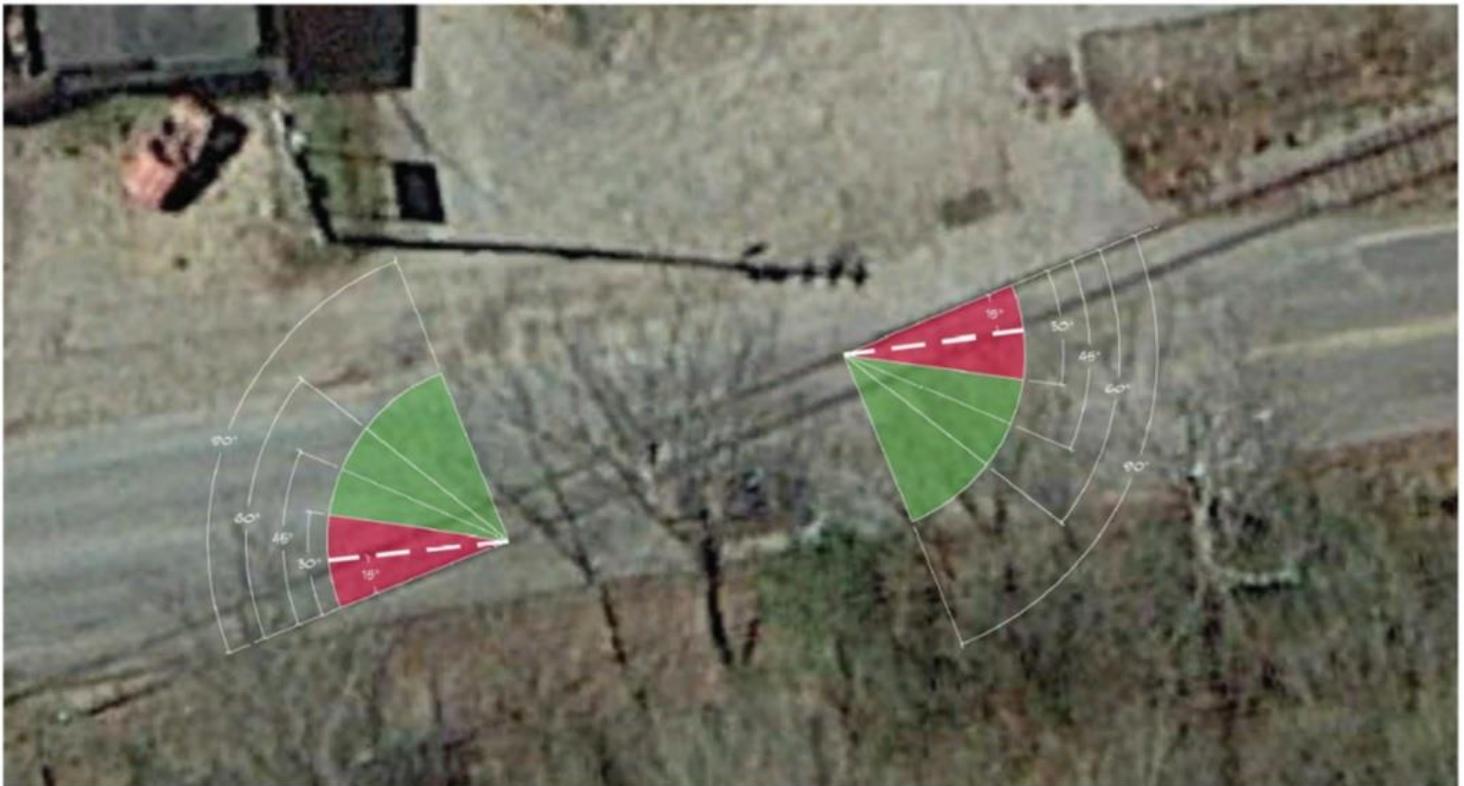




*Asheville on Bikes*  
RIDE YOUR CITY

# Riverside Drive Railroad Crossing Bicycle Incidents: Preliminary Report

September 2017



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0 5' 10' 20'  
SCALE: 1" = 10'-0"

THIS DIAGRAM IS ONLY INTENDED TO ILLUSTRATE A GENERAL PLAN WHICH MAY BE SUBJECT TO FUTURE CHANGE AND REVISION. THIS SHOULD BE USED ONLY FOR GENERAL REFERENCE.

