Worldwide: Traffic Fatalities


<table>
<thead>
<tr>
<th>RANK</th>
<th>LEADING CAUSE</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ischaemic heart disease</td>
<td>12.2</td>
</tr>
<tr>
<td>2</td>
<td>Cerebrovascular disease</td>
<td>9.7</td>
</tr>
<tr>
<td>3</td>
<td>Lower respiratory infections</td>
<td>7.0</td>
</tr>
<tr>
<td>4</td>
<td>Chronic obstructive pulmonary disease</td>
<td>5.1</td>
</tr>
<tr>
<td>5</td>
<td>Diarrhoeal diseases</td>
<td>3.6</td>
</tr>
<tr>
<td>6</td>
<td>HIV/AIDS</td>
<td>3.5</td>
</tr>
<tr>
<td>7</td>
<td>Tuberculosis</td>
<td>2.5</td>
</tr>
<tr>
<td>8</td>
<td>Trachea, bronchus, lung cancers</td>
<td>2.3</td>
</tr>
<tr>
<td>9</td>
<td>Road traffic injuries</td>
<td>2.2</td>
</tr>
<tr>
<td>10</td>
<td>Prematurity and low birth weight</td>
<td>2.0</td>
</tr>
<tr>
<td>11</td>
<td>Neonatal infections and other</td>
<td>1.9</td>
</tr>
<tr>
<td>12</td>
<td>Diabetes mellitus</td>
<td>1.9</td>
</tr>
<tr>
<td>13</td>
<td>Malaria</td>
<td>1.7</td>
</tr>
<tr>
<td>14</td>
<td>Hypertensive heart disease</td>
<td>1.7</td>
</tr>
<tr>
<td>15</td>
<td>Birth asphyxia and birth trauma</td>
<td>1.5</td>
</tr>
<tr>
<td>16</td>
<td>Self-inflicted injuries</td>
<td>1.4</td>
</tr>
<tr>
<td>17</td>
<td>Stomach cancer</td>
<td>1.4</td>
</tr>
<tr>
<td>18</td>
<td>Cirrhosis of the liver</td>
<td>1.3</td>
</tr>
<tr>
<td>19</td>
<td>Nephritis and nephrosis</td>
<td>1.3</td>
</tr>
<tr>
<td>20</td>
<td>Colon and rectum cancers</td>
<td>1.1</td>
</tr>
</tbody>
</table>
USA: Traffic Fatalities

WHEREAS, the worldwide Vision Zero movement is founded on the belief that death and injury on city streets is unacceptable and preventable

- The City of **Bellevue endorses Vision Zero** as part of a comprehensive effort to strive to achieve zero traffic deaths and serious injuries on Bellevue streets by 2030.
• Prepare and implement a Vision Zero Action Plan that incorporates the 6 Es and includes a clear purpose, outcomes, community involvement, action items and performance measures

• Update Vision Zero strategies periodically

• Provide Vision Zero status reports that aggregate and analyze data, document efforts, and communicate progress to the City Council and to the community
Bellevue ITS Master Plan: Stages in Smart City Development

Level 1 – Ad Hoc
Basic access to essential services

Level 2 - Opportunistic
Efficient operations and service delivery using targeted performance measures to improve services

Level 3 - Repeatable
Defined and measured processes and systems performance to consistently meet standards of services or performance benchmarks

Level 4 – Managed
Integrated systems focus on cohesive and optimized strategy, planning and execution to consistently exceed standards of services or performance benchmarks

Level 5 - Optimized
Predictive, proactive and adaptive urban systems creating interoperable systems for the highest levels of performance, optimal customer experience and resiliency from major disruptions
Traditional Crash Reporting Process

1. Crash occurs

2. Police officer collects information

3. Accident report completed by police officer

4. Copy of accident report submitted to the transportation dept.

5. The transportation dept. enters select crash information into database
From 2005 through 2010 there were 60 collisions recorded by the Bellevue Police Department and the WSP at this location.

