US Traffic Accident Data Visualization

This is a countrywide car accident dataset, which covers 49 states of the USA. The accident data are collected from February 2016 to December 2020, using multiple APIs that provide streaming traffic incident (or event) data. These APIs broadcast traffic data captured by a variety of entities, such as the US and state departments of transportation, law enforcement agencies, traffic cameras, and traffic sensors within the road-networks. Currently, there are about 1.5 million accident records in this dataset.

Basic Questions

Which City in US has reported most no. of Accident Cases in last 5 years (2016-2020)?

Which are the top 10 accident prone streets in US ?

Per Day averagely how many road accidents took placed in US ?

In which hours of the day most accidents happened in US ?

How are the basic weather conditions in most of the accident cases in US ?

Which are the top 10 States most no. of road accident cases in US ?

Import all necesary libraries

In [5]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import matplotlib.ticker as ticker
import matplotlib.patches as mpatches
%matplotlib inline
import seaborn as sns
import calendar
import plotly as pt
from plotly import graph_objs as go
import plotly.express as px
import plotly.figure_factory as ff
from pylab import *
import matplotlib.patheffects as PathEffects

import descartes
import geopandas as gpd
from Levenshtein import distance
from itertools import product
from fuzzywuzzy import fuzz
from fuzzywuzzy import process
from scipy.spatial.distance import pdist, squareform
from shapely.geometry import Point, Polygon

import geoplot
from geopy.geocoders import Nominatim

import warnings
warnings.filterwarnings('ignore')


plt.rcParams['font.family'] = "Microsoft JhengHei UI Light"
plt.rcParams['font.serif'] = ["Microsoft JhengHei UI Light"]
```

In [6]:
```
# read & load the dataset into pandas dataframe
df = pd.read_csv('../input/us-accidents/US_Accidents_March23.csv')
```

In [7]:
```
# check the no. of columns & rows
print('The Dataset Contains, Rows: {:,d} & Columns: {}'.format(df.shape[0], df.shape[1]))
```

```
The Dataset Contains, Rows: 7,728,394 & Columns: 46
```

In [8]:
```
# convert the Start_Time & End_Time Variable into Datetime Feature
df.Start_Time = pd.to_datetime(df.Start_Time)
df.End_Time = pd.to_datetime(df.End_Time)
```

Location Analysis

In this dataset, we have different attributes like City, State, Timezone and even street for each accident records. Here we will analyze these four features based on the no. of cases for each distinct location.

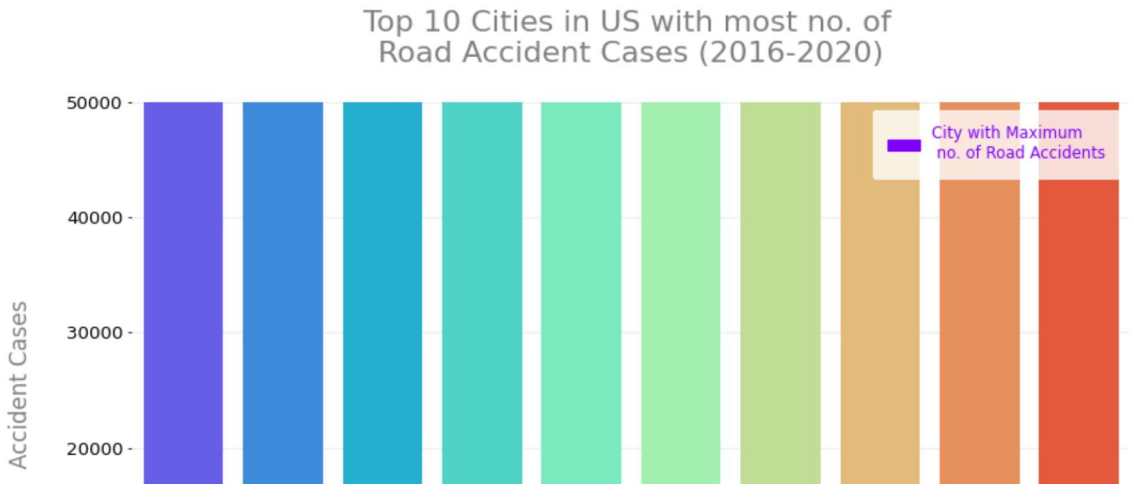
City Analysis

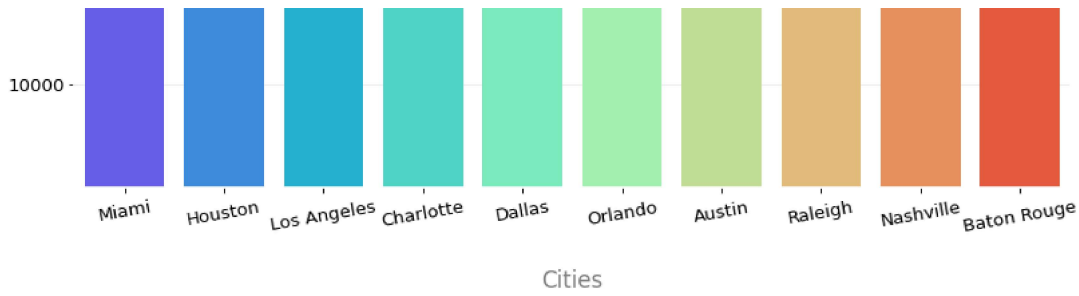
In [9]:
```
# create a dataframe of city and their corresponding accident cases
city_df = pd.DataFrame(df['City'].value_counts()).reset_index().rename(columns={'index':'City', 'City':'Cases'})
```

In [10]:
```
top_10_cities = pd.DataFrame(city_df.head(10))
```

In [11]:
```
fig, ax = plt.subplots(figsize = (12,7), dpi = 80)

cmap = cm.get_cmap('rainbow', 10)
clrs = [matplotlib.colors.rgb2hex(cmap(i)) for i in range(cmap.N)]
```

```
ax=sns.barplot(y=top_10_cities['Cases'], x=top_10_cities['City'], palette='rainbow')

total = sum(city_df['Cases'])
for i in ax.patches:
    ax.text(i.get_x()+.03, i.get_height()-2500, \
            str(round((i.get_height()/total)*100, 2))+'%', fontsize=15, weight='bold',
                color='white')

plt.title('\nTop 10 Cities in US with most no. of \nRoad Accident Cases (2016-2020)\n', size=20, color='grey')

plt.rcParams['font.family'] = "Microsoft JhengHei UI Light"
plt.rcParams['font.serif'] = ["Microsoft JhengHei UI Light"]

plt.ylim(1000, 50000)
plt.xticks(rotation=10, fontsize=12)
plt.yticks(fontsize=12)

ax.set_xlabel('\nCities\n', fontsize=15, color='grey')
ax.set_ylabel('\nAccident Cases\n', fontsize=15, color='grey')

for i in ['bottom', 'left']:
    ax.spines[i].set_color('white')
    ax.spines[i].set_linewidth(1.5)

right_side = ax.spines["right"]
right_side.set_visible(False)
top_side = ax.spines["top"]
top_side.set_visible(False)

ax.set_axisbelow(True)
ax.grid(color='#b2d6c7', linewidth=1, axis='y', alpha=.3)
MA = mpatches.Patch(color=clrs[0], label='City with Maximum\n no. of Road Accidents')
ax.legend(handles=[MA], prop={'size': 10.5}, loc='best', borderpad=1,
          labelcolor=clrs[0], edgecolor='white');
plt.show()
```

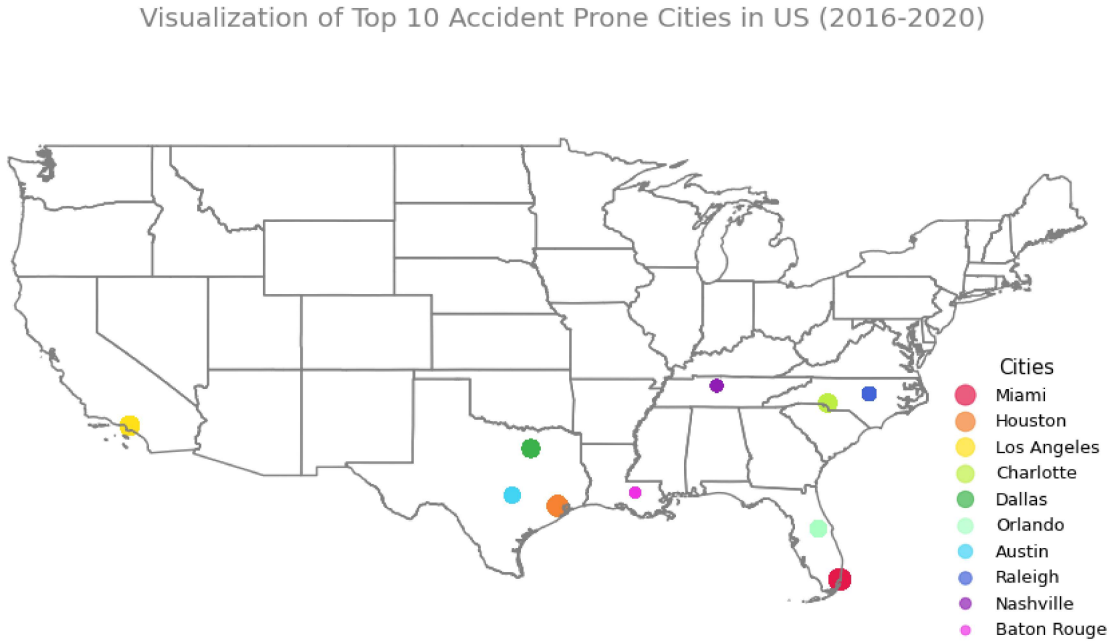

Top 10 Cities in US with most no. of
Road Accident Cases (2016-2020)
Accident Cases
50000
40000
30000
20000
City with Maximum
no. of Road Accidents



In [13]:
```
# US States
states = gpd.read_file('../input/us-states-map')

def lat(city):
    address=city
    geolocator = Nominatim(user_agent="Your_Name")
    location = geolocator.geocode(address)
    return (location.latitude)

def lng(city):
    address=city
    geolocator = Nominatim(user_agent="Your_Name")
    location = geolocator.geocode(address)
    return (location.longitude)

# list of top 10 cities
top_ten_city_list = list(city_df.City.head(10))

top_ten_city_lat_dict = {}
top_ten_city_lng_dict = {}
for i in top_ten_city_list:
    top_ten_city_lat_dict[i] = lat(i)
    top_ten_city_lng_dict[i] = lng(i)

top_10_cities_df = df[df['City'].isin(list(top_10_cities.City))]

top_10_cities_df['New_Start_Lat'] = top_10_cities_df['City'].map(top_ten_city_lat_dict)
top_10_cities_df['New_Start_Lng'] = top_10_cities_df['City'].map(top_ten_city_lng_dict)
```

In [14]:
```
geometry_cities = [Point(xy) for xy in zip(top_10_cities_df['New_Start_Lng'], top_10_cities_df['New_Start_Lat'])]
geo_df_cities = gpd.GeoDataFrame(top_10_cities_df, geometry=geometry_cities)
```

In [15]:
```
fig, ax = plt.subplots(figsize=(15,15))
ax.set_xlim([-125,-65])
ax.set_ylim([22,55])
states.boundary.plot(ax=ax, color='grey');

colors = ['#e6194B','#f58231','#ffe119','#bfef45','#3cb44b', '#aaffc3','#42d4f4','#4363d8','#911eb4','#f032e6']
markersizes = [50+(i*20) for i in range(10)][::-1]
for i in range(10):
    geo_df_cities[geo_df_cities['City'] == top_ten_city_list[i]].plot(ax=ax, markersize=markersizes[i],
                                                                      color=colors[i], marker='o',
                                                                      label=top_ten_city_list[i], alpha=0.7);

plt.legend(prop={'size': 13}, loc='best', bbox_to_anchor=(0.5, 0., 0.5, 0.5), edgecolor='white', title="Cities", title_fontsize=15);

for i in ['bottom', 'top', 'left', 'right']:
    side = ax.spines[i]
    side.set_visible(False)

plt.tick_params(top=False, bottom=False, left=False, right=False,
                labelleft=False, labelbottom=False)

plt.title('\nVisualization of Top 10 Accident Prone Cities in US (2016-2020)', size=20, color='grey');
```



3 out of top 10 cities with most no. of accident cases is from the state

In [16]:
```
def city_cases_percentage(val, operator):
    if operator == '<':
        res = city_df[city_df['Cases']<val].shape[0]
    elif operator == '>':
        res = city_df[city_df['Cases']>val].shape[0]
    elif operator == '=':
        res = city_df[city_df['Cases']==val].shape[0]
    print(f'{res} Cities, {round(res*100/city_df.shape[0], 2)}%')


city_cases_percentage(1, '=')
city_cases_percentage(100, '<')
city_cases_percentage(1000, '<')
city_cases_percentage(1000, '>')
city_cases_percentage(5000, '>')
city_cases_percentage(10000, '>')
```

```
1023 Cities, 7.48%
8947 Cities, 65.41%
12460 Cities, 91.1%
1215 Cities, 8.88%
231 Cities, 1.69%
105 Cities, 0.77%
```

In this Dataset, we have the records of total 10,657 Cities

11% (1167 Cities) only 1 accident record in past 5 years.

81% (8,682 Cities)of all cities in US, have less than 100 total no. of road accidents.

97.64% (10,406 Cities) cities in US, have the road accident records (2016-2020), less than 1,000

There are 251 Cities (2.36%) in US, which have more than 1,000 total no. of road accidents in past 5 years.

40 Cities (0.38%) in US, have more than 5,000 road accident records.

Only 13 Cities (0.12%) in US, have more than 10,000 road accident records.

State Analysis

In [17]:
```
# create a dictionary using US State code and their corresponding Name
us_states = {'AK': 'Alaska',
 'AL': 'Alabama',
 'AR': 'Arkansas',
 'AS': 'American Samoa',
 'AZ': 'Arizona',
 'CA': 'California',
 'CO': 'Colorado',
 'CT': 'Connecticut',
 'DC': 'District of Columbia',
 'DE': 'Delaware',
 'FL': 'Florida',
 'GA': 'Georgia',
 'GU': 'Guam',
```