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There are at least 100,000 at-grade rail crossings in the U.S.<sup>i</sup> Safety concerns arise at crossings that involve bicycle or pedestrian facilities, particularly if the rails cross the facilities at less than a perpendicular angle (are “skewed”). Skewed crossings are hazardous for bicyclists for several reasons, including compromised visibility and increased risk of bicycle wheels catching in the “flangeway gap,” the space between the rail and paved surface. Existing guidance recommends designing rail crossings to maximize traverse angle and considering other factors such as crossing surface, bikeway width, and flange width, to minimize risk to bicycles.<sup>ii,iii</sup>

The railroad crossing at 440 Riverside Drive in the River Arts District is a skewed, at-grade rail crossing with a rail traverse angle of approximately 15°. The posted speed limit along the section of Riverside Drive in which the crossing is located is 45 miles per hour. Existing safety facilities include signs and stop bars.

This railroad crossing is widely recognized as extremely hazardous, and has caused many crashes for novice and experienced bicyclists alike. Asheville on Bikes (AoB) conducted a community incident report survey in collaboration with Asheville Vice-Mayor Gwen Wisler to collect information about bicycle crashes at this crossing.

## Methods

AoB developed a 12-question [survey](#) in Google Forms and disseminated the link publicly through AoB’s website, blog, and social media accounts, as well as through partner organization e-newsletters. Respondents were asked to submit details of the incident they wished to report, including time of day, month, year, a brief description of the incident, any physical injury or damage to property, associated medical or other costs, whether an emergency response was necessary, and whether a police report was filed. All survey fields were open-ended. The survey was opened in early July 2017 and remains open to collect information about incidents ongoing. Responses were reviewed manually and trends and themes were identified.

## Results

Between July 6 and August 19, 2017, the survey received 133 unduplicated responses. Key characteristics of incidents described in these responses are summarized below.

**Direction of travel:** Among responses that indicated direction of travel, incidents were reported for bicyclists traveling both northbound and southbound across the tracks, although more incidents occurred in the northbound direction. Many responses did not indicate direction of travel.

**Time of day:** Of the responses that included exact or estimated times of day, most occurred in the morning or afternoon. Fewer incidents occurred in the evening/dusk hours or at night. Many responses did not indicate time of day.

**Time of year:** Of the responses that indicated a specific date, month, or season, the majority occurred during the summer or spring. Far fewer incidents occurred in the autumn or winter. Some responses did not indicate time of year.

**Circumstances and factors contributing to incidents:** Overall, several strong themes emerged about the circumstances and factors that may have contributed to the incidents. These include:

Bicyclists traversing the crossing at a skewed angle. Of incidents that reported skewed angle as a factor in the incident, several key reasons for a skewed traverse emerged:

