicleID	description	doors	msrp	invoice	series	makeID	bodyID	engineID	sizeID	transmissionID	driveID	fuelID	yearID	make
200725284	60 4dr Sedan (electric DD)	4	69900	69900	60	200018920	tsedn	200700607	slrg	200498571	dtrwd	f9794	y2015	Tesla
200725285	85 4dr Sedan (electric DD)	4	80000	80000	85	200018920	tsedn	200700607	slrg	200498571	dtrwd	f9088	y2015	Tesla
200733228	70D 4dr Sedan AWD (electric DD)	4	75000	75000	70D	200018920	tsedn	200700607	slrg	200498571	dtawd	f102101	y2015	Tesla

Search Assembly Plants by Make: make **and Model:** model Go! ☑**Limit Rows**

Search Vehicles: price min: 0 **To** price max: 2000000 Go! ☑**Limit Rows**

Figure 9: Searching the vehicle with make "Tesla"

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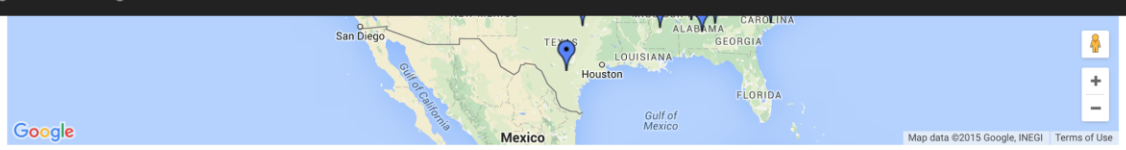

Swagg Black Car Pages

Search for Make: Search for... Go! ☑**Limit Rows**

Search Assembly Plants by Make: Toyota **and Model:** camry Go! ☑**Limit Rows**

2 results found

assembly_name	street	city	state	zipcode	phone
Toyota Motor Manufacturing Kentu	1001 Cherry Blossom Way	Georgetown	Kentucky	40324	5028682000
Subaru of Indiana Automotive, In	5500 Indiana 38	Lafayette	Indiana	47905	7654491111

Search Vehicles: price min: 0 **To** price max: 2000000 Go! ☑**Limit Rows**

Body Type: --Select Body-- ☑Limit Rows

Drive Train: ☐FWD ☐RWD ☐AWD ☐4WD Go! ☑**Limit Rows**

Figure 10: Searching for assembly makes "Toyota" "Camry" model

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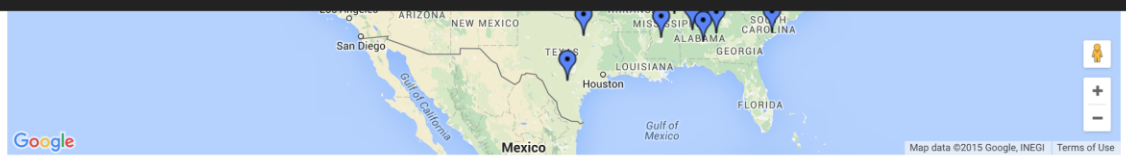

Swagg Black Car Pages

Search for Make: Search for... Go! ☑ **Limit Rows**

Search Assembly Plants by Make: Tesla **and Model:** model-s Go! ☑ **Limit Rows**

1 results found

assembly_name	street	city	state	zipcode	phone
Tesla Factory	45500 Fremont Blvd.	Fremont	California?	94538	8885183752

Search Vehicles: price min: 0 **To** price max: 2000000 Go! ☑ **Limit Rows**

Body Type: --Select Body-- ☑ Limit Rows

Drive Train: ☐ FWD ☐ RWD ☐ AWD ☐ 4WD Go! ☑ **Limit Rows**

Figure 11: Searching for assembly makes "Tesla" "model-s" model

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Search Vehicles: 0 **To** price max: 2000000 Go! ☑ **Limit Rows**

