

# BICYCLE INTERACTIONS AND STREETCARS: Lessons Learned and Recommendations



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## Introduction

In the past few years, Portland’s cycling use has soared at the same time as streetcars are gaining favor as urban transit solutions. In theory, everyone agrees that bicycles and streetcars should be complementary, not contradictory modes. In practice, however, many cyclists feel that the installation of Portland Streetcar has deteriorated cycling conditions on what were previously good routes, and has created new crash dangers for cyclists in Portland.

As the LDTMA considers the integration of streetcar into the Lloyd District, several key questions are under consideration:

- Do streetcar tracks pose a serious danger for bicycles?
- Are bicycle facilities compatible with streetcar tracks?
- What is the optimal facility design for a street with both streetcar and bicycles?
- What design solutions have been applied successfully in other countries?

This report aims to provide an international context for answering these questions by providing a literature review, an analysis of problem statements and best practices from places with mature experience integrating bicycles and streetcars, and recommendations for Portland solutions.

## Study Approach

This study has two main components:

- A web-based survey of Portland bicyclists about their experience with streetcar, and
- An international review of best practices based on extensive literature review and interviews

The survey was conducted in partnership with the Bicycle Transportation Alliance. Questions were asked about the experiences of bicyclists around streetcars (as well as experiences around MAX trains and buses, for related but distinct use by the BTA). See Appendix A for a complete list of all questions asked on the survey.

Respondents were specifically asked if they had experienced a crash related to streetcar or MAX tracks. Each respondent was prompted for up to three crash locations. The BTA geocoded all reported crash locations and created an overall crash map.

International research was conducted through interviews with international experts, site visits to Copenhagen, Amsterdam, Stockholm, Malmö, and Helsinki, web research, and literature review. Literature and interview results were reviewed for common problem statements and best practice recommendations.

## Survey

The “Bikes and Transit” survey publicized widely on the BTA blog, on bikeportland.org, on portlandtransport.com, and through email lists such as the Lloyd District TMA’s Bike Committee, Shift, and via Roger Geller (PDO/T) and Todd Boulanger (City of Vancouver, WA). The survey was well-received, with 1520 completed responses within two weeks.



*Dutch bicycle facilities are often on tram lines, but provide physical separation between modes.*

The primary survey findings are:

- Most respondents were experienced cyclists
- Most respondents regularly use TriMet or Portland Streetcar in addition to bicycling, both with and without their bicycle
- Most respondents report that they value TriMet and Portland Streetcar as transportation options
- Respondents report that they fear falling with their bicycle on tracks (most likely based on prior experience).
- Respondents report greater comfort making right-turns across tracks, but are less comfortable riding next to tracks or making turns across tracks
- Respondents cited a strong preference for a “cycle track” or parallel bicycle route and a much weaker preference for on-street bike lane lanes on the right side of the tracks. These preferences were similar for both confident and timid riders.
- Over 67% of respondents reported that they have experienced a bike crash on tracks, demonstrating that bike-track crashes are a major and underreported problem for Portland-area bicyclists. Most crashes do not result in life-threatening or permanently disabling injuries.
- Less-experienced cyclists are more anxious biking near transit and have less confidence in their own abilities, expected behaviors, and in transit operators. They avoid facilities that are shared with transit, and while they are less likely to have experienced a crash on tracks, they are more afraid than experienced bicyclists that they will crash.

Full survey results are detailed in Appendix C. See also Appendix B for all survey comments related to bicycles and streetcars.

## Research

### ***Existing Portland Practices***

In the course of research, staff discovered that there are no adopted design guidelines or policies for Portland Streetcar related to bicycle accommodation. However, an analysis of existing streetcar installations demonstrates that there is a relatively consistent approach being applied.

Current Portland practices include:

- NW 10<sup>th</sup>/NW 11<sup>th</sup>  
One-way streets with right-running tracks and right-running platforms on curb extensions. On-street parking provided except where curb extensions protrude into parking lane. No bicycle accommodation.
- NW Lovejoy & NW Northrup  
Two-way street, one lane in each direction, streetcar in right (west-bound) lane only. Right-hand platforms. No bike lane on Northrup. Bike lane on Lovejoy from NW 14<sup>th</sup> to the Broadway Bridge; includes a sidewalk detour around streetcar platform between NW 14<sup>th</sup> & NW 13<sup>th</sup>.
- SW Harrison  
Two-way street, with two lane in each direction. Large planted median. Streetcar tracks in both lanes, with center platform. No bicycle accommodation.



*Typical Portland Streetcar cross-section: right-running tracks on a one-way street with on-street parking (except at platform locations).*

<http://www.flickr.com/photos/phillipsalzman/1862145951/>  
(Photo permission pending)

- SW Moody  
Two-lane street (switches between one-way and two-way). On-street parking. Right-running streetcar tracks with right-hand platforms. Bike lane at right-hand side with sidewalk detour around platforms.
- SW Bond  
Two-lane, one-way street with left-running streetcar tracks and left-hand platforms.
- Flange gap: There is no flange filler installed in the flange gap.
- Lane use: Portland streetcar uses standard traffic lanes where all vehicles are permitted; the lanes are not reserved for the exclusive use of streetcars.



*SW Moody cross-section  
(source: Google Street View)*



*SW Bond cross-section  
(source: Google Street View)*

See section titled “Analysis and Recommendations,” below, for a discussion of the pros and cons associated with the current Portland practices.

## **International Best Practices**

Countries with both streetcar/tram use and high bicycle use were identified (including Australia, Denmark, England, Germany, the Netherlands, Scotland, and Switzerland). Contact was attempted with representatives from transit agencies, transportation departments, and/or bicycle advocates in each country (at both the city level and the national level). Staff asked if they knew of policy documents or design guidelines; if they had any bicycle/track crash statistics; and what recommendations they had for improving bicycle safety around streetcar/tram tracks. In some cases, respondents referred staff to another expert, who was then interviewed. See Appendix F for a complete report of international interviews.



*Dutch designs, like this separated bike lane adjacent to a tram line, were reviewed as international best practices for this study.*

Surprisingly, despite extensive research, staff were not able to find many examples of formal design guidelines, either at the national or local level (the Edinburgh Tram Design Manual is the notable exception). However, further searches revealed numerous reports and articles relevant to urban bicycle safety around streetcar/tram tracks. As with interviews, the literature review captured common problem statements and solutions. See Appendix E for a complete report of literature reviewed.

## **Current Practices**

The current practices related to bicycles and streetcars can be defined for the Netherlands (based primarily on Amsterdam), Switzerland (numerous cities including Bern and Zürich), Australia (based on the Melbourne Swanston Street facility), and Nottingham, England. Please note that for each place staff noted many exceptions for every aspect of the facility.

The Dutch approach is primarily center-running trams with center platforms. Separated cycle tracks (or, less frequently, bike lanes) are provided for cyclists to the right of the right-hand vehicle lane (see photo, above).

Turning movements are provided for by bicycle turn signals or, less frequently, by “box left” turns. Cycle tracks may be two-way or one-way.

In Switzerland, bicycle facilities are on-street bike lanes, not raised cycle-tracks, and are one side only. Streetcar tracks are commonly center-running with center platforms, but more recently disability advocates have successfully encouraged the development of right-hand platforms on curb extensions. A formula has been developed to leave sufficient room between the platform curb and the streetcar track that cyclists can proceed, however it should be noted that the formula would almost certainly be rejected as insufficient for North American conditions. In addition, there are frequent sidewalk detours, though an analysis suggests a that these should only be installed on uphill stretches where cyclist speed will be low.

In Australia, the Melbourne Swanston Street tram line has developed a new facility type that is being received well by cyclists. Streetcar tracks are center-running with center platforms, and a separated “Copenhagen bike lane” has been created to the far right of each auto lane. Parking is permitted; the “Copenhagen bike lane” is located between the on-street parking and the sidewalk. Cyclists must turn left using the “box turn” (aka “Copenhagen left turn”).

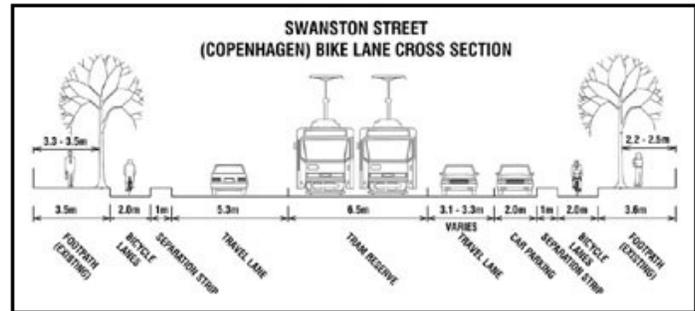
In Nottingham, England, bike lanes are provided along some of the tram streets, but the primary focus has been on creating an alternative low-traffic bicycle route paralleling the tram line, and creating clear and safe track crossing opportunities for bicyclists using signalization and “toucan” crossings. Prominent signage has been installed to direct cyclists to the alternate route, and to help them find the best crossing opportunities. In addition, a tram safety brochure and a map of the alternate bike route have been created.

## Common Problem Statements

International research demonstrated definitively that tracks are considered a major hazard for bicyclists; multiple sources in every country confirmed this.

In addition, the following major problems were identified by multiple sources in multiple countries:

- Curb-tight right-hand streetcar stops conflict with bike lanes and standard bicyclist behavior.
- Turning movements across tracks put bicyclists in danger of crashing; the shallower the turn, the higher the crash risk.
- Bicyclist and motorist education is inadequate.



Tram cross-section for Swanston St. in Melbourne, Australia.



Photo of “Copenhagen bike lane” in Melbourne, Australia. <http://flickr.com/photos/avlxzy/2270515901/> (permission pending)



Track turns are difficult for bicyclists; here, bike lanes in Amsterdam attempt to provide a near-perpendicular crossing of curving tram tracks

- Streetcar planning processes frequently fail to plan early for bicyclists.
- Routing bicycles to the sidewalk is problematic because it may create conflicts with pedestrians, especially on downhill slopes.

The following problem statements were mentioned less universally but are worth noting:

- Streetcar routes and bicycle routes are frequently sited on the same classification of streets, leading to conflicts.
- More streetcar driver training is needed.
- A single type of bicycle facility will not work equally well for all users.
- Jurisdictions sometimes seek to ban bicycles from streetcar streets to reduce conflicts.
- Track metal is slippery.
- Drivers may be distracted by the busy street environment near streetcars and fail to look for bicyclists.
- Bicycle crash reporting systems are inadequate to determine extent of crash danger from streetcar tracks.

It should also be noted that the type of bicycle plays a part in the frequency of problems. In many European cities, the bicycle fleet is almost entirely made up of up-right bicycles with wider tires that are less prone to be caught in tracks than skinny-tired road bikes, which are far more common here. Upright bicycle use leads to slower travel speeds.

## Common Solutions

The following solutions were identified by multiple sources in multiple countries:

- Separated facilities are universally preferred, usually in the form of a grade-separated “cycle track”<sup>1</sup>, but sometimes in the form of a parallel low-traffic bicycle route.
- Center-running or left-running streetcar tracks and platforms are strongly preferred for bicycle safety .
- Bicycles must be integrated into streetcar planning processes from the earliest stages
- Facilities should facilitate right-angle turns by bicyclists (creating a “box turn” or “Copenhagen/Melbourne left turn,”; see explanation in footnote 1).
- Additional bicyclists and motorist education (for both safety and wayfinding) should be implemented, and maps and brochures distributed to bicyclists.



*Bike lane designs (like this one in NW Portland) that help cyclists cross tracks at a perpendicular angle can reduce cyclist crash risks.*

<http://www.flickr.com/photos/paytonc/356335411/> (permission pending)



*Center-running streetcar tracks and platforms are common in Amsterdam, and provide numerous safety benefits for bicyclists.*

<sup>1</sup> A cycle track can best be described as a separated bike lane that is attached to the sidewalk realm. It is often elevated to a higher level than the street level. It is often, but not always, separated from moving motor vehicle traffic by parked cars; contrary to our design, on-street parking is located outside the cycle track. It can be one-way or two-way; both approaches are used extensively throughout Europe. At intersections, bicycle left-turn movements are made from the right-side via signal cycles separation or a two-step (a.k.a, box turn, jughandle, or Melbourne/Copenhagen left-turn), whereby cyclists turn right into a receiving bike box on the intersecting street, reposition themselves, and wait for a green light taking them in the direction they want to go.

- Leave sufficient space between tram track and platform curb such that bicycles can proceed comfortably (note: Swiss recommendations for “sufficient space” are less than American standards would consider safe, but this recommendation still improves cycling conditions if followed).
- Sidewalk detours are not generally a preferred facility type, but if they are used, it should be on an uphill to keep bicycle speeds low.
- Streetcar routes should not deteriorate cycling conditions or eliminate cycling routes; bicycles should not be banned from streetcar routes or banned from passing through tram stops.
- Advanced stop bars are recommended at all junctions with moderate-to-high vehicle and cycle traffic.

The following solutions were mentioned less universally but are worth noting:

- If bicycles and streetcars cannot be separated in space, they should be separated in time, primarily through signalization (but also by creating spaces for bicyclists to wait for streetcars and training streetcar drivers to wait for bicycles).
- Colored pavement can be used to highlight potential conflict areas (such as green in Melbourne and blue in Copenhagen).
- Maintenance is key to maintain a smooth interface between tracks and street.
- Tracks can be coated to reduce slipperiness.
- Multiple facility types serving the same corridor should be implemented to provide for a range of cycling abilities and styles (such as an on-street bike lane and a parallel low-traffic route).
- Flange filler material used for heavy rail can reduce crash danger. However, extensive experiments in Switzerland seem to indicate that flange filler is not appropriate for streetcar tracks.
- Wayfinding signs and markings should be created for bicyclists, particularly to indicate turning opportunities.
- Mid-block or far-side streetcar stops may result in fewer conflicts than near-side corner stops.
- Bicycle groups should be included in outreach and planning efforts.
- “Toucan” crossings should be provided to permit bicycle crossing at pedestrian crossing locations using pavement markings and bicycle signal heads (for more information, see: [http://en.wikipedia.org/wiki/Toucan\\_crossing](http://en.wikipedia.org/wiki/Toucan_crossing)).
- Track crossings should be illuminated.
- Crash reporting mechanisms should be improved for future analysis.
- Lowering vehicle volumes and speeds on streetcar streets can create safer conditions for bicyclists.
- Streetcar stopping times at platforms should be minimized to reduce conflicts with bicyclists.
- Pavement markings at tracks indicating that bicyclists should yield to streetcars.
- Separate bicycle signalization on tram lines eliminates turning conflicts.
- Bike racks should be supplied at all streetcar platforms.



*Pavement markings indicate that the cyclist should yield to streetcars in Amsterdam.*



*A button-actuated countdown bicycle signal head creates a separate signal phase for bicycles to eliminate tram conflicts in Amsterdam.*



*This photo from Amsterdam illustrates many of the international best practices identified above: spatial separation of the cycle track from tram tracks, center-running tracks and platforms, separation of bicyclists and pedestrians, clear pavement markings directing cyclists, and near-perpendicular track crossing angles. Source: <http://www.flickr.com/photos/anw-fr/2744645044/> (used with permission)*

## Analysis and Recommendations

Research to date demonstrates unquestionably that streetcar tracks pose a safety issue for bicyclists. Better integration of bicycle facility designs into streetcar planning is essential as the Portland Streetcar system expands. In addition, it is clear that the lack of design guidelines and clear policy guidance hampers progress towards integrating streetcar and bicycles.

The primary issues for bicyclist-streetcar interaction are:

- Right-running tracks
- Flange gap and angle of crossing
- Streetcar platforms (curb extensions) located in bicycle travelway

Bicycle wheels and tires are very susceptible to getting caught within the gap of the streetcar track flange. This situation occurs when a bicyclist is required to cross the tracks at less than a 60° angle. When a track “catches” a wheel a bicyclist may be thrown from their bicycle and possibly suffer a severe, traumatic injury. Designing streetcar infrastructure that reduces the number of situations in which a bicyclist must cross tracks at an unsafe shallow angle will decrease the number of crashes caused by bicycle interaction with streetcar facilities.

Right-side running tracks and locations in which streetcar tracks curve are two situations in which a bicyclist riding in the right lane must cross tracks at an angle less than 60°. Center-running and left-running tracks are

much safer scenarios for bicyclists. Signs and pavement markings can be used to assist cyclists in maneuvering around track curves at less dangerous angles.



