



Burrard Bridge Renewal and Transportation Improvement Project



Transportation Association of Canada
2018 Road Safety Award Submission

Nominee: Ross Kenny, P.Eng.
February 21, 2018

Background

Burrard Bridge is one of three City-owned bridges that cross False Creek, a body of water separating the high-density downtown core and medium-density neighbourhoods to the south. The bridge was opened in 1932 as a six-lane vehicular bridge with sidewalks on both sides. The bridge was built in the Art Deco style and City Council included it on the City's Heritage Register in 1986. Over the years, the City has completed a series of rehabilitation projects and upgrades to keep the bridge safe and functional.

The role of the bridge has evolved over the years, primarily in response to accommodating a growing number of cyclists using the bridge. Prior to 2009, people walking and cycling shared the sidewalks on both sides of the bridge. As the number of people crossing the bridge using active transportation grew, the shared sidewalk became increasingly hazardous for pedestrians and cyclists. Safety was a particular issue for people cycling, as they were directed to ride in a narrow area adjacent to motor vehicle traffic and a minor error (or conflict with a pedestrian) could cause them to fall off the sidewalk onto the roadway. In 2009, the City reallocated a southbound travel lane from general purpose traffic and prohibited pedestrians from using the east sidewalk in order to create a protected bicycle lane in each direction (refer to Appendix). Since then, walking and cycling volumes have increased significantly with cycling growing by over 30%.

The Transportation 2040 Plan, adopted by Council in 2012, includes a zero transportation related fatality goal and identifies the False Creek Bridges as an area of focus for active transportation improvements to address gaps in the pedestrian and cycling networks. Burrard Bridge is one of the busiest active transportation corridors in the city, with 10,000 walking and cycling trips on a busy summer day. It also carries approximately 55,000 motor vehicles, 13,000 transit passengers, and 500 trucks on a typical day.

Evaluation Criteria Alignment

Anticipated Benefits

Burrard Street and Pacific Street intersection consistently ranks as the second-highest collision location in the City of Vancouver. The majority of accidents involve rear end collisions in the right-turn channel onto the bridge, along with collisions between vehicles merging onto the bridge and southbound vehicles. A high number of collisions also occur in the on and off ramps between vehicles and people walking and cycling.

The project replaces the existing intersection with a protected intersection, eliminating both on and off ramps and provides new right-turn lanes on Pacific St. Based on a conflict analysis study undertaken by the University of British Columbia and a road safety review prepared by TranSafe Consulting Ltd., it is expected that both collision frequency and severity will decrease as a result of the new intersection design.

More specifically, the replacement of existing on and off ramps with protected turn lanes and signal phasing is expected to eliminate most rear-end and side swipe collisions that were occurring in those locations. Furthermore, the protected intersection provides all road users with their dedicated spaces and most potential conflicts between vehicles and people walking and cycling are expected to be eliminated through protected signal phasing.

Degree of Innovation

The project retrofits an existing intersection with on and off ramps to a protected intersection while maintaining motor vehicle capacity. For most movements, the potential for conflicts between road users is eliminated through separate signal phases, creating a safer and more comfortable environment for everyone.

To identify the root cause of collisions, the City extensively studied claims data obtained from the Insurance Corporation of British Columbia. While the dataset is fairly robust for collisions involving motor vehicles, near misses between vehicles and people walking and cycling are not typically captured. To address this issue, the City partnered with the University of British Columbia for an intersection safety diagnosis using automated video analysis, capturing post encroachment time and time-to-collision indicators.

Transferability to other Canadian Communities

Communities and cities across Canada are working towards Vision Zero, an initiative that aims to achieve zero fatalities or serious injuries involving road traffic. This project retrofits an existing highway-style intersection designed purely for the movement of vehicles to a protected intersection that eliminates conflicts between vehicles, pedestrians and cyclists, providing safety improvements for all road users.

Collision History

According to the Insurance Corporation of British Columbia (ICBC), the Burrard Street and Pacific Street intersection on the north end of the bridge has been consistently ranked the second-highest motor vehicle collision location in the City of Vancouver, with an average of over 140 collisions per year over the period 2003-2013 (refer to Appendix). The most frequent collision types include rear end collisions in the right-turn channel onto the bridge, along with collisions between vehicles merging onto the bridge and southbound vehicles.