30 results found

vehicleID	description	doors	msrp	invoice	series	makeID	bodyID	engineID	sizeID	transmissionID	driveID	fuelID	yearID
200711667	LS 4dr Hatchback (1.8L 4cyl 5M)	4	14845	14474	LS	200000404	thbck	200717316	scmp	200717321	dtfwd	f3526	y2015
200724813	L 4dr Sedan (1.8L 4cyl 6M)	4	16170	16089	L	200000404	tsedn	200717316	smid	200711655	dtfwd	f3625	y2015
200704562	SE 4dr Sedan (2.0L 4cyl 6M)	4	16495	16480	SE	200009788	tsedn	200704569	smid	200711655	dtfwd	f3625	y2015
200699915	Sport 4dr SUV (2.0L 4cyl 5M)	4	16895	16853	Sport	200001510	tsuvv	200699561	scmp	200717321	dtfwd	f3023	y2015
200707278	L 4dr Sedan (1.8L 4cyl 6M)	4	16950	16018	L	200003381	tsedn	200707293	scmp	200711655	dtfwd	f3728	y2015
200696414	S 4dr Sedan (2.0L 4cyl 5M)	4	17170	16183	S	200005143	tsedn	200704569	scmp	200717321	dtfwd	f3626	y2015
200711664	LT 4dr Sedan (1.8L 4cyl 6A)	4	17245	16555	LT	200000404	tsedn	200717316	scmp	200712026	dtfwd	f3525	y2015
200699916	Altitude Edition 4dr SUV (2.0L 4	4	17490	17394	Altitude Edition	200001510	tsuvv	200699561	scmp	200700860	dtfwd	f2722	y2015
200717326	LS 4dr Sedan (1.8L 4cyl 6M)	4	17745	17124	LS	200000404	tsedn	200717316	smid	200711655	dtfwd	f3625	y2015
200700051	SE 4dr Sedan (1.8L 4cyl 6A)	4	18250	17629	SE	200001398	tsedn	200700713	scmp	200712026	dtfwd	f3828	y2015
200714230	LX 2dr Coupe (1.8L 4cyl 5M)	2	18290	17008	LX	200001444	tcope	200714235	scmp	200717321	dtfwd	f3628	y2015
200707286	LE 4dr Sedan (1.8L 4cyl CVT)	4	18565	17189	LE	200003381	tsedn	200707293	scmp	200712026	dtfwd	f3829	y2015
200707280	LE Eco 4dr Sedan (1.8L 4cyl CVT)	4	18965	17559	LE Eco	200003381	tsedn	200707292	scmp	200712026	dtfwd	f4230	y2015
200707276	S 4dr Sedan (1.8L 4cyl CVT)	4	19195	17773	S	200003381	tsedn	200707293	scmp	200712026	dtfwd	f3729	y2015

Figure 12: Searching vehicle with price range from $0 with limited results

Swagg Black Car Pages

Search Vehicles: 0 **To** price max: 2000000 Go! ☐ **Limit Rows**

231 results found

vehicleID	description	doors	msrp	invoice	series	makeID	bodyID	engineID	sizeID	transmissionID	driveID	fuelID	yearID
200711667	LS 4dr Hatchback (1.8L 4cyl 5M)	4	14845	14474	LS	200000404	thbck	200717316	scmp	200717321	dtfwd	f3526	y2015
200724813	L 4dr Sedan (1.8L 4cyl 6M)	4	16170	16089	L	200000404	tsedn	200717316	smid	200711655	dtfwd	f3625	y2015
200704562	SE 4dr Sedan (2.0L 4cyl 6M)	4	16495	16480	SE	200009788	tsedn	200704569	smid	200711655	dtfwd	f3625	y2015
200699915	Sport 4dr SUV (2.0L 4cyl 5M)	4	16895	16853	Sport	200001510	tsuvv	200699561	scmp	200717321	dtfwd	f3023	y2015
200707278	L 4dr Sedan (1.8L 4cyl 6M)	4	16950	16018	L	200003381	tsedn	200707293	scmp	200711655	dtfwd	f3728	y2015
200696414	S 4dr Sedan (2.0L 4cyl 5M)	4	17170	16183	S	200005143	tsedn	200704569	scmp	200717321	dtfwd	f3626	y2015
200711664	LT 4dr Sedan (1.8L 4cyl 6A)	4	17245	16555	LT	200000404	tsedn	200717316	scmp	200712026	dtfwd	f3525	y2015
200699916	Altitude Edition 4dr SUV (2.0L 4	4	17490	17394	Altitude Edition	200001510	tsuvv	200699561	scmp	200700860	dtfwd	f2722	y2015
200717326	LS 4dr Sedan (1.8L 4cyl 6M)	4	17745	17124	LS	200000404	tsedn	200717316	smid	200711655	dtfwd	f3625	y2015
200700051	SE 4dr Sedan (1.8L 4cyl 6A)	4	18250	17629	SE	200001398	tsedn	200700713	scmp	200712026	dtfwd	f3828	y2015