```
 'HI': 'Hawaii',
 'IA': 'Iowa',
 'ID': 'Idaho',
 'IL': 'Illinois',
 'IN': 'Indiana',
 'KS': 'Kansas',
 'KY': 'Kentucky',
 'LA': 'Louisiana',
 'MA': 'Massachusetts',
 'MD': 'Maryland',
 'ME': 'Maine',
 'MI': 'Michigan',
 'MN': 'Minnesota',
 'MO': 'Missouri',
 'MP': 'Northern Mariana Islands',
 'MS': 'Mississippi',
 'MT': 'Montana',
 'NC': 'North Carolina',
 'ND': 'North Dakota',
 'NE': 'Nebraska',
 'NH': 'New Hampshire',
 'NJ': 'New Jersey',
 'NM': 'New Mexico',
 'NV': 'Nevada',
 'NY': 'New York',
 'OH': 'Ohio',
 'OK': 'Oklahoma',
 'OR': 'Oregon',
 'PA': 'Pennsylvania',
 'PR': 'Puerto Rico',
 'RI': 'Rhode Island',
 'SC': 'South Carolina',
 'SD': 'South Dakota',
 'TN': 'Tennessee',
 'TX': 'Texas',
 'UT': 'Utah',
 'VA': 'Virginia',
 'VI': 'Virgin Islands',
 'VT': 'Vermont',
 'WA': 'Washington',
 'WI': 'Wisconsin',
 'WV': 'West Virginia',
 'WY': 'Wyoming'}

# create a dataframe of State and their corresponding accident cases
state_df = pd.DataFrame(df['State'].value_counts()).reset_index().rename(columns={'index':'State', 'State':'Cases'})


# Function to convert the State Code with the actual corressponding Name
def convert(x): return us_states[x]

state_df['State'] = state_df['State'].apply(convert)


top_ten_states_name = list(state_df['State'].head(10))
```

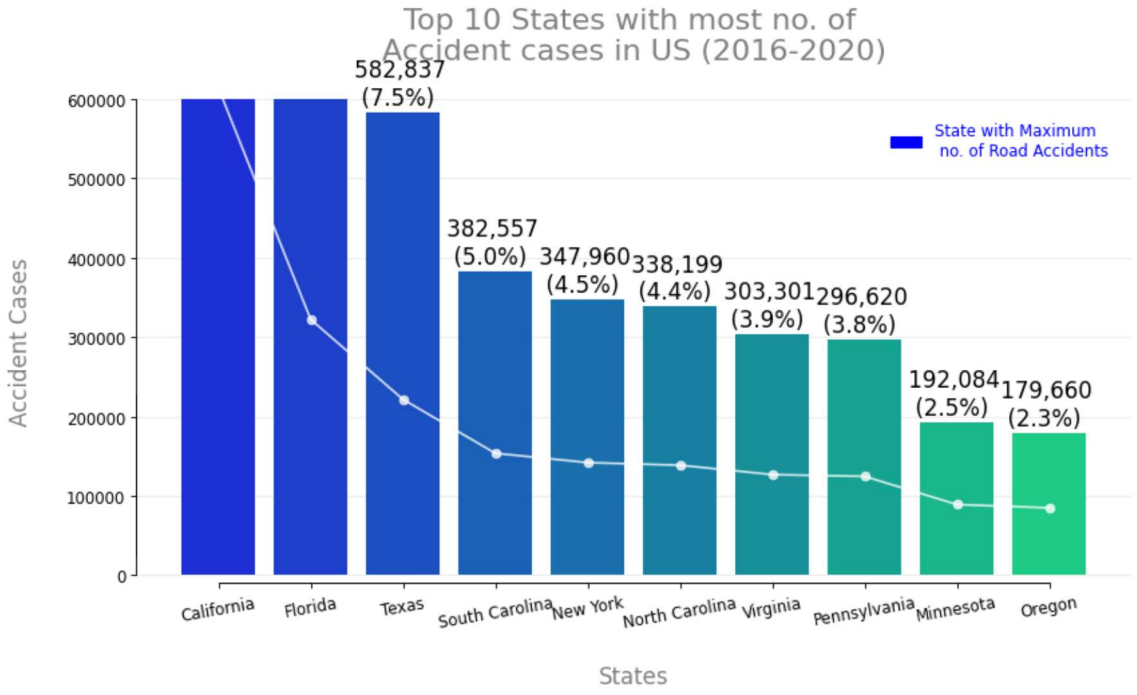
In [18]:

```
fig, ax = plt.subplots(figsize = (12,6), dpi = 80)

cmap = cm.get_cmap('winter', 10)
clrs = [matplotlib.colors.rgb2hex(cmap(i)) for i in range(cmap.N)]

ax=sns.barplot(y=state_df['Cases'].head(10), x=state_df['State'].head(10), palette='winter')
ax1 = ax.twinx()
sns.lineplot(data = state_df[:10], marker='o', x='State', y='Cases', color = 'white', alpha = .8)


total = df.shape[0]
for i in ax.patches:
    ax.text(i.get_x()-0.2, i.get_height()+10000, \
            ' {:,d}\n  ({}%) '.format(int(i.get_height()), round(100*i.get_height()/total, 1)), fontsize=15,
               color='black')


ax.set(ylim =(-10000, 600000))
ax1.set(ylim =(-100000, 1700000))

plt.title('\nTop 10 States with most no. of \nAccident cases in US (2016-2020)\n', size=20, color='grey')
ax1.axes.yaxis.set_visible(False)
ax.set_xlabel('\nStates\n', fontsize=15, color='grey')
ax.set_ylabel('\nAccident Cases\n', fontsize=15, color='grey')

for i in ['top','right']:
    side1 = ax.spines[i]
    side1.set_visible(False)
    side2 = ax1.spines[i]
    side2.set_visible(False)

ax.set_axisbelow(True)
ax.grid(color='#b2d6c7', linewidth=1, axis='y', alpha=.3)
```

```
ax.spines['bottom'].set_bounds(0.005, 9)
ax.spines['left'].set_bounds(0, 600000)
ax1.spines['bottom'].set_bounds(0.005, 9)
ax1.spines['left'].set_bounds(0, 600000)
ax.tick_params(axis='y', which='major', labelsize=10.6)
ax.tick_params(axis='x', which='major', labelsize=10.6, rotation=10)

MA = mpatches.Patch(color=clrs[0], label='State with Maximum\n no. of Road Accidents')
ax.legend(handles=[MA], prop={'size': 10.5}, loc='best', borderpad=1,
          labelcolor=clrs[0], edgecolor='white');
```

1,741,433
(22.5%)

880,192
(11.4%)

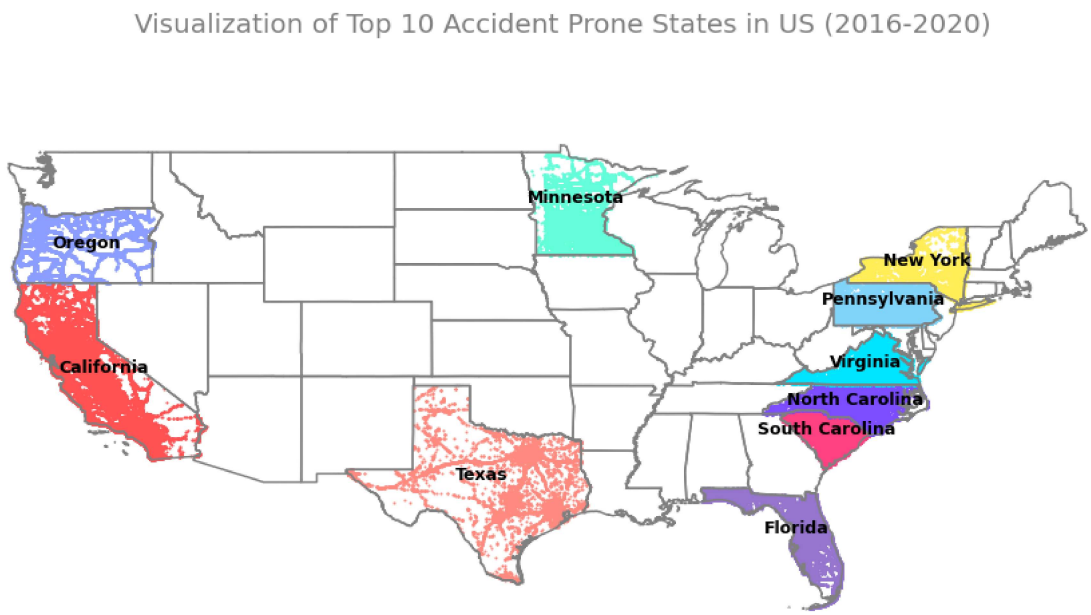


In US, California is the state with highest no. of road accidents in past 5 years.

About 30% of the total accident records of past 5 years in US is only from California

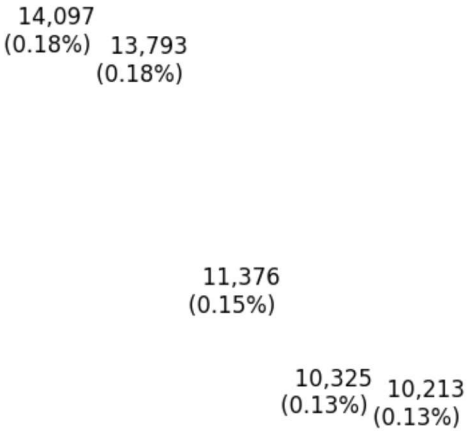
In [19]:
```
geometry = [Point(xy) for xy in zip(df['Start_Lng'], df['Start_Lat'])]
geo_df = gpd.GeoDataFrame(df, geometry=geometry)

geo_df['year'] = geo_df.Start_Time.dt.year

geo_df['State'] = geo_df['State'].apply(convert)
```

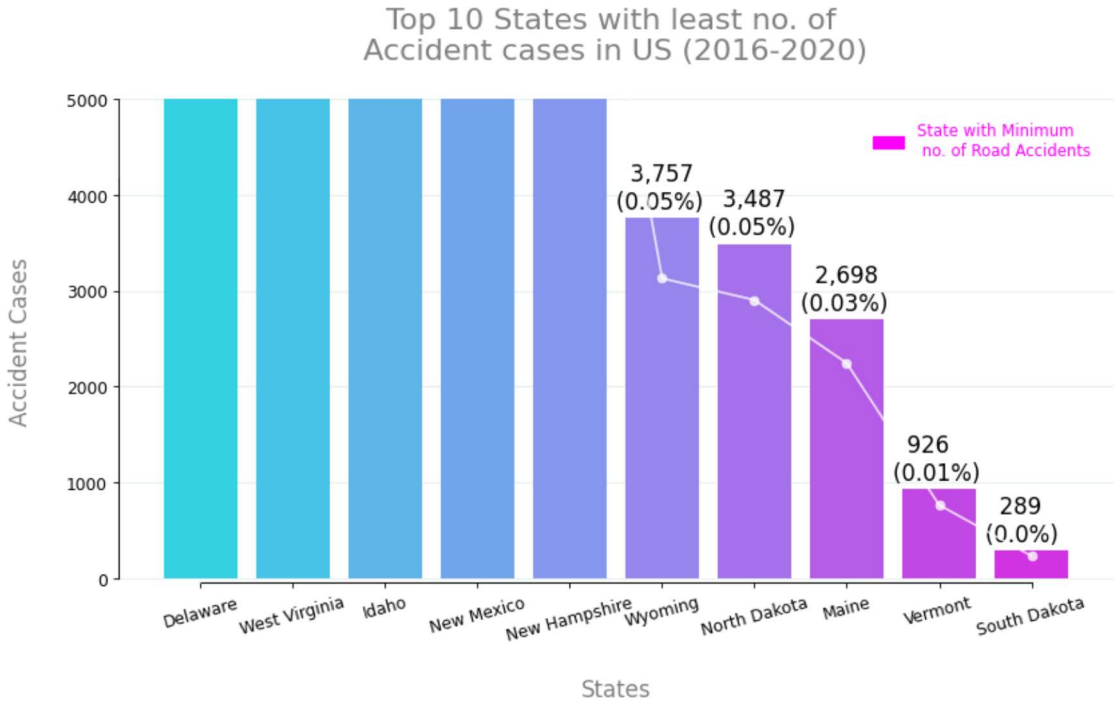
In [20]:
```
fig, ax = plt.subplots(figsize=(15,15))
ax.set_xlim([-125,-65])
ax.set_ylim([22,55])

states.boundary.plot(ax=ax, color='grey');
states.apply(lambda x: None if (x.NAME not in top_ten_states_name) else ax.annotate(s=x.NAME, xy=x.geometry.centroid.coords[0], ha='cente