The Burrard and Pacific intersection was also identified in the City of Vancouver's Cycling Safety Study as the location with the greatest number of reported cycling collisions. The majority of incidents involved collisions between right turning vehicles and cyclists crossing with right-of-way.

In addition to the motor vehicle and cycling collisions, the City also partnered with the University of British Columbia to undertake an automated traffic safety diagnosis at the intersection of Burrard and Pacific. The collision data set obtained from ICBC typically only includes collisions involving a claim, while the use of conflict analysis reveals near-miss events that would have been omitted otherwise.

Similar to the data from ICBC, the conflict analysis identified the merger between the on-ramp and Burrard Street as having the highest number of vehicle-vehicle conflicts per square meter. The study also identified the bike crossings through the on and off ramps, as well as the Pacific Street crossing as locations with high conflict between vehicles and people walking and cycling.



Vehicle-vehicle (left) and vehicle-pedestrian/cyclist conflict frequency heat map
Source: Bigazzi, A., Puscar, F., Safed, T., & Zaki, M. (2016). Intersection Safety Diagnosis Using Automated Video Analysis.

Safety Improvements

In July 2015, after extensive public engagement, City Council approved the Burrard Bridge upgrades and north intersection improvements project to improve the safety of all road users at the Burrard and Pacific intersection.

The intersection was redesigned as a protected intersection, similar in concept to the recently rebuilt Burrard and Cornwall intersection at the south end of the bridge. Key features of the redesign include the removal of slip lanes on and off the bridge, improved sidewalks, protected walking and cycling crossings and increased separation between people walking, biking and driving.

In order to maintain current motor vehicle capacity through the Burrard-Pacific intersection, dual right turn lanes onto and off of the bridge were included in the redesign. To do this, the structure was widened by cantilevering the sidewalks on the outside of the existing. Based on micro-simulation traffic modelling, the overall impact to motor vehicle travel times is expected to be negligible.

With the exception of a low-volume westbound to northbound right turn, all movements are separated with protected signal phases to eliminate conflict between vehicles, cyclists and pedestrians. The geometric improvements to the intersection are expected to significantly reduce collisions of all types as the contributors of past collisions, including the slip lanes and uncontrolled crossings, have been removed. In addition to the geometric improvements, green paint treatment for bike crossings and LED lighting upgrades to meet IES levels were also included.

The intersection improvements also include new physically separated bike facilities that extend at least 1 block in all directions from the bridge. These new facilities will better connect the Burrard Bridge to the downtown for people cycling and provide an opportunity to extend the protected cycling network further into the downtown in the future.

Conclusion

The Transportation 2040 plan identifies a mode shift towards walking, cycling, and transit to accommodate regional population growth, as well as a Vision Zero goal for zero traffic-related fatalities and serious injuries. The recent Burrard Bridge project addresses a major collision hotspot and improves the comfort, convenience and safety for people walking and cycling across the bridge.

Appendix

Select pages have been uploaded from the open house materials uploaded as an appendix. The full document can be found at: <http://vancouver.ca/files/cov/burrard-bridge-pacific-street-intersection-upgrades-open-house-information-displays.pdf>.



Burrard Bridge Renewal and Transportation Improvement Project Appendix



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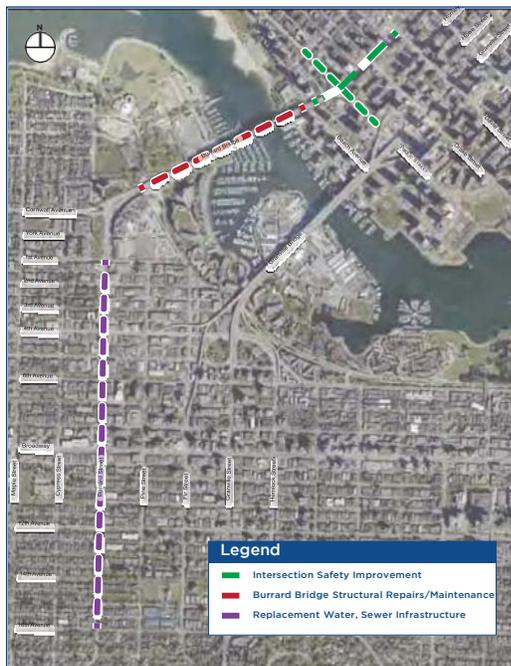
1 Welcome

We want to hear from you!