Figure 13: Searching vehicle with price range from $0 without limited results

Swagg Black Car Pages

Search Vehicles: price min: 0 **To** 18000 Go! ☑ **Limit Rows**

9 results found

vehicleID	description	doors	msrp	invoice	series	makeID	bodyID	engineID	sizeID	transmissionID	driveID	fuelID	yearID
200711667	LS 4dr Hatchback (1.8L 4cyl 5M)	4	14845	14474	LS	200000404	thbck	200717316	scmp	200717321	dtfwd	f3526	y2015
200724813	L 4dr Sedan (1.8L 4cyl 6M)	4	16170	16089	L	200000404	tsedn	200717316	smid	200711655	dtfwd	f3625	y2015
200704562	SE 4dr Sedan (2.0L 4cyl 6M)	4	16495	16480	SE	200009788	tsedn	200704569	smid	200711655	dtfwd	f3625	y2015
200699915	Sport 4dr SUV (2.0L 4cyl 5M)	4	16895	16853	Sport	200001510	tsuvv	200699561	scmp	200717321	dtfwd	f3023	y2015
200707278	L 4dr Sedan (1.8L 4cyl 6M)	4	16950	16018	L	200003381	tsedn	200707293	scmp	200711655	dtfwd	f3728	y2015
200696414	S 4dr Sedan (2.0L 4cyl 5M)	4	17170	16183	S	200005143	tsedn	200704569	scmp	200717321	dtfwd	f3626	y2015
200711664	LT 4dr Sedan (1.8L 4cyl 6A)	4	17245	16555	LT	200000404	tsedn	200717316	scmp	200712026	dtfwd	f3525	y2015
200699916	Altitude Edition 4dr SUV (2.0L 4	4	17490	17394	Altitude Edition	200001510	tsuvv	200699561	scmp	200700860	dtfwd	f2722	y2015
200717326	LS 4dr Sedan (1.8L 4cyl 6M)	4	17745	17124	LS	200000404	tsedn	200717316	smid	200711655	dtfwd	f3625	y2015

Body Type: --Select Body-- ☑ Limit Rows

Drive Train: ☐ FWD ☐ RWD ☐ AWD ☐ 4WD Go! ☑ **Limit Rows**

Figure 14: Searching vehicle with price range from $0 - $18000

Swagg Black Car Pages

200704562	SE 4dr Sedan (2.0L 4cyl 6M)	4	16495	16480	SE	200009788	tsedn	200704569	smid	200711655	dtfwd	f3625	y2015
200699915	Sport 4dr SUV (2.0L 4cyl 5M)	4	16895	16853	Sport	200001510	tsuvv	200699561	scmp	200717321	dtfwd	f3023	y2015
200707278	L 4dr Sedan (1.8L 4cyl 6M)	4	16950	16018	L	200003381	tsedn	200707293	scmp	200711655	dtfwd	f3728	y2015
200696414	S 4dr Sedan (2.0L 4cyl 5M)	4	17170	16183	S	200005143	tsedn	200704569	scmp	200717321	dtfwd	f3626	y2015
200711664	LT 4dr Sedan (1.8L 4cyl 6A)	4	17245	16555	LT	200000404	tsedn	200717316	scmp	200712026	dtfwd	f3525	y2015
200699916	Altitude Edition 4dr SUV (2.0L 4	4	17490	17394	Altitude Edition	200001510	tsuvv	200699561	scmp	200700860	dtfwd	f2722	y2015
200717326	LS 4dr Sedan (1.8L 4cyl 6M)	4	17745	17124	LS	200000404	tsedn	200717316	smid	200711655	dtfwd	f3625	y2015