In 2013, WSDOT built a new roundabout at the intersection of the WB I-90 on- and off-ramps and WLSP SE/180 Ave SE.
Vision Zero: Reframing Traffic Deaths & Injuries as Preventable

Amy Carlson, Vice President, CH2M HILL

Vision Zero = All of us getting home safe each night.
Conflict-Based Approach: Don’t Wait For Crashes to Happen

Hyden’s Safety Pyramid (adapted from Hyden, 1987)
Conflict-Based Approach: Public Involvement Strategy

<table>
<thead>
<tr>
<th>Category</th>
<th>Total Points Placed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ped Facilities</td>
<td>514</td>
</tr>
<tr>
<td>Bike Facilities</td>
<td>573</td>
</tr>
<tr>
<td>Ped Behaviors</td>
<td>57</td>
</tr>
<tr>
<td>Bike Behaviors</td>
<td>22</td>
</tr>
<tr>
<td>Car Behaviors</td>
<td>452</td>
</tr>
<tr>
<td>Total</td>
<td>1618</td>
</tr>
</tbody>
</table>

- Ped Facilities: 514 points (32%)
- Bike Facilities: 573 points (35%)
- Ped Behaviors: 57 points (4%)
- Bike Behaviors: 22 points (1%)
- Car Behaviors: 452 points (28%)
- Total: 1618 points
Leverage a city’s existing traffic camera system to simultaneously:

- monitor counts and travel speed of all road user groups (vehicle, pedestrian, and bicycle);
- document the directional volume of all road user groups as they move through an intersection; and,
- assess unsafe “near-miss” trajectories and interactions between all road user groups.
Trajectory Detection & Turning Movement Counts
Volume Charts

VEHICLE DISTRIBUTION CHARTS BY TIME OF DAY

MONTH:  May, 2016
DATE:  5.1.2016 - 5.31.2016

CARS
11pm  12pm  10pm
30,000 cars/day

BUSES/TRUCKS
11pm  12pm  10pm
400 buses & trucks/day

PEDESTRIANS
11pm  12pm  10pm
1,000 pedestrians/day

BICYCLISTS
11pm  12pm  10pm
100 bikes/day
Near-Miss Detection
Near-Miss Detection
Milestone 1: Demonstrate the capability of vision technologies by detecting relevant events in the sample traffic videos (e.g., detecting cars, pedestrians, and bikes and tracking their movements).

Milestone 2: Demonstrate an end-to-end system that will, continuously in real-time, detect and store the events, and present aggregated information.

Milestone 3: Pilot deployment of end-to-end system in the City of Bellevue traffic control center. The system will run off of a live feed.

Milestone 4: Support additional scenarios (e.g., near-collisions of cars with pedestrians and bikes or patterns of bikers crossing a busy intersection).
Traffic Analytics Dashboard

<table>
<thead>
<tr>
<th>Location</th>
<th>Week count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bellevue, 116th - NE12th</td>
<td>1356K</td>
</tr>
<tr>
<td>Bellevue, Archer, 23rd</td>
<td>1356K</td>
</tr>
<tr>
<td>Bellevue, 150th, Newport</td>
<td>1356K</td>
</tr>
<tr>
<td>Bellevue, 150th, Eastgate</td>
<td>1356K</td>
</tr>
<tr>
<td>Bellevue, 116th - NE12th</td>
<td>1356K</td>
</tr>
<tr>
<td>Bellevue, 116th - NE12th</td>
<td>1356K</td>
</tr>
<tr>
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<td>Bellevue, 116th - NE12th</td>
<td>1356K</td>
</tr>
</tbody>
</table>

Busiest crossings
Traffic Analytics Dashboard

Traffic Analysis

Bellevue, 116th - NE12th

From 22/05/2017 To 29/05/2017

05.23.17  5:30 pm

Vehicle turning movements

Vehicle Distribution chart

Export
Reset to 22/05/2017 - 29/05/2017
Traffic Analytics Dashboard

Traffic Analysis

From 22/05/2017 To 29/05/2017

05.23.17 5:30 pm

Vehicle turning movements

Vehicle Distribution chart

Reset to 22/05/2017 - 29/05/2017

Export
Object Classification Accuracy

When it really is... We recognized it as...

<table>
<thead>
<tr>
<th>Classified-as Truth</th>
<th>Vehicles</th>
<th>Bikes</th>
<th>Peds</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicles</td>
<td>0.95</td>
<td>0.01</td>
<td>0.02</td>
<td>0.02</td>
</tr>
<tr>
<td>Bikes</td>
<td>0.08</td>
<td>0.67</td>
<td>0.16</td>
<td>0.08</td>
</tr>
<tr>
<td>Peds</td>
<td>0.15</td>
<td>0.15</td>
<td>0.73</td>
<td>0.05</td>
</tr>
<tr>
<td>None</td>
<td>0.09</td>
<td>0.03</td>
<td>0.11</td>
<td>0.81</td>
</tr>
</tbody>
</table>
How Neural Networks Work