The City of Vancouver will carry out **necessary structural repairs and maintenance** to the Burrard Bridge in 2016/17.

In coordination with this work, we are proposing **safety improvements** at the Burrard and Pacific intersection, **improved connections** that enable people to walk on both sides of the bridge, and **replacement of aging sewer and water infrastructure**.

We are sharing information about construction impacts, and would like input on the design details as we finalize the plan.



Bridge repairs and intersection improvements include:

- Replace bridge railings and light fixtures, and repair sidewalks
- Improve safety for all users at the Burrard-Pacific intersection
- Enable walking on both sides of the bridge
- Improve walking and biking connections at the Burrard-Pacific intersection

Your feedback will help us refine the final design. Staff will report to City Council this summer on what was heard, along with a recommended design and implementation plan.

All the information shown today is available on our website at: vancouver.ca/burrardbridgenorth.

② Project Overview

Project Goals

The project will deliver needed **repairs** to ensure the Burrard Bridge is in good condition for many years to come.

We also propose **safety improvements** at the Burrard-Pacific intersection and **improved connections** that allow people to walk on both sides of the bridge. Doing this work at the same time will reduce overall disruption and is more cost-effective.

Key Objectives

- Make necessary repairs on the Burrard Bridge, including replacement of the railings, sidewalks and light fixtures
- Make the intersection of Burrard Street and Pacific Avenue safer for everyone, including people walking, cycling, and driving
- Enable walking on both sides of the bridge (currently not permitted on east side)
- Improve walking and biking connections
- Maintain motor vehicle capacity across the bridge
- Minimize construction impacts by coordinating required repairs with safety improvements and utility work
- Respect the heritage value of the bridge
- Maintain access to nearby businesses and residents during and after construction

1. Make Critical Repairs



Figure A



Figure B

The Burrard Bridge is more than 80 years old, and critical repairs are needed to keep it in safe condition. The first round of repairs took place in 2013-14 and included replacement of bearings and expansion joints. This round includes replacement of the crumbling railings (Figure A) and more.

2. Improve Safety

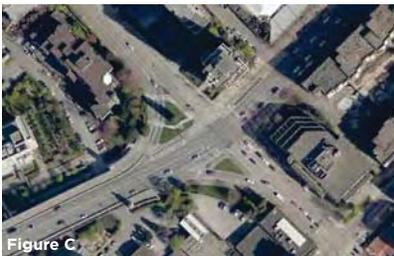


Figure C



Figure D

The Burrard-Pacific intersection (Figure C) is the second highest collision location in the city, and can be uncomfortable to access on foot or by bike. The proposed design would make it safer and more comfortable by making it more like the new protected intersection at Burrard-Cornwall (Figure D).

3. Improve Connections



Figure E



Figure F

At present, people are not allowed to walk on the east side of the bridge. The proposed design would allow walking on both sides of the bridge by making the east side (Figure E) more like the west side (Figure F).

3 In a Nutshell

10 things to know

1. The Burrard Bridge is **more than 80 years** old and major repairs are needed to keep it in good condition
2. Major safety upgrades are required to the Burrard-Pacific intersection, the **second highest collision location** in the city
3. Aging sewer and water infrastructure on Burrard St between 1st & 16th Ave and between Pacific St & Davie St **needs replacement**
4. To minimize overall disruption and reduce costs, we will **coordinate** all this work
5. Motor **vehicle flow will be maintained** by adding right turn lanes at the Pacific intersection and by widening about 100 metres of the bridge at the the intersection
6. People will again be able to **walk on both sides of the bridge**. This will be achieved by **converting a northbound travel lane** on the centre portion of the bridge and by widening the bridge at the Pacific intersection
7. All changes will **respect the heritage value** of the bridge
8. Parking will generally be **maintained**
9. During construction, **access will be maintained** across the bridge for all road users, but delays should be expected
10. The work will begin in **early 2016** and will take up to **20 months to complete**

4 Context

The western gateway to Downtown Vancouver

The Burrard Bridge is a major gateway between Downtown Vancouver and the western part of the city.

Tens of thousands of people walk, bike, take transit, and drive across the bridge every day.