*Streetcar Track Flange Gap: The width of the gap allows for bicycle tires to easily get caught. This situation can result in bicycle crashes.*



*Track Curves in Portland on SW 10<sup>th</sup> between Morrison and Alder: In order for a streetcar to turn it must create a wide angle. The resulting geometry can be difficult for cyclists to cross. The situation becomes more dangerous when the tracks are wet because they are slick and require a crossing angle closer to 90°.*

# Streetcar-Bicycle Recommendations

The primary recommendations are as follows:

1. Align tracks on the left side or center side of a multi-lane street as opposed to the right side, because bicycle travel is most comfortable and feasible on the right side of the street.
2. Separate bicycle travel from streetcar tracks to the extent possible. This can be accomplished by:
  - Development of a parallel, excellent bikeway facility, such as a high-quality bicycle boulevard
  - Marked cycle tracks or bicycle lanes adjacent to streetcar tracks, with platforms designed such that bicyclists can bypass pedestrian zones without encountering waiting pedestrians; this should only be considered on uphill grades.
  - Offering 90 degree track crossings whenever possible, by positioning the bike lane or cycle track to cross at 90 degrees (see photo on page 9); signing and/or marking the best angle for tuning (see photo, above) and creating “Melbourne left turn” opportunities (see page 14). According to the Dutch Design Manual for Bicycle Traffic, cyclists should be able to cross the rails at an angle of at least 45 degrees, but preferably more than 60 degrees.
3. Create a policy framework that addresses bicycle safety issues.
4. Create supporting programs for education and wayfinding.

## Option 1a: Left-Running Tracks on One-way Street

On one-way streets, the streetcar track should be located in the far left lane, and platforms should be located on the left-hand side. The platform design may be identical to the current practice, but reversed for left-side placement. This leaves the right-hand lane free for normal bicycle movement and permits cyclist turning movement across the track to be closer to perpendicular; a bike lane or cycle track may be provided.



*Left-running streetcar tracks on SW Bond, a one-way street in Portland, significantly reduce bicycle-streetcar conflicts.*

## Option 1b: Center-Running Tracks and Platforms on Two-way Street

For two-way streets with multiple lanes in each direction, tracks should be placed in the left-most lane (aka “center-running”), with center streetcar platforms that serve both directions of streetcar traffic. This will greatly improve bicyclist safety; as with Option 1a (above), a bike lane or cycle track may or may not be appropriate depending on the situation, but in either case, the bicyclist will be able to travel in either a bike lane or a vehicle lane free of streetcar tracks.

For two-way streets with one lane in each direction, there is no flexibility in track placement, but the platforms should be placed in the center. Center-running platforms eliminate the danger to cyclists that happens when the curb extension platform forces them to cross streetcar tracks at a very shallow angle.



*Center-running track with center platform in Portland on SW Harrison: The center platform eliminates the pinch point at curb extension platforms, while the lack of parked cars eliminates conflict with parking cars and doors.*

## Option 1c: Streets with Right-Running Tracks and Platforms and Cycle Track or Bike Lane

If both a right-running track *and* right-side platforms are selected (either because there is only one travel lane in each direction and center platforms are not feasible, or because it is not feasible to place left-running tracks on a one-way street) bicyclists are significantly disadvantaged compared to Option 1a and Option 1b. A higher level of countermeasures is required to mitigate this risk; in most instances this will be either a bike lane or a cycle track.

It should be noted that both bike lane options and cycle track options on a street with right-running tracks and right-hand platforms have disadvantages: bike lanes position the cyclist between parked car doors and tracks, and place cyclists in a hazardous position for left turns and evasive maneuvers. Bike lanes also necessitate a sidewalk detour around platforms, which is not desirable because of pedestrian conflicts. Cycle tracks, on the other hand, decrease cyclist visibility to cyclists and require treatments to facilitate left turns (such as signals or “box left” turn facilities) which slow cyclists down and, in the case of signals, require signal time to be transferred from motorist movements to dedicated bicycle phases. The decision between a bike lane and a cycle track will depend greatly on the specific situation, and should be analyzed carefully in each case.

### Bike Lanes

If a bike lane is provided on a street with right-running tracks, bicyclists are still subject to a heightened risk of crashing on tracks because any left turns or evasive maneuvers from the bike lane result in a shallow crossing angle. Analysis of survey crash data indicates that a large percentage of track crashes occur because of bicyclist evasive maneuvers. For this reason, it is important to take steps to mitigate crash risk on this type of facility. Possible countermeasures include eliminating parking to eliminate conflicts with opening car doors and cars entering and exiting parking spots (as seen in the SW Harrison example, above), or creating an extra-wide bike lane to provide cyclists with more maneuvering room and more protection from car doors.

Another challenge for bike lanes on streets with right-running tracks and platforms is routing cyclists safely through the “pinch point zone.” Routing cyclists around the platform to the right helps cyclists avoid being pinched by streetcar, but it presents new challenges by introducing conflict with pedestrians and visibility concerns as cyclists are moved farther away from the sight of drivers. Sidewalk detours should only be considered if they are on a flat or uphill grade (so cyclist speed will be controlled) and where a grade separation can be created between the pedestrian zone and the cyclist zone. Careful design of the re-entry point must increase cyclist visibility to motorists.



*This sidewalk detour around a transit stop in NW Portland successfully eliminated the “pinch point” danger as the curb extension joins the tracks, but has been a source of conflict for cyclists and pedestrians (perhaps due to a slight downhill grade that increases cyclist speed).*



*At this sidewalk detour in Portland, pavement markings and railings differentiate between cyclist and pedestrian zones.*



*This detour design in Portland, on a flat grade with a grade separation between cyclist and pedestrian zones, has been well-received to date.*



*Bern, Switzerland: Bicycles are routinely routed onto the sidewalk to bypass tram stops, but policy states that this is only appropriate on uphill grades.*

## Cycle Tracks

An alternative to bike lanes, cycle tracks offer many advantages to bicyclists: increased comfort, physical separation from vehicles, and greater clarity about expected behavior. (See definition in footnote 1, page 7.) Danish research shows that cycle tracks are very appealing to cyclists; one study showed that while bike lanes increase bicycle ridership approximately five to seven percent, cycle tracks can create bicycle traffic increases of eighteen to twenty percent. Cycle tracks eliminate the danger of “car dooring” or conflicts with cars entering or exiting on-street parking spots. Cycle tracks create maximum separation between cars, bicycles, and streetcars, and is the recommended facility type according to European experts (see Appendix F).

Along with these advantages, however, cycle tracks bring with them a major disadvantage: bicyclists are set back from the sight of drivers, making them more vulnerable to crashes at intersections as turning motorists may not be aware of them. Other challenges include maintenance, as regular street sweeping trucks cannot maintain the cycle track, and conflicts with pedestrians. Cycle tracks are a possibility for future streetcar installations, but must be designed carefully to increase cyclist visibility and limit pedestrian conflicts, as well as developing a realistic maintenance plan.



*A cycle track in the Netherlands: Bicycles, automobiles, and streetcars are all separated. (Photo: Shelly Oylear)*

## **Option 2: Parallel Bikeway**

A parallel bikeway separates the bicycle infrastructure from the streetcar infrastructure. This separation reduces almost all conflicts between bicycles and streetcars. The philosophy of separating different modes of transportation is common in bicycle-friendly European countries such as The Netherlands and Denmark, and has been applied recently with great success in Nottingham, England.

In the City of Portland, PDOT has often developed parallel bikeways adjacent to major roadways without bicycle lanes. Portland has found that parallel but direct bikeways located on lower volume streets function quite well for cyclists, and in fact are preferred by many cyclists who are uncomfortable cycling on major roads. Examples include:

- SE Salmon/Taylor, SE Lincoln/Harrison, and SE Clinton as parallel corridors to SE Belmont, Hawthorne, and Division Streets.
- SE Ankeny and NE Couch/Davis/Everett parallel to E. Burnside.

An option for future Portland Streetcar projects is to create high-quality parallel bicycle facilities (bicycle boulevards or bicycle lanes) that are both direct and comfortable, and that serve the same corridor. The parallel route may be instead of or in addition to bicycle facilities on the streetcar route.

## Left-Turn Opportunity

If bicyclists need to turn left across tracks at an angle less than 45 degrees, they are highly susceptible to crashing.

To direct cyclists to do this safely, one option is to create a bicycle-only signal phase for cyclists turning left from the right-hand bike lane or cycle track. Right turn on red is not permitted; instead motorist right turns are governed by a signal phase. Cyclists at the intersection prohibited actuate a bicycle-only signal (see photos to right), then receive a dedicated signal phase for left turns. Left turn pockets can also help create opportunities to turn left at an advantageous track angle (see photo, next page).

Another option is to direct cyclists to turn right into a jug-handle waiting area, and then make a left at a hard (90 degree) angle. This is not unlike making the move as a pedestrian would, in two stages. This technique is used in Australia and in parts of Europe.



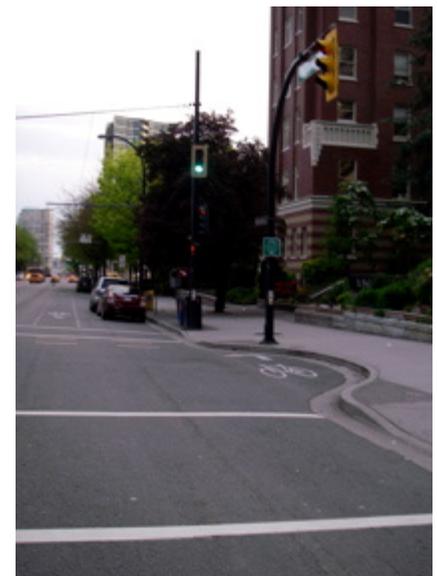
*Dutch cyclists actuate a bicycle-only countdown signal head and wait for a dedicated left-turn signal phase in Amsterdam.*



*Winterthur, Switzerland: left-turn accomplished from right side of road via bicycle-signal head/phase.*



*Troisdorf, Germany: Bicyclist directed to right to make a "box left" turn.*



*"Melbourne left" – Bicyclists directed to right in order to make left turn in Vancouver, BC.*



*Left turn bike pocket to encourage track crossing at a safer angle at Bond and Whitaker in Portland.*



*"Pour Tourner a Gauche" ("To turn left") sign directs cyclists in Strasbourg, France.*



*Bicyclists are directed off the street and onto a separated bike path in order to cross the tracks at a right angle at this Portland MAX stop.*



*After bicyclists have been directed off street they cross the tracks at a right angle at this North Interstate MAX stop.*

## Policy Framework

Further policy work is needed to improve bicycle-streetcar conditions. The Portland Office of Transportation and Portland Streetcar should work together to lead a planning process to develop:

- Clear policies related to bicycle integration in streetcar planning processes
- Design guidelines and tools for integrated streetcar and bicycle facilities
- Performance measures to evaluate facility safety on existing and future facilities

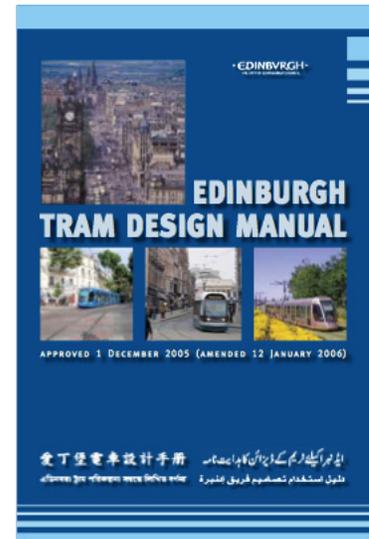
Portland is a leader in planning with community input, and this process should be no different; community input should be solicited.

## Programmatic Support

Educational efforts should be created to:

- Inform bicyclists how to bike around tracks
- Inform motorists and streetcar drivers what to expect from bicycles around streetcars
- Show bicyclists route options, including alternate routes that serve the streetcar corridor, and directing bicyclists to businesses on the commercial corridor
- Show bicyclists where and how to turn safely across tracks

Wayfinding and directional signage are essential and should be first priorities for programmatic support. Additional tools include creating maps and brochures, information posted at tram stops, articles for blogs and magazines, working with streetcar driver training processes, and/or hosting a training event for bicycles at the depot or a closed-off street where they can practice cycling on and across streetcar tracks.



*The Edinburgh Tram Design Manual includes facility designs that accommodate bicycles.*



*Swiss pavement markings show that space should be shared between bicyclists and pedestrians.*



*This cycling map of the Nottingham tram system shows signaled crossings, alternate routes, bicycle parking locations, and the meaning of pavement markings.*



*This brochure from Nottingham, England explains safety recommendations for bicycling around trams.*



*Signs can inform bicyclists about the safest way to cross streetcar tracks. (Photo: Brian Ellin. Used with permission.)*

## Conclusion

Portland has reached a critical moment in its multimodal transportation growth, as ever-greater numbers of bicyclists struggle with new challenges posed by a growing streetcar network. Yet with great challenge comes great opportunity, and Portland Streetcar, the Portland Office of Transportation, and community partners are poised to create a new model of bicycle-streetcar integration.

Portland streetcar designs to date have not provided adequately for bicycles, and as a result many cyclists report having crashed on tracks and experiencing anxiety and fear about the possibility of a crash. Based on an analysis of existing Portland designs, input from the cycling public, and international interviews and literature review, the following recommendations are made:

- Streetcar tracks and platforms should be center-running or left-running wherever possible.
- Bicycle facilities should be separated from streetcar tracks as much as possible by:
  - a. Developing a parallel, excellent bicycle facility.
  - b. Creating high-quality cycle tracks or bicycle lanes adjacent to streetcar tracks.
  - c. Offering 90 degree track crossings whenever possible, by positioning the bike lane or cycle track to cross at 90 degrees (see photo on page 9); signing and/or marking the best angle for tuning (see photo, above) and creating “Melbourne left turn” opportunities (see page 15).
- Develop a policy framework for future bicycle and streetcar integration, including:
  - a. Developing policies related to bicycle integration in streetcar planning processes.
  - b. Developing innovative design guidelines for integrated streetcar and bicycle facilities.
  - c. Developing performance measures to evaluate safety.
- Create supporting programs for education and wayfinding.

As with so many transportation-related issues, the nation looks to Portland to lead the way on bicycle-streetcar safety. With a combination of strong leadership, a sense of urgency, and a path forward, Portland Streetcar and the Portland Office of Transportation, together with community partners, will undoubtedly set the bar high for bicycle-streetcar integration.

# APPENDICES

## Appendix A: Survey Questions

SURVEY QUESTION	ANSWER OPTIONS
1. How would you classify yourself as a bicyclist?	Learning or timid Comfortable Confident Fearless
2. When you bike, you ride (check all that apply):	To work or school To social outings On errands On fast recreational rides On slow recreational rides Other
3. On average, how many days per week do you:	Ride TriMet (without a bike / with a bike) Ride Streetcar (without a bike / with a bike)
4. Please describe how these statements resemble your opinion or experiences.  "Tracks" means rails used by MAX, Portland Streetcar or freight trains.  TriMet is a valuable part of Portland's transportation choices Biking is a valuable part of Portland's transportation choices Streetcar is a valuable part of Portland's transportation choices I am comfortable biking on bus routes I am comfortable biking on routes where I have to ride parallel to tracks I am comfortable crossing tracks I am afraid of falling on tracks	Options: Strongly Agree Agree Neutral Disagree Strongly Disagree
5. Please describe how these statements resemble your opinion or experiences.  "Tracks" means rails used by MAX, Portland Streetcar, or freight trains.  Expansion of the streetcar system is essential to improving Portland's transportation system Expansion of the streetcar system will alleviate traffic congestion in neighborhoods and business districts I am concerned that streetcar system expansion will degrade existing bicycle routes I know what is expected of me when riding a bicycle around transit vehicles I find that TriMet drivers are generally respectful and safe around bicyclists	Options: Strongly Agree Agree Neutral Disagree Strongly Disagree

6. Please rate your level of comfort and confidence when, while biking, you must:

- Cross tracks at a right angle
- Turn right or left over tracks
- Merge over tracks
- Ride parallel to tracks
- Ride alongside buses
- Share the lane with buses

- Options:
- Afraid
  - Cautious but comfortable
  - At ease and confident
  - I avoid this
  - N/A

7. When you think about riding near tracks (e.g. streetcar and MAX), rank these route types based on your preference:

- On-street bike lane to the right of tracks
- Raised "Euro-style" cycle track between sidewalk and lane - see sample photo here
- Bicycle route on a different street from tracks

- Options:
- First choice
  - Second choice
  - Third choice

8. Have you ever fallen on tracks while biking in Portland? If so, please describe up to three incidents. If not, skip ahead to question 18.

Yes / No

9. Intersection or roadway stretch

Injury options:

10. What were your injuries, if any?

- None
- Bruises, cuts, muscle and/or joint pain
- Broken bones and/or serious joint injury
- Head and/or neck trauma

11. What caused you to fall?

18. When you bike, are there locations where you have felt endangered or encroached upon by TriMet buses?

If so, please describe up to three intersections or roadway stretches where this has occurred. If not, skip to question 25.

25. What is your full name?

26. What is your age?

27. What is your gender?

28. What city (or unincorporated area) do you live in?

29. What zipcode do you live in?

30. What is your email address?

31. Is there anything else you'd like us to know?

## Appendix B: Survey Comments

This table includes comments received as part of the survey related to bicycles and streetcars; the question prompt was, "Is there anything else you'd like us to know?"