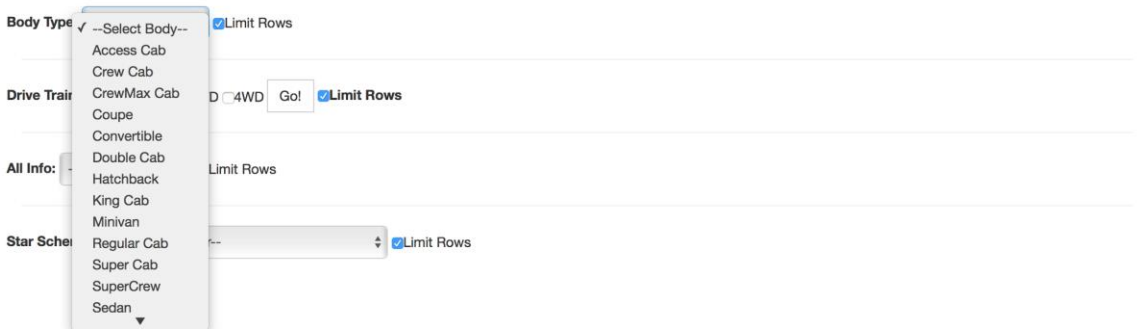
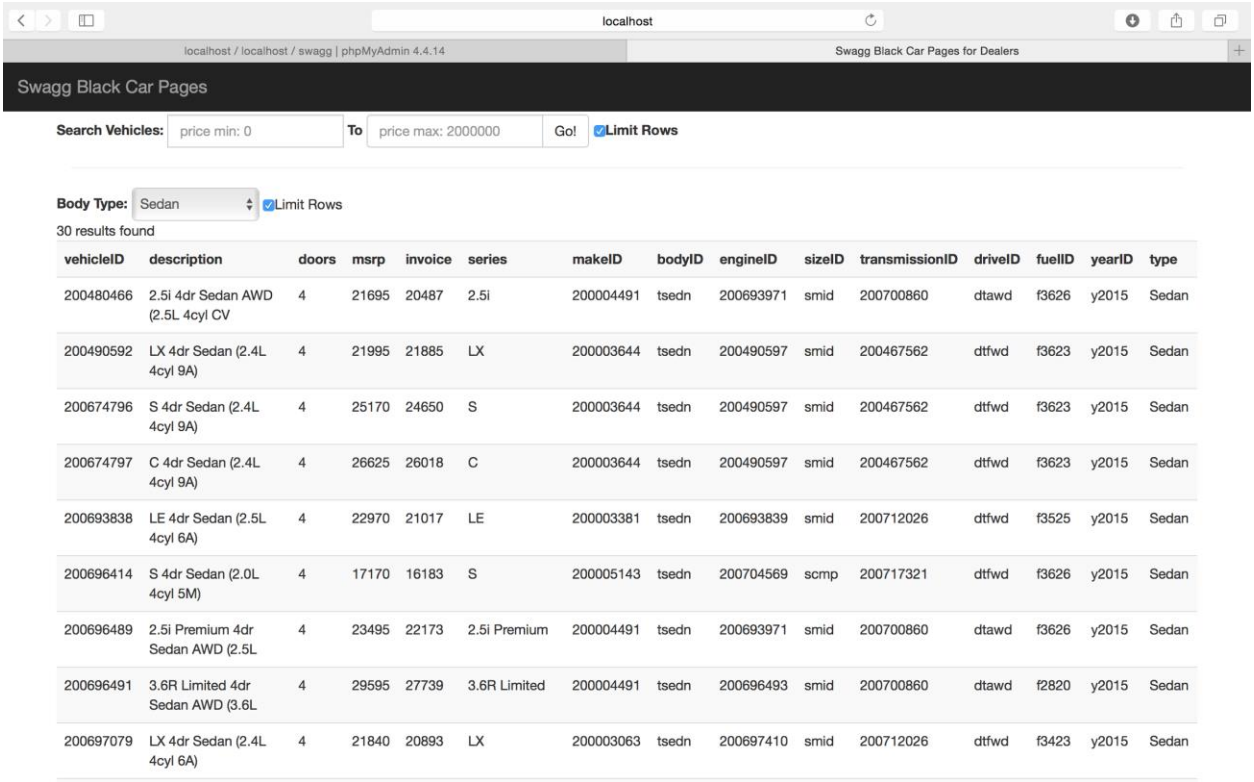


Figure 15: Drop down menu for body type of vehicle



vehicleID	description	doors	msrp	invoice	series	makeID	bodyID	engineID	sizeID	transmissionID	driveID	fuelID	yearID	type
200480466	2.5i 4dr Sedan AWD (2.5L 4cyl CV	4	21695	20487	2.5i	200004491	tsedn	200693971	smid	200700860	dtawd	f3626	y2015	Sedan
200490592	LX 4dr Sedan (2.4L 4cyl 9A)	4	21995	21885	LX	200003644	tsedn	200490597	smid	200467562	dtfwd	f3623	y2015	Sedan
200674796	S 4dr Sedan (2.4L 4cyl 9A)	4	25170	24650	S	200003644	tsedn	200490597	smid	200467562	dtfwd	f3623	y2015	Sedan
200674797	C 4dr Sedan (2.4L 4cyl 9A)	4	26625	26018	C	200003644	tsedn	200490597	smid	200467562	dtfwd	f3623	y2015	Sedan
200693838	LE 4dr Sedan (2.5L 4cyl 6A)	4	22970	21017	LE	200003381	tsedn	200693839	smid	200712026	dtfwd	f3525	y2015	Sedan
200696414	S 4dr Sedan (2.0L 4cyl 5M)	4	17170	16183	S	200005143	tsedn	200704569	scmp	200717321	dtfwd	f3626	y2015	Sedan
200696489	2.5i Premium 4dr Sedan AWD (2.5L	4	23495	22173	2.5i Premium	200004491	tsedn	200693971	smid	200700860	dtawd	f3626	y2015	Sedan
200696491	3.6R Limited 4dr Sedan AWD (3.6L	4	29595	27739	3.6R Limited	200004491	tsedn	200696493	smid	200700860	dtawd	f2820	y2015	Sedan
200697079	LX 4dr Sedan (2.4L 4cyl 6A)	4	21840	20893	LX	200003063	tsedn	200697410	smid	200712026	dtfwd	f3423	y2015	Sedan