The bridge is also important for moving goods and services, and is designated as a truck route.

A typical summer weekday can see over:

- 55,000 motor vehicles
- 13,000 people using transit
- 10,000 people walking or biking
- 500 trucks

Photo: Conrad Olson, Flickr

Transportation 2040 Plan

Overview

Improvements to the Burrard Bridge were **approved in principle** as part of the Transportation 2040 Plan, which was adopted by Council in 2012.

Directions include

- Improve safety: eliminate transportation related fatalities
- Increase green transportation: make at least two-thirds of all trips on foot, bike, or transit by 2040
- Make walking and cycling safe, convenient, and comfortable for people of all ages and abilities
- Manage the road network efficiently for all road users



Photo: Gord McKenna, Flickr

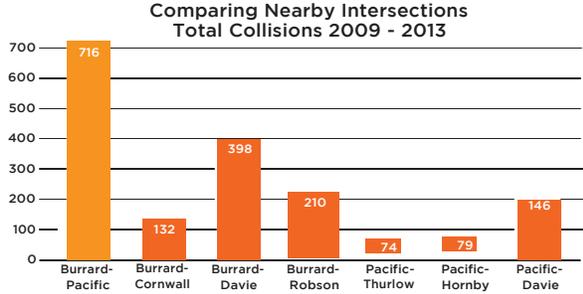
Improvements to the Burrard Bridge are timely since:

- The Burrard-Pacific intersection is the second highest collision location in the city
- There is a major gap in the walking network, as walking is currently not permitted on the east side of the bridge
- Required maintenance creates an opportunity to improve safety and enhance walking and cycling connections while accommodating existing motor vehicle demand

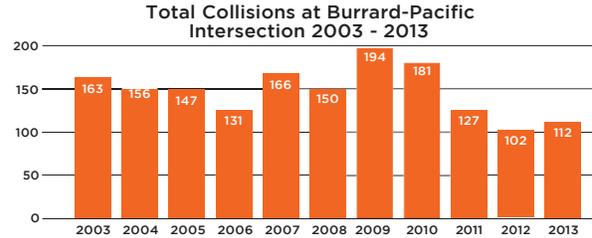
8 Improving Safety

Addressing a Collision Hotspot

The Burrard-Pacific intersection is the second highest collision location in the city.



While total number of collisions has fallen somewhat since protected bike lanes were added in 2009, it remains a high collision location.



Source: ICBC

Designing for Improved Safety



We've already made some safety improvements to the Burrard-Pacific intersection.

One issue has been southbound drivers illegally turning right from Burrard onto Pacific, colliding with people cycling straight who have the right-of-way. In 2012 we extended the 'nose' of the median to make illegal right hand turns more difficult.

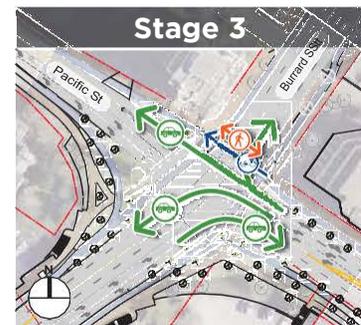
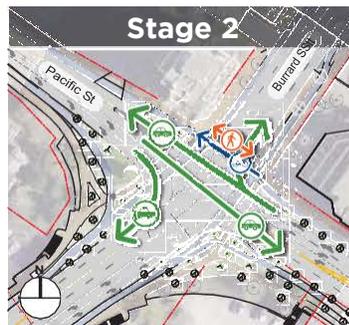
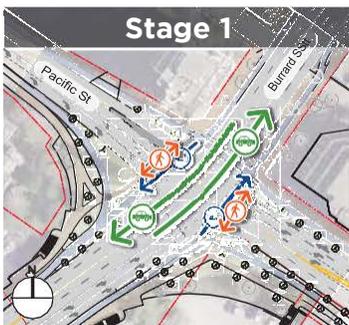
Reported bicycle-motor vehicle collisions at the intersection fell from 13 in 2011 to 4 in 2013 with the help of changes like this.

The proposed design will greatly improve safety by creating a protected intersection, similar in concept to the recently rebuilt Burrard-Cornwall intersection.