COMMENT
1. I'd like to see the BTA get behind the streetcar system plan, but support expansion on streets like NE MLK (as opposed to Hawthorne or Williams/Vancouver) that won't impact bikes too much and that need less auto-centric transit options. 2. I'd like to see more of a concerted initiative to get the 7th Ave bike/ped bridge built over 84.
A good friend of mine fell on the Max track in the Pearl District (exact location unknown, but somewhere where the tracks parallel the road) and broke his hip, will never walk normally again, likely. I don't think he'll be filling out this survey, as he isn't a BTA member.
All tracks should be in the LEFT lane so that cyclists can continue to use the right lane on streets! The streetcar is the saddest excuse for public transit I've ever seen and would only be useful if it came more than once every half hour.
Elaborating on general streetcar issues, my experience is that because the streetcar needs to act like a car (there are no places that are "streetcar only" like with MAX), it inherently can't be any faster than a bus, so I don't understand how it's so much better except in terms of emissions. How does a streetcar mean better service for patrons compared to the alternatives? Considering the on-street tracks that can injure people when the streetcar isn't there, it might possibly be worse than a bus! On a personal level, I'd like to be able to get home from downtown in an hour or less, car-free. Right now, the only way I can do that is by riding my bike. (That's right, despite being a really sluggish bicyclist, it takes me 15 minutes *less* than riding the bus! And the streetcar? Forgetaboutit!)
Am cautious of crossing tracks on bike because of fall in Salem. Abrasions, but no permanent injury.
Anything that can be done to remove other-than-right-angle rail crossings on bike lanes/routes will be appreciated by all.
Anything to ease up traffic to and out of downtown during rush hour would improve safety for bike riders than the inherent dangers the tracks or buses will pose.
As a cyclist and tax-paying resident, I'd greatly prefer a better bus system than the streetcar network.
As a transportation planner, I appreciate what streetcar can provide, however the proliferation of rail tracks, especially at choke points (future Broadway Bridge extension) will make it very dangerous for bicyclists. I ride about 8,000 miles per year and frequently cross the Broadway Bridge, but I avoid eastbound Lovejoy and westbound Northrup at all costs. These areas are much too dangerous to bicycle. I commute daily to Gresham and each time I'm westbound crossing the MAX tracks at Burnside st/1205 I feel I'm taking my life in my hands. Ed Abrahamson
bicycling on the new lightrail lines on SW 5th and 6th will be impossible for me, since the tracks weave from lane to lane. adding busses, cars and pedestrians will make bicycling too hazardous
Biking is a wonderful way to commute, but does not work for everyone. It's a viable option. The bus system should be expanded; the MAX line and streetcar should not be expanded because they cannot pay for themselves. I would like to see more responsible bicyclists...ones who actually stop at stop signs and red lights, who obey all traffic laws as they would if they were behind a wheel, ones who have functioning lights and wear reflective clothing. Riding a bike does not give one permission to flaunt the rules.
Bus drivers need to be educated to be far more courteous and exercise extreme caution with bicyclists when pulling into and out of a bus stop. Tracks and bicyclists (and scooters) are a deadly combination
Buses are VERY careful, especially since the death of the teen @ SW Murray & SW Farmington. Most of my riding is on suburban streets- with no trolley tracks. I can handle occasional MAX tracks, but in Portland, the narrowness of the streets coupled with the tracks is scary, especially since my fall.
cars scare me more than any buses, streetcars/max, or rail tracks ever have.
Don't have a car, use bike for all transportation... I do really love being able to throw my bike on a bus or Max when needed (if I get a flat, to get out of town to ride out in the country, etc.). I don't use public transit regularly, though. I do think crossing tracks is one of the most immediate dangers for urban cyclists... I have known several people who suffered severe injuries (tracks hidden under huge puddle, forced into tracks by traffic, hit tracks at too oblique an angle, etc.). The newish streetcar tracks on 4th downtown (?) seem particularly dangerous, as they wander all across the road.
EUROPEAN BIKE TRACKS!!!!
For the most part, I think Tri-met drivers do an excellent job of watching out for me and being courteous. While I'm not too afraid of riding near/beside tracks, I don't think it's a good idea. I usually avoid them by choosing other streets. I don't know enough about "Euro-style cycle tracks" to answer Question 7.
From my viewpoint, the streetcar tracks are THE most common cause of injury accidents for cyclists in Portland. I don't know if they've caused any fatalities, but whenever a customer (I work in a bike shop) tells me that they crashed their bike I ask if it was downtown, if they say yes, I ask them if it was the streetcar tracks, then at least 90% of the time they say yes. It might not be making headlines, but many many many many thousands (possibly millions) of dollars have been spent on healthcare for these people.
Generally, I think Tri-met drivers are some of the best on the road. I can't recall ever seeing one drive with a cell phone, or while doing their makeup... Also, I have tried to take the street car from the Art Museum to NW 18th several times. The thing is so slow and useless, that unless it is there when I get to the stop, I can walk the entire distance along the tracks and not have a single streetcar pass me. Those are the days when I wished I had just biked in the first place.

COMMENT
Generally, TriMet Ops are aware of bicyclists, but they have lots of distractions as well; Op training should be a constant for TriMet. Streetcars are more predictable and tend to reduce auto traffic and speeds in lane with tracks. Broadway would be better with Streetcar as it would help reduce some of the excessive traffic speed. Tracks must always be crossed with care, especially when wet, but I used to ride up NW Northrup between the tracks with no problems, taking care when "exiting." Visibility and predictability are the #1 requirements for bicyclist safety. Motor vehicle speed is the #1 threat to bicyclists.
Given a choice between riding parallel to a track or bus, it'd take the track. At least the track has a known path, while most buses are unpredictable and have many blind spots where they will overlook to notice a bicyclist. Bus drivers 40% of the time do not give right of way to bicyclists, I'm not saying I would ever challenge a bus, but given that I am clearly passing a bus - the bus does not have the right of way the instant they turn on their yield light.
Glad you are asking the questions. based on what I see with the streetcar downtown, I have a hard time seeing how it improves transportation, relieves congestion, or gets cars off the road. But I'm open to the possibility.
Hopefully expansion of the streetcar system can be done w/out degrading existing bike paths and routes. If laying new tracks hopefully there's a least room for a nice bike lane where appropriate.
How can I help push for "European" Style bike lanes?
I actually like the concrete between and next to streetcar tracks. It's more reliably smooth than most downtown roads. However, it takes some planning to be able to cross tracks safely. My questions about expanding the street car system are more about cost efficiency and affordability.
I actually think Tri-Met and public transport are extremely important and I don't want to discourage new systems at all. I just want to make sure there aren't dangerous tracks with no other roads or bike lanes to the right. There are some places that just don't make sense. Coming downtown from anywhere North is easy but getting back out is ridiculously difficult. There needs to be both egress and ingress. Also, the streetcar seems a lot slower than MAX. I have taken it before but it almost seems faster to walk sometimes. Is this just a function of the city placement or are streetcars actually slow? If all the streetcars on the Eastside are as slow as the current one it might not be that worth it.
I am a very new rider, and new to the Lents neighborhood. I have not biked near tracks much at all, so am still unsure of it.
I am a year-round bike commuter and enthusiast. I ride about 75-100mi per wk in winter and 100-250mi per wk in summer. I am very comfortable in Portland traffic and on the open road. Trimet drivers are superb in my opinion. I don't know what "you" mean by "parallel to", "alongside", and "share the lane". 1. I find that riding between the rails ("my" parallel) is the safest option on many of the streetcar routes. If you ride to the right you get doored. Always the biggest danger when it gets tight comes from a cyclist encouraging cars to try to pass. If you don't want cars to pass you, take the whole lane. 2. I am comfortable alongside a bus if we each have a lane. This is "my" alongside. You did not say how many lanes in that question, so you'll get fruit salad for answers. 3. When I share the lane with a bus ("my" share the lane) I get all the way out in the lane so the we use the lane sequentially. Some responders might think you mean the same thing as "alongside". Again, you'll get potluck results. Streetcars in traffic lanes are for LIDs, not for transportation. Rubber tires are better in traffic, and they are LOT better for bikes. It is true that trains can't swerve into you, but it is also true that electric trolleys "can" avoid you (though that kid in the Beav died anyhow). The streetcar has been wonderful for development, and meaningless as a transportation option. If there are rails there must be a dedicated lane or else you have thrown it all away. Take a look at your "euro" picture. It also becomes obvious when you compare the actual outcomes of Max and the Streetcar. Enjoyed the survey. Keep up the good work. Don't be stupid. Ignore the results from questions that are ambiguous, and resolve to write a better survey in the future. Don't put streetcars in areas that are already developed and gentified. They can't use them. Put in overhead wires and rubber-tired electric trolleys. They can be sleek. They can be retro. They can be Stealth or Flintstones. Anything is cheaper than a rail car, eh? Have some fun with it. But avoid rails unless you need them for development or you can dedicate a lane.
I am concerned about the plans for a streetcar in the N.Portland/St Johns' area.
I am concerned about the tracks that run along Northwest Front just south of where 21st comes in. While this is not part of the survey that you are doing, they are abandoned tracks that need to be filled in. They are at a very bad angle on the road and a constant hazard. It would be great if BTA could tackle this problem and have them decommissioned and made safe for cyclists. Thanks so much
I am entirely in favor of mass transit. I think bike commuting is an excellent way to alleviate the strain put on mass transit, especially in the high commuting hours in the morning and late afternoon. However, I would appreciate better and safer bike lanes in downtown Portland that offer bikers bike lanes (especially headed north in downtown) that kept bikes and buses and trams a healthy distance apart.
I am in favor of as much expansion of both MAX and Streetcar as possible, as well as expansion in biking, and do not want to see these thought of as in conflict with each other. Good design can make both safe, sometimes sharing the same street, other times on separate routes, and good design should be the expectation and requirement as we expand both options.
I am in full support of cycling and the streetcar. being from San Francisco, I am very well adjusted to riding with tracks on the roadway, however there must be thoughtful planning involved so there is space for all types of road users.
I am not concerned at this time about bicycles and train tracks, but if Portland builds a lot more tracks, this could become a significant issue. A lot of the other bicyclists I ride with are more worried about crossing tracks or riding next to tracks than I am. I don't think more streetcars are NECESSARY for Portland's transit strategy, but I like them. The biggest hazard I face regularly associated with buses is that their weight has warped the pavement in some bike lanes in the Lloyd Center area (e.g., the west-bound bike lane on NE Multnomah just east of 16th and next to the Lloyd Center). These bike lanes now have some spots that are very dangerous as a result of pavement damage.
I am very concerned about the new MAX tracks through downtown Portland. These tracks do not follow a straight line. This causes cyclists to have to weave back and forth over the tracks. This will become more dangerous when there is more car traffic on these streets since cyclists will be crossing over tracks while avoiding cars.
I avoid riding on streets with tracks downtown because when riding in traffic I like to preserve options for sudden avoidance maneuvers. The presence of tracks reduces those options.
I believe strongly in mass transit, but I'm starting to have some major issues with how the MAX is being planned and implemented with respect to coexisting/supporting other modes of transit, especially biking. I'd love to talk at more length about this with someone from TriMet planning. I don't want to gripe, but to give feedback as someone who uses TriMet and bikes daily who also has a lot of experience with other cities' systems.

COMMENT
I believe the BEST way to avoid traffic and track difficulties is to ride my bike on streets where there few of these potential conflicts. It seems like a matter of ego and stupidity to ride a bike on SE Hawthorne, Division, SW Broadway, Burnside, Sandy, and similar streets when there are perfectly safe and sand streets one or two over going the same direction. Thanks for the survey. Kirk <a href="http://www.kirkdeford.com">http://www.kirkdeford.com</a>
I commute by bike from Sherwood to Cornell/Hwy26 without the aid of Tri-met, I'm not afraid to take my lane, I use left turn lanes at stoplights. I am fearless (or it that foolish) in traffic. In general tri-met bus drivers are courteous . When I ride downtown I avoid any street with parallel tracks on it like the plague. It's just too dangerous especially when vehicles are stopped (illegally?) blocking the bike lanes and forcing bikes into or very close to the tracks. It's just very scary.
I consider all transportation options as working together to reduce car use. I don't think that conflict with buses or Max tracks is so much of an issue in Portland when it's all said and done. Creating greater bike access to/through various parts of town is the key issue. Thanks for your efforts!
I do not believe that expansion of street car routes are am impediment to cycling in Portland. However, the best solution is designated bike routes on non-street car streets. I do strongly feel that TriMet bus drivers frequently operate as if they have the right to do whatever they want on the road and are generally oblivious to all other traffic - bikes and cars. I have seen buses run red lights, have had to swerve to avoid being hit by buses that cross over yellow (middle of the road) lines, slam on the brakes to avoid buses turning right on top of me, etc. For this reason I always ride/drive with extreme caution around buses - they are the biggest menace on the road.
I don't hate streetcars; I just hate streetcar streets that force bicycles to ride among the tracks. A nearby bike route is good, but people will end up riding bicycles on every street with tracks, and those streets need to be safe, even if it means no on-street parking.
I don't think I fully understand the european bike lane, but anything that gets me away from cars makes me feel safer. I would rather ride alongside max or a streetcar that alongside cars
I don't think people will ride streetcars unless they're free. If they're not free they can ride a bus and it's probably faster. I don't want streetcars on bike blvds. We worked to get those for bikes. I know they're probably great places to put streetcars but if you put streetcars on the bike blvds. then they're not great places to bike anymore especially for new inexperienced bikers that we're trying to get on bikes! I hate riding on streets with tracks if I know I'm going to have to eventually cross them and I ride my bike to work all the time.
I feel much more comfortable around the streetcar and max than around buses because they do not change lanes into the bike lane and they run a predictable course. I feel this is much safer than buses and am personally comfortable around the tracks.
I feel somewhat safer around the Street Car and the Max because they are in a very defined area (i.e. their tracks) vs. busses and other automobiles that can swerve or turn in front of me unexpectedly. At least with the Max and Street Car I know where they are going.
I figure it's only a matter of time before I fall on the streetcar or max tracks. The location I predict is right outside the new OHSU facility in the South Waterfront area - at the corner of SW Bond and SW Whitaker where bikes have to turn across the tracks. At least there will be help nearby.
I find tracks crossing at a slight angle to be the most worrisome issue, especially since motorists may not understand that I am weaving through the lane in order to reduce the potential of a crash. Let me be clear by example. If the track is "drifting" to the right over my lane, I will hug the right side of the lane and then cut sharply to the left in order to cross it. I always worry that a motorist will assume that is a good time to try to pass me. Do you understand? Similarly, when I am traveling down 10th (is that the one the streetcar is on?) if I am "stuck" to the right of the tracks, I have to maneuver a sharp snap in order to move to the left in order to make a left turn. I am over so far to the right that I worry that a motor vehicle to the LEFT of my chosen lane may take my lane without my noticing.
I had a terrible fall on the tracks that gave me a six + week concussion, stitches above my right eye and over \$8000 in hospital bills. I think there needs to be absolute defined bike routes. I also think it should be illegal to ride on the same streets as the Max or Trolley. Because people just don't realize how fast an accident can happen with these tracks. I would just prefer a street parallel to the max and or trolley for bikes only just like the public transportation gets.
I have bike commuted from N. Portland to the SW 11th & Taylor area for many years, and there is NO GOOD WAY to get to the Broadway bridge without either going out of my way or riding parallel to (and merging over) the streetcar tracks. Check a map -- SW 12th is as good as it gets, and it's slow and congested, with no accomodations for bikes.
I have had good luck with trimet bus drivers paying attention. The tracks down lovejoy scare me a little but I still ride there.
I have no particular bad feeling about TriMet operators as a class of people. As a whole they do a difficult job very well. However, there are some who display clear bad feeling against cyclists. I can understand that frustration occurs in any profession but there is no need to take potentially dangerous actions to make up seconds. If anything, buses and bikes make a better mix than buses and cars. I think trains are great, but train tracks and bikes are a lousy mix. 5th and 6th avenues downtown, with a mix of cars, tracks, and bikes, shape up to be a nightmare. Striping may help bit but if the design is no better than other local examples I have no great expectations.
I have seen people fall on the tracks, but I've never seen anyone get seriously hurt.
I have slipped on wet tracks in other cities when I was younger and less cautious. I got a bit bruised and sprained which healed long ago, but the lesson remains. I have been scared by buses, but this has only been when the driver could not see me. I have always found them to be respectful when they know I am there. I am skeptical of your email privacy statement.
I haven't fallen on max tracks, but I have been riding with two friends who did.
I hope that cyclist and pedestrian safety will be important considerations in the design of new streetcar and light rail routes.
I know the local bus routes very well, and I generally avoid them, except for unavoidable small sections. For instance, my daily commute involves only four intersections at which I really have to be on my game. Yes, I feel cautious at those intersections, but I don't mind being scared for 30 seconds a day each way. So far, no accidents at those spots(jinx). On the other hand, if I had to deal with wet streetcar tracks as well as cars, trucks, and busses at those intersections, I might wish to dismount, and cross as a pedestrian.