Figure 16: Searching for sedan with limited results

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Swagg Black Car Pages

Search Vehicles: price min: 0 **To** price max: 2000000 Go! ☑ **Limit Rows**

Body Type: Sedan ☐ Limit Rows

79 results found

vehicleID	description	doors	msrp	invoice	series	makeID	bodyID	engineID	sizeID	transmissionID	driveID	fuelID	yearID	type
200480466	2.5i 4dr Sedan AWD (2.5L 4cyl CV	4	21695	20487	2.5i	200004491	tsedn	200693971	smid	200700860	dtawd	f3626	y2015	Sedan
200490592	LX 4dr Sedan (2.4L 4cyl 9A)	4	21995	21885	LX	200003644	tsedn	200490597	smid	200467562	dtfwd	f3623	y2015	Sedan
200674796	S 4dr Sedan (2.4L 4cyl 9A)	4	25170	24650	S	200003644	tsedn	200490597	smid	200467562	dtfwd	f3623	y2015	Sedan
200674797	C 4dr Sedan (2.4L 4cyl 9A)	4	26625	26018	C	200003644	tsedn	200490597	smid	200467562	dtfwd	f3623	y2015	Sedan
200693838	LE 4dr Sedan (2.5L 4cyl 6A)	4	22970	21017	LE	200003381	tsedn	200693839	smid	200712026	dtfwd	f3525	y2015	Sedan
200696414	S 4dr Sedan (2.0L 4cyl 5M)	4	17170	16183	S	200005143	tsedn	200704569	scmp	200717321	dtfwd	f3626	y2015	Sedan
200696489	2.5i Premium 4dr Sedan AWD (2.5L	4	23495	22173	2.5i Premium	200004491	tsedn	200693971	smid	200700860	dtawd	f3626	y2015	Sedan
200696491	3.6R Limited 4dr Sedan AWD (3.6L	4	29595	27739	3.6R Limited	200004491	tsedn	200696493	smid	200700860	dtawd	f2820	y2015	Sedan
200697079	LX 4dr Sedan (2.4L 4cyl 6A)	4	21840	20893	LX	200003063	tsedn	200697410	smid	200712026	dtfwd	f3423	y2015	Sedan

Figure 17: Searching for sedan without limited result

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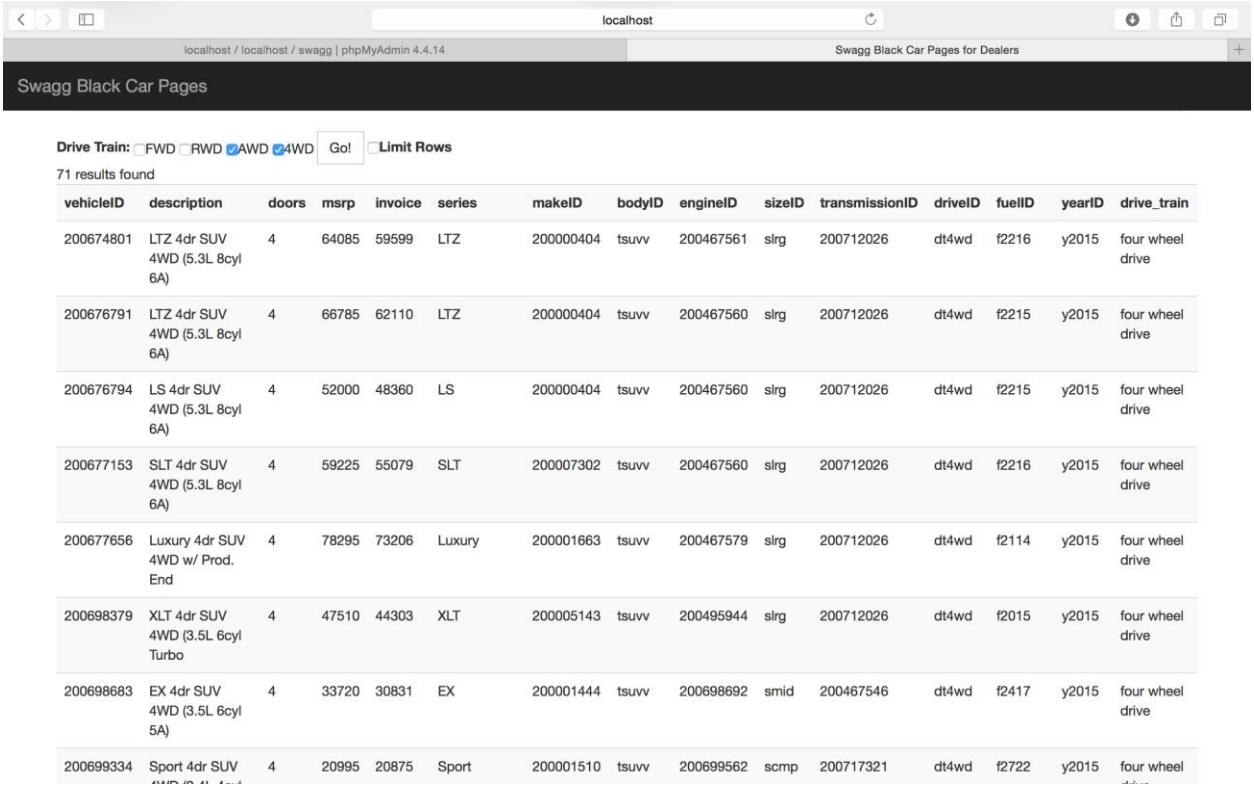
Swagg Black Car Pages