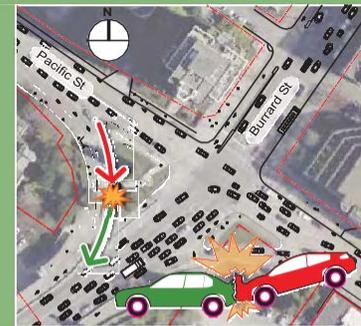
Key features include:

- Removing the slip lanes
- Creating protected signal phases for different road users and turn movements
- Increasing separation between people walking, biking, and driving

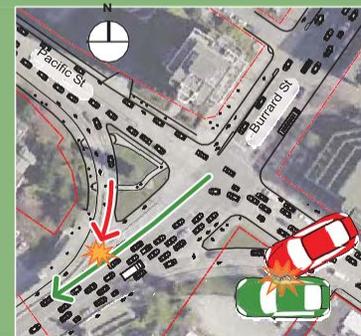
The traffic signal phasing could be as follows:



Frequent types of collisions



Eastbound drivers turning right from Pacific onto the bridge and rear-ending other vehicles in the slip lane



Eastbound drivers turning right from Pacific onto the bridge and sideswiping other vehicles

10 Heritage Value

Respecting a heritage landmark

- The Burrard Bridge opened on July 1, 1932 and is one of Vancouver's most iconic structures
- City staff worked with the heritage community to ensure the proposed design achieves the needed safety and structural improvements while also respecting the bridge's heritage significance



History, importance, and heritage features

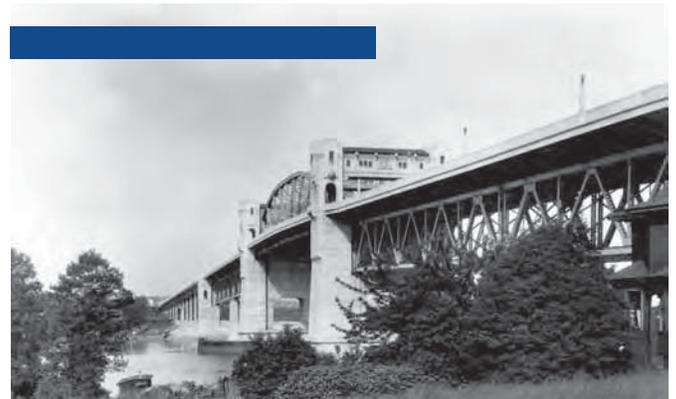
A gateway to False Creek and a key connection to downtown



- Vancouver's first high-level bridge, allowing uninterrupted flow of both marine and road traffic
- Features rivetted steel trusses both above and below the bridge deck

An important landmark

- One of Vancouver's most important examples of Art Deco style
- A defining skyline element from both the land and water
- Masonry piers extend into massive concrete towers connected by elaborate overhead galleries