# CFOTNYMVNPI
colors = ['#FF5252','#9575CD','#FF8A80','#FF4081','#FFEE58','#7C4DFF','#00E5FF','#81D4FA','#64FFDA','#8C9EFF']
count = 0
for i in list(state_df['State'].head(10)):
    geo_df[geo_df['State'] == i].plot(ax=ax, markersize=1, color=colors[count], marker='o');
    count += 1

for i in ['bottom', 'top', 'left', 'right']:
    side = ax.spines[i]
    side.set_visible(False)

plt.tick_params(top=False, bottom=False, left=False, right=False,
                labelleft=False, labelbottom=False)

plt.title('\nVisualization of Top 10 Accident Prone States in US (2016-2020)', size=20, color='grey');
```



In [21]:
```
fig, ax = plt.subplots(figsize = (12,6), dpi = 80)

cmap = cm.get_cmap('cool', 10)
clrs = [matplotlib.colors.rgb2hex(cmap(i)) for i in range(cmap.N)]

ax=sns.barplot(y=state_df['Cases'].tail(10), x=state_df['State'].tail(10), palette='cool')
ax1 = ax.twinx()
sns.lineplot(data = state_df[-10:], marker='o', x='State', y='Cases', color = 'white', alpha = .8)

total = df.shape[0]
for i in ax.patches:
    ax.text(i.get_x()-0.1, i.get_height()+100, \
            '  {:,d}\n({}%) '.format(int(i.get_height()), round(100*i.get_height()/total, 2)), fontsize=15,
                color='black')

ax.set(ylim =(-50, 5000))
ax1.set(ylim =(-50, 6000))

plt.title('\nTop 10 States with least no. of \nAccident cases in US (2016-2020)\n', size=20, color='grey')
ax1.axes.yaxis.set_visible(False)
ax.set_xlabel('\nStates\n', fontsize=15, color='grey')
ax.set_ylabel('\nAccident Cases\n', fontsize=15, color='grey')

for i in ['top', 'right']:
    side = ax.spines[i]
    side.set_visible(False)
```

```
    side1 = ax1.spines[i]
    side1.set_visible(False)


ax.set_axisbelow(True)
ax.grid(color='#b2d6c7', linewidth=1, axis='y', alpha=.3)

ax.spines['bottom'].set_bounds(0.005, 9)
ax.spines['left'].set_bounds(0, 5000)
ax1.spines['bottom'].set_bounds(0.005, 9)
ax1.spines['left'].set_bounds(0, 5000)
ax.tick_params(axis='y', which='major', labelsize=11)
ax.tick_params(axis='x', which='major', labelsize=11, rotation=15)

MI = mpatches.Patch(color=clrs[-1], label='State with Minimum\n no. of Road Accidents')
ax.legend(handles=[MI], prop={'size': 10.5}, loc='best', borderpad=1,
          labelcolor=clrs[-1], edgecolor='white');
```





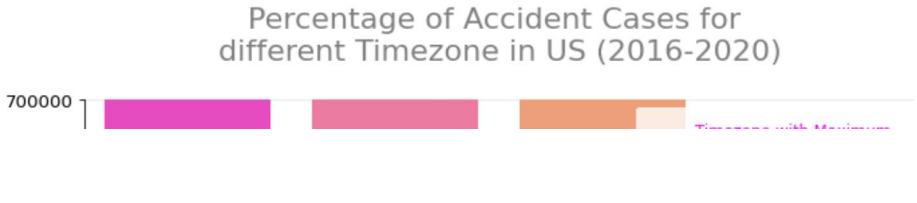
South Dakota is the city with lowest no. of road accidents in past 5 years.

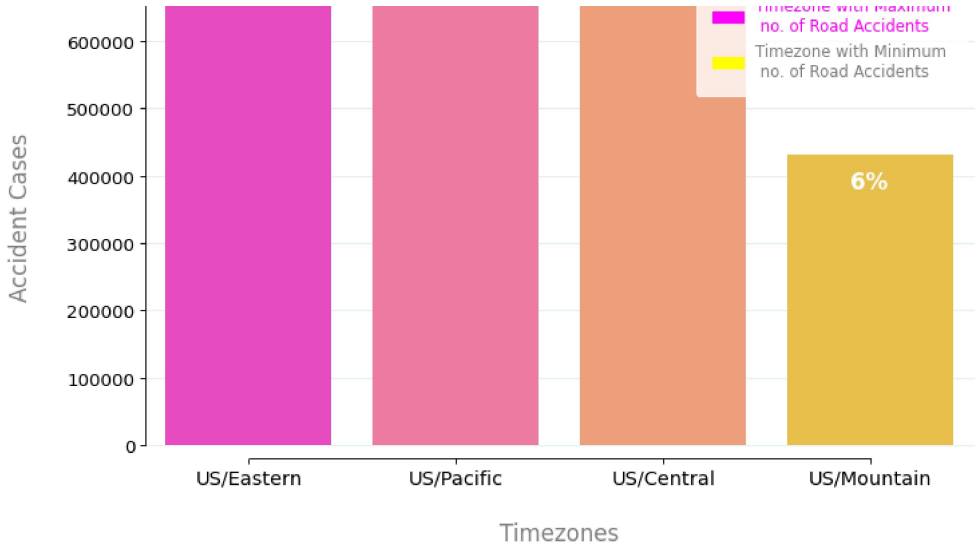
Timezone Analysis

In [22]:
```
timezone_df = pd.DataFrame(df['Timezone'].value_counts()).reset_index().rename(columns={'index':'Timezone', 'Timezone':'Cases'})
```

In [23]:
```
fig, ax = plt.subplots(figsize = (10,6), dpi = 80)

cmap = cm.get_cmap('spring', 4)
clrs = [matplotlib.colors.rgb2hex(cmap(i)) for i in range(cmap.N)]

ax=sns.barplot(y=timezone_df['Cases'], x=timezone_df['Timezone'], palette='spring')

total = df.shape[0]
for i in ax.patches:
```

```
    ax.text(i.get_x()+0.3, i.get_height()-50000, \
            '{}%'.format(round(i.get_height()*100/total)), fontsize=15,weight='bold',
                color='white')


plt.ylim(-20000, 700000)
plt.title('\nPercentage of Accident Cases for \ndifferent Timezone in US (2016-2020)\n', size=20, color='grey')
plt.ylabel('\nAccident Cases\n', fontsize=15, color='grey')
plt.xlabel('\nTimezones\n', fontsize=15, color='grey')
plt.xticks(fontsize=13)
plt.yticks(fontsize=12)

for i in ['top', 'right']:
    side = ax.spines[i]
    side.set_visible(False)

ax.set_axisbelow(True)
ax.grid(color='#b2d6c7', linewidth=1, axis='y', alpha=.3)
ax.spines['bottom'].set_bounds(0.005, 3)
ax.spines['left'].set_bounds(0, 700000)

MA = mpatches.Patch(color=clrs[0], label='Timezone with Maximum\n no. of Road Accidents')
MI = mpatches.Patch(color=clrs[-1], label='Timezone with Minimum\n no. of Road Accidents')
ax.legend(handles=[MA, MI], prop={'size': 10.5}, loc='best', borderpad=1,
          labelcolor=[clrs[0], 'grey'], edgecolor='white');
```

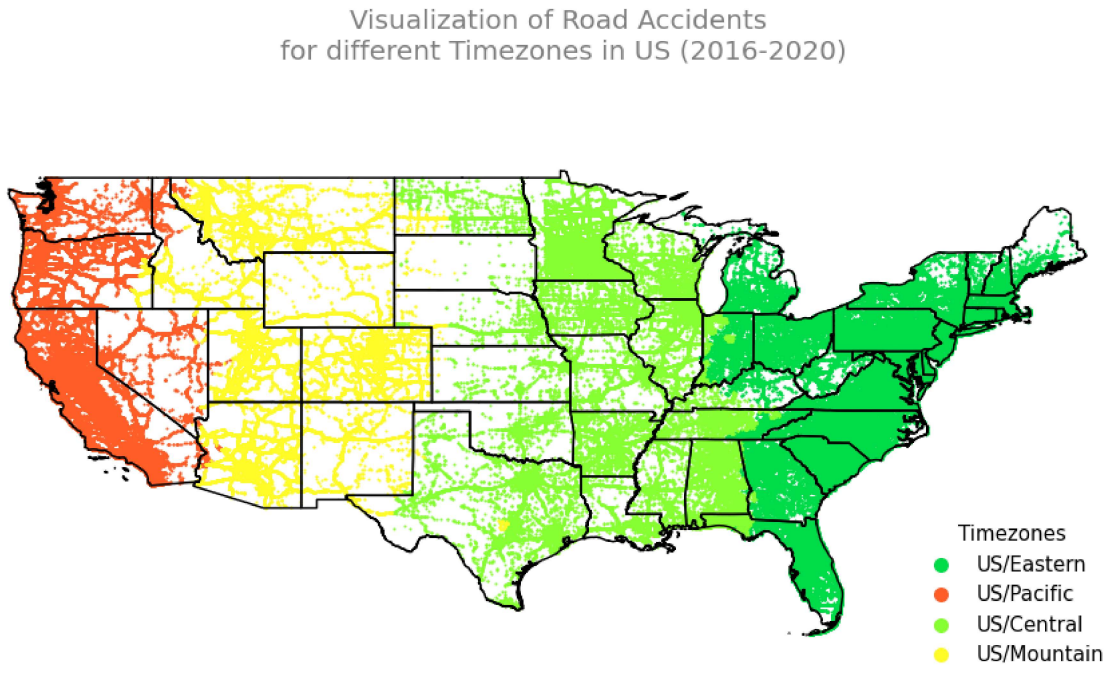

Percentage of Accident Cases for
different Timezone in US (2016-2020)
700000



Eastern time zone region of US has the highest no. of road accident cases (39%) in past 5 years.

Mountain time zone region of US has the lowest no. of road accident cases (6%) in past 5 years.

In [24]:
```
fig, ax = plt.subplots(figsize=(15,15))
ax.set_xlim([-125,-65])
ax.set_ylim([22,55])
states.boundary.plot(ax=ax, color='black');

colors = ['#00db49', '#ff5e29', '#88ff33', '#fffb29']
#4132
count = 0
for i in list(timezone_df.Timezone):
    geo_df[geo_df['Timezone'] == i].plot(ax=ax, markersize=1, color=colors[count], marker='o', label=i);
    count += 1

plt.legend(markerscale=10., prop={'size': 15}, edgecolor='white', title="Timezones", title_fontsize=15, loc='lower right');

for i in ['bottom', 'top', 'left', 'right']:
    side = ax.spines[i]
    side.set_visible(False)

plt.tick_params(top=False, bottom=False, left=False, right=False,
                labelleft=False, labelbottom=False)

plt.title('\nVisualization of Road Accidents \nfor different Timezones in US (2016-2020)', size=20, color='grey');
```

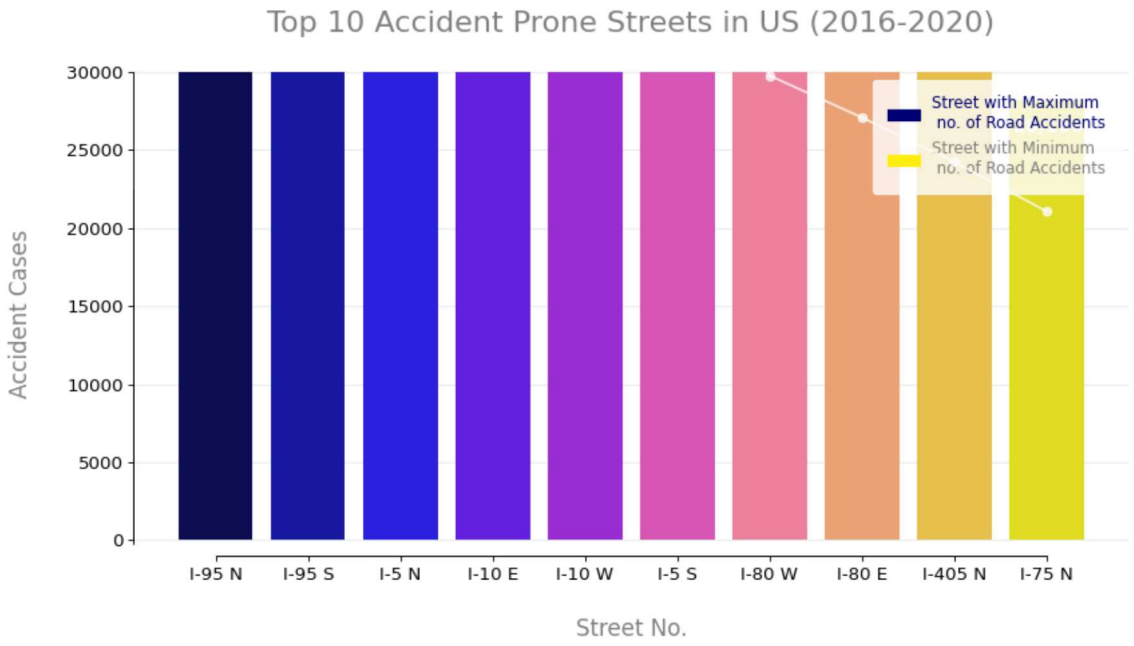


Street Analysis

In [25]:
```
# create a dataframe of Street and their corresponding accident cases
street_df = pd.DataFrame(df['Street'].value_counts()).reset_index().rename(columns={'index':'Street No.', 'Street':'Cases'})
```

In [26]:
```
top_ten_streets_df = pd.DataFrame(street_df.head(10))
```

In [27]:
```
fig, ax = plt.subplots(figsize = (12,6), dpi = 80)

cmap = cm.get_cmap('gnuplot2', 10)
clrs = [matplotlib.colors.rgb2hex(cmap(i)) for i in range(cmap.N)]

ax=sns.barplot(y=top_ten_streets_df['Cases'], x=top_ten_streets_df['Street No.'], palette='gnuplot2')
ax1 = ax.twinx()
sns.lineplot(data = top_ten_streets_df, marker='o', x='Street No.', y='Cases', color = 'white', alpha = .8)

total = df.shape[0]
for i in ax.patches:
    ax.text(i.get_x()+0.04, i.get_height()-2000, \
            '{:,d}'.format(int(i.get_height())), fontsize=12.5,weight='bold',
                color='white')

ax.axes.set_ylim(-1000, 30000)
ax1.axes.set_ylim(-1000, 40000)
plt.title('\nTop 10 Accident Prone Streets in US (2016-2020)\n', size=20, color='grey')

ax1.axes.yaxis.set_visible(False)
ax.set_xlabel('\nStreet No.\n', fontsize=15, color='grey')
ax.set_ylabel('\nAccident Cases\n', fontsize=15, color='grey')

for i in ['top','right']:
    side1 = ax.spines[i]
    side1.set_visible(False)
    side2 = ax1.spines[i]
    side2.set_visible(False)


ax.set_axisbelow(True)
ax.grid(color='#b2d6c7', linewidth=1, axis='y', alpha=.3)

ax.spines['bottom'].set_bounds(0.005, 9)
ax.spines['left'].set_bounds(0, 30000)
ax1.spines['bottom'].set_bounds(0.005, 9)
ax1.spines['left'].set_bounds(0, 30000)
ax.tick_params(axis='both', which='major', labelsize=12)