COMMENT

I know there is a lot of controversy about mixing streetcars with bikes and cars. It can be done well. See, e.g. Barcelona and Amsterdam. I actually think that putting all forms of traffic together slows the whole deal just a bit and that is good. It spaces transportation and makes alternative commuting palatable and interesting. I've been commuting solely by bike, as well as grocery shopping, etc. for 20 years and commuting in general since the early 70's. The availability of bike lanes has definitely improved the process and encouraged more folks to try it. Create more opportunities for bikes, not less. Tracks are a BIG deal: make the lanes user friendly for bikes. That stretch on Lovejoy is hard for bikes; I used to ride it everyday. The part where it widens down near the Office Depot store all the way to the Hoyt street post office should be the exemplar to which you point for design. Good Luck. Pete Petersen

i like streetcars, but the bike routes along the Lovejoy route are a deathtrap. i'm sure we can do better.

I liked Euro-style bicycle lane should built-in Portland area.

I love the streetcar, and I think the area the streetcar services should be expanded. I am a daily cyclist, and I don't want to lose the wonderful bike avenues already available. Bikes, bus, and streetcar lanes all need to be expanded.

I love to ride my bike and am in excellent physical condition but am continually decreasing my routes because train tracks, buses and cars provide too much danger for bikes. I do not believe motorized vehicles and bikes can share the same routes with any safety for the cyclist. I feel like a major and important form of recreation, gas saving and health is being taken from me.

I no longer support the expansion of the streetcar system because it makes cycling so difficult and scary. I think the city needs to prioritize cycling safety.

I only vaguely remember one or two occasions when I thought bus drivers were overstepping their bounds in doing their jobs. Car/truck drivers are far more dangerous. I quickly learned how to cross tracks without getting stuck and I'm careful. Now I have wide tires because I have an Xtracycle so that I can comfortably carry more weight, but I'm still careful. Whatever one drives in Portland, one must drive defensively.

I prefer busses, street cars and trains to regular drivers in cars. They are pretty predictable and stick to their part of the road. I have never had a street car or a bus suddenly right hook me to grab a parking space...

I prefer more bus service vrs. light rail, (even as a biker!) I commute by bike from SW thru downtown to N. Pdx. almost daily, especially in the 6 months around summer. Geneva Switzerland is a prime example of a high-density city with great bus service and less light rail or streetcars (than pdx). I feel that the streetcar is less cost-effective than the bus. What to use does depend on whether the future pdx economy will have scarcity in fuel or electricity. Actually I think the electric bus with overhead wires like San Francisco would be more cost effective than streetcars, and solve the fuel vrs. electricity energy supply problem.

I regularly bike to work from Beaverton to downtown Portland and I feel far more "endangered" from cars than from buses. I hate riding alongside tracks - they're slick and potentially very dangerous to bicyclists. I've fallen on them decades ago, but never in Portland. I do not think the streetcars are going to solve that much in the way of traffic congestion, but I am not opposed to them - I might be really wrong! :-)

I ride almost everyday (since age 10 or so) and have had 2 bad accidents in my lifetime - 1 of which has been from crossing tracks. I hate riding anywhere near them! But, I like the fact we use the streetcars. I just avoid them like the plague. Please do not mix bike paths and streetcar tracks.

I ride along the #15 route from SE 74th to SE Grand in my route and to my recollection have never had a safety problem with a TriMet bus driver. As a youth I did have a bike accident involving rails in another city. The rails were crossing the road at about 165 degrees from my path and I got caught in the rail and forced onto a high speed limit road. Since then I have avoided riding on roads with rails. I particularly dislike the new transit mall rails and the StreetCar rails downtown which I think are very unsafe for cyclists.

I sometimes feel endangered by other cyclists, mainly because I am a relatively slow rider and most cyclists who pass do not give a verbal or bell alert. This is of particular concern on the bridges where there is a concentration of riders mixed with pedestrians. Buses and bicycles are a bad mix. I don't ever ride next to a bus. They have enough trouble watching for pedestrians. Although streetcar rails can be dangerous, at least the path of the streetcar is predictable.

I support rail as an efficient mode of public transportation. Cycling public NEEDS to be educated how to cross rails (in all weather); automotive public NEEDS to be educated that bicycles will drive weird near rail lines and crossings. TV ads followed up with heavy fines for offenders.

I think bike lanes should not be on the same streets as the max or streetcar. Just seems always dangerous...

i think it's possible for all of us to get along and provide light rail and cycling routes. it may require the sacrifice of parking spaces or lanes. as a primary cyclist, I'd prefer more dedicated right of ways for bicycles than shared spaces. i see cars and trains sharing much more equally than bikes and cars or bikes and trains

I think riding on streets where Tri-Met has a heavy presence is asking for trouble. The only exception I can think of in my area is NE Knott, where you have a very wide street with some bus traffic. That feels fairly safe to me. Otherwise, I avoid it. Railroad tracks, whether light rail or street car, are potential trouble. I've never crashed on them here, but I'm wary because I've crashed on them in other places. Also, I don't ride in the rain here, so my exposure to wet tracks is nil. Wet tracks are far worse than dry ones, imo.

I think that adding street cars is a good idea-- but I wouldlike to see tracks more carefully engineered to accomodate bikes. I also would like to see more training for Tri-Met drivers, and perhaps for cyclists as well. I ahve seen some cyclists do pretty crazy things as well

I think that proper rider education/skills is a critical factor to avoiding problems with the PDX rail tracks. I have never had any issues and feel comfortable around them, but have ridden with people who are genuinely afraid of the tracks - I think it is a more psychological fear than one founded on thier experience. Once you understand how to ride over them and that you shouldn't apply your brakes while crossing tracks, they are fine. I think bike shops should have "test tracks" set up to show new riders how to properly navigate them.

I think that streetcar and buses are essential to the future of Portland and that we need to find a way for bikes and transit to work well together. Thanks!

COMMENT

I think the biggest thing needed are safe routes through downtown and northwest Portland. I am pretty confident but I know many less confident riders who avoid going downtown. I think many people who work downtown would be more likely to commute by bike if they didn't feel like they will get run over. I think it is especially attractive to downtown workers with the parking issues there. I think the streetcar expansion is a great idea. I think drawing the bike lanes so they cross tracks at 90 degree angles helps a lot. I feel like they do a good job on N Interstate near the Steel Bridge and especially good in the new waterfront area of southwest. NW Lovejoy has been bad in the past but I believe was improved last time I rode that way.

I think the streetcar is great but the tracks truly present a hazard to experienced and inexperienced cyclists alike.

I think we should be cautious about the design of streets with tracks and bikeways...especially turns, track junctions, and where car speeds and volumes are not lowered. The city needs to initiate a bike box level marketing effort to build comfort among bikers about tracks and how not to ride along the curb side of tracks. Also, I generally like to ride between the streetcar tracks in the as it is almost a defacto bike lane where none exist and most drivers tend to avoid them.

I think your questions may be a bit skewed - with proper design, streetcars and bikes can co-exist very comfortably. Please don't send me any emails other than the results

I took this survey under the assumption that I ride my mountain bike with wider "slick" tires in urban areas. My thinner wheeled fixed gear 10-speed would change my answers, but I choose not to ride that when I go downtown. I feel safer on the rail streets with this bike, and I consciously make this choice as a responsibility to my safety.

I work at a bike shop in inner SE and regularly deal with customers who have fallen on rail tracks. My coworkers continually remind customers test riding new bikes to mind the tracks.

I work in a dental office and have seen a few face vs. pavement injuries as a result of the downtown street car tracks. That may be the cause a my "track fear"!!

I worry a lot more about crossing freeway entry ramps in Washington County, particularly US26 at Cornelius Pass, than I do about rail tracks in Portland. As a recreational rider, I can generally avoid routes that have MAX and streetcar tracks. It could be a different story if I was a cycle commuter.

I would love to see the city test out the use of cycle tracks and bike only signals at strategic locations. Bike lanes are only a painted line, and im glad for we have some of them, but often feel sandwiched between potentially getting doored and traffic on busy streets. I have not personally fallen due to current streetcar or max tracks, but have come very close especially when its wet out. Friends of mine have fallen due to tracks and I know to watch myself. In parts of old industrial areas where unused tracks still exist they serve as an unnecessary hazard. The city should look at removing them in the inner SE and NW. Thanks for listening.

I would much much rather see trolley buses like they have in Seattle than more streetcars or more max trains.

I would much rather see money put into MAX than into the streetcar UNLESS people start paying to ride the streetcar. Perhaps a few downtown streets can be designated as "bicycle-only" lanes? On my bike, I try not to get anywhere near the streetcar or its tracks. Thank you!

I'd love to see street cars on sandy, and I think we could incorporate a separated raised bike lane by removing all parking on Sandy. The on street parking does not represent that many spaces but significantly impacts traffic on sandy as cars are often stopped in the road as they try to parallel park. This is a dangerous situation for all road users as everyone has to merge left in an attempt to go around. Also the cars when parked represent a dooring danger to bicycles. The addition of street cars to a street is an ideal time to remove parking.

If possible, I avoid roads with streetcar tracks. For example, I do not ride east on NW Lovejoy if I can avoid it. I ride towards the middle lanes on SW 10th and 11th downtown.

If the streetcar doesn't ride along the curb but in the left lane, it would offer more than enough room for bikes and cars to operate without any danger - especially of a car getting doored by the streetcar. That danger of people stepping out into the path of a streetcar after parking will probably make the streetcar drivers stay well below the speed limit. Also, being in the left lane would make it safe for stupid bicyclists who try to ride - and crash - on the rails. I NEVER ride along them unless I can be in another lane.

im a bit more unflappable about tracks and buses and the like than most, having been a bike messenger for the past 14 years, so my answers are necessarily skewed by this experience. having ridden in cities (toronto, amsterdam, etc) where there are way more tracks than here, i am confident, however, that cyclists in portland will adapt, and hope i am right, as light rail totally kicks bus ass as a public transportation format.

i'm afraid to cross tracks even if i don't have to bike along side them. they jerk my bike \*a lot\* and i feel as though i'm going to get a flat. it's especially scary at intersections like near the lloyd center MAX stop near the double tree inn intersection. eEEP.

I'm comfortable on a bike because I grew up in The Netherlands, I'm also very happy that Portland is so bike friendly that I can get around on a bike. However a bike lane is a far cry from a "fietspad". I am very uncomfortable near tracks (I cringe when I see other bicyclist near them), I'm also very uncomfortable on bike lanes painted on busy roads such as Greely (I ALWAYS avoid them). I usually ride on neighborhood roads, sometimes on side walks. I ride to down town once a week, I find it somewhat confusing to find my way around legally. I try to avoid going the wrong way on one way streets but wonder how I should go north and not have to deal with the tracks on 10th(?)ave. One more thing: bike safety should be a MUST IN elementary schools.

I'm confident that we can get bikes, buses, and street cars to play nice together. However, I hate cycling near the street car tracks. Typically, they're on the right side of the roadway where bikes typically travel. Instead, to avoid the tracks, I ride on the left most side of the roadway. I feel this raises levels of uncertainty for both me the cyclist and the nearby drivers. None of us know what the 'rules' are when there is no bike lane, I'm at the left most on the roadway, and street cars come rocketing along. And I love taking the street car too, so let's promote them rather than cars and make this multimodal stuff work!

I'm glad to see you are looking into potential rail/cycling conflicts. While I'm glad to see an expansion of Portland's rail system, I'm very concerned about the potential for creating cycling hazards. Perhaps Portland should investigate whether there are any technological options for making rails safer to cross at critical places, such as devices that can be attached to rails that minimize the chance bike tires could fall into the track groove, or products to make the rails less slippery when wet.

COMMENT

I'm very concerned that the new "NEXT BIG THING" has not incorporated bike safety into their design! this Max line going side to side along these new streets is a BIG PROBLEM. I lived in Denmark for a year. WE NEED DANISH STYLE INFRASTRUCTURE WITH SEPERATE BIKE LANES THAT ARE AS WIDE AS CAR LANES AND THAT ARE ELEVATED THREE INCHES ABOVE THE CAR LANE, WITH PEDESTRIANS SIDE WALKS ELEVATED THREE INCHES ABOVE THAT....COMPLETE SEPARATION....WE ARE LOOKING TO FIND "A BEST COMPROMISE" WHEN THE BEST SOLUTION IS OBVIOUS. The problem with a compromise is that IT STILL ENDANGERS AND HEIGHTENS THE STRESS LEVEL CONSIDERABLY FOR BIKES, PEDS, BUSES, TRAINS, CARS, ETC...THE STRESS LEVEL OF THE USER EXPERIENCE IS SOMETHING THAT SHOULD BE INCLUDED WITHIN YOU STUDY. IF THESE TRANSPORTATION OPTIONS ARE SEPARATED COMPLETELY, THE STRESS LEVEL DROPS CONSIDERABLY!!!! THAT IS TELLING OF THE BEST ANSWER!!!!

In general, I am opposed to much of the expansion of the street car system. For the large cost I think it will provide very little usefulness as a transportation mode and will have little to no effect on reducing traffic congestion. I also think it will degrade cycling conditions by making streets more difficult to ride on. I would much rather see the money spent on improving the roads in the downtown area; many downtown area streets are falling apart or otherwise have rough, bumpy pavement that is uncomfortable to ride on. The excessive congestion in the downtown area is also bothersome, and I doubt street cars will mitigate it.

In NW, the streetcar tracks on 10th Ave feel very unsafe when I'm riding my bike, and there really isn't an alternate route. I end up riding between the tracks. The curbs that come right out to the tracks are a huge problem. I hope new streetcar tracks and stops are MUCH better designed for bicycles. PS: email addresses are not a valid way to verify unique responses. I assume you know that.

In regard to cycling and transit, the curb extension and transit stops on the curb extension are also danger areas to be avoided.

It's getting better, but there's still room for improvement. Wet RR tracks are treacherous and TriMet bus drivers seem to be a little fed up with cyclists. I'm not the hipster brakeless-fixie guy either, I'm dressed in bright colors with reflectors & lights.

I've been a serious cyclist for over 25 years. In all that time I've been fortunate enough to have only fallen on the road 3 times. One of those times was two weeks ago while crossing trolley tracks in the NW. They were amazingly slippery - like ice. I'm guessing that many more cyclists have and will fall due to the tracks when they're wet. I'm not sure if there's any thing to be done about it, but it seems that some sort of 'scoring' (like a file pattern) could be made to the tracks at key intersections. Just an idea....

I've bent a bicycle wheel on streetcar tracks. No injury, but lost time and money dealing with it. What a shame that the various "alternative" modes of transportation come into conflict with each other.

I've found bus drivers to be considerate and careful. I've only had positive road sharing experiences with Trimet buses. No complaints about street cars- I rarely share the road with them.

I've had streetcar conductors honk at me continually when riding in the traffic lane where the streetcar tracks run. Very disturbing.

Judging from the current line, the streetcar itself is basically a non-issue -- cars are so few and far between that the tracks (which are tricky, but manageable) are the major issue. Even when I do encounter the fabled streetcar, it's very easy to predict what they're going to do because they basically have one degree of freedom. I definitely prefer dealing with tracks over riding near buses, which are noisy, stinky, and tend to lurch out unpredictably across other lanes of travel. Some operators are quite considerate, but quite a few "do not" give a shit who's behind them -- they've had that little YIELD signal flashing for at least half a second, and they HAVE THE RIGHT OF WAY, GODDAMNIT, and all ye behind them shall brake or be crushed. ;>

Just moved from seattle, i've crashed on tracks in seattle at trail crossings when I got my wheel caught, so i'm a little paranoid. Some of the bike lanes here really suck, a lane on a 4 lane major arterial with an 1-5 on-ramp is pretty sketchy. Conversely, the bike streets are really cool, as long as i go relatively slow to watch out for cross traffic.

Keep trolly lines on separate alignments from bike routes.

Leaving work, I take a left turn on 11th onto Holladay where there is MAX tracks. I have had a train come up behind me blowing its horn on two occasions and have felt threatened. I don't think there is actually space for train and bike here so I turn off at the next street. I try and just not go this route if I see a train heading west. A bit scary though.

Let's spend the money getting people out of cars. I think Tri-met could work better with bicyclist, but I think bikers are bigger problems to busses than other way around. A couple time a month I see bikers cutting off busses (approach to Hawthorne bridge). Pretty stupid and gives bikers bad names. I can only think of couple of times I have seen busses encroach on riders. As the rails, I would rather have a lot more rails as they currently are, than limiting rails and keeping cars on the road. We need more and more mass transit to give drivers less and less excuses to drive.