Character-defining elements



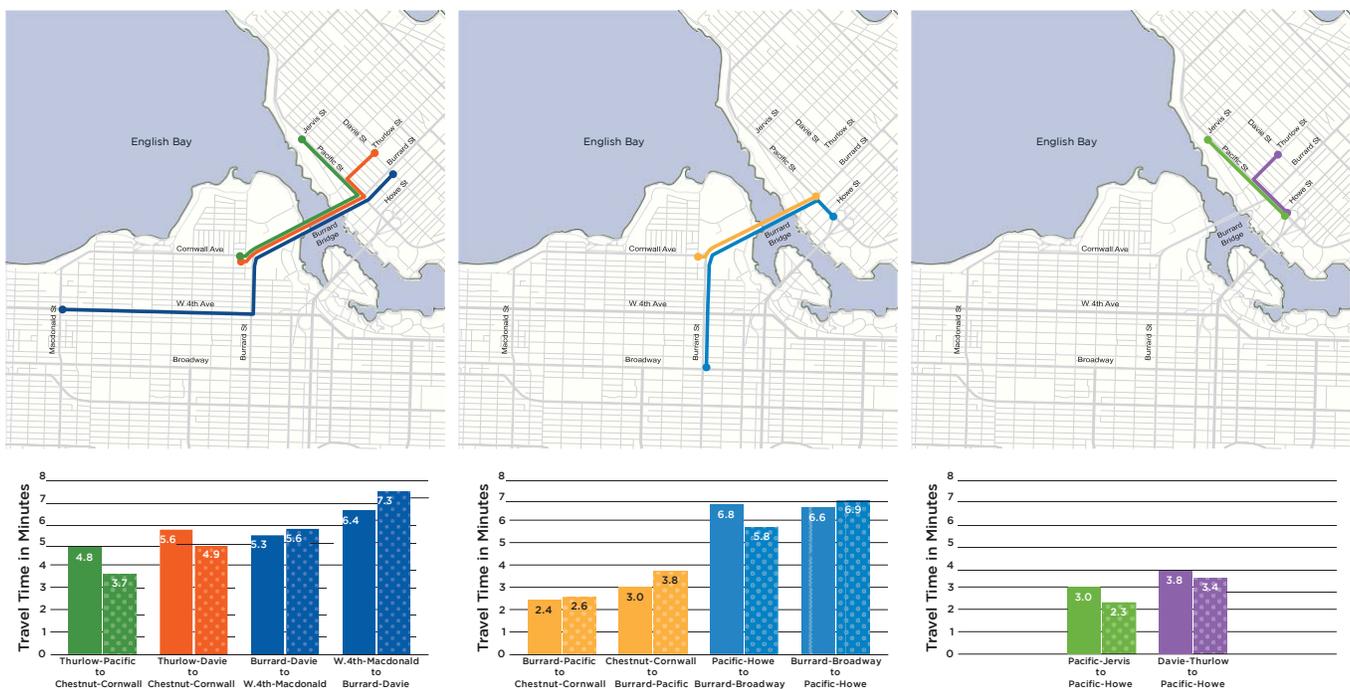
- Shuttered concrete handrails offer panoramic views at roadspeeds at around 50 km/h
- Pylons at each end of the bridge feature neon-lit flaming torches, a memorial to the First World War
- Rehabilitation will allow for future reintroduction of heritage lighting poles and fixtures

11 Traffic and Parking

Maintaining traffic flow

- The completed project will have **minimal impacts** on motor vehicle travel times
- During the busiest time of the day, average travel times for motor vehicles travelling through the Burrard-Pacific intersection are predicted to be about the same
- Travel times through the intersection will become **more reliable**, since each movement will have dedicated signal time
- Projected impacts to travel times for various routes are highlighted below

Before & After Travel Times for Select Routes (PM Peak)



Solid bars indicate current travel time. Dotted bars indicate projected travel times once the project is complete. Travel times are for the PM peak period, which is the busiest time of day for the bridge. Projected travel times are based on modelling completed by independent consultants.

Preserving access and parking

- Access to all businesses, residences, and other destinations will be maintained
- Laneway access south of Pacific Street between Hornby and Howe will be modified due to changes to the street slope
- About 5 parking spots will be removed over the entire 6-block project area
- During and after construction, the City will monitor parking occupancy and adjust regulations if necessary to help maintain access for customers and deliveries

12 Walking & Biking

Safer and more convenient walking connections

The bridge is a busy walking corridor. Between 2,000 and 3,000 people cross each day on foot.

Prior to 2009, people walking and biking were forced to share a busy sidewalk, resulting in many conflicts. Safety and comfort improved after 2009 when people cycling were provided separate space; however people are no longer permitted to walk on the east side, making the bridge less convenient for some trips.

The proposed design will enable people to comfortably walk on both sides of the bridge, with fewer road crossings for trips beginning or ending east of the bridge.

Re-opening the east sidewalk



Walking is not permitted on the east side today



The proposed design includes separate walking and biking paths on both sides of the bridge

At present, people are not allowed to walk on the east side of the bridge, adding a lot of inconvenience to some trips. A walking trip from from the southwest corner of Hornby-Pacific to Granville Island requires six road crossings, for example.

By allowing walking on both sides of the bridge, and by creating a protected intersection, the new design would reduce the number of road crossings for the same trip to zero.

A safer and more connected bike network

The bridge is one of the busiest bike corridors in the region, seeing around 7,000 cycling trips on a typical summer weekday in 2014.

Major improvements for cycling have been made in recent years. With each improvement, the number of people riding across the bridge grew significantly.

The proposed design will further enhance cycling by making the Burrard-Pacific intersection safer and more convenient, and by improving connections to existing routes in the downtown.



In the first full year after the 2014 Burrard-Cornwall intersection improvements were made, the number of cycling trips across the bridge grew more than 25% to over 1.3 million annually.