MA = mpatches.Patch(color=clrs[1], label='Street with Maximum\n no. of Road Accidents')
MI = mpatches.Patch(color=clrs[-2], label='Street with Minimum\n no. of Road Accidents')
ax.legend(handles=[MA, MI], prop={'size': 10.5}, loc='best', borderpad=1,
          labelcolor=[clrs[1], 'grey'], edgecolor='white');
```



In [28]:
```
def street_cases_percentage(val, operator):
    if operator == '=':
        val = street_df[street_df['Cases']==val].shape[0]
    elif operator == '>':
        val = street_df[street_df['Cases']>val].shape[0]
    elif operator == '<':
        val = street_df[street_df['Cases']<val].shape[0]
    print('{:,d} Streets, {}%'.format(val, round(val*100/street_df.shape[0], 2)))


street_cases_percentage(1, '=')
street_cases_percentage(100, '<')
street_cases_percentage(1000, '<')
street_cases_percentage(1000, '>')
street_cases_percentage(5000, '>')
```

```
129,934 Streets, 38.64%
326,421 Streets, 97.06%
335,489 Streets, 99.76%
817 Streets, 0.24%
133 Streets, 0.04%
```

In Our dataset, there are total 93,048 Streets enlisted for accidental cases,

There are 36,441 Streets (39%) in US which have only 1 accident record in past 5 years.

98% Streets of US, have less than 100 road accident cases.

0.2% Streets in US have the accident cases greater than 1000

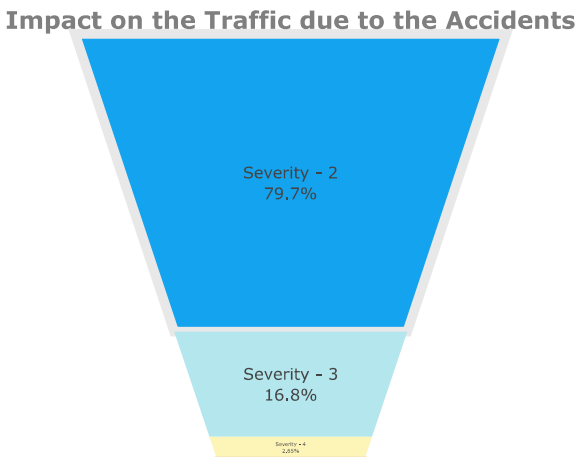
In last 5 years record of road accidents, only 24 Streets (0.03%) have greater than 5000 cases.

Severity Analysis

It shows the severity of the accident, a number between 1 and 4, where 1 indicates the least impact on traffic (i.e., a short delay as a result of the accident), and 4 indicates a significant impact on traffic (i.e., a long delay). Note that the severity reported by different sources may differ in their underlying impact on traffic, so please separate data from different sources when conducting a severity-based analysis.

In [29]:
```
# create a dataframe of Severity and the corresponding accident cases
severity_df = pd.DataFrame(df['Severity'].value_counts()).rename(columns={'index':'Severity', 'Severity':'Cases'})
```

In [30]:
```
fig = go.Figure(go.Funnelarea(
    text = ["Severity - 2","Severity - 3", "Severity - 4", "Severity - 1"],
    values = severity_df.Cases,
    title = {"position": "top center",
             "text": "<b>Impact on the Traffic due to the Accidents</b>",
             'font':dict(size=18,color="#7f7f7f")},
    marker = {"colors": ['#14a3ee', '#b4e6ee', '#fdf4b8', '#ff4f4e'],
                "line": {"color": ["#e8e8e8", "wheat", "wheat", "wheat"], "width": [7, 0, 0, 2]}}
    ))

fig.show()
```

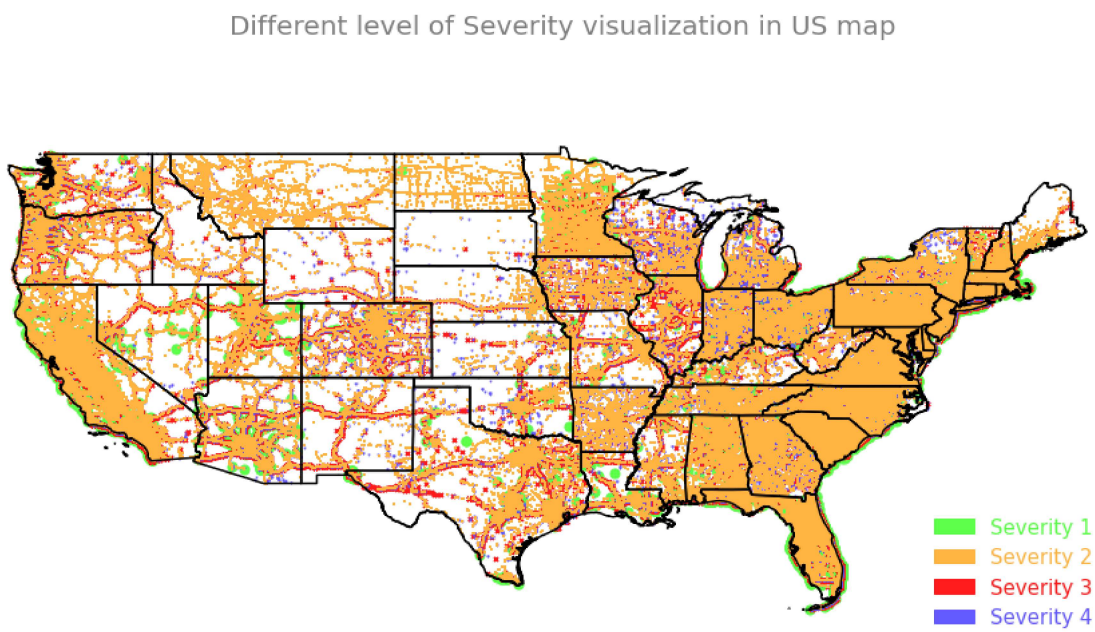


In 80% Cases of road accidents, the impact on the traffic was Moderate (Severity-2)

In 7.5% Cases of road accidents, the impact on the traffic was highly Severe (Severity-4)

In [31]:
```
fig, ax = plt.subplots(figsize=(15,15))
ax.set_xlim([-125,-65])
ax.set_ylim([22,55])
states.boundary.plot(ax=ax, color='black');

geo_df[geo_df['Severity'] == 1].plot(ax=ax, markersize=50, color='#5cff4a', marker='o', label='Severity 1');
geo_df[geo_df['Severity'] == 3].plot(ax=ax, markersize=10, color='#ff1c1c', marker='x', label='Severity 3');
geo_df[geo_df['Severity'] == 4].plot(ax=ax, markersize=1, color='#6459ff', marker='v', label='Severity 4');
geo_df[geo_df['Severity'] == 2].plot(ax=ax, markersize=5, color='#ffb340', marker='+', label='Severity 2');

for i in ['bottom', 'top', 'left', 'right']:
    side = ax.spines[i]
    side.set_visible(False)

plt.tick_params(top=False, bottom=False, left=False, right=False,
                labelleft=False, labelbottom=False)

plt.title('\nDifferent level of Severity visualization in US map', size=20, color='grey');

One = mpatches.Patch(color='#5cff4a', label='Severity 1')
Two = mpatches.Patch(color='#ffb340', label='Severity 2')
Three = mpatches.Patch(color='#ff1c1c', label='Severity 3')
Four = mpatches.Patch(color='#6459ff', label='Severity 4')
```

```
ax.legend(handles=[One, Two, Three, Four], prop={'size': 15}, loc='lower right', borderpad=1,
          labelcolor=['#5cff4a', '#ffb340', '#ff1c1c', '#6459ff'], edgecolor='white');
```



Time Analysis

In this dataset we have Start_Time & End_Time for the timings of each accident.

Start_Time shows start time of the accident in local time zone.

End_Time shows end time of the accident in local time zone. End time here refers to when the impact of accident on traffic flow

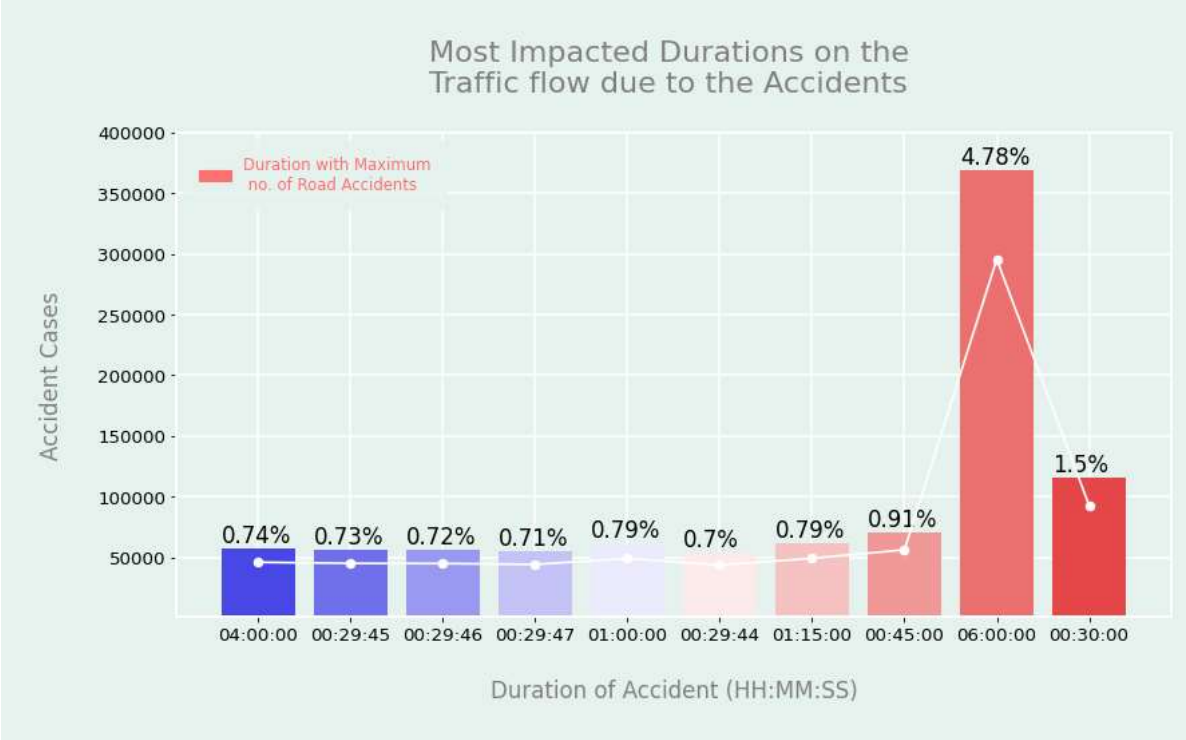
Accident Duration Analysis

In [32]:
```
accident_duration_df = pd.DataFrame(df['End_Time'] - df['Start_Time']).reset_index().rename(columns={'index':'Id', 0:'Duration'})
```

In [33]:
```
top_10_accident_duration_df = pd.DataFrame(accident_duration_df['Duration'].value_counts().head(10).sample(frac = 1)).reset_index().renam