Like everything in bike commuting, it is experience and often a matter of expecting people to pull right or out in front of you and knowing how to react quickly. I know my commute well and know the intersections where I will likely have someone invade my bike lane, car, bus, etc. I do feel more comfortable that I have a bike lane and on North Interstate (north of Kaiser) and Denver I don't have to compete with buses. Downtown, at least we're all going slow enough but its always a game to figure out when you should wait or when you should go around and pass on the left. Southeast Ladd and crossing over to Clinton is one that can be competitive with bus #10. Overall, I think trimet buses drivers are good and cyclists have to be aware that they have big blind spots and not to ride right beside it near busy stops. I make sure if I do come from behind that I pull in front of the bus (often in the pedestrian way - my version of bike box) so they can see me. I cross over tracks every day and it is always a bit unnerving on a road bike when turning. I try to avoid the street car lines (fine if you're going straight)as it is often not clear the best place to be and you have to position yourself so you can have the best sharp angle when you're turning. I'm also not liking the concrete quality that was laid around the new tracks on 5th and 6th that also mark the intersections. Its very slick in wet weather and I have had near wipe outs on several occasions turning from a east-west street onto 5th/6th.

Maxes are better than streetcars because of their wide turning radius. Streetcars tempt designers to construct corkscrew routes that are slow to get riders from one place to another (It's often quicker to walk), and also leave accute-angled rails scattered randomly around town. (eg, 4th and Harrison, 10th & market). Also, one page of the survey took me back to the start when filled in. But I didn't have much to say about busses encroaching that hasn't already been said.

COMMENT
Most bus drivers are cautious and considerate. Conflicts are rare. As for MAX/Streetcar tracks, crossing at anything other than a right angle guarantees disaster. In cases where tracks cross at an angle, such as approximately 92nd and E Burnside, there should be signage encouraging cars to avoid passing cyclists over the tracks, allowing cyclists to cross the lane diagonally to line up perpendicular to the tracks. Maybe a colored bike lane?
Most bus drivers are very considerate of cyclists. Most streetcar tracks are dangerous and I always try to avoid them whenever possible. Falling on them once left me with the largest set of bruises I've ever had and prevented me from working for several days - I am VERY cautious and apprehensive around them now. (The fall happened 5 years ago and I still feel the same way.)
My experiences with Tri-met have been mostly good over the years. When I am on my bike I usually avoid being on major transit lines for too long. My school is next to the streetcar tracks on Lovejoy so I deal with those regularly as well and freight tracks. I am not so much concerned with my ability to cross the tracks while in the lane with them or turn etc. My concern comes from the not being able to react as swiftly. Say if a car pulls out in front of me I can swerve quickly to miss him but will I be able to swerve quickly and not fall from the rails. NW is known for its terribly distracted drivers.
My main problem with riding parallel to tracks is if the sidewalk is very close so that it's narrow. I don't ride in NW often, so I can't remember it exactly right--and I think it was a temporary bike route, so the problem may be fixed right now--but the main place I remember feeling uncomfortable was westbound on Northrup, I think (or maybe it was Lovejoy??) right alongside the tracks in the industrial area, maybe around 16th or 17th.
My major concern/observation based on watching the construction of the new N-S MAX tracks downtown is that 5th and 6th are no longer appropriate bike routes. Bikes should be encouraged and better accommodated on streets such as 4th (northbound) and Broadway (southbound). Where bikes use 5th and 6th (and other "tracked" streets, they should be directed to use the curb lane farthest from the tracks.
My primary bike routes are down Everett, shared with buses, and Lovejoy, shared with the streetcar. I've never had a real problem with either one. Bus drivers have been courteous and allowed me to clear a corner before pulling into a stop on Everett. On Lovejoy, I ride in the lane with the streetcar and behave like any other vehicle. I've never had a problem.
My roommate crossed the max tracks and bent her tire. She had pretty bad roadrash, and I believe she ended up with a concussion, her shoulder and hip was sore for about a week. I'm a fairweather cyclist and I like bike paths that only share with pedestrians and dogs! :0) Portland drivers AND cyclists are NUTS and there are very few covered bike racks (it rains a lot around here)... I will stick to the amazing and wonderful springwater trail!
My route to work crosses the Max tracks in three places--Burnside just south of Gateway TC, Cascade Station, and Mount Hood Avenue--and in all three places the tracks cross the road at a sharp angle. This is far more dangerous than crossing at a right angle. I'm not comfortable riding across at all--I get off and walk instead.
My tracks crash happened ~20 years ago; I learned from the experience.
On question 6, I wanted one more option, for "uncomfortable," which is how I would describe how I feel about cycling near tracks.
Overall I find Trimet drivers and the general Portland population of drivers to be courteous and respectful toward cyclists. The biggest problems I have are with the MAX and light rail tracks. I now avoid traveling east on NW Lovejoy with my bike to avoid those problems. I still travel west on NW Lovejoy, but I feel the tracks in the westbound lane at the intersection of NW Lovejoy and 16th are a major hazard for cyclists.
please don't forget to engineer bike trans along with the streetcar expansion.
Please work on getting the old, unused tracks out of SE 2nd Avenue. I know many people besides myself who have been injured by them while cycling.
Portland needs to either: 1) keep more cars out of the city or 2) start putting those Tri-met tracks above or below ground... BUT NOT ON THE ROADS that are already full.
Push for the Sullivan's Gulch trail. The best way to avoid street car tracks is a totally separate trail like the Eastbank.
Street sweepers should frequently clean next to track lines or bus routes. This would help keep cyclists out of the major part of lanes due to debris.
Streetcars displacing bike lanes on a major commercial street is okay as long as a parallel bike boulevard (with auto traffic diverters) can be created on a local street in the same vicinity.
Streetcars need to trump concerns about bikes crossing rails. We can come up with a way for bikes and streetcars to work together - but there are people who cannot ride a bike (old, young, disabled, scared) that NEED the streetcar system to expand to get out of their car.
streetcars should be taking car lanes not reducing access for bicyclists and pedestrians. Streetcars also need their own lane, with full right of way over cars.
streetcars shouldn't go on bike routes
Terrible stretch of route planning on NW Lovejoy for bikers from the Eastside attempting to cross over Broadway bridge into West Hills. Addition of trolley tracks makes cyclists choose either sharing Lovejoy with streetcars or taking a stopsign ridden parallel route. Should create more cyclist friendly East to West route and vice versa for those living in NE Portland.
thank you for asking, I am truly concerned about the eastside light rail.
Thank you for getting community feedback. I do think that streetcars, light rail and buses are important and that they can co-exist with bikes when there is proper planning and education.
Thanks for the opportunity to comment. In general, Portland does a great job accommodating bikers. I am concerned about the expansion of streetcar onto bikeways. I am in favor of light rail knowing that it does make it harder to bike on the same street as the train.
The more safe routes for biking located away from congested roads and traffic the better. People feel safer when there is at least a distance separation but preferably a physical separation between vehicles weighing thousands of pounds versus a 25lb bicycle. The bike blvd's (esp inner SE) are a good start but more can and should be done.

COMMENT

The most spectacular bike accident I've witnessed involved streetcar tracks. A bicyclist, eastbound at high speed on Lovejoy at NW 14th, dropped both wheels into the track groove. The bike froze and the rider went over the handlebars, did a complete 360 degree somersault in the air and landed on his feet! He was OK but the front wheel on his bike was trashed. It was not a bad outcome, but definitely made me more nervous around MAX/streetcar tracks.

The new WES line on Lombard (between Farmington Rd. and BTC) was designed totally without bikes in mind. The tracks cross Lombard at very low angle through two intersections. That area is an accident waiting to happen with bikes trying to cross at a higher angle and swerving out into traffic to do so. Unfortunately, that is one of the only approaches to the BTC and MAX. Then the buses coming out of BTC seem to target bikes (described above). Thanks.

The path of the new light rail is tricky. Once cars fill the road a biker will be in a very tricky situation when they are in traffic and suddenly realize they the rails are changing direction beneath them. Trimet must have some kind of agreement with OHSU. First, have the biker weave through rails. Once they fall they can ride the light rail (\$1.75) down to the TRAM (\$4) and then head straight up to OHSU (\$????)

The surface surrounding the tracks is important. Cement or bricks are better than bumpy plastic as far as causing crashes. They become less slippery when wet.

The thought of having to ride around rails all over town is depressing. I have given this a lot of thought before this survey came about. What is it going to be like biking downtown when the construction is done? There has never been any mention of bicycle accomodations, which has me worried. MAX doesn't seem to be a problem, but the streetcar locations are. Trying to turn right on 10th in NW Portland, over the streetcar rails is a pain. NW 10th has been ruined, as has the Lovejoy connection.

The trimet tracks in downtown are one of the most frustrating parts of bike commuting as they are in areas of frequent construction which means frequent unanticipated detours for cars. Having already broken my arm (the only broken bone I've ever had) due to an incident with tracks I'm very hesitant on road with tracks and traffic. If this issue were alleviated I would rank myself as a confident bike rider, but the fact that I often chose to walk my bike through downtown at rush hour keeps me from selecting this option.

The Trolley tracks are a severe hazard not only to cyclist but to autos, pedestians and motercyclist as well. The street cars are in my opinion are a bad idea. I thought they were a bad idea before my fall. My fall just reinforces this in my mind. I feel and allways have that they are a complete waste of the taxpayer money and have poor ridership to boot. There are a lot of better places for transprtation dollars to be spent.

The worst accident I have had have involved rail tracks.

There ARE streetcar designs that use tires! Streetcar tracks are ugly, dangerous for bikers, reduce stopping distance of cars, and cause inflexible routes.

There should be an avenue to report incidents with bikes and Max or Streetcar tracks. That data might be both helpful and influential in future designs. I have yet to meet a cyclist who HASN'T fallen on the tracks. I am a huge supporter of the max and streetcar but there could be infrastructure improvements that would keep cyclists and other thin wheeled vehicles safe.

This survey is primarily about tracks - I don't ride downtown or anywhere near tracks. However I would ride from Lewis & Clark College area down Barbur all the way to Lloyd Center if I felt safer doing it -- and the traffic on Barbur is really daunting. On the other hand, the route along the river on the west side is too complicated and time consuming. So that's all I'd like you to know -- I don't know what the solution is.

Though adding more streetcars will add more tracks to Portland streets, the reduced automobile traffic that will result, will make cycling safer. A few streets cars and busses are easier to avoid than hundreds of SOVs rushing everywhere, swarming around like flies...

Tracks are dangerous for bicycles (Max railway streetcarwhatever) I do see the advantage of mass transit for our clogged roadways but I also know the huge danger to cyclists around tracks, especcially when they are wet...which lets face it we are in the NW it is rainy here!!...I try to avoid roadways where there are tracks,if I have to ride parallel to them it elliminates an escape route for me I cannot just merge across them like a car so if something happens in front of me I lose an avenue to avoid the problem. The Euro style system seems best as it does a good job of seperating cyclists and the tracks. Thanks for allowing me to share my opinions.

Tracks are fine if you can cross perpendicular to them. Some bus drivers and train operators seem to have a negative attitude with cyclists when dealing with them directly. We are customers just like everyone else and should be treated with the same respect. Some bus drivers pass cyclists too closely while others are caucious and courteous, which can be more confusing than if they were all rude/unsafe, because you don't know what to expect.

You didn't ask if I would prefer a bike lane to the left of the streetcar tracks -- only if I would prefer one to the right. I think to the left would be the more logical, if unconventional, choice, if there were to be a bike lane parallel to streetcar tracks at all.

usually the buses are very courteous... on vancouver and williams they are very careful. the streetcar tracks prove difficult only when they are wet (for me but maybe are difficult for less experienced bikers when dry?). after falling i am scared of them:)

Wet fracks are a problem to all riders. It is best to keep the bike lanes away from tracks and buses if possible. Buses have to pull to the right and then merge into traffic. Sometimes they don't or can't see the riders and it is dangerous so I stay away from the bus streets when possible or stop when it gets to dangerous. And it is!!!!

When it comes to tracks, I'm uncomfortable riding IN THE SAME LANE parallel to tracks - I usually go to the other side of the street if possible or go to another street. I'm am also comfortable riding in a bike lane that runs next to tracks. I wasn't clear what this survey was referring to when it asked about riding parallel to tracks.

When riding on streets with the streetcar, I ride all the way to the left (that is, on the left side of the left most lane.) I know that I'm supposed to stay on the right as a cyclist and I do--on all streets except streetcar streets. Then I feel safest on the left. For about a year, my ride home took me South on 11th Ave. to PSU and up to Barbur. I found that riding on the left side of 11th was comfortable and cars seemed to be fine with me there too.

When you say parallel to tracks, I'm not sure if you mean parallel and along side (right next to) or parallel and separated. Max goes down the center of most streets and is separate for cars and bikes. Through downtown I avoid the streets that ride next to/along side Max and the street car. I can't do that in the Pearl along Lovejoy. There is a bikelane that is on Lovejoy near 14th and it rides up and through the waiting Streetcar people and then lowers to a traffic light where people turn right. This always feels like a disaster waiting to happen.

COMMENT

While I am a confident, fearless rider, I have many friends who are more timid and very afraid of the tracks. They are also more likely to fall and hurt themselves.

While i understand the advantages of rail systems downtown, i think the existing streetcar has been an enormous failure. It has so many stops, and it must keep with the pace of traffic that i can walk just as quickly as it can travel. As a cyclist, i don't mind sharing the road - even with rail lines that occasionally grab a front wheel, but i'd like to know that the safety hazards have come with some benefit for the community, and I don't feel like the existing streetcar has.

While I've never fallen on streetcar tracks, it is probably because I've cleaned up other cyclists who have. The big problems aside from the more obvious are the intersections where a cyclist tries to turn left or right crossing tracks from the lane into a side street when they are biking parallel to the tracks. anything besides turning at a right angle to the tracks seems to have a possibility of getting your wheel stuck, however the cars surrounding you are the big problem then. They are by volume at least 50% unaware of needing to make a wide 90degree turn to the tracks to keep moving, causing potential accident situations on most fronts.

With streetcar tracks, my preferred option would be something like SW Harrison down to the South waterfront with the tracks in the left lane and a bike lane on the right side. This would probably be the best for any one-way streets. In downtown, however, I just ride in the left lane of traffic where there are streetcar tracks.

Yes. Streetcars v. electric buses. Since there is basically no difference between the two from a user standpoint, I'm left to conclude that street cars are being opted for because fashion conscious city government feels that they look cooler. My guess: electric buses are much less expensive too, and do not require expensive to maintain, highly dangerous to cyclists, train-tracks peppered over what was once alternative routes for cyclists. The irony. The best, least obtrusive place to put street-car traffic is on streets with low car traffic. This too is the best place to ride a bicycle. Therefore, streetcars directly interfere with safe cycling downtown.

## Appendix C: Survey Results Memo

The “Portland Area Bicycling Conditions” survey was launched on April 7, 2008 and left open for nine days. It was publicized widely on the BTA blog, on bikeportland.org, on portlandtransport.com, and through email lists such as the Lloyd District TMA’s Bike Committee, Shift, and via Roger Geller (PDOI) and Todd Boulanger (City of Vancouver, WA). 1520 people completed the survey.

Demographics: Respondents were primarily “confident” cyclists (63%, or 1128 people), though nearly 20% (348 people) reported as “comfortable.” The remaining responses are split between “fearless” (12%, or 222 people) and “learning or timid” (5%, or 86 people).

Transit use: Roughly half of respondents take TriMet at least once a week, and 15% ride Streetcar at least once a week. A much smaller percentage of respondents use TriMet (27%) and Streetcar (3%) *with bike* more than once a week. *Conclusion: respondents are experienced transit users, and offer the perspective of multimodal transportation users.*

### Opinions and experiences:

Consistent with that point, respondents overwhelmingly agree that TriMet is valuable to them (85% strongly agree, and an additional 13% agree). Unsurprisingly, 99% of respondents say that bicycling is a valuable transportation choice. Fewer respondents value Streetcar, though 71% still agree or strongly agree that it is a valuable transportation choice. *Conclusion: respondents value transportation options and the role of both transit and bicycles in Portland’s transportation system.*

Respondents report the following comfort levels related to riding near transit and tracks:

- I am comfortable biking on bus routes (60% agree, 21% disagree)
- I am comfortable biking on routes where I have to ride parallel to tracks (43% agree, 34% disagree)
- I am comfortable crossing tracks (66% agree, 17% disagree)
- I am afraid of falling on tracks (50% agree, 27% disagree)

*Conclusion: Cyclists are more comfortable bicycling around buses than tracks; when it comes to tracks, cyclists report that they fear falling (most likely based on prior experience).*

A majority of respondents believe that:

- Expansion of the streetcar system is essential to improving Portland's transportation system (60% agree)
- Expansion of the streetcar system will alleviate traffic congestion in neighborhoods and business districts (54% agree)
- I know what is expected of me when riding a bicycle around transit vehicles (73% agree)
- I find that TriMet drivers are generally respectful and safe around bicyclists (58% agree)

Results were inconclusive for the statement that “I am concerned that streetcar system expansion will degrade existing bicycle routes” (36% agree, 34% neutral, 30% disagree).