**training**
during the training phase, a neural network is fed thousands of labeled images of various objects, learning to classify them

**input**
new image is shown to the pretrained network

**first layer**
the neurons respond to simple shapes, like edges

**higher layer**
the neurons respond to complex shapes

**top layer**
neurons respond to highly complex abstract concepts that we would identify as different objects

**output**
the network predicts what the object most likely is based on its training.

example:
- The network predicts a 90% probability that the object is a bicycle.
- The network predicts a 10% probability that the object is a runner.
Crowdsourcing Promotion

When the Vision Zero LA team comes to work every day, they hear the statistics about traffic collisions. In addition to the national numbers of 40,000 deaths and 4.5 million injuries, we know locally. Every year more than 2,000 people die or are injured in traffic crashes. Half of these are pedestrians or cyclists. Traffic collisions are the leading cause of death for children between the ages of 2 and 11.

Crowdsourced technology has already changed the way many of us get around by bike, often, and for many. What if we could use technology to prevent behavioral video collations in reducing pedestrian and bicyclist injuries and fatalities and to assist with the task of route assessment? Thanks to a new online collision and photography tool called Video Analytics Towards Vision Zero, everyone can play a role in teaching the community how to recognize and prevent potential traffic collisions before they happen.

By using footage from traffic cameras across South Dakota, LA’s "Smart" computer learns to recognize new data collisions. Data from these models can then be shared with others to prevent new collisions from occurring and help prevent injuries or fatalities.

Crowdsourcing Promotion
Video Analytics towards Vision Zero

Worldwide problems demands bold action

- Worldwide 1.25 million people are killed annually in traffic accidents
- In 2016, road crashes resulted in 40,000 deaths and 4.6 million injuries in the United States.
- Crashes are preventable and we need not wait for someone to be killed or injured before we take action

Make a difference, teach computers to learn

- Unique opportunity to help prevent traffic crashes and save lives
- “Teach” our computers how to recognize vehicles, people walking and bicyclists
- Cities will be able to rapidly detect road conflicts and traffic engineers can then take preventative action to avoid crashes

Participate starting June
Annotate all objects of interest, moving, stationary, or obstructed, for the entire video.

What type of object did you just annotate?
- Pedestrian
- BiCycle
- PedestrianWithStroller
- MotorBike
- Car
- Bus
- Truck
- WheelChair

Pedestrian 2
- Outside of view frame
- Temporarily not visible
- Crossing Road

Pedestrian 1
- Outside of view frame
- Temporarily not visible
- Crossing Road

In this video, please track all of these objects:
- Pedestrian
- BiCycle
- PedestrianWithStroller
- MotorBike
Fall 2017: Classify Near-Miss Events

<table>
<thead>
<tr>
<th>Focused object</th>
<th>Vehicle</th>
<th>Pedestrian</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>Vehicle time to collision (Vehicle TTC)</td>
<td>Pedestrian time to vehicle (Pedestrian TTV)</td>
</tr>
</tbody>
</table>

**Definition**

Vehicle TTC = \( \frac{L}{V} \)  
Pedestrian TTV = \( \frac{L_d}{v} \)

**Study**

Previous study (Matsui et al., 2011b)  
Present study

Time to Collision (Matsui et al., 2013)

The border between Serious and Non-serious Conflict

Definition of a Serious Conflict

\[ TA = \text{Time to Accident} \]

The time that is remaining from when the evasive action is taken until the collision would have occurred if the road users had continued with unchanged speeds and directions. The TA value can be calculated based on the estimates of distances \( d \) and speed \( v \).

\[ d = \text{Distance to the potential point of collision} \]

\[ v = \text{Speed when the evasive action is taken} \]

Post Encroachment Time (Van der Horst et. al., 2014)

Swedish Conflict Technique (Hyden et. al., 1987)
Deployment Strategy: Trusted Data Platform

A TRUSTED DATA PLATFORM

MULTI-PARTY DATA
- Land parcels
- Population health
- Public works data
- Crime data
- Transit data
- Traffic data

SECURE MULTI-PARTY DATA VAULTS
ACCESSIBLE DATA
SECURE ANALYSIS
TRUSTED DATA COLLABORATIVE
SECURE PUBLICATION PROCESS
VERIFIED COMPLIANCE

NEEDED BUSINESS MODEL INNOVATIONS
TRUST FRAMEWORKS | DATA TRUSTEES
DATA VALUE EXCHANGES & DATA MARKETS

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