Drive Train: ☐ FWD ☐ RWD ☐ AWD ☑ 4WD Go! ☑ **Limit Rows**

29 results found

vehicleID	description	doors	msrp	invoice	series	makeID	bodyID	engineID	sizeID	transmissionID	driveID	fuelID	yearID	drive_train
200674801	LTZ 4dr SUV 4WD (5.3L 8cyl 6A)	4	64085	59599	LTZ	200000404	tsuvv	200467561	slrg	200712026	dt4wd	f2216	y2015	four wheel drive
200676791	LTZ 4dr SUV 4WD (5.3L 8cyl 6A)	4	66785	62110	LTZ	200000404	tsuvv	200467560	slrg	200712026	dt4wd	f2215	y2015	four wheel drive
200676794	LS 4dr SUV 4WD (5.3L 8cyl 6A)	4	52000	48360	LS	200000404	tsuvv	200467560	slrg	200712026	dt4wd	f2215	y2015	four wheel drive
200677153	SLT 4dr SUV 4WD (5.3L 8cyl 6A)	4	59225	55079	SLT	200007302	tsuvv	200467560	slrg	200712026	dt4wd	f2216	y2015	four wheel drive
200677656	Luxury 4dr SUV 4WD w/ Prod. End	4	78295	73206	Luxury	200001663	tsuvv	200467579	slrg	200712026	dt4wd	f2114	y2015	four wheel drive
200698379	XLT 4dr SUV 4WD (3.5L 6cyl Turbo	4	47510	44303	XLT	200005143	tsuvv	200495944	slrg	200712026	dt4wd	f2015	y2015	four wheel drive
200698683	EX 4dr SUV 4WD (3.5L 6cyl 5A)	4	33720	30831	EX	200001444	tsuvv	200698692	smid	200467546	dt4wd	f2417	y2015	four wheel drive
200699334	Sport 4dr SUV 4WD (2.4L 4cyl 5M)	4	20995	20875	Sport	200001510	tsuvv	200699562	scmp	200717321	dt4wd	f2722	y2015	four wheel drive
200699336	Limited 4dr SUV 4WD (2.4L 4cyl 6	4	28795	27998	Limited	200001510	tsuvv	200699562	scmp	200712026	dt4wd	f2721	y2015	four wheel drive
200701040	Laredo 4dr SUV 4WD (3.6L 6cyl 8A	4	31995	31840	Laredo	200001510	tsuvv	200715850	smid	200700845	dt4wd	f2417	y2015	four wheel drive

Figure 18: Searching for vehicle which has 4WD



vehicleID	description	doors	msrp	invoice	series	makeID	bodyID	engineID	sizeID	transmissionID	driveID	fuelID	yearID	drive_train
200674801	LTZ 4dr SUV 4WD (5.3L 8cyl 6A)	4	64085	59599	LTZ	200000404	tsuvv	200467561	slrg	200712026	dt4wd	f2216	y2015	four wheel drive
200676791	LTZ 4dr SUV 4WD (5.3L 8cyl 6A)	4	66785	62110	LTZ	200000404	tsuvv	200467560	slrg	200712026	dt4wd	f2215	y2015	four wheel drive
200676794	LS 4dr SUV 4WD (5.3L 8cyl 6A)	4	52000	48360	LS	200000404	tsuvv	200467560	slrg	200712026	dt4wd	f2215	y2015	four wheel drive
200677153	SLT 4dr SUV 4WD (5.3L 8cyl 6A)	4	59225	55079	SLT	200007302	tsuvv	200467560	slrg	200712026	dt4wd	f2216	y2015	four wheel drive
200677656	Luxury 4dr SUV 4WD w/ Prod. End	4	78295	73206	Luxury	200001663	tsuvv	200467579	slrg	200712026	dt4wd	f2114	y2015	four wheel drive
200698379	XLT 4dr SUV 4WD (3.5L 6cyl Turbo	4	47510	44303	XLT	200005143	tsuvv	200495944	slrg	200712026	dt4wd	f2015	y2015	four wheel drive
200698683	EX 4dr SUV 4WD (3.5L 6cyl 5A)	4	33720	30831	EX	200001444	tsuvv	200698692	smid	200467546	dt4wd	f2417	y2015	four wheel drive
200699334	Sport 4dr SUV	4	20995	20875	Sport	200001510	tsuvv	200699562	scmp	200717321	dt4wd	f2722	y2015	four wheel