Most respondents reported that they were generally “cautious but comfortable” performing the following maneuvers:

- Turning right or left over tracks
- Riding parallel to tracks
- Riding alongside buses
- Sharing the lane with buses

By contrast, most respondents reported feeling “at ease and confident” when crossing tracks at a right angle. *Conclusion: facility designs should prioritize and facilitate cyclists crossing tracks at a right angle.*

Preferred facility type: Cyclists clearly disliked an on-street bike lane to the right of tracks compared to either a European-style cycle track or a parallel bicycle route. Of these other types, the cycletrack option was slightly preferred. *Conclusion: bike lane solutions are not sufficient to address cyclist concerns about tracks; bicycle accommodations near tracks should provide a greater degree of separation, either on the same street or on a parallel facility.*

Safety and crashes: Over 67% of respondents reported that they have experienced a bike crash on tracks. Further analysis of bike-track crash locations and causes is currently being performed. When a crash occurred, most (70%) of those bicyclists experienced only minor injuries (bruises, cuts, muscle and/or joint pain). 8% reported broken bones or serious joint injury (or about 96 survey respondents), and 2% reported head or neck trauma (or about 24 survey respondents). *Conclusion: Bike-track crashes are a major and underreported problem for Portland-area bicyclists. Most crashes do not result in life-threatening or permanently disabling injuries.*

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### Analysis of less-experienced bicyclist responses

A special analysis was performed of the 86 respondents who labeled themselves as “learning or timid.” Compared to the aggregate response, they are:

- Much more likely to ride TriMet or Streetcar regularly
- Roughly similar in their belief that TriMet, biking and Streetcar are valuable to Portland
- Very uncomfortable riding on bus routes
- Less comfortable riding parallel to tracks and crossing tracks
- Far more worried about falling on tracks (63% agree or strongly agree that they are afraid, compared to 50% of average)
- Less confident about what is expected from them around transit vehicles
- Less in agreement that TriMet drivers are safe and respectful around bicyclists (48% agree or strongly agree, compared to 58% of average)
- Report that they **avoid** the following maneuvers: merging over tracks, riding alongside buses, and sharing the lane with buses (by contrast, the average respondent did not report avoiding any maneuvers)
- Show a slight preference for a cycletrack, next prefer a parallel route, and only as a third choice prefer a bike lane to the right of tracks
- Only 11% of less-experienced cyclists report that they have fallen on tracks compared to 67% of the average

### *Conclusions:*

*Less-experienced cyclists are more anxious biking near transit and have less confidence in their own abilities, expected behaviors, and in transit operators. They avoid facilities that are shared with transit, and while they are less likely to have experienced a crash on tracks, they are more afraid than experienced bicyclists that they will.*

*In order to create facilities that appeal to less-experienced cyclists, we need to create more separation from transit. A major strategy to provide this separation is to continue to create robust bicycle boulevards on low-traffic neighborhood streets (not shared with transit) to provide inexperienced cyclists with environments where they are not required to mix with transit vehicles.*

*The importance of creating comfortable environments for these ‘learning or timid’ cyclists goes beyond just responding to their stated preferences. In order for any non-cyclist to give biking a try, they will have to pass through this phase. It is essential that we provide facilities that make new and timid users feel comfortable so that they can continue to build their skills and confidence.*

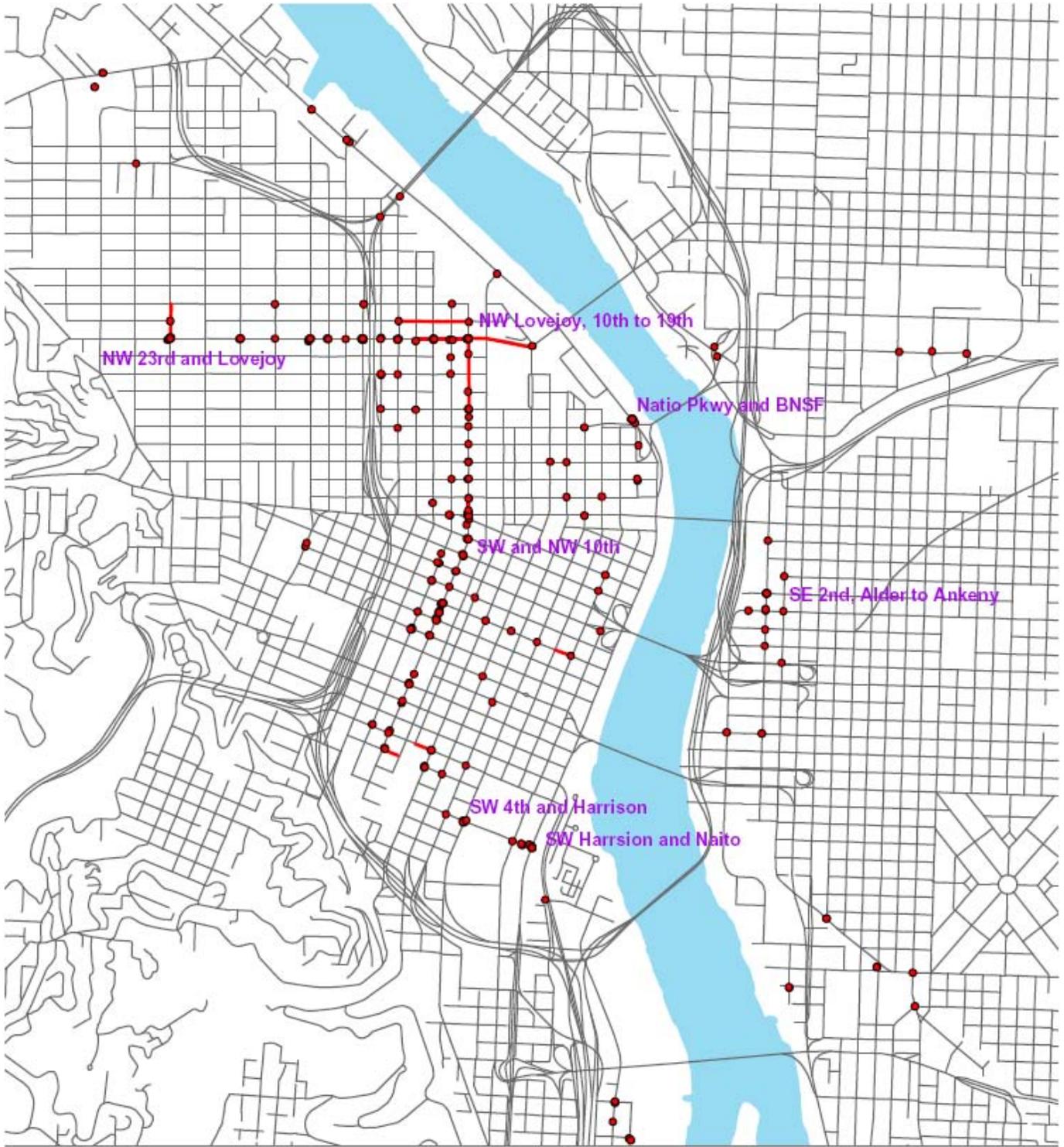
*As learning cyclists get more confident they will become more comfortable sharing streets with transit vehicles, at which point they will have the option of 'graduating' to facilities on transit streets.*

*While it is clear that bike facilities on transit main streets are important because they support local business and provide cyclists access to business districts and destinations, it is also clear that less-experienced users need other alternatives.*

*In other words: bike facilities should not be **either** on the transit street **or** on a nearby street, but rather should be provided **both** on the transit street and as part of a separate bicycle boulevard network.*

# Appendix D: Survey Crash Map

This map shows the location of track crashes reported by survey participants.



## Appendix E: Summary of Literature Reviewed

Document	Place/Source	URL
<b>United States &amp; Canada</b>		
Bike 2015 Plan - City of Chicago No discussion of bicycle safety & tram tracks	Chicago, IL	<a href="http://www.bike2015plan.org/">http://www.bike2015plan.org/</a>
Chicago Bike Lane Design Guide No discussion of bicycle safety & tram tracks	Chicago, IL	<a href="http://egov.cityofchicago.org/webportal/COCWebPortal/COC_EDITORIAL/bike_lane.pdf">http://egov.cityofchicago.org/webportal/COCWebPortal/COC_EDITORIAL/bike_lane.pdf</a>
Bike Plan Source Streetcar Track Question <b>Daniel Egan - City of Toronto:</b> "We use rubber flange fillers at a few locations where bicycle lanes and trails cross skew angle railway spurs - generally low speed, infrequent train activity. I have never seen a comparable product designed for use with streetcar tracks." "The most dangerous locations for cyclists are where the streetcar tracks turn to the right either to travel along a perpendicular street or to enter a transit station or loop." Notes that tracks are particularly hazardous when wet and a challenge for inexperienced cyclists who may not know to cross the tracks at a right angle. Streetcars generally occupy the two center lanes on four lane roads, which allows cyclists to ride comfortably to right of the streetcar tracks. Also easier for cyclists to cross the tracks at an angle closer to 90 degrees. <b>Ernst Poulsen - The Bicycle News Agency:</b> Danish Rail Roads in Jutland used rubber flange filler. While expensive, it created a smooth surface for cyclists. Weight of streetcar depresses rubber when it is rolling on top of the track. <b>Diane Bishop - City of Eugene:</b> At acute angle track x-ings used flange filler. Also painted stencil depicted cyclist x-ing at perpendicular angle. <b>Howard Boyd, P.E.- Birmingham, England:</b> High skid resistance coloured surfacing may be used to draw attention to possible tram / cycle or cycle / rail conflict points, for example where widths are limited and at tram stops. <b>Tom Huber - WI Bike/Ped Coord.:</b> In Freiburg, Germany, tracks located in center of street. No filler used.	General, US	<a href="http://www.bikeplan.com/traxq.htm">http://www.bikeplan.com/traxq.htm</a>
San Francisco Bicycle Master Plan - 1997 "Where possible, abandoned railroad tracks should be removed to improve safety conditions for bicyclists. Active railroad track crossings should be made safer by installing rubberized surfaces adjacent to the tracks including LRV and cable car tracks where possible. It is recommended that all railroad tracks across which a bicyclist would travel, i.e., in all intersections, receive such treatment. Highest priority should be given to tracks that cross cyclists' travel direction at a diagonal." "Drainage grates and railroad tracks present the possible danger of catching a wheel and throwing a bicyclist from their bicycle at worst, or causing expensive wheel damage at best. A discussion of methods for mitigating these risks is given in Chapter 8 under maintenance policies." "Existing railroad and trolley tracks that are still in use can be made safer by installing rubberized surfaces adjacent to the tracks. It is recommended that rubberized surfaces be installed across all active tracks to improve safety for bicyclists. Diagonal crossings should receive priority treatment as they pose the most difficulty for bicyclists."	San Francisco, CA	<a href="http://www.sfgov.org/site/bac_index.asp?id=11525">http://www.sfgov.org/site/bac_index.asp?id=11525</a>
San Francisco Bicycle Plan, Policy Framework (2007 update, currently in litigation) Action 2.17: Inventory railroad tracks parallel or intersecting bicycle route network. "Appropriate measures should be undertaken to mitigate the impact of track crossings to bicyclists. Removal of unused tracks along the bicycle route network should be undertaken." Also recommends "covering" tracks in asphalt paving if removal not feasible. Cross-section depict warning signage for track crossings.	San Francisco, CA	<a href="http://www.sfmta.com/cms/bproj/documents/Draft_Entire_Plan_000.pdf">http://www.sfmta.com/cms/bproj/documents/Draft_Entire_Plan_000.pdf</a>
1999 Bicycle Plan - Vancouver, BC No discussion of bicycle safety & tram tracks	Vancouver, Canada	<a href="http://www.city.vancouver.bc.ca/engsvcs/transport/cycling/pdf/1999bikeplan.pdf">http://www.city.vancouver.bc.ca/engsvcs/transport/cycling/pdf/1999bikeplan.pdf</a>
<b>Europe &amp; England</b>		
The Amsterdam experiment in mixing pedestrians, trams and bicycles	Amsterdam, Netherlands	<a href="http://findarticles.com/p/articles/mi_qa3734/is_199908/ai_n8857866">http://findarticles.com/p/articles/mi_qa3734/is_199908/ai_n8857866</a>

No discussion of bicycle safety & tram tracks Cycle Policy 2002 - 2012 - City of Copenhagen	Copenhagen, Denmark	<a href="http://www.vejpark2.kk.dk/publikationer/pdf/413_cykelpolitik_uk.pdf">http://www.vejpark2.kk.dk/publikationer/pdf/413_cykelpolitik_uk.pdf</a>
No discussion of bicycle safety & tram tracks Livable Copenhagen: The Design of a Bicycle City	Copenhagen, Denmark	<a href="http://www.sightline.org/research/sprawl/res_pubs/Livable_Copenhagen_reduced.pdf">http://www.sightline.org/research/sprawl/res_pubs/Livable_Copenhagen_reduced.pdf</a>
No discussion of bicycle safety & tram tracks Copenhagen Bicycle Account report, 2006	Copenhagen, Denmark	<a href="http://www.vejpark2.kk.dk/publikationer/pdf/464_Cykelregnskab_UK_%202006.pdf">http://www.vejpark2.kk.dk/publikationer/pdf/464_Cykelregnskab_UK_%202006.pdf</a>
No discussion of bicycle safety & tram tracks Collection of Cycle Concepts (national bicycle facilities guidelines)	Denmark	<a href="http://www.vejdirektoratet.dk/pdf/cykelrapport/999Complete.pdf">http://www.vejdirektoratet.dk/pdf/cykelrapport/999Complete.pdf</a>
In discussion of contributing factors to bicycle accidents, train rails were listed as insignificant. Tram-Related Injuries in Sheffield	England	<a href="http://www.injuryjournal.com/article/S0020-1383(00)00196-0/abstract">http://www.injuryjournal.com/article/S0020-1383(00)00196-0/abstract</a>
Significant number of injuries related to the Sheffield Tram. Of those injured, cyclists were at the greatest risk. "Bikes and trams--integrating the benefits"	England	<a href="http://www.allbusiness.com/professional-scientific/architectural-engineering-related/744822-1.html">http://www.allbusiness.com/professional-scientific/architectural-engineering-related/744822-1.html</a>

*But the rise of LRT has also illustrated how the extent and practicality of different forms of integration can be controversial. For example, although cyclists can gain greatly from the reduction in traffic volumes, noise, and air pollution that trams can bring, and from new cycle facilities provided alongside tram routes, they are often very worried about the danger of getting their wheels caught in tram tracks on narrower streets shared with trams....*

*The most important findings of the project were in relation to the first two areas: safety and bike access. On safety, it was found that it was very difficult to avoid creating any new safety problems for cyclists arising from on-street LRT, but that, through a wide range of infrastructural and other measures (including publicity, education, and awareness raising), the potential problems could be significantly reduced. The likely impacts on cyclists--both on existing special facilities and roads and on proposed new cycle links--must be systematically considered from the outset. It is vital that existing routes used by cyclists are not fragmented, particularly if adequate alternatives cannot be provided.*

#### Observations:

- \* Most cyclists will not want to ride on sidewalk behind tram stop but rather proceed forward
- \* Development of tram network may reduce overall vehicle traffic, a net gain for cyclists
- \* Cyclist survey showed many problems with first generation design, that had insufficiently planned for bikes

#### Recommended countermeasures:

- \* Educate drivers to expect evasive maneuvers from bicyclists
- \* Clear signs & road markings to increase road user awareness and facilitate safe turns
- \* Provide place for cyclist to wait for tram
- \* Tram driver training to wait for bicyclists
- \* Need better recording of bike/tram crashes for future analysis
- \* Jug-handle turns
- \* Important to have range of options for different types of cyclists

Cycle Interaction with Trams – TfL report	London, England	Not available online
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#### Problem identification:

- Safety risks associated with cyclists crossing tram tracks;
- Conflicts in narrow roads, at pinch-points and at tram stops between cycles and trams, buses or other vehicles; and
- Issues associated with cyclists having to use alternative routes.

Causes of issues for cyclists:

- Insufficient width of cycle lanes;
- Crossing tram tracks, particularly at tram stops and junctions;
- Overtaking at tram stops;
- Negotiating pinch-points;
- Poor road surfacing, road markings and road cleanliness;
- Intimidation from trams and other vehicles;
- Over-reliance on the provision of cycle tracks/shared-use paths and alternative routes;
- Access restrictions for cyclists; and
- Uncertainties over priority.

Tramway links recommendations:

- Distance from the kerb to inside edge of cycle lane marking should be a minimum of 1.25m (variations on this depending on gradient, road speed and the presence of parked vehicles).
- Care should be taken with the design of transition areas where the road narrows to ensure that cyclists have sufficient width between the kerb and inside rail to align themselves to cross the track at a safe angle.
- Where possible, ensure that there are adequate on-road provisions for cyclists so that cycle tracks and alternative routes can be avoided.
- Do not restrict access on tramways for cyclists.
- Swept-path markings should be used on tramways across the path of side-roads, through junctions, across right-turn refuges, and where the tram tracks diverge.
- Ensure that kerbside road markings are placed tight against the kerb and minimum width markings are used.
- Warning signs

Tram stop recommendations:

- Use a sharp platform taper and provide sufficient distance between kerb and inside track.
- Where possible, locate stops immediately after priority junctions.
- The strip between platform edge and inside rail should be kept clear of obstacles.
- The carriageway should be sufficiently wide such that cyclists can pass safely between stationary trams, but should not be overly wide so that it encourages cyclists to overtake.
- Deflection arrows help to alert cyclists.
- Consideration should also be given to introducing coloured (skid resistant) surfacing to indicate the crossing path of cyclists. The deflection arrow could be placed within this path.
- Cyclists should not be banned from passing through tram stops.