Duration = [str(i).split('days')[-1].strip() for i in top_10_accident_duration_df.Duration]

top_10_accident_duration_df['Duration'] = Duration
```

In [34]:
```
fig, ax = plt.subplots(figsize = (12,6), dpi = 80)
ax.set_facecolor('#e6f2ed')
fig.patch.set_facecolor('#e6f2ed')

cmap = cm.get_cmap('bwr', 10)
clrs = [matplotlib.colors.rgb2hex(cmap(i)) for i in range(cmap.N)]

ax=sns.barplot(y=top_10_accident_duration_df['Cases'], x=top_10_accident_duration_df['Duration'], palette='bwr')
ax1 = ax.twinx()
sns.lineplot(data = top_10_accident_duration_df, marker='o', x='Duration', y='Cases', color = 'white', alpha = 1)

total = df.shape[0]
for i in ax.patches:
    ax.text(i.get_x(), i.get_height()+5000, \
            str(round((i.get_height()/total)*100, 2))+'%', fontsize=15,
                color='black')

ax.set(ylim =(1000, 400000))
ax1.set(ylim =(1000, 500000))

plt.title('\nMost Impacted Durations on the \nTraffic flow due to the Accidents \n', size=20, color='grey')

ax1.axes.yaxis.set_visible(False)
ax.set_xlabel('\nDuration of Accident (HH:MM:SS)\n', fontsize=15, color='grey')
ax.set_ylabel('\nAccident Cases\n', fontsize=15, color='grey')

for i in ['bottom', 'top', 'left', 'right']:
    ax.spines[i].set_color('white')
    ax.spines[i].set_linewidth(1.5)
    ax1.spines[i].set_color('white')
    ax1.spines[i].set_linewidth(1.5)

ax.set_axisbelow(True)
ax.grid(color='white', linewidth=1.5)
```

```
ax.tick_params(axis='both', which='major', labelsize=12)
MA = mpatches.Patch(color=clrs[-3], label='Duration with Maximum\n no. of Road Accidents')
ax.legend(handles=[MA], prop={'size': 10.5}, loc='best', borderpad=1,
          labelcolor=clrs[-3], facecolor='#e6f2ed', edgecolor='#e6f2ed');
```

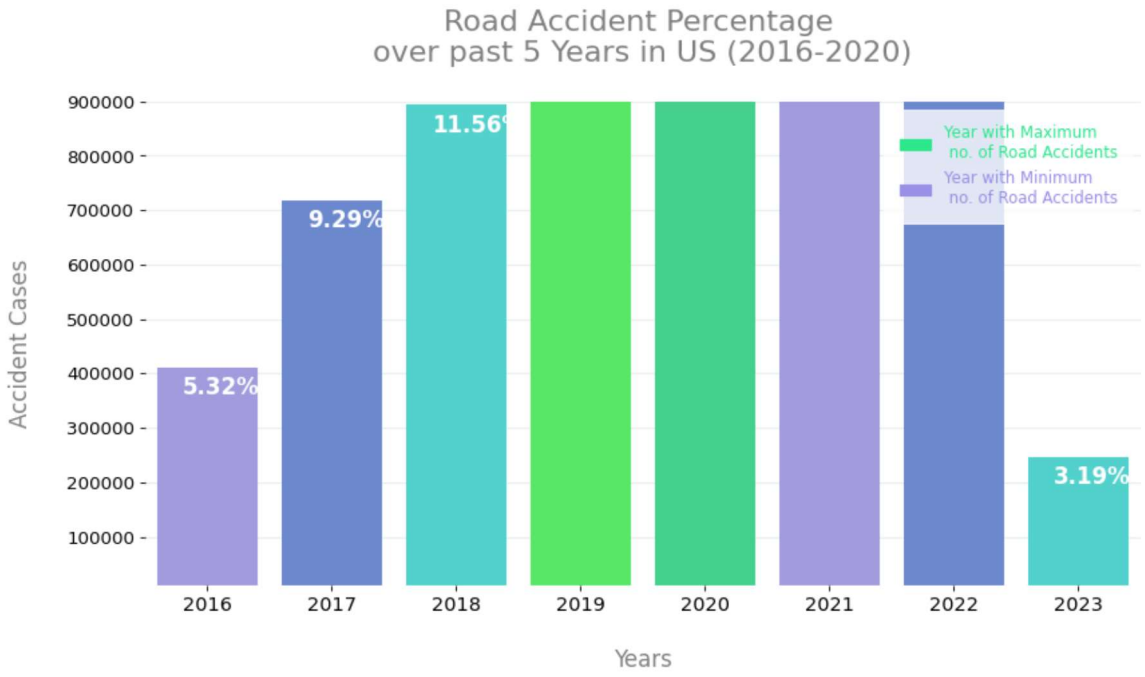


From the above plot, it is inferred that majority (24.25%) of road accidents, have impacted on the traffic flow for 6 hours

Year Analysis

In [35]:
```
year_df = pd.DataFrame(df.Start_Time.dt.year.value_counts()).reset_index().rename(columns={'index':'Year', 'Start_Time':'Cases'}).sort_va
```

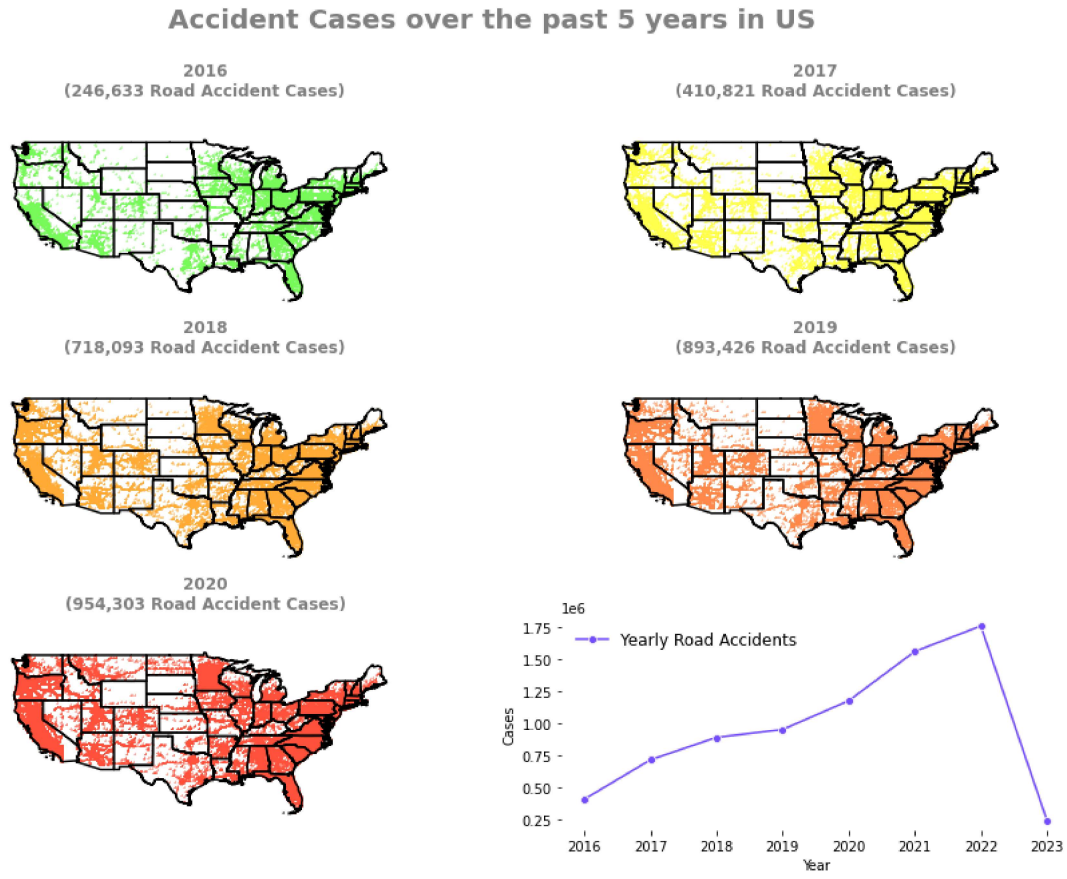
In [36]:
```
fig, ax = plt.subplots(figsize = (12,6), dpi = 80)

ax=sns.barplot(y=year_df['Cases'], x=year_df['Year'], palette=['#9a90e8', '#5d82de', '#3ee6e0', '#40ff53','#2ee88e'])

total = df.shape[0]
for i in ax.patches:
    ax.text(i.get_x()+0.2, i.get_height()-50000, \
            str(round((i.get_height()/total)*100, 2))+'%', fontsize=15,weight='bold',
                color='white')

plt.ylim(10000, 900000)
plt.title('\nRoad Accident Percentage \nover past 5 Years in US (2016-2020)\n', size=20, color='grey')
plt.ylabel('\nAccident Cases\n', fontsize=15, color='grey')
plt.xlabel('\nYears\n', fontsize=15, color='grey')
plt.xticks(fontsize=13)
plt.yticks(fontsize=12)
for i in ['bottom', 'top', 'left', 'right']:
    ax.spines[i].set_color('white')
    ax.spines[i].set_linewidth(1.5)


for k in ['top', 'right', "bottom", 'left']:
        side = ax.spines[k]
        side.set_visible(False)

ax.set_axisbelow(True)
ax.grid(color='#b2d6c7', linewidth=1, axis='y', alpha=0.3)
MA = mpatches.Patch(color='#2ee88e', label='Year with Maximum\n no. of Road Accidents')
MI = mpatches.Patch(color='#9a90e8', label='Year with Minimum\n no. of Road Accidents')
ax.legend(handles=[MA, MI], prop={'size': 10.5}, loc='best', borderpad=1,
          labelcolor=['#2ee88e', '#9a90e8'], edgecolor='white');
plt.show()
```



From the above figure, it is clear that in last 5 years (2016-2020) in US accidents percentage has increased significantly

70% of the total road accident records of last 5 years happened only within last 2 years (2019, 2020)

In [37]:
```
fig, ((ax1, ax2), (ax3, ax4), (ax5, ax6)) = plt.subplots(nrows=3, ncols=2, figsize=(15, 10))
fig.suptitle('Accident Cases over the past 5 years in US', fontsize=20,fontweight ="bold", color='grey')
count = 0
years = ['2016', '2017', '2018', '2019', '2020']
colors = ['#77fa5a', '#ffff4d', '#ffab36', '#ff894a', '#ff513b']
for i in [ax1, ax2, ax3, ax4, ax5]:
    i.set_xlim([-125,-65])
    i.set_ylim([22,55])
    states.boundary.plot(ax=i, color='black');
    geo_df[geo_df['year']==int(years[count])].plot(ax=i, markersize=1, color=colors[count], marker='+', alpha=0.5)
    for j in ['bottom', 'top', 'left', 'right']:
        side = i.spines[j]
        side.set_visible(False)
    i.set_title(years[count] + '\n({:,} Road Accident Cases)'.format(list(year_df.Cases)[count]), fontsize=12, color='grey', weight='bold
    i.axis('off')
    count += 1

sns.lineplot(data = year_df, marker='o', x='Year', y='Cases', color = '#734dff', ax=ax6, label="Yearly Road Accidents");

for k in ['bottom', 'top', 'left', 'right']:
        side = ax6.spines[k]
        side.set_visible(False)
ax6.xaxis.set_ticks(year_df.Year);
ax6.legend(prop={'size': 12}, loc='best', edgecolor='white');
```

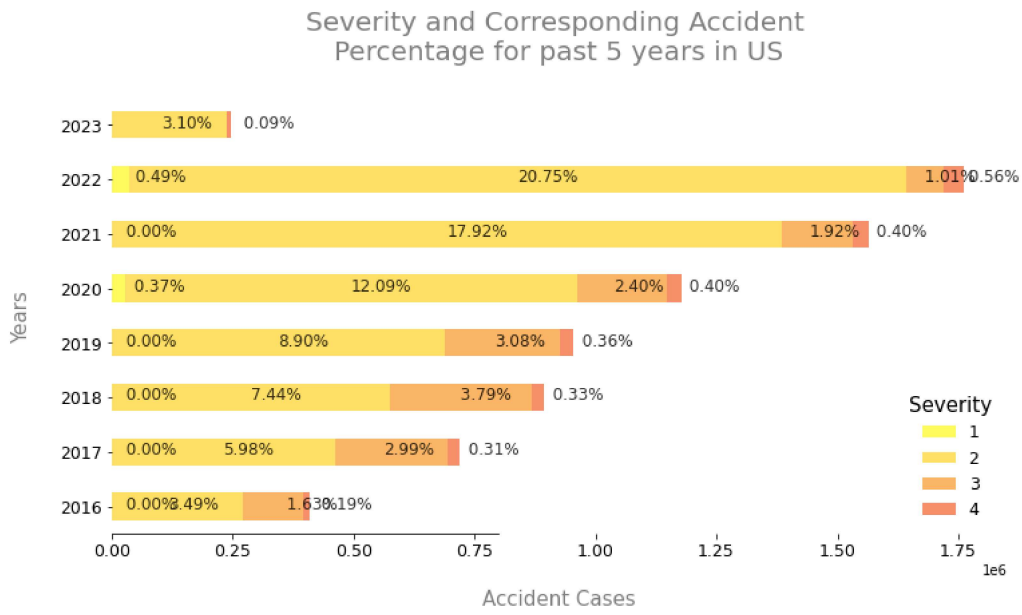


Year Analysis based on Severity

In [38]:
```
accident_severity_df = geo_df.groupby(['year', 'Severity']).size().unstack()
```

In [39]:
```
ax = accident_severity_df.plot(kind='barh', stacked=True, figsize=(12, 6),
                               color=['#fcfa5d', '#ffe066', '#fab666', '#f68f6a'],
                               rot=0);

ax.set_title('\nSeverity and Corresponding Accident \nPercentage for past 5 years in US\n', fontsize=20, color='grey');

for i in ['top', 'left', 'right']:
    side = ax.spines[i]
    side.set_visible(False)

ax.spines['bottom'].set_bounds(0, 800000);
ax.set_ylabel('\nYears\n', fontsize=15, color='grey');
ax.set_xlabel('\nAccident Cases\n', fontsize=15, color='grey');
ax.legend(prop={'size': 12.5}, loc='best', fancybox = True, title="Severity", title_fontsize=15, edgecolor='white');
ax.tick_params(axis='both', which='major', labelsize=12.5)
#ax.set_facecolor('#e6f2ed')

for p in ax.patches:
    width, height = p.get_width(), p.get_height()
    x, y = p.get_xy()
    var = width*100/df.shape[0]
    if var > 0:
        if var > 4:
            ax.text(x+width/2,
                        y+height/2-0.05,
                        '{:.2f}%'.format(width*100/df.shape[0]),
                        fontsize=12,  color='black', alpha= 0.8)
        elif var > 1.8 and var < 3.5:
            ax.text(x+width/2-17000,
                        y+height/2-0.05,
                        '{:.2f}%'.format(width*100/df.shape[0]),
                        fontsize=12,  color='black', alpha= 0.8)
        elif var>1.5 and var<1.8:
            ax.text(x+width/2+7000,
                    y+height/2-0.05,
                    '  {:.2f}%'.format(width*100/df.shape[0]),
                    fontsize=12,  color='black', alpha= 0.8)
        elif var>1:
            ax.text(x+width/2-20000,
                    y+height/2-0.05,
                    '  {:.2f}%'.format(width*100/df.shape[0]),
                    fontsize=12,  color='black', alpha= 0.8)
        else:
            ax.text(x+width/2+10000,
```