Figure 19: Searching for vehicle which has 4WD and AWD

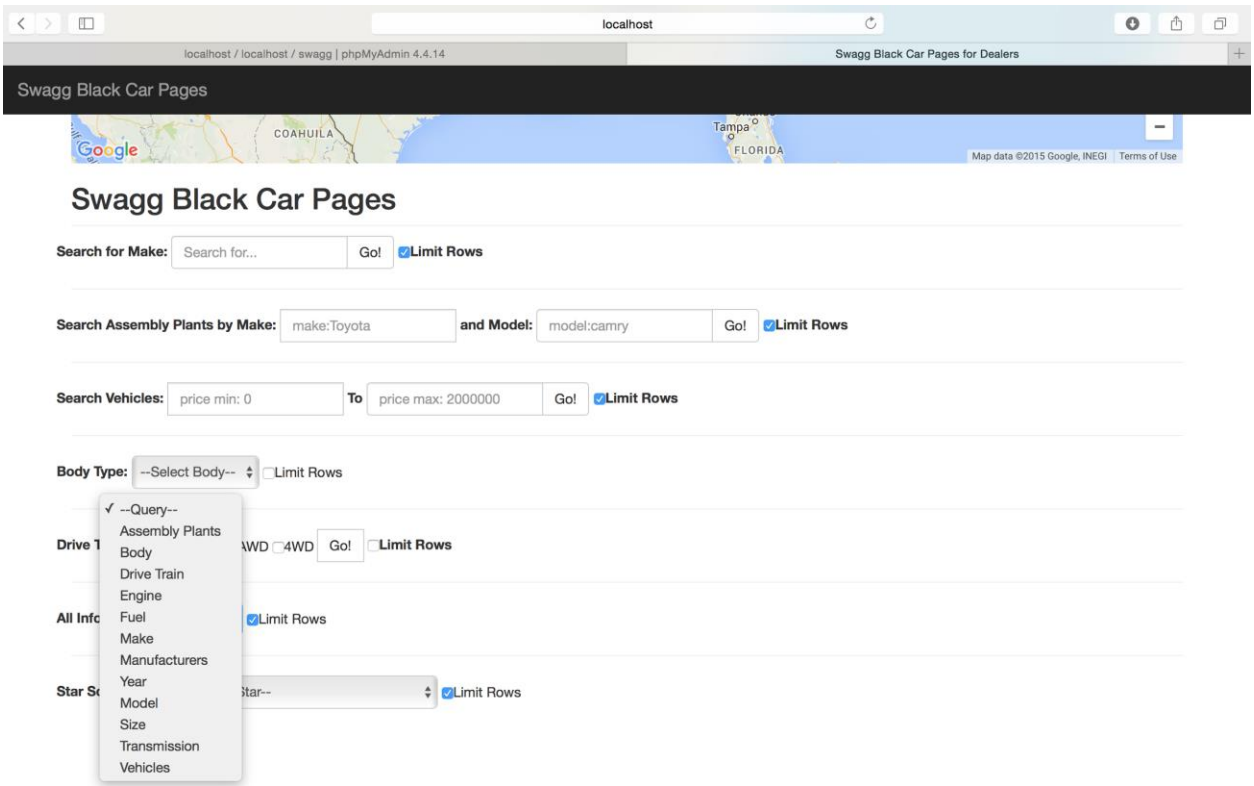


Figure 20: Drop down menu to retrieve all the information from different table

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All Info: Assembly Plants ☐ Limit Rows

37 results found

assemblyID	assembly_name	street	city	state	zipcode	phone	longitude	latitude	manufacturerID
10VNAG	Jefferson North Assembly	2101 Conner Avenue	Detroit	Michigan	48215	3139567729	-82.9672	42.3731	mfcm
4ICAG9	Toyota Motor Manufacturing India	4000 Tulip Tree Drive, P.O. Box	Princeton	Indiana	47670	8123872000	-86.365	37.009	mtmc
4INAG2	Kansas City Assembly	8121 NE 69th Hwy.	Claycomo	Missouri	64068	0	-84.6773	42.695	mfdm
4ITCG1	Michigan Assembly Plant	37625 Michigan Ave.	Wayne	Michigan	48184	7344670500	-80.8733	41.1481	mfdm
4ITCG2	Flat Rock Assembly Plant	1 International Dr.	Flat Rock	Michigan	48134	8002484444	-83.2601	42.7158	mfdm
4MTCG2	Conner Avenue Assembly	20000 Conner Avenue	Detroit	Michigan	48234	8003349200	-86.9575	35.7422	mfcm
4R1452	Lordstown Assembly	2300 Hallock-Young Rd.	Warren	Ohio	44481	3308245220	-83.2483	42.105	mgms
6C1570	Arlington Assembly	2525 E Abram	Arlington	Texas	76010	8176522200	-87.5604	41.6632	mgms
6K1570	Spring Hill Manufacturing	100 Saturn Parkway	Spring Hill	Tennessee	37174	9314865440	-83.1645	42.3133	mgms
6VNAF3	Louisville Assembly Plant	2000 Fern Valley Rd.	Louisville	Kentucky	40213	8003923673	-94.4265	39.2035	mfdm
6VNAG3	Chicago Assembly	12600 S Torrance Ave.	Chicago	Illinois	60633	7736463100	-85.5314	38.293	mfdm
6VNAG4	Toyota Motor Manufacturing Texas	1 Lone Star Pass	San Antonio	Texas	78264	2102634000	-85.7103	38.1537	mtmc
6VTTG3	Kentucky Truck Plant	3001 Chamberlain Ln.	Louisville	Kentucky	40241	8003923673	-83.4076	42.2783	mfdm
6YNAG4	Toyota Motor Manufacturing Kentu	1001 Cherry Blossom Way	Georgetown	Kentucky	40324	5028682000	-88.8703	42.2371	mtmc