Intersection recommendations:

- Cyclists should be encouraged to cross tram tracks at angles of between 60-90 degrees.
  - At junctions, right-turn markings can be a useful measure to indicate the safe turning path for cyclists.
  - As an alternative to right-turn markings, coloured (skid-resistant) surfacing should be considered. The surfacing should be used in combination with deflection arrows and/or the smallest permissible cycle symbol.
  - Advanced Stop Lines (5m in depth) should be provided at all junctions where the volume of cyclists and general traffic is relatively high.
  - Jug-handles should be considered at informal crossings where cycle activity is high, and where footways are suitably wide.
- See full report for more details.

Light Rapid Transit and Cyclists: Guidelines for Planning and Design

Europe

Not available online (order from <http://www.ctc.org.uk/desktopdefault.aspx?tabid=4723>)

Policy statements: *LRT should not eliminate or sever routes used by cyclists: Cyclists should not be banned from streets...adopted by LRT. Cyclists should be exempt from turning restrictions at streets crossing LRT routes.*

*The safety of cyclists should not be compromised by new LRT systems; Wherever possible, cyclists should be allocated adequate segregated space. Where space is shared, rails should be positioned at least 2.0 m from the nearside kerb and careful design of track alignment and positioning of trams tops should ensure that cyclists do not have to cross rails at angles of less than 45 degrees. The skid resistance of the polymer bedding and surrounding concrete supporting the rails should be maximized. Reducing the volume and speed of other traffic on the tram route is of major benefit in enabling cyclists to deal with tram rails.*

*Where all-purpose traffic lanes are removed to accommodate a segregated tramway, it is important that any remaining traffic lanes are wide enough to allow safe overtaking of cyclists by other motor traffic.... Widths of 4.25m to 4.60m are preferred.*

*Under no circumstances should a ban of on-street cycling be introduced on LRT routes, although physical separation of trams and cycles is the preferred option. Where physical separation is not possible (or would introduce conflict with pedestrians or unacceptable delays to cyclists), and where no direct, safe, and convenient cycle route alternative can be provided, every effort should be made to provide street space, time separation, and reduced traffic volumes and speed differentials.*

*If an LRT route displaces motor traffic on to nearby routes, care will be needed to ensure that this does not disadvantage cyclists using formerly lightly trafficked alternative routes.*

*Where street widths are insufficient to provide dedicated cycle operating space, the quality of alternative cycle routes should be assessed. Where an alternative route offers a good level of service for cycling, the route should be signed to attract cycle users. Generally a cycle route will be considered circuitous and not utilized fully by cyclists if it introduces a deviation of more than 10% in total distance (or journey time) over and above the most direct route between trip attractors.*

Problem statements and solutions:

- Problem: *Low skid resistance of rails; Solution: High skid resistance surfacing, drainage, and good lighting*

- Problem: *Wheels trapped in the flange groove; Solutions: cycle lane/rail intersection angle (minimum 45 degree, prefer 90); depressible rail inserts*

- Problems: *Inattention to traffic caused by rails; positioning problems caused by rails; Solutions: Kerb to rail distance (rails must be 2.0m from kerb at absolute minimum, 2.5m is preferred, more if car parking permitted); center-running tram line preferred; 20 MPH maximum on streets with both trams and on-street parking*

- Problems: *Obstructions at platform buildouts; obstruction caused by tram passengers; solution: tram stop design*

General recommendations:

*Cyclists' safety, convenience and route continuity need to be considered early in the design of the LRT system and incorporated into the design and operation.*

*Cycling, walking and public transport provision should be combined in justifying the reallocation of urban road space and in providing a comprehensive alternative to excess motor traffic in preference to removing space from cyclists or pedestrians*

Cycling: The Way Ahead for Towns and Cities

Europe

[http://ec.europa.eu/environment/cycling/cycling\\_en.pdf](http://ec.europa.eu/environment/cycling/cycling_en.pdf)

No discussion of bicycle safety & tram tracks

FHWA Study Tour for Pedestrian and Bicyclist Safety in England,

Germany, and The Netherlands

Europe

<http://ntl.bts.gov/DOCS/bikeped.html>

No discussion of bicycle safety & tram tracks

"Radverkehr an Bus- und Straßenbahnhaltstellen" (ADFC report on "Bicycle Accommodation at Bus and Tram Stops")

Germany

[http://www.adfc.de/37\\_1](http://www.adfc.de/37_1)

Main focus is transit stops; only one recommendation seems to apply (minimize bus & tram stop times to minimize conflicts with bicyclists). They also state that routing the bike lane onto the sidewalk is often damaging to the pedestrian environment.

National Cycling Strategy 2006 - 2015

Norway

<http://tinyurl.com/6gev62>

No discussion of bicycle safety & tram tracks

Cycle Path Inspections No discussion of bicycle safety & tram tracks	Norway	<a href="http://tinyurl.com/4rujfa">http://tinyurl.com/4rujfa</a>
Nottingham Cycle Map Cyclist map showing alternate route	Nottingham, England	<see attachment>
Nottinghamshire Cycling Design Guide No discussion of bicycle safety & tram tracks	Nottingham, England	<a href="http://tinyurl.com/6m6zje">http://tinyurl.com/6m6zje</a>
Cyclists and Trams (brochure) <i>The interaction of cyclists and trams has been an important consideration in designing the system. The Highway Authority has worked closely with local cycle group PEDALS to adopt and improve the sorts of cycle-friendly features on other tram systems and even come up with some features unique to NET. One of the key features developed is an alternative cycle route parallel to but away from the tram tracks, as detailed on the map overleaf. This links up with existing local cycle routes and includes sections on and off the road, Toucan crossings and clearly-signed routes. For the first time ever, some new signs have been developed in conjunction with the Department for Transport to help cyclists who choose to cycle near tram tracks to do so safely. A number of features have been developed for cyclists near tracks. These include:</i>	Nottingham, England	<a href="http://www.thetram.net/gfx/howto/cyclists/cycleleaflet.pdf">http://www.thetram.net/gfx/howto/cyclists/cycleleaflet.pdf</a>
<ul style="list-style-type: none"> <li>• <i>Cycle lanes in some places, eg, Waverley Street</i></li> <li>• <i>Road markings and signs to help cyclists make the right manoeuvres, eg on the approach to tram stops</i></li> <li>• <i>Designated track crossing points, eg Middle Hill</i></li> <li>• <i>Cycle stands at tram stops (all with CCTV)</i></li> <li>• <i>Secure parking at five Park and Ride sites</i></li> <li>• <i>Existing cycle lockers, eg Hucknall and Nottingham railway stations</i></li> <li>• <i>Existing cycle stands, eg Old Market Square plus new stands proposed for Beastmarket Hill</i></li> </ul> <p><i>An alternative cycle route has also been developed, featuring:</i></p> <ul style="list-style-type: none"> <li>• <i>An optional route on quiet roads and off-road sections parallel to the tram route</i></li> <li>• <i>Clear and distinctive signs directing cyclists to and along the alternative route</i></li> <li>• <i>Signed links to local and national cycle networks planned</i></li> <li>• <i>Some dedicated and lit cycle lanes, eg, through The Forest</i></li> <li>• <i>Toucan crossings on Gregory Boulevard and Forest Road</i></li> </ul>		
Edinburgh Tram Design Manual	Edinburgh, Scotland	<a href="http://www.tramtime.com/newdownloads06/TDM_Intro.pdf">http://www.tramtime.com/newdownloads06/TDM_Intro.pdf</a>

• Where pedestrian/cycle paths cross the track, the surfacing and edging of these will continue across the track infill. "Cycle tracks should be well defined and aligned with the tram track, only merging with each other at tram stops if no other design solution can be implemented."

#### **Design Guidelines Checklist:**

- Pedestrians and cyclists should be given priority by providing appropriate circulation space adjacent to the tram route.
- Dropped kerbs and flush crossing of tram lines should be provided.
- Crossings should, ideally, be at right angles to the tram track or the street, with minimal physical barriers surrounding them.
- Crossings should be sufficiently illuminated to enhance the visibility of pedestrians and cyclists by other road users.
- Crossing points should be provided at frequent intervals along the tram route and provide easy access for all users, including those with prams and wheelchairs etc.
- Sufficient ambient lighting must be incorporated along pedestrian and cycle routes.
- Cycle/pedestrian routes are to be provided alongside the tram track on those sections where the tram route follows a corridor currently occupied by a cycle/pedestrian path only.
- Where space allows, cycle/pedestrian paths should be separated from the tram track by a grass verge, with 2m desirable optimum.
- For on-street sections, cycle lanes should be implemented where possible, to encourage segregation from the tram tracks.
- Cycling on platforms will not be accepted and should be designed out.
- Cycle routes should be fluent throughout the tram route, avoiding interaction with both trams and other vehicles, such as parked cars or unloading areas, and be designed so as to minimise the crossing of the tracks.
- Where there is restricted space and cycle routes cannot be implemented safely, they should merge with pedestrian routes rather than tram or vehicular paths.

"Fuss- und Veloverkehr auf gemeinsamen Flecken"

("Pedestrian and Bicycle Traffic in Shared Spaces")

Switzerland

[http://www.pro-velo.ch/pdf/Fuss-und-Veloverkehr-auf-gemeinsamen-Flaechen\\_d.pdf](http://www.pro-velo.ch/pdf/Fuss-und-Veloverkehr-auf-gemeinsamen-Flaechen_d.pdf)

Discussion of increasing frequency of "curb tight" tram stops (aka curb extensions that permit the pedestrian to enter the transit vehicle without stepping off the sidewalk level). According to the report, *"some cyclists feel trapped at curb-tight tram stops, because there is only a narrow strip of pavement between the curb and the tram track. This is of particular concern to cyclists towing trailers, because one of the wheels of the trailer could get caught in the tracks...For this reason, it is common for bicycles to be directed to the sidewalk in order to protect bicyclists from fast-moving auto and tram traffic, and to prevent them slowing down motorized traffic flow.*

*In order to direct bicycles onto the sidewalk and tram stop, the following criteria must be followed:*

*\* Ideally, only uphill bike lanes should be directed to the sidewalk;*

*\* For flat surfaces, the recommendation depends on the situation, but in every case it is important to install treatments that will slow bicycle traffic appropriately;*

*\* Bicycles must be directed behind the waiting area;*

*\* The place where bicycle and pedestrian traffic will cross must be designed in a way that makes it unmistakably clear that both types of users are expected*

*\* If the bicycle facility is a separated cycletrack, a crosswalk can be striped in the crossing area*

*\* If there is insufficient room for separating modes, the crossing area may be indicated with stencils showing both pedestrians and bicycles*

*\* If the area is marked with signs, the proper signs is a "pedestrian" sign with an additional "bicycles permitted" sign*

*\* It is not recommended to direct bicycles onto the sidewalk if the bike lane is downhill. Bicycles are fast enough in this case to remain in the lane.*

(See pg. 47 for photos)

- "Velomassnahmen mit ungenügender rechtlicher Abstützung" ("Bicycle Facility Practices Requiring Legal Clarification") Switzerland <http://www.velokonferenz.ch/dateien/Velomass.pdf>  
 Discussion of "indirect left turns" (aka "box turn") - photos show this facility type used in situations where the left turn would conflict with tram tracks. Alta's understanding of Swiss traffic right-of-way is that left turns are prohibited where there is a center-running tram lane. The "indirect left turn" is most commonly indicated with pavement markings (e.g. bicycle stencil with arrow to indicate the box turn movement) and a bicycle-specific signal on the cross street. The report finds that this approach is easily understood by bicyclists, and successfully facilitates the left-turn movement without creating legal or practical conflicts. (See pg. 31 for photos)
- Web article: Kap-Haltestellen im Kanton Basellandschaft ("Curb-Tight Tram Stops in Basel Canton") Switzerland [http://www.pro-velo.ch/beidebasel/Politik/Verkehr/Kap-Haltestellen\\_BL/kap-haltestellen\\_bl.html](http://www.pro-velo.ch/beidebasel/Politik/Verkehr/Kap-Haltestellen_BL/kap-haltestellen_bl.html)  
*"Cyclists do not like curb-tight tram stops when the remaining space between the curb and the tram only leaves a narrow passageway for bicycles. The height of the curb is an important variable as well: the higher the curb, the greater the necessary passage width in order to prevent the cyclist catching a pedal. In the future, this problem can be solved by designing ... greater separation between the tram track and the curb, and a deeper curb for passengers. In Bern, curb-tight tram stops are built to leave a through passage width of at least 80 cm (2.62 feet) with a maximum curb height of 12 cm (4.72 inches). This permits a comfortable stop for tram passengers (including seniors and the disabled) while simultaneously providing safe bicycle facilities."*
- Zufrieden mit der neuen Strasse? ("Satisfied with the New Street?") Switzerland [http://www.bve.be.ch/site/zufrieden\\_mit\\_der\\_neuen\\_strasse\\_d.pdf](http://www.bve.be.ch/site/zufrieden_mit_der_neuen_strasse_d.pdf)  
 Redux after major streetscape project. Mentions that tram stations were converted to curb-tight (right-running) stops for pedestrian convenience. Less-experienced cyclists are routed onto sidewalk "mixed traffic" detour; presumably more-experienced cyclists can proceed in travel lane
- "Unsere 10 Wünsche an die Velofahrerinnen und Velofahrer" ("Our 10 Wishes from Bicyclists") Switzerland Not available electronically  
 Advises bicyclists how to ride around public transportation vehicles, including trams. No specific mention of track dangers. Advises cyclists to give crossing trams the right-of-way (the law in Switzerland) and wait for tram passengers to exit before proceeding at tram stop. Also advises cyclists to signal and to look for trains before crossing tracks.
- "Velo und Tram Vertragen Sich" ("Bicycles and Trams Get Along") – Feb 08 article from *Velojournal* Switzerland [http://www.provelobern.ch/uploads/media/velojournal\\_2008\\_2\\_01.pdf](http://www.provelobern.ch/uploads/media/velojournal_2008_2_01.pdf)  
 Report about bicycle safety near trams. Dangerous bicycle behaviors include passing trams on the left at stops, and chaos in crowded intersections. Most interactions between trams and bicycles are positive; in the last 5 years there have been 41 bus/tram crashes, which is only 1.5% of all crashes involving transit. Blame for the crashes is divided evenly between bicyclists and tram drivers. The director of BERNMOBIL (the local transit agency) invited bicyclists to drive a tram to get a better understanding of the very long stopping distance required for the 35-ton vehicles..
- "Prise en compte des aménagements cyclables dans le cadre de la reconstruction des lignes de trams à Genève." ("Cycling improvements/managements in the reconstruction work on streetcar lines in Geneva.") Geneva, Switzerland Not available electronically  
 Tram lines pulled out in 1969 except for one remaining line. In the early 1990s, the City decided to reconstruct a tram network. The first line was constructed without regard to cyclists, and as a result cycling conditions were degraded considerably along that corridor. The next tram line was constructed in coordination with streetscape improvements; some bike lanes were installed but the result was not satisfactory. In 2004 the next tram line was installed, and the Cyclists' Union was consulted, but extreme right-of-way limitations again led to a poor result. In 2007 the most recent tram line opened with center-running tram lines, and bicycle accommodation was made along the entire route in the uphill direction, and on part of the downhill route; this project was considered satisfactory.  
 The document then shows a series of 6 intersections with "before" sketches showing cyclist, auto, and tram conflict points, and "after" improvements. Tools used to reduce conflict include bike boxes/advance stop bars, coupled with opportunities for 'box turns'; signalization with bike-only phases; and authorizing use of a bus lane by bicyclists.