```
                y+height/2-0.05,
                '  {:.2f}%'.format(width*100/df.shape[0]),
                fontsize=12,  color='black', alpha= 0.8)
```

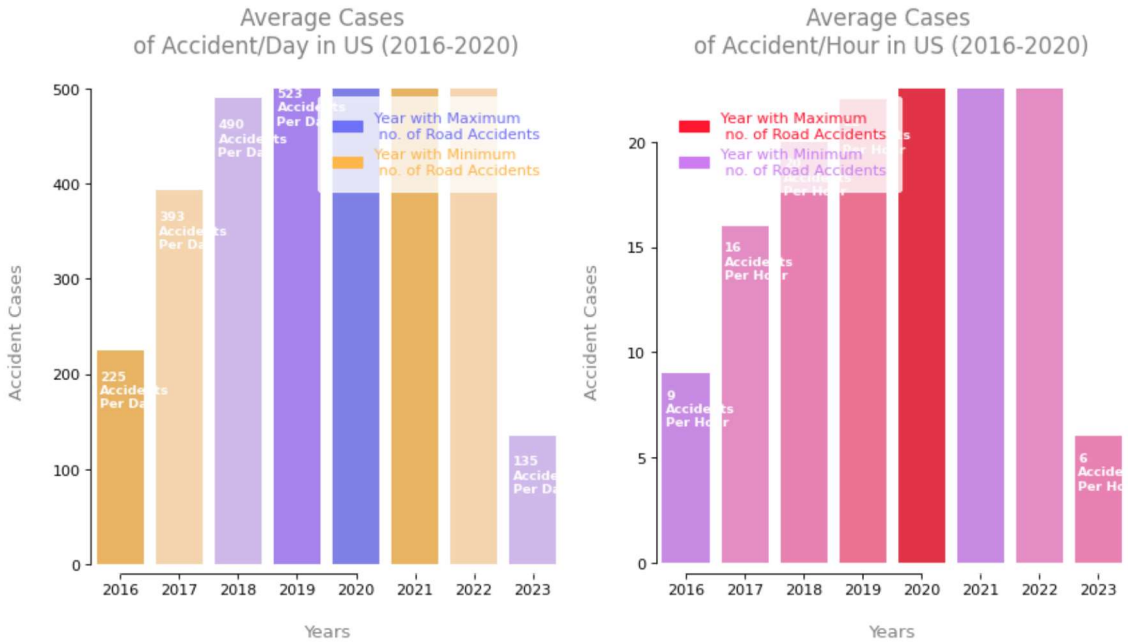


In last 4 years (2017-2020) highly severe (Severity-4) accident cases in us remain in the range of 1.55% to 1.8%

45% of the total road accidents of last 5 years which occurred only in color:#122ecc">2020 moderately severe (Severity-2)

In [40]:
```
year_df['accident/day'] = round(year_df['Cases']/(5*365))
year_df['accident/hour'] = round(year_df['Cases']/(5*365*24))
```

In [41]:
```
fig, (ax1, ax2) = plt.subplots(1, 2, figsize = (12.5,6), dpi = 80)

count = 0
plots = ['accident/day', 'accident/hour']
plots_limit = [(-10, 500), (-0.5, 22.5)]
plots_bound = [(0, 500), (0, 20)]
plot_text = [60, 2.5]

colors = [['#ffb74b', '#ffd6a4', '#ceb1f2', '#a071ff', '#6f71f7'],
          ['#cd7cf2', '#f27ec8', '#fa70b3', '#ff5e86', '#ff1732']]

for i in [ax1, ax2]:

    sns.barplot(ax=i, y=year_df[plots[count]], x=year_df['Year'], palette=colors[count])

    var = plots[count].split('/')[-1].capitalize()

    for j in i.patches:
        i.text(j.get_x()+0.06, j.get_height()-plot_text[count], \
                str(int(j.get_height()))+'\nAccidents\nPer {}'.format(var), fontsize=8.5, color='white', weight='bold')

    i.axes.set_ylim(plots_limit[count])
    i.axes.set_ylabel('\nAccident Cases\n', fontsize=12, color='grey')
    i.axes.set_xlabel('\nYears\n', fontsize=12, color='grey')
    i.tick_params(axis='both', which='major', labelsize=10)

    i.set_title('\nAverage Cases \nof Accident/{} in US (2016-2020)\n'.format(var), fontsize =15, color='grey')
    i.spines['bottom'].set_bounds(0.005, 4)
    i.spines['left'].set_bounds(plots_bound[count])

    for k in ['top', 'right']:
            side = i.spines[k]
            side.set_visible(False)

    i.set_axisbelow(True)
    MA = mpatches.Patch(color=colors[count][-1], label='Year with Maximum\n no. of Road Accidents')
    MI = mpatches.Patch(color=colors[count][0], label='Year with Minimum\n no. of Road Accidents')
    i.legend(handles=[MA, MI], prop={'size': 10}, loc='best', borderpad=1,
          labelcolor=[colors[count][-1], colors[count][0]], edgecolor='white');
    count += 1
```



In the year 2020, averagely 432 accidents happened per day in US.

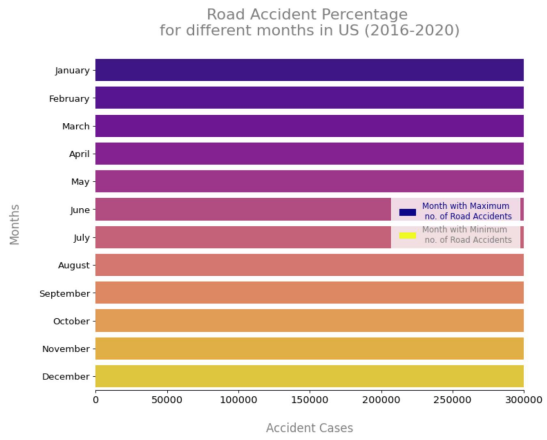
From 2019 to 2020 the average accident/day has increased 3 times in US.

Month Analysis

In [42]:
```
month_df = pd.DataFrame(df.Start_Time.dt.month.value_counts()).reset_index().rename(columns={'index':'Month', 'Start_Time':'Cases'}).sort

month_names = list(calendar.month_name)[1:]
month_df.Month = month_names
```

In [43]:
```
fig, ax = plt.subplots(figsize = (10,8), dpi = 80)

cmap = cm.get_cmap('plasma', 12)
clrs = [matplotlib.colors.rgb2hex(cmap(i)) for i in range(cmap.N)]

ax=sns.barplot(x=month_df['Cases'], y=month_df['Month'], palette='plasma')

total = df.shape[0]
for p in ax.patches:
    plt.text(p.get_width()-17000, p.get_y()+0.4,
             '{:.2f}%'.format(p.get_width()*100/total),ha='center', va='center', fontsize=15, color='white', weight='bold')

plt.title('\nRoad Accident Percentage \nfor different months in US (2016-2020)\n', size=20, color='grey')
plt.xlabel('\nAccident Cases\n', fontsize=15, color='grey')
plt.ylabel('\nMonths\n', fontsize=15, color='grey')
plt.xticks(fontsize=13)
plt.yticks(fontsize=12)
plt.xlim(0, 300000)

for i in ['top', 'left', 'right']:
    side = ax.spines[i]
    side.set_visible(False)

ax.set_axisbelow(True)
ax.spines['bottom'].set_bounds(0, 300000)
ax.grid(color='#b2d6c7', linewidth=1, axis='y', alpha=.3)

MA = mpatches.Patch(color=clrs[0], label='Month with Maximum\n no. of Road Accidents')
MI = mpatches.Patch(color=clrs[-1], label='Month with Minimum\n no. of Road Accidents')
```

```
ax.legend(handles=[MA, MI], prop={'size': 10.5}, loc='best', borderpad=1,
          labelcolor=[clrs[0], 'grey'], edgecolor='white');
```



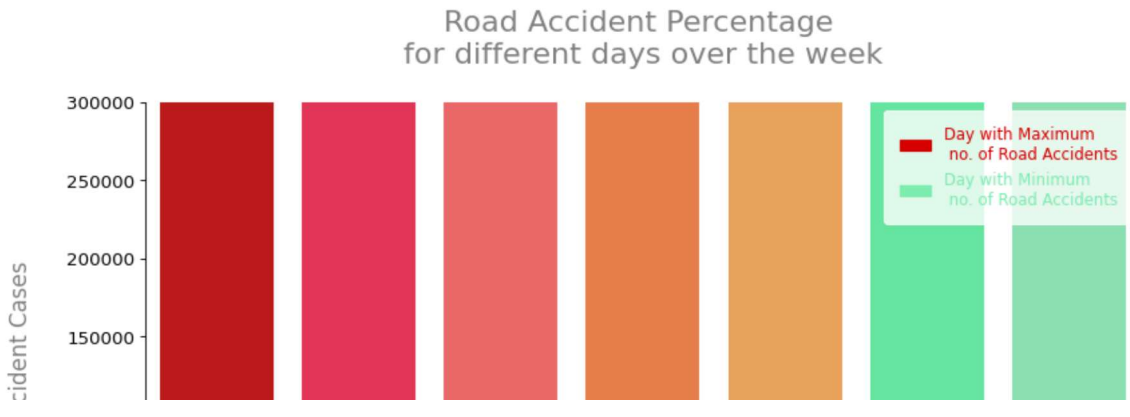
Around 18% of the road accidents occurred in the month of December

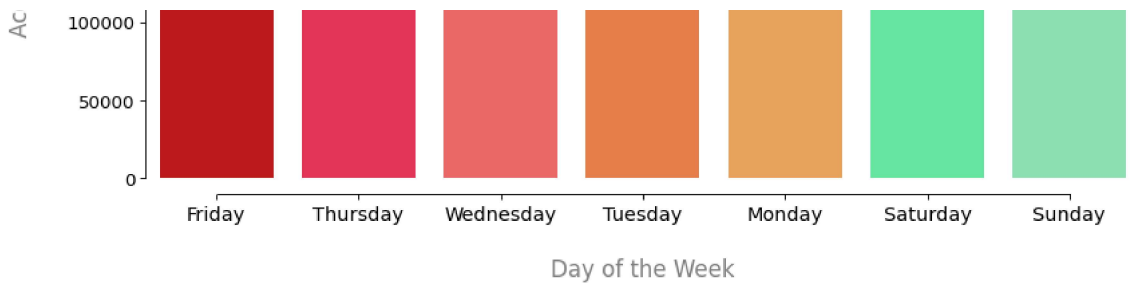
July is month with least (3.54%) no. of road accidents in US.

Day Analysis

In [44]:
```
day_df = pd.DataFrame(df.Start_Time.dt.day_name().value_counts()).reset_index().rename(columns={'index':'Day', 'Start_Time':'Cases'})
```

In [45]:
```
fig, ax = plt.subplots(figsize = (12,6), dpi = 80)

ax=sns.barplot(y=day_df['Cases'], x=day_df['Day'], palette=['#D50000', '#FF1744', '#FF5252', '#ff7530', '#ffa245', '#50fa9d', '#7eedb0'])

total = df.shape[0]
for i in ax.patches:
    ax.text(i.get_x()+0.1, i.get_height()-20000, \
            str(round((i.get_height()/total)*100, 2))+'%', fontsize=15,weight='bold',
                color='white')

plt.ylim(-10000, 300000)
plt.title('\nRoad Accident Percentage \nfor different days over the week\n', size=20, color='grey')
plt.ylabel('\nAccident Cases\n', fontsize=15, color='grey')
plt.xlabel('\nDay of the Week\n', fontsize=15, color='grey')
plt.xticks(fontsize=13)
plt.yticks(fontsize=12)

for i in ['top', 'right']:
    side = ax.spines[i]
    side.set_visible(False)

ax.set_axisbelow(True)
ax.spines['bottom'].set_bounds(0.005, 6)
ax.spines['left'].set_bounds(0, 300000)

MA = mpatches.Patch(color='#D50000', label='Day with Maximum\n no. of Road Accidents')
MI = mpatches.Patch(color='#7eedb0', label='Day with Minimum\n no. of Road Accidents')

ax.legend(handles=[MA, MI], prop={'size': 10.5}, loc='best', borderpad=1, edgecolor='white', labelcolor=['#D50000', '#7eedb0']);
```


Road Accident Percentage
for different days over the week
300000
250000
200000
150000
cident Cases
Day with Maximum
no. of Road Accidents
Day with Minimum
no. of Road Accidents



Working Days of the week have almost 2 times higher accident percentage, compared with the Weekend Days which is as our expectation.

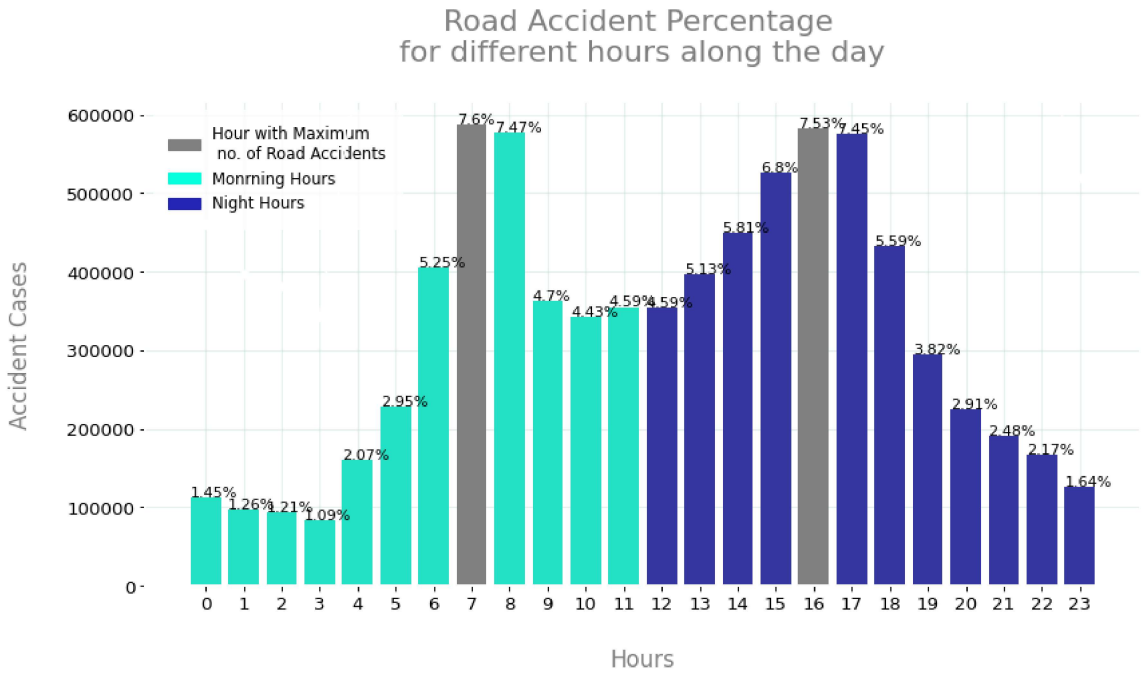
Only around 17% road accident records occurred in weekend

Thursday of a week is having the highest percentage of road accidents.

Hour Analysis

In [46]:
```
hour_df = pd.DataFrame(df.Start_Time.dt.hour.value_counts()).reset_index().rename(columns={'index':'Hours', 'Start_Time':'Cases'}).sort_v
```

In [47]:
```
fig, ax = plt.subplots(figsize = (12,6), dpi = 80)