Figure 21: All the information of assembly

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Swagg Black Car Pages

All Info: Vehicles ☐ Limit Rows

231 results found

vehicleID	description	doors	msrp	invoice	series	makeID	bodyID	engineID	sizeID	transmissionID	driveID	fuelID	yearID
200467582	Premium 4dr SUV w/ Prod. End 10/	4	80195	74982	Premium	200001663	tsuvv	200467579	slrg	200712026	dtrwd	f2115	y2015
200471954	4dr SUV (2.0L 4cyl Turbo 6A)	4	33100	31445	Base	200001777	tsuvv	200677385	scmp	200712026	dtfwd	f2920	y2015
200480466	2.5i 4dr Sedan AWD (2.5L 4cyl CV	4	21695	20487	2.5i	200004491	tsedn	200693971	smid	200700860	dtawd	f3626	y2015
200490592	LX 4dr Sedan (2.4L 4cyl 9A)	4	21995	21885	LX	200003644	tsedn	200490597	smid	200467562	dtfwd	f3623	y2015
200491059	4dr SUV (3.5L 6cyl Turbo 6A)	4	61480	58406	Base	200001777	tsuvv	200495944	slrg	200712026	dtrwd	f2216	y2015
200498570	Z06 2dr Coupe w/2LZ (6.2L 8cyl S	2	82270	74768	Z06	200000404	tcope	200498573	scmp	200467575	dtrwd	f2215	y2015
200498605	EcoBoost 2dr Coupe (2.3L 4cyl Tu	2	25300	23592	EcoBoost	200005143	tcope	200699880	smid	200711655	dtrwd	f3122	y2015
200674796	S 4dr Sedan (2.4L 4cyl 9A)	4	25170	24650	S	200003644	tsedn	200490597	smid	200467562	dtfwd	f3623	y2015
200674797	C 4dr Sedan (2.4L 4cyl 9A)	4	26625	26018	C	200003644	tsedn	200490597	smid	200467562	dtfwd	f3623	y2015
200674800	LT 4dr SUV (5.3L 8cyl 6A)	4	51505	47900	LT	200000404	tsuvv	200467561	slrg	200712026	dtrwd	f2316	y2015
200674801	LTZ 4dr SUV 4WD (5.3L	4	64085	59599	LTZ	200000404	tsuvv	200467561	slrg	200712026	dt4wd	f2216	y2015

Figure 22: All the information of vehicle

localhost

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Swagg Black Car Pages

Star Schema Info: Trend of HP against Invoice ☑ Limit Rows

30 results found

invoice	make	horsepower
14474	Chevrolet	138
16018	Toyota	132
16089	Chevrolet	138
16183	Ford	160
16480	Dodge	160
16555	Chevrolet	138
16853	Jeep	158
17008	Honda	143
17124	Chevrolet	138
17189	Toyota	132
17394	Jeep	158
17559	Toyota	140
17629	Hyundai	145
17773	Toyota	132
18582	Honda	143

Figure 23: Analysis of trend of HP against invoice

localhost

localhost / localhost / swagg / assemblydview | phpMyAdmin 4.4.14 | Swagg Black Car Pages for Dealers

Swagg Black Car Pages

Star Schema Info: Trend of Transmission against Invoice ☑ Limit Rows

30 results found

invoice	make	series	mpg_highway	mpg_city
14474	Chevrolet	LS	35	26
16018	Toyota	L	37	28
16089	Chevrolet	L	36	25
16183	Ford	S	36	26
16480	Dodge	SE	36	25
16555	Chevrolet	LT	35	25
16853	Jeep	Sport	30	23
17008	Honda	LX	36	28
17124	Chevrolet	LS	36	25
17189	Toyota	LE	38	29
17394	Jeep	Altitude Edition	27	22
17559	Toyota	LE Eco	42	30
17629	Hyundai	SE	38	28
17773	Toyota	S	37	29
18582	Honda	SE	39	30

Figure 24: Analysis of trend of transmission against invoice