- *Vehicles crowding or attempting to pass riders as they traverse the crossing, either to the left or the right of the cyclist.* Example responses include:
  - “We swung wide to cross the tracks at a perpendicular angle. We used appropriate signaling to the car behind us that we would be taking the width of the lane. We were traveling approx 15mph and there was a drizzle just beginning. The driver behind us became enraged, accelerated suddenly and passed us closely (hitting my arm w/ the passenger side mirror). Unable to cross the tracks at a safe angle, our wheels caught in the tracks and we were pitched from our bikes into the road/ditch.”
  - “On my way home from work in the rain, a car was riding my tail and not giving enough space for me to cross wet tracks at a right angle, so I slowed down as much as possible but still crashed.”
  - “I was headed south on Riverside Dr, with several cars approaching from the rear, as I signaled to move left and cross the track perpendicular, the first car in line sped to pass, forcing me back to the side of the road. As I crossed the tracks at the less than optimal angle, I caught my wheel in the tracks, went down and skidded several feet on my left side.”
  - “I was practically hit by a teenager driving a pickup truck as I tried to angle myself to cross these tracks perpendicularly. The pickup truck decided to pass me on my right causing me to have swerve to miss him. My tire got caught in the track and nearly caused me to be hit by the truck.”
- *Bicyclists not able or not wanting to “take the lane” due to traffic or safety concerns, and traversing the crossing at a skewed angle.* Example responses include:
  - “On one occasion a friend crashed while crossing the tracks, nearly landing in the path of an oncoming vehicle. Fortunately he was not injured beyond minor lacerations. On another occasion saw two riders crash simultaneously, and a vehicle that stopped to provide first aid parked dangerously in the middle of the road. On another occasion saw a cyclist dismount to walk bike across tracks, but in doing so accidentally stepped into traffic and was nearly hit by a passing vehicle.”
  - “I was riding at a high speed on my road bike and didn't expect the rail to be going diagonally across the road. There were cars behind me so I wasn't able to correct in time because I would have ridden into traffic. My bike went out from under me and I hit my head on the rail (helmet cracked). I stood up and was disoriented. I called for help and went to the ER.”
  - “I could not cross the tracks at a 90 degree angle because a large truck was coming from behind, so I did my best but the bike tire caught in the track and I fell.”
- *Nonspecific reasons for crossing at a skewed angle* (Note: these reasons occurred even when bicyclists were experienced and/or were familiar with best practices for traversing skewed crossings). Example responses include:
  - “I was with a small group of 5 riders, mostly novice. The locals told the out of town folks about the track and how to best cut across it. Still, one person did get their tire stuck and went over their handlebars, injuring his shoulder and helmet.”
  - “I was just starting to commute everywhere by bike and was going to meet up with friends. I had not crossed the tracks there before, though I have to admit I had seen the warning

sign. The sign was enough warning that I slowed down, which probably reduced my injuries but I still wreaked pretty hard with my bike ending up in the ditch, my basket in the road and myself sprawled on the road. Traffic was slowed/stopped as someone checked on me and helped me gather my belongings.”

- “On a good hard 14 mile ride I do on regular basis, this one time didn't pay attention to the tracks like I should have. Front tire dropped into the track and threw me over the handle bars, and onto the gravelly pavement.”
- “My 10 year old was injured trying to cross the tracks. Not sure of exact day but June on 2016. Our whole family was riding from Montford to New Belgium and she didn't turn her wheel enough to cross. Her front wheel was caught and she hit the pavement and was left with bad scrapes and bruised knee and hand.”
- “Despite having ridden this rail road crossing many times and teaching others how to angle properly on a bicycle, I thought I had the angle correct to cross and immediately my bike tire slipped off the rail and bike & me thrown down on my right side. I heading towards the River Arts District. Other bicyclists were attempting to cross, and their bikes were quickly thrown down to one side.”

Wet or slick conditions. Some responses indicated wet, rainy, or otherwise slick conditions on the rails contributed to slipping tires. In some cases, the slick conditions combined with a skewed traverse of the rails may have contributed to the incident. In other cases, slick conditions contributed to an incident even if a cyclist reported traversing the rails at an ideal angle. Many incidents did not report involving wet or slick conditions.

**Injuries and Medical Costs:** The majority of incidents that involved crashes resulted in physical injury of some sort, in some cases severe. A number of respondents reporting having to miss work for extended periods of time. Estimated medical costs ranged widely, in numerous cases thousands of dollars. Incidents also had psychological impact. Multiple respondents said their experience at the crossing made them more afraid to ride their bicycle in general, or at least at this particular crossing. Example responses include:

- “Banged up chin, cheek, and knees. Bruises all over. Destroyed lulu lemon leggings : ( I have a internal freakout every time I have to cross that spot even though I haven't had an accident since.”
- “I had road rash on my left knee and ended up needing about 6 stitches. I was concerned that I had broken a bone in the palm of my hand, so I had xray taken and my urgent care bill amounted to about \$750.”
- Torn shoulder that I nursed along for several years before had surgery. After insurance, surgery bill was ~\$6000. MRI with contrast was covered.”
- “I landed on my shoulder, scraped my face and top of my shoulder and broke my elbow. I have permanent elbow mobility problems and recurring pain from the injury. This accident gave me the fear. I used to commute to work but after the accident I haven't ridden at all.”
- “I had a mild concussion and superficial scrapes on my cheek, chin and my lip. There is scaring [sic]. The visit to the ER cost approximately \$1800. I had to have a head CT to rule out swelling of my brain. Tetanus shot, clean up my face and antibiotic ointment. I got really lucky!!!! There were some folks behind me in a car who were kind enough to stop and help me. I was in shock and experiencing intermittent memory loss. They picked me and my bike up, took me to my house to

drop off my bike, I don't have any memory of this or of them picking me up and I also don't remember telling them how to get to my house. They took me to the ER and told the nurse I had introduced myself to them 6 times in the car on the way there. Again, I have no memory of that. I am so grateful for them both. This wreck was a scary! Since then I have met many other people who have also wrecked in the exact same spot. Thank you so much for addressing this. The angle of those tracks are so dangerous for cyclists.”

- “I came down on the top tube prior to being launched. The inferior ramus of my pubic bone was shattered and I had a concussion (bike helmet cracked in 3 places). My husband had significant road rash the length of one leg, hip, and arm. ER visit at MMH, including radiology charges and IV. Subsequent regular outpatient orthopedic visits x at least 4 months and X-rays monitoring fracture healing. Durable medical goods included a walker then crutch. Physical therapy for a couple months after that. How many thousands of dollars does that add up to?... I was on bed rest for a month (during the busiest time of year in my office). After that I used a walker for a month and worked part time time. Then went back to work full time using a crutch for another 6 wks or so. At the time I had no disability insurance. Therefore the associated costs of my missed work and the increased work load for my colleagues was enormous.”
- “I broke my right olecranon-a bone in my elbow- I had to have surgery on it and a pin placed in it – as well as months of physical therapy. I had stitches in my hand and road rash in my hand and shoulder. I had a very limited insurance plan so applied and received 100% charity care through Mission Hospital as my total bills were greater than 20,000. I was lucky and grateful for charity care received through mission hospital. I was unable to work for months given I did not have full range of motion of my right arm and at that time worked in a position requiring this in order to safely work. There was no short-term disability for this job so I lost wages for those months I don't work.”

**Property damage:** Many responses indicated some degree of damage to bicycles, ranging from minor scratches or scrapes to bent wheels and broken frames. Other cycling equipment, including helmets, were also damaged or destroyed.

**Other feedback:** Respondents overall voiced strong support for improving the crossing as soon as possible. Example comments include:

- “I have worked several serious bicycle accidents at this location as a police officer. Something needs to change.”
- “as the number of out of town cyclists come to Asheville and ride on the most level road in WNC in RAD this very dangerous crossing will cause further injury to cyclists unfamiliar with this railroad track crossing. IT MUST BE FIXED for everyone's safety!”
- “Even as a devoted cyclist I realize that cycling is done at our own risk and that it is not possible for the city of Asheville to accommodate all cyclist safety needs. However the railroad crossing at Riverside is a "perfect storm" of danger to both cyclists and motorists because 1.) it is highly trafficked by cyclists, 2.)it is highly trafficked by cars often traveling over 45 mph, and 3.) has a high rate of cycling accidents. Considering these factors, I feel it is only a matter of time before someone is critically injured or killed in this location, which is why improvement of the bike lane at this crossing should be a top priority for the city.”

- “Please fix this. We are the example of what a progressive city is and can be for the south. We need to open up our city to cyclist. Many elderly and many more children and youth ride these roads and it's already dangerous enough with the threat of being stuck by a car and potentially killed. If you will not give us proper green ways at least give us decent roads to share.”
- Please note that [my incident] happened EVEN THOUGH the hazard was communicated. Signage and communication cannot make this track crossing safe, only addressing the roadway will help.”