clrs = []
for x in hour_df['Cases']:
    if int(hour_df[hour_df['Cases']==x]['Hours']) <= 11:
        if (x == max(list(hour_df['Cases'])[:12])):
            clrs.append('grey')
        else:
            clrs.append('#05ffda')
    else:
        if (x == max(list(hour_df['Cases'])[12:])):
            clrs.append('grey')
        else:
            clrs.append('#2426b3')
ax=sns.barplot(y=hour_df['Cases'], x=hour_df['Hours'], palette=clrs)
ax1 = ax.twinx()

sns.lineplot(data = hour_df, marker='o', x='Hours', y='Cases', color = 'white', alpha = 1)

total = df.shape[0]
for i in ax.patches:
    ax.text(i.get_x(), i.get_height()+1000, \
            str(round((i.get_height()/total)*100, 2))+'%', fontsize=10,
                color='black')

plt.ylim(1000, 150000)
plt.title('\nRoad Accident Percentage \nfor different hours along the day\n', size=20, color='grey')

ax1.axes.yaxis.set_visible(False)
ax.set_xlabel('\nHours\n', fontsize=15, color='grey')
ax.set_ylabel('\nAccident Cases\n', fontsize=15, color='grey')

for i in ['bottom', 'top', 'left', 'right']:
    ax.spines[i].set_color('white')
    ax.spines[i].set_linewidth(1.5)
    ax1.spines[i].set_color('white')
    ax1.spines[i].set_linewidth(1.5)

ax.set_axisbelow(True)
ax.grid(color='#b2d6c7', linewidth=1, alpha=.3)
ax.tick_params(axis='both', which='major', labelsize=12)

MA = mpatches.Patch(color='grey', label='Hour with Maximum\n no. of Road Accidents')
MO = mpatches.Patch(color='#05ffda', label='Monrning Hours')
NI = mpatches.Patch(color='#2426b3', label='Night Hours')

ax.legend(handles=[MA, MO, NI], prop={'size': 10.5}, loc='upper left', borderpad=1, edgecolor='white');
```

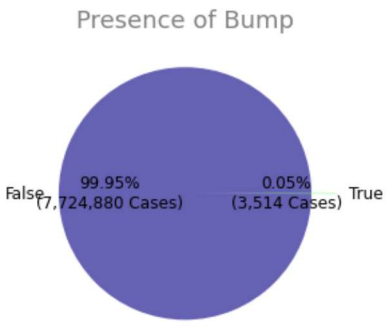


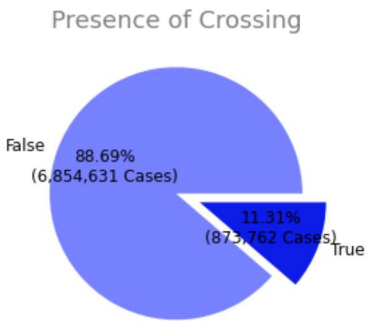
Around 18% of the road accidents occurred in between 6:00AM to 9:00AM

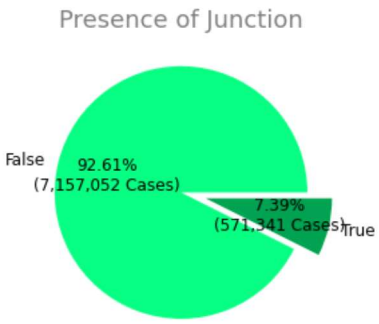
In evening, around 27% of the road accidents occurred in between 3:00PM6:00PM

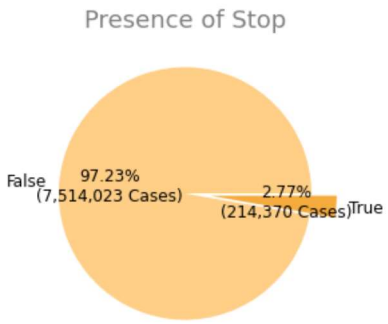
Road Condition Analysis

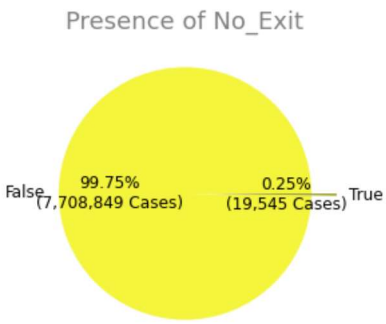
In [48]:
```
fig, ((ax1, ax2), (ax3, ax4), (ax5, ax6), (ax7, ax8)) = plt.subplots(nrows=4, ncols=2, figsize = (16,20))

road_conditions = ['Bump', 'Crossing', 'Give_Way', 'Junction', 'Stop', 'No_Exit', 'Traffic_Signal', 'Turning_Loop']
colors = [('#6662b3', '#00FF00'), ('#7881ff', '#0e1ce8'), ('#18f2c7', '#09ad8c'), ('#08ff83', '#02a352'), ('#ffcf87', '#f5ab3d'),
          ('#f5f53d', '#949410'), ('#ff9187', '#ffc7c2'), ('tomato', '#008000')]
count = 0

def func(pct, allvals):
    absolute = int(round(pct/100*np.sum(allvals), 2))
    return "{:.2f}%\n({:,d} Cases)".format(pct, absolute)

for i in [ax1, ax2, ax3, ax4, ax5, ax6, ax7, ax8]:

    size = list(df[road_conditions[count]].value_counts())
    if len(size) != 2:
        size.append(0)

    labels = ['False', 'True']



    i.pie(size, labels = labels, colors = colors[count],
                  autopct = lambda pct: func(pct, size), labeldistance=1.1,
                  textprops={'fontsize': 12}, explode=[0, 0.2])

    title = '\nPresence of {}'.format(road_conditions[count])

    i.set_title(title, fontsize = 18, color='grey')

    count += 1
```

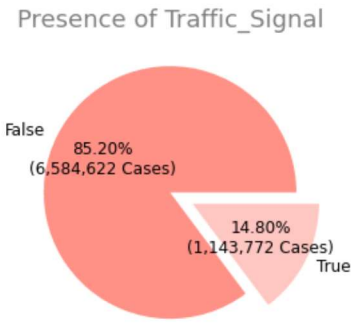


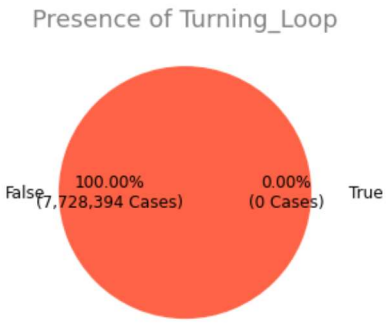












Almost in every case (99.98%) Bumper was absent in the accident spot.

In 5.7% cases, road accidents happened near the crossing

In 98.83% cases, there were no Stop near the accident area.

Weather Analysis

In [49]:
```
def generate_intervals_labels(attribute, split, gap):
    var_min = min(df[attribute])
    intervals = [int(var_min)]
    labels = []
    for i in range(1, split+1):

        lower_limit = int(var_min+((i-1)*gap))

        if i==split:
            upper_limit = int(max(df[attribute]))
```

```
        else:
            upper_limit = int(var_min + (i*gap))

        #intervals
        intervals.append(upper_limit)

        # labels
        label_var = '({} to {})'.format(lower_limit, upper_limit)
        labels.append(label_var)

    return intervals, labels
```

In [50]:

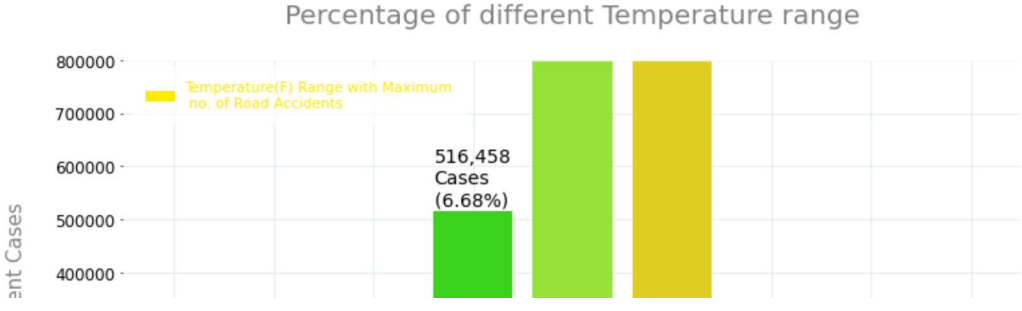
```
def Feature_Bin_Plot(dataframe, attribute, clrs, intervals, labels, fig_size, font_size, y_lim, adjust, title):

    new_df = dataframe.copy()
    xlabel = 'Different {} Grouped Value'.format(attribute)
    new_df[xlabel] = pd.cut(x = new_df[attribute], bins = intervals, labels = labels, include_lowest=True)
    temp_df = pd.DataFrame(new_df[xlabel].value_counts()).reset_index().rename(columns={'index':'Bins', xlabel:'Cases'}).sort_values('Bin

    count,max_index = 0, 0
    cases_list = list(temp_df['Cases'])
    for i in cases_list:
        if i == max(temp_df['Cases']):
            max_index = count
            break
        count += 1

    total = len(new_df[xlabel])
    plt.figure(figsize=fig_size)

#     clrs = ['mediumspringgreen' if (x < max(temp_df['Cases'])) else 'grey' for x in temp_df['Cases']]
    cmap = cm.get_cmap(clrs, len(intervals))
    clrs = [matplotlib.colors.rgb2hex(cmap(i)) for i in range(cmap.N)]

    ax=sns.barplot(y=temp_df['Cases'], x=temp_df['Bins'], palette=clrs);

    for i in ax.patches:
        ax.text(i.get_x()+adjust[0], i.get_height()+adjust[-1], \
            '{:,d}\nCases\n({}%) '.format(int(i.get_height()), round(100*i.get_height()/total, 2)), fontsize=font_size,
                color='black')

    plt.title(title, size=20, color='grey')
    plt.ylim(y_lim)

    for i in ['bottom', 'top', 'left', 'right']:
        ax.spines[i].set_color('white')
        ax.spines[i].set_linewidth(1.5)

    ax.set_xlabel('\n{}\n'.format(xlabel), fontsize=15, color='grey')
    ax.set_ylabel('\nAccident Cases\n', fontsize=15, color='grey')

    ax.set_axisbelow(True)
    ax.grid(color='#b2d6c7', linewidth=1, alpha=.3)
    ax.tick_params(axis='both', which='major', labelsize=12)
    MA = mpatches.Patch(color=clrs[max_index], label='{} Range with Maximum\n no. of Road Accidents'.format(attribute))
    ax.legend(handles=[MA], prop={'size': 10.5}, loc='best', borderpad=1,
              labelcolor=[clrs[max_index]], edgecolor='white');
```

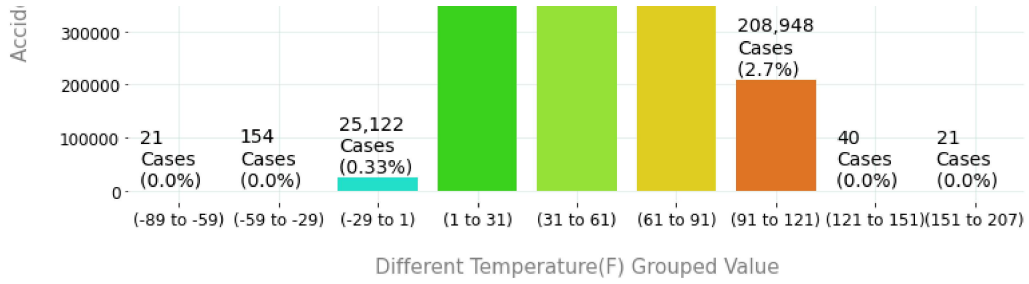
In [51]:

```
temp_intervals, temp_labels = generate_intervals_labels('Temperature(F)', 9, 30)