Design Manual for Bicycle Traffic	The Netherlands	<a href="http://www.crow.nl/shop/subwebshopResults.aspx?category=90">http://www.crow.nl/shop/subwebshopResults.aspx?category=90</a>
<p><i>Cyclists have to make sure they do not cross the rails at too small an angle, particularly in wet weather. Tram rails also contribute indirectly to risky situations:</i></p> <p>* <i>Cyclists sometimes have to concentrate so much on not falling (especially when they are following rails at points and in bends) that they miss other dangers.</i></p> <p>* <i>Cyclists are not always able to choose a safe track, far enough away from parked cars, for example.</i></p> <p>* <i>Tram rails restrict the freedom of movement during evasive maneuvers (p. 133)</i></p>		
Institute for Road Safety Research (SWOV): Light Rail and Sustainable Safety Fact Sheet	The Netherlands	<a href="http://www.swov.nl/rapport/Factsheets/UK/FS_Light_Rail.pdf">http://www.swov.nl/rapport/Factsheets/UK/FS_Light_Rail.pdf</a>
<p><i>Research has shown that the chance of crashes between [light rail vehicles] and...cyclists and pedestrians is relatively great. Includes crash statistics for bicycles and pedestrians and light rail vehicles; 2 of 8 deaths were cyclists and 7 of 24 hospitalizations were cyclists.</i></p>		
Dutch Bicycle Master Plan 1999	The Netherlands	<a href="http://tinyurl.com/5nhj6f">http://tinyurl.com/5nhj6f</a>
<p>No discussion of bicycle safety &amp; tram tracks</p>		
Cycling in the Netherlands (Dutch National Bicycle Policy)	The Netherlands	<a href="http://www.fietsberaad.nl/library/repository/bestanden/Cycling%20in%20the%20Netherlands%20VenW.pdf">http://www.fietsberaad.nl/library/repository/bestanden/Cycling%20in%20the%20Netherlands%20VenW.pdf</a>
<p>No discussion of bicycle safety &amp; tram tracks</p>		
"Ongevallen bij fietsers en voetgangers" ("Bicycle and Pedestrian Crashes")	The Netherlands	<a href="http://www.fietsberaad.nl/library/repository/bestanden/rapportage%20fietsers-voetgangers.pdf">http://www.fietsberaad.nl/library/repository/bestanden/rapportage%20fietsers-voetgangers.pdf</a>
<p>One isolated mention of track crash but no conclusions drawn; could be reporting omission</p>		
Making Walking and Biking Safer - Lessons from Europe	Quarterly	<a href="http://www.vtpi.org/puchertq.pdf">http://www.vtpi.org/puchertq.pdf</a>
<p>No discussion of bicycle safety &amp; tram tracks</p>		
Veloverträglichkeit von Tram-Kaphaltestellen ("Bicycle Accommodation at Curb-Tight Tram Stops")	Switzerland	<a href="http://www.proveloern.ch/docs/verkehr/Kaphaltestellen-Tram-ProVelo-Dok.pdf">http://www.proveloern.ch/docs/verkehr/Kaphaltestellen-Tram-ProVelo-Dok.pdf</a>
<p>See write-up</p>		

## Australia

An Innovative Design for Safe and Accessible Light Rail/Tram Stops Suitable for Mixed Traffic with Median Track Operations	Australia	<a href="http://www.patrec.org/atrf/papers/2005/Currie%20&amp;%20Smith%20(2005).pdf">http://www.patrec.org/atrf/papers/2005/Currie%20&amp;%20Smith%20(2005).pdf</a>
<p>No mention of bicyclists and trams or tracks.</p>		
Melbourne Bicycle Account - Cycling Census 2007	Melbourne, Australia	<a href="http://www.melbourne.vic.gov.au/rsrc/PDFs/WalkingSkatingCycling/MBACensus.pdf">http://www.melbourne.vic.gov.au/rsrc/PDFs/WalkingSkatingCycling/MBACensus.pdf</a>
<p>No mention of trams or tracks; cross-section of new "Copenhagen bike lanes" (cycletracks) on Swanston Street shows that bicycles are on a raised cycletrack on a street with center-running tram tracks</p>		
City of Melbourne Bicycle Plan 2007 - 2011	Melbourne, Australia	<a href="http://www.melbourne.vic.gov.au/rsrc/PDFs/WalkingSkatingCycling/bike_plan_2007.pdf">http://www.melbourne.vic.gov.au/rsrc/PDFs/WalkingSkatingCycling/bike_plan_2007.pdf</a>
<p>Swanston Street: Mentions cyclists being forced to ride on tram tracks due to parked vehicles and the need for cyclists to be careful when riding on this street. Includes action item to improve cycling conditions in the vicinity of tram stops (where cycling space narrows), but doesn't provide recommendations or identify specific problems. One mention of a difficult rail crossing, but due to presence of steps which require the cyclist to dismount, rather than danger crossing the rails themselves.</p>		
Melbourne info on 'Copenhagen style bike separated lanes'	Melbourne, Australia	<a href="http://www.melbourne.vic.gov.au/info.cfm?top=70&amp;pa=1154&amp;pg=3476">http://www.melbourne.vic.gov.au/info.cfm?top=70&amp;pa=1154&amp;pg=3476</a> <a href="http://www.melbourne.vic.gov.au/rsrc/PDFs/WalkingSkatingCycling/BikeFactSheet.pdf">http://www.melbourne.vic.gov.au/rsrc/PDFs/WalkingSkatingCycling/BikeFactSheet.pdf</a>

Fact Sheet: Cross-section depicts tram lines located in the center of the roadway. Use of green pavement to highlight conflict points (but no specific mention of use at tram/bikeway conflicts). No discussion of bike/tram interactions, only bike/ped and bike/car. No discussions of cyclists executing turns.

"Tram Tracks – how to cross them"

Victoria, Australia

<http://tinyurl.com/5n7nrw>

Describes tram tracks as "a unique hazard for bicyclists." Discusses right-hand turns (which are equivalent to US left-hand turns) and recommends positioning bicycle such that a near 90-degree turn can be made; it recommends pulling over and waiting for a gap if necessary, basically equivalent to the "box turn" described above as "indirect left turn"

Port Phillip: Danks St tram stop

Victoria, Australia

<http://www.bv.com.au/change-the-world/10796/>

Tram located in center of roadway. Marked bike lanes located at the curb are recommended to maintain width for cyclists through the tram stops (instead of sharing lane with motor vehicles). Also has traffic calming benefit."They are more bicycle-friendly than other types of tram stops that do not slow down traffic or force cyclists to share a narrow traffic lane with motor vehicles." No discussion of bikes crossing tram tracks.

## Appendix F: Summary of International Interviews Conducted

Person / Organization	Place	
Juerg Tschopp, VCS Verkehrs-Club der Schweiz	Bern, Switzerland	
<p>In Switzerland, the streetcar system is 100 years old, and they never dismantled them as many US cities did. For that reason, people in Switzerland grow up around streetcars, and cyclists are used to them. Obviously, in the US, where it is a new thing, people don't know how to handle the new infrastructure. Juerg encourages us to embrace both trams and bicycles, be open to having them share space, and learn from each other.</p> <p>He sent me a newspaper article about an event that lets cyclists ride in a tram to see what the operator can see and get a sense of the vehicle's mass and stopping distance. At the same time, transit operators have the opportunity to ride bicycles near tracks and get a better sense of cyclists' concerns and limitations (especially as regards turning across tracks).</p> <p>In general, Jürg says that only 1 or 2% of reported vehicle crashes involve trams and bicycles. While he doesn't want to say that's unimportant, it counters the arguments of those who are critical that bicycles and trams can co-exist.</p> <p>While they prefer to put bicycle route on parallel street, that isn't always possible. In Switzerland, bike lanes are on-street (as they are in the US), not grade-separated, and there are places where they are routed on the sidewalk to go around platforms.</p> <p>There are also many areas that are 30 KPH (19 MPH) zones with all modes mixed, as well as pedestrian zones that prohibit cars but permit trams, bikes, and pedestrians.</p> <p>Education: The Verkehrsclub der Schweiz teaches cycling skills courses, and encourages cyclists to ride between tracks instead of alongside them. Their course is 4.5 days and is sponsored by a health care organization; their target group is experienced adult cyclists or young or inexperienced adults. The first day is theory, and participants practice in a safe area, including practicing on tram tracks in depot (with permission of the transit company).</p> <p>Swiss agencies and advocates continue to discuss platform curb extensions and bicycles. They have developed a specific type of platform that does not reach all the way to the tracks, and cyclists can pass between the platform and the tracks, but this doesn't work for all types of stops and tram vehicles.</p> <p>Flange filler: Zuerich &amp; Basel both tried it out, and it works for train tracks where train traffic is occasional (3 -5 times per day), but tram tracks have a different geometry, and the hard rubber gets compressed too often and crumbles. VBZ (Vertrieb...zuerich) did extensive tests over many years, and finally they had to conclude that it was a no-go. If we have similar types of wheels, he predicts the same result.</p>		
Oliver Schulze, Gehl Architects	Denmark	No guidance about trams and bicycles
ADFC – Berlin	Berlin, Germany	No response
ProVelo – Basel	Basel, Switzerland	No response
Pascal van den Noort, VeloMondial	Amsterdam, Netherlands	No guidance about trams and bicycles
Martijn Sargentini, Bike Transport, Amsterdam Regional Authority	Amsterdam, Netherlands	No guidance about trams and bicycles
Geert de Jong, Policy Advisor, City of Amsterdam	Amsterdam, Netherlands	No guidance about trams and bicycles
Tom Bertulius, ITDP	Mexico City, Mexico	
<p>The main issue with trams in the UK is bike tires getting stuck in them and throwing their riders. That happened a lot with the old kind of tram rail sections, known as the "Tramrail Ri 60 N." It has a gap of 36mm that tends to catch bike tires. The new kind, the "Tramrail Ri 59 N" has a gap of 42mm and doesn't tend to catch bike tires. Works much better. I know it is counter intuitive, but a gap smaller than a bike wheel is then too small for the tram to use. They don't make them that small. But they do make tram tracks slightly bigger than a bike wheel, so that, apparently, is the way to go. (If it is the same size as the bike wheel that is the worst of all worlds as that is when the bike wheel gets caught.) Plus the common sense approach of channelizing cyclists so they cross the rail lines at a 90 degree angle, etc.</p>		
Christian Ensslin, Sustrans	England	
<p>"From my own experience (I was brought up in Germany where there are many trams around towns, and they used to be running on streets), the main problems are that modern trams are very quiet and fast, tracks are slippery when wet and that cycle wheels can (when cycling alongside a tram track) slip into the lower bit of the rail, therefore causing falls. I would not normally like to have a cycle path running alongside a tram rail (in the street) other than where there is ample space for cyclists without coming into contact with the rail even when cycling around obstacles / potholes etc. A separate track bed would be more appropriate (note that in Germany there would not necessarily be a fence alongside a rail/tram track, the ballast would be sufficient deterrent to go anywhere near the track. In England fences next to rails are compulsory).</p> <p>Crossing tracks perpendicularly is fine - although there are many accidents of people underestimating speeds of rail vehicles and there are regular accidents at crossings where there is no barrier. Therefore there must be some kind of warning system in place. "</p>		
European Cyclists Federation	Europe	No response
Roland Huhn, ADFC	Germany	
<p>No design guidelines for Germany that he is aware of. Legal precedent: tracks are considered a normal hazard and the state is not liable for injuries due to crashes. Product: VeloSTRAIL is a bicycle-friendly track filler product between open tracks, but is only used at</p>		

trail crossings; probably not suitable for use along entire system (<http://www.strail.de/index.php?id=197&L=1>). His recommendation: separation is necessary; avoid shallow crossings.

John DiNunzio	England	Sent me TFL report Trackless trolleybuses present no special dangers to bicyclists.
Ashley Bruce, Trolleybus UK	England	No response, but he authored several reports that were reviewed
Hugh McClintock	England	No response
HTM Personenvervoer NV	Netherlands	No guidance about trams and bicycles
Jens Loft Rasmussen, President, Danish Cyclists Federation	Denmark	No guidance about trams and bicycles (no trams in Copenhagen)
Andreas Roehl, City of Copenhagen Department of Transportation	Copenhagen, Denmark	No guidance about trams and bicycles (no trams in Copenhagen)
Lasse Lindholm, City of Copenhagen Department of Transportation	Copenhagen, Denmark	No guidance about trams and bicycles (no trams in Copenhagen)
Nils Jensen, City of Copenhagen Department of Transportation	Copenhagen, Denmark	No guidance about trams and bicycles (no trams in Copenhagen)
Henrik Nejst Jensen, Danish Ministry of Transport	Copenhagen, Denmark	No guidance about trams and bicycles (no trams in Copenhagen)
Mikael Colville-Anderesen, copenhagenize.com	Copenhagen, Denmark	No guidance about trams and bicycles (no trams in Copenhagen)
Gil Peñalosa	Ontario, Canada	No response
Arjen Jaarsma, VeloMondial	Amsterdam, Netherlands	Most Dutch cyclists know how to cross tracks at a safe angle. Trams are relatively safe for bicyclists because they go so slowly; light rail is more problematic. Not aware of flange filler use. Separated facility is very important. Typical Dutch roadway section: sidewalk, cycle track, one auto lane, one center-running tram lane (repeats to other curb). Tram tracks are slightly raised except at intersections, discouraging cyclists and vehicles from entering that lane. Sometimes there is not sufficient ROW in historical centers for the ideal approach.
Ineke Spape	Amsterdam, Netherlands	No response
Wim Bot, Fietserbond	Amsterdam, Netherlands	In Holland there are trams in the big cities only (Amsterdam, Rotterdam, The Hague, Utrecht). In the future more cities are planning to run tram lines. Crashes between cyclists and trams do happen on a regular basis, as they do between pedestrians and trams. The best solution is to keep them separated and to build a free tramway (dedicated tram lane). A mixed situation can however also work when it is really mixed. But of course the situation in the US is different from the situation here. Tram drivers in the US will not be used very much to cyclists, so maybe separation will work best.
Thomas Krag	Denmark	No response
Dave Holladay	England	"Do you know of any formal policies or designs related to bicycles and tram tracks?" We have HM Railway Inspectorate standards - especially the railhead - road profile, MVA and CTC both did reports on tram systems and cyclists, and Sustrans did a study on the Avon Tram in 1990 I think. We do have good practice guidance and advice from CTC or myself. The preferred option however is BRT as seen in Bogota/Curitiba etc, at 10-20% of the cost with the ability to begin services as soon as the vehicles are delivered rather than have to wait for rails and wires to be placed throughout the route.  "What process/guidance do UK planners/engineers use when designing bicycle facilities on streets with tracks?" See above, and note the best practice design is to use another street! The performance of a light rail system is such that for the mature systems a reserved track is generally provided in the middle of the street and many modern systems use 'grassed track' which has a very aesthetically pleasing effect, drains well and considerably reduces noise. Glasgow's system ran largely on reserved track outside the city centre, and in the centre of the street in town, with a strict regime practised in Toronto, less so in Boston and also in Hong Kong, that traffic cannot pass on the inside of a tram when it stops at a tram stop and passengers can walk out from the kerbside if no platform is provided. In Sheffield most crashes happen at 2-3 very clearly identified locations. Maintenance is a key issue - the delivery of a rail-road surface profile which does not lift ANY tyre off the higher friction edges of the supporting roadway. Note also that some crashes can occur when the crossing panel units become misaligned and the tyres go down into the gaps between or hit the edge running almost in-line with the tyre which has dropped a sufficiently large amount (although this could be as little as 1 cm) Avoid cross-hatching tram tracks with thermoplastic markings for obvious reasons! Cleaning is another aspect of maintenance which is neglected by UK and US systems along with the rail-road vertical alignments (Philadelphia was notorious I recall for its on-street tracks)  "Do you know of any experiences where flange filler or other products were effective in reducing the chance of bicycle tires becoming

stuck in the tracks?"

In San Diego and LA ordinary rail and check-rail construction has been used, but for most the best practice design is to use another street! A product called Velostrail claims to be better than previous attempts although I have yet to be convinced and as for the OMNI units with hose pipe fitted in the flange way- a total mess in Seattle after only relatively few movements. In Europe the main rail sections are IR59 and IR60 and IR 59 is just the perfect size to take a 32-XXX or a 37-XXX tyre and 'grab' it - you can stand a bike up with the front tyre wedged in the flangeway.

"What guidance would you give us Americans as we approach this problem of streetcar/bicycle interactions?"

It is not only (bi) cycles (note that CTC was BTC until 1882 when we became a properly inclusive club for cyclists of all types - remember to be PC in all your documentation ;-)) In Sheffield the long running case of Roe vs Sheffield Supertram and others was for a motorist paralysed after his car lost control in rail-tracks in the carriageway

"Are bicyclist crashes on tracks frequent? Are they tracked anywhere?"

You may well experience the same theory & practice issues. I have personal experience and a current case of a cyclist falling on a rail crossing where the single vehicle crash record is not logged by the Police (Stats 19 in the UK is reckoned to be under reported by a factor of 12:1 for minor injuries, and this has been tested against casualties presenting at local hospitals from road crashes) and for the rail crossing that any incident blocking a rail line was never recorded is emerging from our study of known incident and actual records.

"What is your personal opinion of integrating streetcars and bicycles? Is it a good idea? Is it a bad idea and we should keep the two parties separated?"

Avoid putting rail vehicle traffic in with road vehicle traffic wherever possible - just as laminar flow in a pipe or channel becomes turbulent and less efficient when any variable element (or bubble trouble) is introduced so the efficient way to shift the maximum capacity of a route is to use vehicles with a common performance and use pattern - hence bus lanes, and commuter rail lines which have no freight or long haul passenger services etc. That said all intersections are crucial in getting the design detail right.

Mike Maher	Perth, Australia	No response
Mark Dixon	Victoria, Australia	No response
City of Melbourne Department of Transportation	Melbourne, Australia	Referred me to Melbourne Bicycle Plan