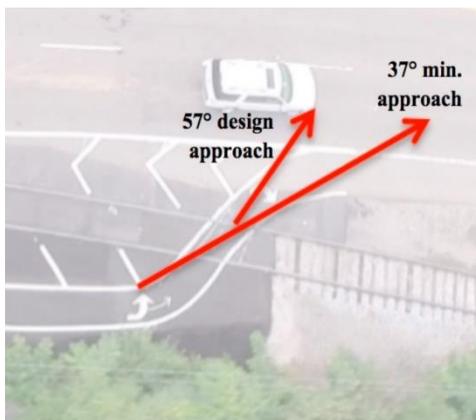
## Discussion

Findings from the incident report survey indicate the railroad crossing at 440 Riverside Drive poses significant risk to bicyclists of all ability levels. The survey also indicates there is strong community support to improve the crossing.

A recent study examined a similar skewed, at-grade crossing in Knoxville, Tennessee. This crossing has 10° rail skew at the shoulder crossing and 20° at an adjacent greenway crossing. The posted speed limit at the crossing is 45 miles per hour. Researchers analyzed continuous video footage of the heavily traveled shoulder crossing over a two month period (August 2 to October 3, 2014), documenting more than 2,000 traversings and 32 single-bicycle crashes at that crossing. The researchers found that 90 percent of crashes at this intersection occurred at traversing angles less than 30°, and no crashes occurred at traversing angles greater than 60°. While approach angle was the most significant factor contributing to crashes, the authors found bicyclists riding in groups, gender, and wet roadway conditions were also associated with higher crash rates. Their findings indicate that when 90° traversing angles are not feasible, ensuring a traversing angle greater than 30° could be highly effective at reducing crashes, and angles greater than 60° could effectively eliminate them.<sup>iv</sup>



Knoxville crossing. Source: Chris Cherry/Journal of Transport & Health



Jughandle design for Knoxville crossing. Source: Chris Cherry/Journal of Transport & Health

In response to the problem, the City of Knoxville and the railroad company considered a 90° crossing, but the estimated cost (\$200,000) was prohibitive, partly due to the need to build retaining walls because the route was near a river. Eventually, the city and the railroad decided to build a jughandle detour at a total cost of \$5,000. The jughandle design included a tangent angle of 57°, with a possible minimum angle of 37° (inside-to-outside of bike lane). This improvement has effectively eliminated crashes except in cases where bicyclists traverse through the hash marks and cross the railway at low angles.<sup>v</sup>

## Limitations

Findings from the incident report survey are based on self-reported data. The report form included open-ended response fields, and each respondent determined what information to provide about each incident. As a result, some details about each incident (for example, direction of travel or time of day) were not collected systematically across all responses.

## Conclusion

The AoB community incident report survey findings indicate the railroad crossing at 440 Riverside Drive poses significant risk to bicyclists. Incidents at this crossing have occurred among cyclists traveling both northbound and southbound, at all times of day, at all times of year, in a range of weather conditions, and among cyclists of all ability levels. These incidents have resulted in physical injury, psychological impact, and damage to property. There is strong community support to improve the crossing. Other communities have addressed similar crossings through engineering and design changes that have very effectively reduced single-bicycle crashes.

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<sup>i</sup> Federal Railroad Administration. “Highway-Rail Grade Crossings Overview.” Available at <https://www.fra.dot.gov/Page/P0156>.

<sup>ii</sup> American Association of State Highway and Transportation Officials, 2012. *Guide for the development of bicycle facilities*. Washington, DC.

<sup>iii</sup> National Association of City Transportation Officials, 2016. *NACTO Transit Street Design Guide*. Available at: <https://nacto.org/publication/transit-street-design-guide/>

<sup>iv</sup> Ling Z, Cherry C and Dhakal N, 2017. Factors influencing single-bicycle crashes at skewed railroad grade crossings. *Journal of Transport & Health*. In press.

<sup>v</sup> Metcalfe J. “The Brutal Saga of One Extremely Evil Railroad Crossing.” *CityLab*. August 4, 2017. Available at: <https://www.citylab.com/transportation/2017/08/the-brutal-saga-of-one-very-poorly-designed-railroad-crossing/535926/>.