Feature_Bin_Plot(df, 'Temperature(F)', 'gist_ncar',temp_intervals, temp_labels,
                 (12, 6), 14, (-20000, 800000), [0.01, 10000], '\nPercentage of different Temperature range\n')
```

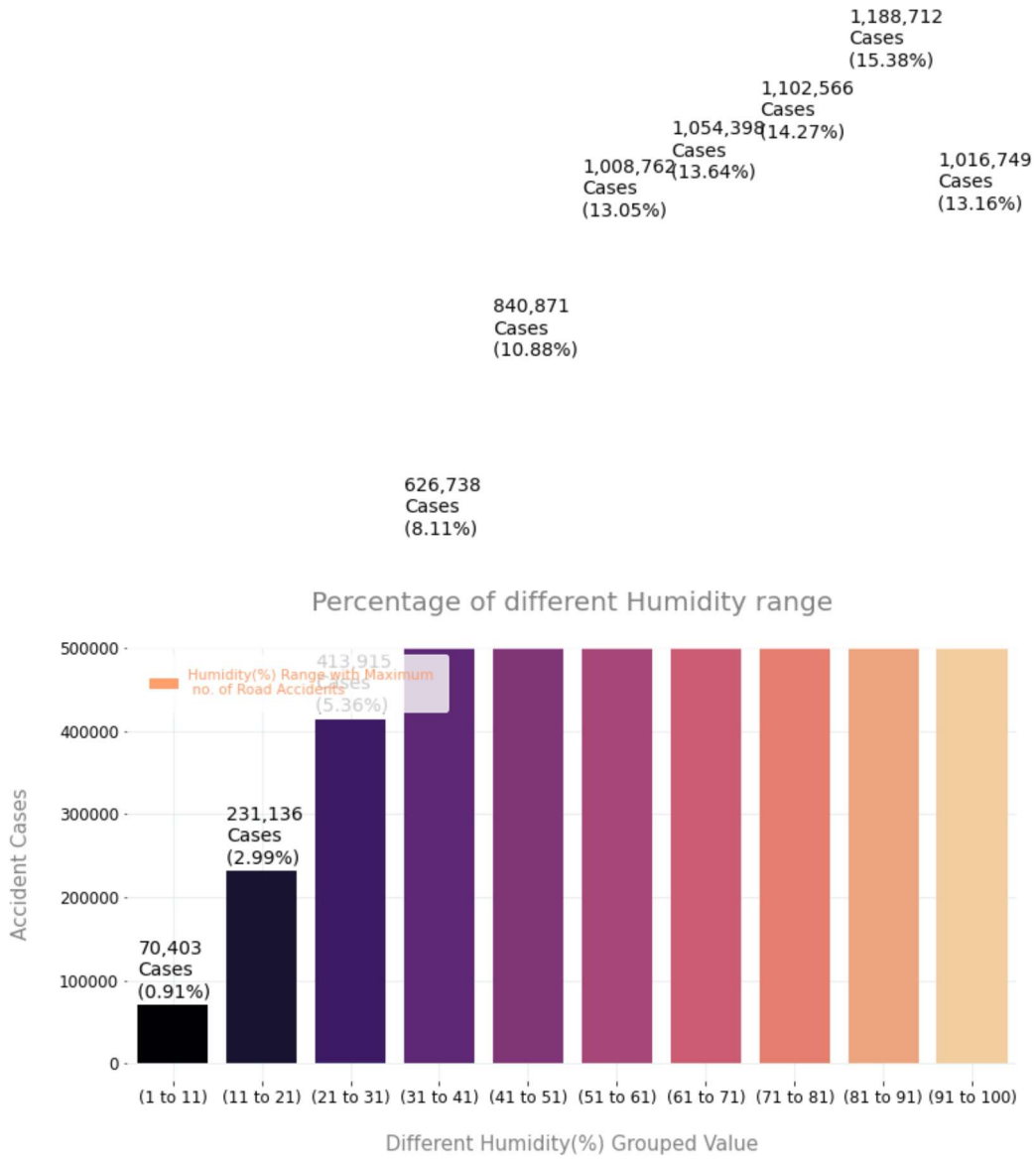
3,907,749
Cases
(50.56%)

2,906,028
Cases
(37.6%)



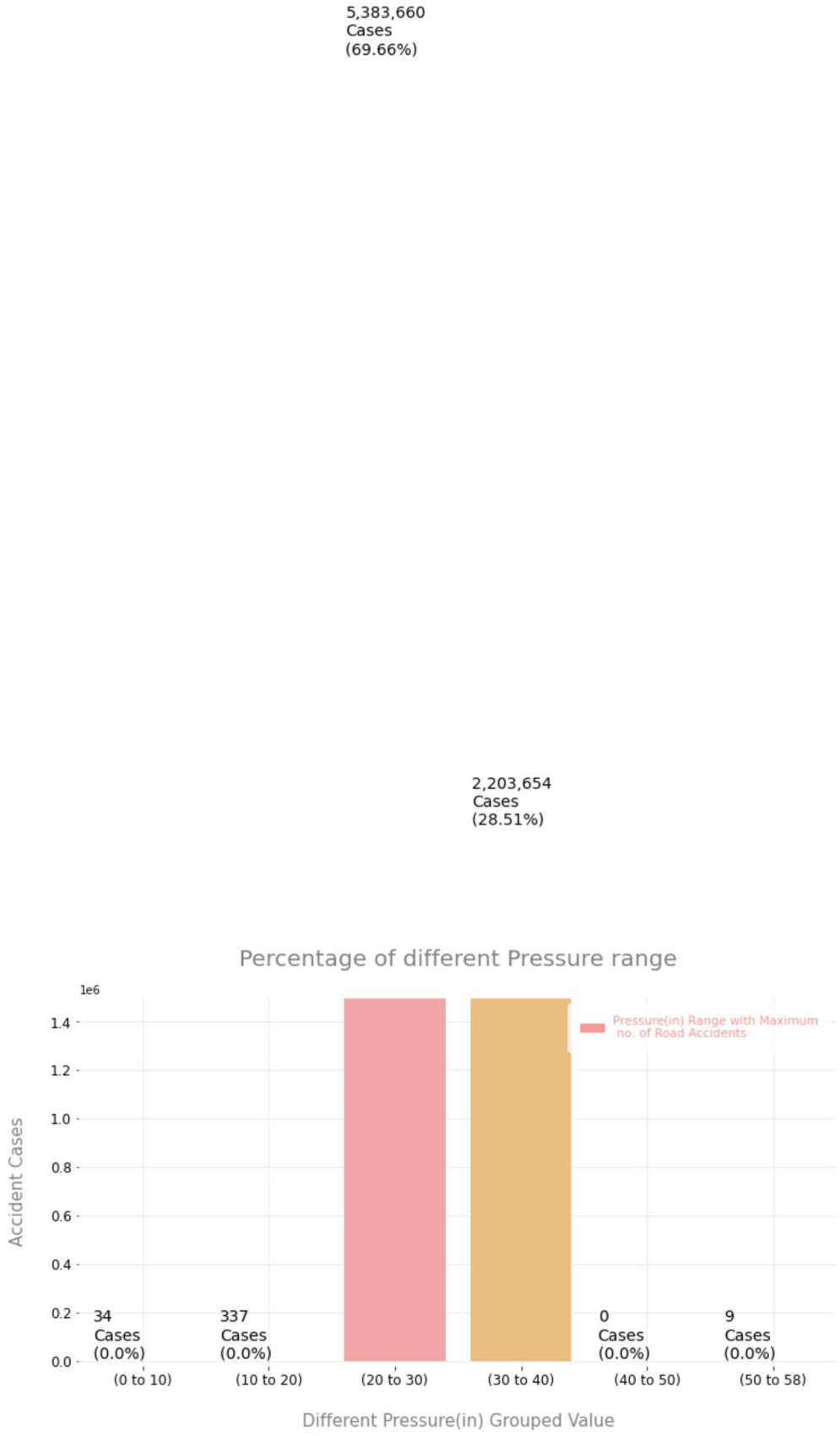


In [52]:
```
Humidity_intervals, Humidity_labels = generate_intervals_labels('Humidity(%)', 10, 10)

Feature_Bin_Plot(df, 'Humidity(%)', 'magma', Humidity_intervals, Humidity_labels,
                 (12, 6), 14, (-20000, 500000), [0.01, 10000], '\nPercentage of different Humidity range\n')
```



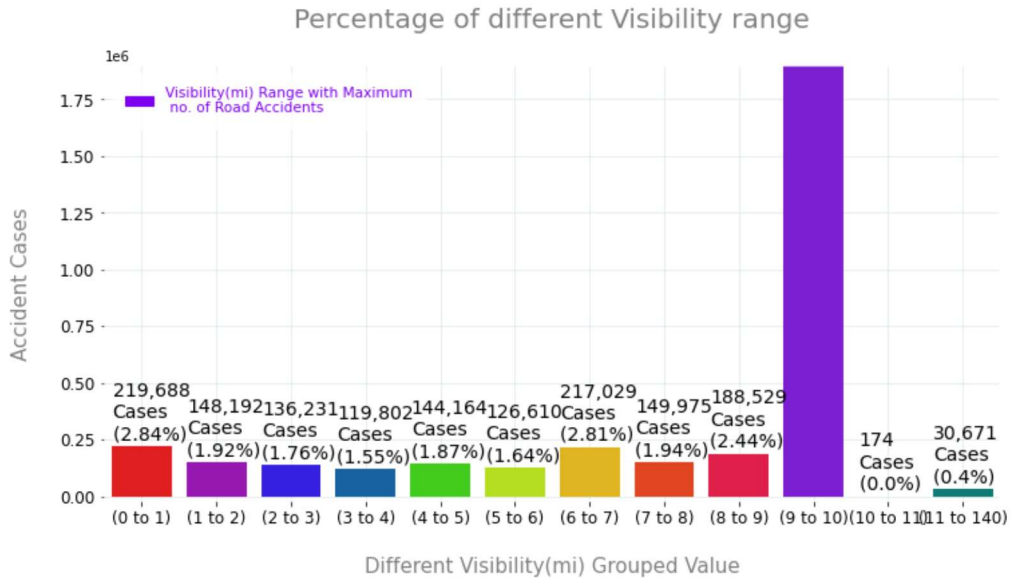
In maximum cases (15.74%) of road accident, the humidity range is between 81% - 91%

In [53]:
```
Pressure_intervals, Pressure_labels = generate_intervals_labels('Pressure(in)', 6, 10)

Feature_Bin_Plot(df, 'Pressure(in)', 'Paired', Pressure_intervals, Pressure_labels,
                 (12, 6), 14, (-20000, 1500000), [0.01, 10000], '\nPercentage of different Pressure range\n')
```



In [56]:
```
Visibility_intervals, Visibility_labels = generate_intervals_labels('Visibility(mi)', 12, 1)

Feature_Bin_Plot(df, 'Visibility(mi)', 'prism', Visibility_intervals, Visibility_labels,
                 (12, 6), 14, (-20000, 1900000), [0.01, 30000], '\nPercentage of different Visibility range\n')
```

6,070,231
Cases
(78.54%)

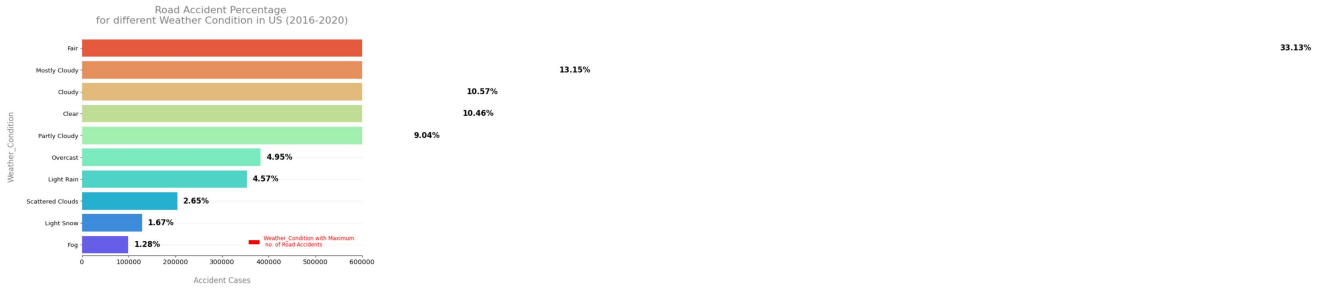


In maximum cases (77.71%) of road accident, the Visibility range is between 9(mi) - 10(mi)

In [57]:
```
weather_condition_df = pd.DataFrame(df.Weather_Condition.value_counts().head(10)).reset_index().rename(columns={'index':'Weather_Conditio
```

In [58]:
```
fig, ax = plt.subplots(figsize = (10,8), dpi = 80)

cmap = cm.get_cmap('rainbow_r', 10)
clrs = [matplotlib.colors.rgb2hex(cmap(i)) for i in range(cmap.N)]

ax=sns.barplot(x=weather_condition_df['Cases'], y=weather_condition_df['Weather_Condition'], palette='rainbow_r')

total = df.shape[0]
for p in ax.patches:
    plt.text(p.get_width()+40000, p.get_y()+0.4,
             '{:.2f}%'.format(p.get_width()*100/total),ha='center', va='center', fontsize=15, color='black', weight='bold')
```

```
plt.title('\nRoad Accident Percentage \nfor different Weather Condition in US (2016-2020)\n', size=20, color='grey')
plt.xlabel('\nAccident Cases\n', fontsize=15, color='grey')
plt.ylabel('\nWeather_Condition\n', fontsize=15, color='grey')
plt.xticks(fontsize=13)
plt.yticks(fontsize=12)
plt.xlim(0, 600000)

for i in ['top', 'left', 'right']:
    side = ax.spines[i]
    side.set_visible(False)

ax.set_axisbelow(True)
ax.spines['bottom'].set_bounds(0, 600000)
ax.grid(color='#b2d6c7', linewidth=1, axis='y', alpha=.3)

MA = mpatches.Patch(color=clrs[0], label='Weather_Condition with Maximum\n no. of Road Accidents')
ax.legend(handles=[MA], prop={'size': 10.5}, loc='best', borderpad=1,
          labelcolor=[clrs[0]], edgecolor='white');
```



In most of the cases (30.69%) the weather was Fair and approximately in 13% cases it was mostly cloudy